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Emergency Care Centers, Hospital Performance and Population Health

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Abstract

Hospitals are under increasing pressure as they bear a growing burden of chronic disease while also dealing with emergency cases that do not all require hospital care. Many countries have responded by introducing alternative facilities that provide 24/7 care for basic and medium-complexity cases. Using administrative data, we investigate impacts of the opening of these intermediate facilities (UPA) in the state of Rio de Janeiro in Brazil. We find that an UPA opening in the catchment area of a hospital reduces hospital outpatient procedures and admissions and that this is associated with improved hospital performance. There is a decline in inpatient mortality, particularly mortality from the more complex conditions that hospitals are best equipped to deal with. There is no discernible change in the risk profile of cases going to hospital, and no concurrent policy changes that can account for these findings. In order to capture displacement effects, we investigate city-level population outcomes. We find that two-thirds of the decline in hospital mortality is offset by deaths in UPAs. Looking at individual death causes, we see a net decline in deaths from congestive heart failure.

JEL: I11, I15, I18.

Keywords: urgent care centers; hospital performance; displacement effects; health outcomes.

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1 Introduction

Health systems are increasingly under pressure to do more with less, and policymakers around the world are faced with the challenge of improving both coverage and efficiency. Hospitals are under particular pressure as they are the default providers of emergency care. Individuals often resort to hospital emergency departments not only for unavoidable or high-complexity emergencies but also for low-complexity cases that reflect unmet demand in other layers of the health system. A response to this situation has been to strengthen primary and ambulatory care and other rearguard non-hospital services. However there is still fairly limited evidence of the extent to which this lowers the pressure on hospitals. There is even less evidence on the extent to which it improves population-level health outcomes. As we move forward into an era with populations continuing to age, with rising medical costs and the impositions of fiscal austerity, the need for such evidence is pressing.

In this paper we assess the impacts of the opening of Emergency Care Centers (*Unidades de Pronto Atendimento* henceforth UPA) in the state of Rio de Janeiro in Brazil, on hospital caseload, hospital performance, population-level health outcomes, and service diversion. UPAs are health care facilities that provide an intermediate layer of services within health systems, between primary and hospital care. They are, essentially, free-standing emergency rooms. Similar to walk-in centres in the UK, and urgent care centers and retail clinics in the US, UPAs are open 24/7 and are designed to take the burden off hospital emergency rooms (ER). Unlike the retail clinics in the US, however, they are universally available and free of charge. UPAs provide qualified and resolutive care for acute and chronic clinical conditions, first aid for surgical and trauma cases, and medical consultations on basic and medium complexity cases (Konder and O'Dwyer, 2016). Quoting the Health Secretary of the State of Rio de Janeiro (RJ), UPAs came to "provide quality health care to the neediest population, and to rescue them [...] from death in the queues of overcrowded hospital corridors".[1] The first UPA in RJ was opened in 2007 and, a decade later, 32% of municipalities in the state had received a unit. In 2016, UPAs delivered nearly 30 million ambulatory procedures, approximately 43% of all ambulatory procedures performed in ER facilities in the state (this includes general hospitals with emergency departments and UPAs).

The analysis proceeds in two steps. In the first leg of the analysis, the hospital is the unit of analysis, and treatment is defined as the opening of an UPA in the hospital catchment area. We geo-coded the location of every hospital and UPA, and obtained the exact date of opening of every UPA in RJ during 2005-2016. We then compared the evolution of outcomes between treated and untreated hospitals. In the second leg of the analysis, the city (municipality) is the unit of analysis, the event is the opening of the first UPA in the city, and we compare the evolution of outcomes between treated and untreated cities to study population-level impacts. In both cases, we track outcomes for eight quarters before and sixteen quarters after UPA opening. We estimate difference in difference event studies following de Chaisemartin and D'Haultfoeuille (2022) to obtain estimates that are consistent when treatment is staggered across units and treatment effects are heterogeneous. Identification relies upon the assumption that the timing of opening of an UPA is idiosyncratic. We provide tests of placebo coefficients to support this assumption. The remaining threat to identification is that, even if UPA opening is quasi-random, it may have coincided with other health policy changes. We assemble data on a range of health system changes and are able to undermine this concern.

[1] Op-Ed in O Globo, 03/26/2009.

The hospital outcomes we analyse include outpatient procedures, inpatient admissions and hospital deaths. Since UPAs were designed to treat conditions sensitive to both ambulatory and emergency care, we classify all admissions and deaths by whether or not they were amenable to ambulatory and emergency care. To do this we use administrative data on cause of admission or death, and follow the classifications provided in Alfradique et al. (2009) and Vashi et al. (2019). We investigate displacement by analysing data on the exact location of all deaths in a city across facilities, including hospitals, UPAs, the home and the street.

Our main findings are as follows. We first establish the extent to which UPA opening improved access to ER services. We estimate a decline in the median distance between residential census tracts and the nearest ER service of 27%, and that UPAs became the closest ER facility for 50% of the population once rollout of the policy was complete. We find that the opening of an UPA in the catchment area of a hospital is associated with a 20% decline in hospital outpatient procedures. Turning to inpatient admissions, we identify a 30% decline in hospital admissions for cases amenable to ambulatory care (e.g. gastroenteritis), and a further 21% decline for conditions amenable to both ambulatory and emergency care (e.g. asthma). Together these conditions account for 25% of all hospital inpatient admissions, an indication of the size of the hospital caseload that can be shifted away from hospitals. These results suggest that UPAs fulfilled their purpose of taking the pressure off hospitals. We find, in line with some existing studies for the US (cited below) that UPA-opening led to a decline in the burden on hospital outpatient services, including ER. We additionally find that UPA-opening reduced inpatient admissions. So as to investigate if this improved hospital performance, we analysed hospital inpatient deaths.

We find that UPA opening is associated with a decline in the inpatient death rate of 1.5 percentage points for conditions not amenable to either ambulatory or emergency care (e.g. cancer), conditions which account for half of all hospital inpatient cases. These are conditions typically not treatable in UPAs, in line with which there was no decline in hospital admissions of patients with these conditions. Thus this result is consistent with hospitals being able to direct the resources saved on account of having fewer outpatients and fewer admissions for ambulatory care towards saving lives for patients that genuinely required hospital care.

To illuminate this conjecture, we analysed changes in the allocation of hospital resources following UPA opening. We find a decrease in the number of hospital beds, and no change in the bed occupancy rate. This is consistent with substantial resource savings given the considerable costs of maintaining hospital bed capacity (Keeler and Ying, 1996). We also see an increase in human and capital resources dedicated to inpatient services.

Even if UPA opening was successful in reducing hospital caseload and death rates, the ultimate policy target is to improve population health. We assess this using city-level vital statistics which, in Brazil, provide population level death counts identified by cause and by location of death. These data confirm a substantial decline in deaths in hospitals but they reveal that this is, on average, offset by deaths in UPAs. Deaths in hospital fall by 17.9 per 100,000 people once a city has an UPA, but the number of deaths in UPAs increases by 13.5. Accounting also for deaths at home, on the street and so on, UPAs are associated with a meaningful net decline of 7 deaths per 100,000 people, albeit this is not statistically significant. What is notable, however, is that deaths from causes that are not amenable to ambulatory or emergency care account for 80% of the population-level decline in deaths. This is the category for which we documented a decline in the hospital death rate. This demonstrates the potential for facilities like UPA to improve population health by allowing hospitals to focus their resources on treating the more complex conditions that require hospital care.

We address the concern that a decline in hospital deaths could reflect endogenous selection by examining the profile of inpatient cases by patient characteristics. We find no systematic evidence of selection on age, gender and, importantly, socioeconomic status. Any selection on unobservables is likely to be negative as individuals experiencing a severe or urgent need for care are likely to go direct to hospital. If they go to an UPA, the UPA has a triage system designed to direct severe cases to hospitals. If there is negative selection into hospital, then our estimates of improvements in hospital outcomes are conservative.

Estimates of dynamic effects of UPA opening confirm that the identified effects at both the hospital and the city level tend to persist through the four years for which we track outcomes. Placebo tests support the identifying assumption that the timing of UPA opening was quasi-random. We consistently control for unit (hospital or city) and quarter fixed effects. The estimates are robust to adding city-time varying controls including GDP, other health system variables, to city-quarter fixed effects in the hospital analysis and health region-quarter fixed effects in the city analysis, and to running conventional two-way fixed effects regressions. We also demonstrate robustness to using alternative definitions of the hospital catchment area, leaving out hospitals with inadequate data, and to dropping the capital city of Rio de Janeiro which is more population dense than the rest of the state.

So as to increase our confidence that the results we identify flow directly from access to UPAs rather than from coincident policy events, we tested whether the introduction of UPAs was associated with changes in local health systems. We observe no significant changes in primary care coverage and provision, and no change in access to ambulance services. We also observe no significant association of UPAs with the opening or closure of hospitals.

Our contribution to the literature is that we not only analyse the impacts of creating new medium-complexity emergency care facilities outside hospitals on hospital outpatient procedures, admissions and mortality, but also additionally study impacts on population-level mortality, thus identifying displacement. The available evidence is overwhelmingly from multiple-payer managed care settings, particularly from the US, where demand is often constrained by private insurance schemes. We provide evidence from a public system similar to the UK national health service where health care is fully subsidized by the state and services are free of charge at the point of access. The available evidence base is small and draws primarily on the US experience, and there is scarcely any evidence from developing countries where hospital capacity constraints are increasingly severe.

Possibly the closest related studies are Alexander et al. (2019), Hollingsworth (2014) and Allen et al. (2021), who find that retail clinics in the US lead to fewer hospital emergency room (ER) visits. Alexander et al. (2019), for instance, find that people residing close to a retail clinic are between 4% and 12% less likely to use a hospital ER for preventable minor acute conditions. We similarly estimate an 20% decline in outpatient procedures (which include ER). We additionally investigate hospital admissions, deaths, and hospital resource allocation, and look at the full death register to identify the extent of displacement of deaths from hospitals to UPAs. The two settings are not strictly comparable: while retail clinics in the US cover only specified conditions and are not integrated with the hospital system, UPA are equipped to deal with a more comprehensive set of conditions and are part of the national public health system, allowing any citizen to walk in at no charge for any condition they deem fit. It therefore becomes relevant to understand how patient admissions and deaths are re-assigned between UPA and hospitals.

Some recent studies analyse the problem in reverse, examining the closure of ER departments and hospitals, which limits timely access. Avdic (2016) for Sweden and Hsia and Shen (2019) and Gujral and Basu (2019) for the US show that ER/hospital closure led to a sharp increase in CVD deaths. We similarly find that UPA opening led to a decrease in deaths from cardiovascular causes. Also related are studies analysing short term fluctuations in hospital demand (Sharma and Stano, 2008; Schwierz et al., 2012; Johar et al., 2013), but we look at the effects of a structural policy change in demand.

Following a major investment in universal and free primary health coverage (Rocha and Soares, 2010), Brazil has more recently recognized the relevance of providing emergency care. Our results are directly relevant to policy in Brazil as the RJ experience has since been extended to other states. Brazil also offers a potential model to other developing countries. The provision of timely treatment of life-threatening emergencies has not been a priority for health systems in most developing countries (Razzak and Kellermann, 2002). Yet a significant burden of disease in developing countries is caused by time-sensitive illnesses and injuries, such as severe infections, hypoxia caused by respiratory infections, dehydration caused by diarrhea, intentional and unintentional injuries, postpartum bleeding, and acute myocardial infarction (Razzak and Kellermann, 2002).

Our results are also relevant for richer countries where time-sensitive conditions including sepsis, stroke, asthma/chronic obstructive pulmonary disease (COPD) and acute myocardial infarction (AMI) loom large (Gujral and Basu, 2019). Primary care is often inadequate and this leads to unnecessary use of ER facilities (Cowling et al., 2013). Inpatient admissions are often excessive (WHO, 2010; Currie and Slusky, 2020). Yet, even as ER demand indicated by the number of ER visits increased between 1998 and 2008, the number of hospital-based ER in the United States declined (Hsia et al., 2011). Similarly, in Sweden, the 1990s economic crisis triggered hospital closures, increasing distance to ER (Avdic, 2016). In the UK, ER waiting times are a key electoral statistic and performance targets are widely discussed in the media. Recognizing that not all acute conditions need specialist clinicians or hospitalization (Currie and Slusky, 2020), many countries are experimenting with providing ER services outside hospitals. Retail clinics first appeared in the US in 2000 and have since grown rapidly, with over 2,000 clinics operating in 41 states and Washington D.C. in 2015 (NCSL, 2016). Publicly funded walk-in centres opened in the UK, also in the year 2000 (Torjesen, 2013) but they are thought to have been poorly integrated with the pre-existing health infrastructure and to have created additional demand rather than met unmet demand. As a result, a third of these facilities have suffered closure, albeit in the absence of any large-scale scientific evaluation. This highlights that in most countries, including the UK, it is difficult to find the wealth of administrative data that Brazil allows us to bring to the problem.

The paper is structured as follows. Section 2 describes the institutional background. Section 3 describes the data and Section 4 outlines our empirical strategy. Section 5 presents the effects of the opening of UPAs on hospital-level outcomes, while Section 6 describes the impacts on population outcomes at the city level. In Section 7 we discuss impacts on resource allocation within hospitals and further effects on health systems. We present further robustness checks in Section 8. We discuss costing in Section 9. Section 10 concludes.

2 Institutional Background

2.1 The Brazilian Health System

In 1988 Brazil established universal, egalitarian, and integral access to health care as a constitutional right. In the following years, infra-constitutional legislation introduced the Unified Health System (*Sistema Único de Saúde*, SUS). The system follows a single-payer social insurance model of financing of health care, funded by taxes. It delivers free-of-charge services at the point of access through public or private-accredited providers.

SUS has successfully expanded access to health services throughout the country, improved health outcomes, and reduced health inequalities (Castro et al., 2019; Bhalotra et al., 2019). The new system expanded along with scale-up of the Brazilian Family Health Program (FHP), the primary care arm of SUS. There was a shift in the provision of health care from large public hospitals towards a decentralized model in which primary care teams are responsible for the delivery of preventive and basic health care at the community level (Rocha and Soares, 2010). Despite constitutional commitments, inequalities in access to health care persist, with many populations underserved and many layers of the system strained by coverage, quality and coordination issues. One manifestation of the latter is the overcrowding of hospitals, with patients resorting to hospital emergency departments for simpler conditions and unmet demand for other health or social assistance services (Bittencourt and Hortale, 2009). This was acknowledged by the federal government in the early 2000s as particularly disruptive for urgent care and emergency services (Brasil, 2002).

In order to lower the pressure on hospitals and overcome dissatisfaction with the fragmented and scarce provision of urgent care and emergency services in SUS, in 2003 the federal government enacted the National Policy for Urgent Care (*Política Nacional de Atenção à Urgências*, PNAU).[2] The PNAU reinforced previous regulatory attempts to expand and better coordinate urgent care and emergency services at the regional level (eg. Brasil, 2002). This led to introduction of new Emergency Care Units (*Unidades de Pronto Atendimento*, UPA24h). The guidelines for setting up these facilities were regulated in 2008 by the federal government, one year after the first units opened in the State of Rio de Janeiro (RJ).

2.2 UPA 24h: Institutional Setting and Program Roll-Out

The UPAs are pre-hospital fixed health care facilities aimed at occupying an intermediate layer of services within local health systems, inbetween the primary and the hospital care layers. UPAs are open 24/7. They have X-ray facilities, electrocardiography, simple laboratory for clinical examinations and observation beds. They should accept all cases, but are equipped to handle conditions of basic to intermediate complexity and are particularly designed to provide: i) qualified and resolutive care for acute or chronic clinical conditions; ii) first aid to surgical and trauma cases, and; iii) medical consultations for cases of lower severity (Konder and O'Dwyer, 2016).

The scale of physical and human resources available to UPAs varies with expected demand and location.[3] Administratively UPAs are public facilities, the operation of which is the responsibility of

[2]See Ordinance No. 1863/2003, which established the PNAU.

[3]Smaller facilities may occupy an area of 700m^2, have at least 2 doctors per shift and 7 beds, and are expected to cover an average of 150 visits per day. Larger facilities may occupy an area size greater than 1,300m^2, have at least 6 doctors and 15 beds, and are expected to cover more than 350 visits per day. These parameters have changed over time, but in general

municipalities or states. Costs are partially covered by the federal government, on a monthly basis according to the size and infrastructure of the facility, to complement funds from municipalities and states.[4]

In the Brazilian public health system, facilities do not compete over funding or patients in order to keep case volumes high. In this sense, UPAs are not expected to compete with hospitals for patients and, as shown in Section 7, we do not observe crowding out of physical or human resources in hospitals after the introduction of UPAs.[5]

Upon arrival at an UPA, patients undergo a triage process in which they are classified according to risk bands, and the severe cases are treated first or referred to the hospital system. Some patients might be kept under clinical observation for up to 24 hours for diagnostic elucidation or clinical stabilization, and referred afterwards to a hospital if the case is not solved (O'Dwyer et al., 2013). UPAs are also meant to fit the network of urgent care and emergency services in a coordinated way by acting as a rearguard for the stabilization of patients rescued by public ambulances.[6] In that sense, UPAs are expected to absorb part of the demand for ambulatory services and cases of basic to intermediate complexity. In doing this, they are expected to contain unnecessary pressure on hospital emergency departments.

There is little systematic evidence on the profile of services being delivered at UPAs in general, and in comparison to hospital emergency departments in particular. We rely on administrative data for RJ to characterize service production. Appendix Table A.1 shows the total number and the distribution of ambulatory procedures performed in hospital emergency departments, in 2006 and 2016, which are the year before the first UPA was created in RJ and the last year in our period of analysis, respectively. We also show all ambulatory procedures performed in UPAs for 2016. We observe in columns 4 and 5 that UPAs have delivered more clinical procedures than hospitals (79.4% against 47.4%), in particular related to doctor appointments, nursing care and emergency consultations. On the other hand, hospitals perform more diagnostic procedures than UPAs (34.9% *versus* 20.0%), and provide a wider range of ambulatory procedures, including surgical and more specialized services. Still, UPAs cover a substantial number of diagnostic procedures and other services that are typically also delivered by hospitals. In 2016, UPAs delivered approximately 42.9% of all ambulatory procedures performed in RJ if we consider the total number of procedures in UPAs and in hospitals with emergency departments.

The State of Rio de Janeiro was a forerunner in the introduction of UPAs. A possible reason is that, in the mid-2000s, it had among the lowest primary care coverage among all capitals of Brazil, hospital capacity was under continuous stress and emergency departments were overloaded (Sousa and Hamann, 2009; Bittencourt and Hortale, 2009).By 2016, when our period of analysis ends, there were 459 UPAs operating in Brazil, 68 of which in RJ. Figure 1a shows the rapid increase in the number of UPAs in the state, reaching nearly 50 units in 2010, and then stabilizing just below 70 units from 2014 onwards. The share of cities with at least one UPA increased fast as well, reaching 32% in 2016, com-

correlate with expected demand. More recently, for instance, Ordinance No. 10/2017 established eight size categories.

[4]Their operation has been increasingly delegated to Social Organizations (OS), which are private non-profit entities that are contracted to receive funds and run the facility, managing its physical and human resources.

[5]In Section 9 we assess the overall costs of UPAs in comparison with hospital and primary care spending.

[6]More specifically, by the *Serviço de Atendimento Móvel de Urgência* (SAMU), which is a network of ambulance services connected to call centers, available upon the 192 phone hotline.

pared with 6% in the rest of the country.[7] Appendix Table A.1 shows that, in 2016, UPAs delivered approximately 30 million ambulatory procedures in RJ.

3 Data

This section first describes the data sources, samples, and variables used in our analysis. Then, it discusses how we defined and interpreted conditions amenable to ambulatory and emergency care. Appendix D provides more details.

We focus on the state of RJ for two reasons. First, as discussed, RJ was a forerunner in the introduction of UPAs and served as a model for the rest of the country. The number of units increased rapidly, across many cities, providing useful variation in a relatively homogeneous setting. Second, by focusing on a specific state, we are able to accurately geocode facilities and health services, and acquire comprehensive data on facilities, procedures, and outcomes. We draw upon numerous data sources to create balanced panels of quarterly data at the hospital and city level over the 2005Q1 throughout the 2016Q4 period.

3.1 Hospital-Level Indicators

We generated longitudinal data on hospitals and UPAs by linking four administrative data sets publicly available from the Brazilian Ministry of Health (MS/Datasus). First, we used the National Register of Health Establishments (CNES), an information system containing all health facilities, their location, the type of services provided, and human and physical resources available from 2005 onwards. This database allowed us to identify and precisely geocode the location of all 68 UPAs that opened in our sample period, and all 114 hospitals with an emergency room (ER) in RJ. It also allowed us to identify the exact date of opening of each UPA.

We obtained data on all hospital admissions covered by the public health system (SUS), both in public facilities and private hospitals accredited by the government from the National System of Information on Hospitalizations (SIH). These data provide information on patient age, gender, cause of hospitalization (ICD-10), final outcome (discharge or death), municipality and zipcode of residence, the date of hospital admission, and the code of the health facility in which the admission occurred. Every hospital admission and death was classified following Alfradique et al. (2009) and Vashi et al. (2019), who categorize conditions as amenable to ambulatory and emergency care, respectively. Section 3.3 provides details on these two groups of conditions and on how they were defined in our setting.

Third, we also used data on all outpatient (ambulatory) care services funded by SUS from the National Ambulatory Information System (SIA). The data cover procedures related to diagnosis, observation, consultation, treatment, intervention, and rehabilitation services.[8] Data on mortality conditional on admission to inpatient services was drawn from hospital registers (SIH). We complement these data with population-level mortality from vital statistics collected by the National System of Mortality Records (SIM). SIM collects data on every death registered in Brazil and contains the deceased's age, gender, municipality of residence, cause of death (ICD-10), and location of death.

[7] Percentage obtained from CNES data.

[8] SIA provides microdata at the procedure level Many procedure codes have changed over time and it proved difficult to harmonize them. We therefore analyze totals and their subdivision as basic, medium, and high-complexity procedures.

The microdata from CNES, SIH, SIA, and SIM allowed us to compute resource and production indicators as well as health outcomes at the hospital-by-quarter level between 2005 and 2016. Appendix Table A.2 presents descriptive statistics for the baseline period between 2005Q1 and 2007Q1, just before the first UPA is inaugurated in RJ.

3.2 City-level Indicators

At the city level, our analysis focuses on data from the ambulatory system (SIA), the vital statistics records (SIM), and the Primary Care Information System (SIAB). We built a balanced panel of quarterly data covering all of the 92 cities of RJ from 2005 to 2016.

SIM allowed us to identify whether the death occurred at home, in the street or in health facilities including UPAs and hospitals. We use this information, together with ICD for cause of death to compute mortality rates by cause and location. SIA also gives us the exact health facility in which procedures were performed and permits the computation of procedures rates by location.[9]

We computed Family Health Program (FHP) coverage, primary care consultations, exams prescribed and measures of patients registered with data from the Ministry of Health (SIAB/MS). As for information related to other layers of the health system, we collected the presence of ambulance services (SAMU) on the Brazilian Open Data Portal[10] and tracked the opening and closure of hospitals using SIH and CNES.

Controls. Controls introduced in hospital and city-level analyses are: (i) city GDP per capita (Brazilian Institute of Geography and Statistics, IBGE); (ii) Bolsa Família transfers (former Ministry of Social Development, MDS); (iii) dummies indicating the political party of the incumbent mayor, and whether the mayor and the state governor were aligned in the same party for each period (Superior Electoral Court, TSE); (iv) a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. The share of the population covered by private health insurance (National Supplementary Health Agency, ANS) is also used as a control in robustness checks. These were all computed at the municipality-year level. Appendix Table A.3 presents summary statistics of all variables defined at the city level for the baseline period between 2005Q1 and 2007Q1.

3.3 Classification of Conditions Sensitive to Ambulatory and/or Emergency Care

We classify deaths and hospitalizations according to whether the condition is amenable to ambulatory and emergency care following Alfradique et al. (2009) and Vashi et al. (2019), respectively. We merged these two classifications and generated four categories that guide our analysis: (a) conditions amenable to both ambulatory and emergency care; (b) conditions sensitive only to ambulatory care; (c) conditions sensitive only to emergency care; (d) conditions that are not amenable to either ambulatory or emergency care. Figure D.1 illustrates these four categories and the percentage of hospitalizations associated with each of them in the baseline period (2005/Q1-2007/Q1). Figure D.2 depicts the four categories and the main conditions classified within each of them, considering hospitalizations also in the baseline period.

[9] Population data used to construct the mortality and procedure rates per capita at the city level come from the Brazilian Institute of Geography and Statistics (IBGE).

[10] More specifically on `http://dados.gov.br/dataset/samu_cobertura`.

Conditions amenable to both ambulatory and emergency care include acute complications from diabetes, bacterial pneumonia, stroke, asthma, and chronic obstructive pulmonary disease (COPD). These are cases that can be treated or prevented by ambulatory care but, if unattended, can lead to complications in which emergency care is needed. Conditions that are amenable to ambulatory care but are not emergent include infectious gastroenteritis, urinary tract infection, and congestive heart failure, among others. Conditions that are only amenable to emergency care include heart attacks, accidents, poisoning, and viral or unidentified pneumonia. These tend to be inevitable and severe conditions for which emergency care is needed.

Conditions that cannot be treated in an ER or prevented by access to ambulatory care (and hence are most suited to hospital care) includes, but are not limited to childbirth, cancer, digestive system diseases (diverticulitis, hernia, Crohn's disease, cirrhosis, and others) and diseases of veins and arteries (atherosclerosis, aneurysm, thrombophlebitis, varicose veins, and others).

4 Empirical Strategy

4.1 Conceptual Framework and Model

To investigate the impacts of UPA opening on hospital and municipality-level outcomes, we take advantage of the policy's staggered implementation across locations in a difference-in-differences strategy. As shown in Goodman-bacon et al. (2018), when the timing of treatment varies, the usual fixed effect estimator recovers a weighted average of all possible pairs of the underlying DiD estimator. Extending their work, de Chaisemartin and D'Haultfœuille (2020) demonstrate that when treatment effects are heterogeneous across time and units, some of these weights might be negative. We use the dynamic estimator proposed by de Chaisemartin and D'Haultfoeuille (2022), which provides unbiased estimates under treatment effect heterogeneity.

In our setting, the unit of observation g is either a general hospital with ER or a city observed in quarter t. We define $D_{g,t-\ell}$ as a treatment indicator that switches from 0 to 1 when an UPA is opened in period $t-\ell$ in the hospital or city unit. Our purpose is to identify the contemporaneous ($\ell = 0$) and dynamic ($\ell > 0$) average treatment effects across cells $(g, t-\ell)$ that sequentially received treatment such that $D_{g,t-\ell-1} = 0$ and $D_{g,t-\ell} = 1$ for any pair of consecutive time periods $t-\ell-1$ and $t-\ell$.

The de Chaisemartin and D'Haultfoeuille (2022) estimator uses groups whose treatment status is stable to infer the trends that would have affected switchers if their treatment had not changed. Formally, let A_g =min{t: $UPA_{gt} = 1$} be the quarter in which the hospital or city is treated by an UPA, and $A_g = \infty$ for the never treated. We compute the family $\hat{\tau}_\ell^{ATT} \geq 0$ of dynamic treatment effects, one corresponding to each distance $\ell \geq 0$:

$$\hat{\tau}_\ell^{\text{ATT}} = \sum_t^T \omega_{t,\ell} \left[\sum_{\{g:A_g=t-\ell\}} \frac{Y_{g,t} - Y_{g,t-\ell-1}}{\#\{g : A_g = t-\ell\}} - \sum_{\{g:A_g>t\}} \frac{Y_{g,t} - Y_{g,t-\ell-1}}{\#\{g : A_g > t\}} \right] \quad (1)$$

where the term $Y_{g,t}$ refers to a hospital or city outcome, and $w_{t,\ell}$ are weights capturing the relative size of the group of hospital or cities treated by an UPA in each panel quarter t for a fixed ℓ.[11] Notice that

[11] With the exception of mortality conditional on admission, occupation and average hours worked, we apply the inverse hyperbolic sine to all hospital outcomes, so the coefficients are interpreted as (approximate) fractional changes. The city

the term in brackets is simply a DiD estimator comparing outcome evolution from period $t-\ell-1$ to t in groups that become treated in $t-\ell$ (first difference) and in groups that are still untreated at t (second difference).[12] The period of analysis runs from two years previous to treatment to four years after, on a quarterly basis. We will report in tables the averages of the dynamic estimates $\widehat{\tau}_{\ell}^{ATT}$ computed over the quarters after treatment as well as average placebo estimates for the quarters before, and event-study plots covering the entire period.

A generalization of equation 1 allows for the inclusion of covariates. We add hospital or city fixed effects to control for unobservables that vary across establishments/location but are fixed over time, for example, climate, geography and initial health infrastructure. Quarter fixed effects adjust for determinants that are constant across hospitals or cities but vary over time, including seasonality in disease, or political cycles. We account for other potential confounders by including unit-time varying controls. We add the city gross domestic product per capita, Bolsa Família coverage, an indicator for cities that suffered from heavy rains and the collapse of hills in 2011, dummies for the political parties in government in each city, and a dummy indicating alignment between city and state parties in each period. The latter dummy should absorb potentially confounding effects arising from other policies determined by political alignment.

We also include non-parametric city-specific time trends in the hospital analysis (fixed-effects for each combination of city and quarter), and health region specific time trends in the city level analysis (fixed-effects for each combination of health region and quarter).[13] These are potentially relevant since many health policies in Brazil are determined at the city or health region levels. Standard errors are clustered at the hospital or city level, accounting for the possibility of serially correlated and heteroscedastic errors, and are computed using a bootstrap procedure in 150 replications.[14]

Equation 1 allows one to consider outcome trends in not-yet-treated and never-treated hospitals or cities as a counterfactual for the trends that we would have seen in treated groups if they had not started receiving the treatment. Under a parallel trends assumption, $\widehat{\tau}_{\ell}^{ATT}$ is an unbiased estimator of the average treatment effect among switchers, at the time they switch. Our finding that the estimates are robust to the inclusion of covariates and trends mitigates the concern that our results are driven by differential trends across switchers and non-switchers. We also rely on placebo estimators defined by de Chaisemartin and D'Haultfoeuille (2022) to directly assess the plausibility of the underlying parallel trends assumption. Their test for pre-trends differs from the standard event study pre-trends test (Autor, 2003), which has been shown to be invalid when treatment effects are heterogeneous (Sun and Abraham, 2021). Once we establish in this way that the timing of UPA opening is quasi-random, the main threat to identification in our design is the possibility of competing time-varying events that may be correlated with UPAs and the outcomes. We consider relevant health system variables. We test whether these are orthogonal to UPA opening, and whether controlling for them modifies the UPA coefficient.

outcomes are measured in per capita rates.

[12] The first and second DiD terms are assumed to be 0 if $\#\{g : A_g = t-\ell\} = 0$ or $\{g : A_g > t\} = 0$.

[13] The provision of public health care in RJ is organized in nine health regions.

[14] In the hospital-level analysis, more specifically, we cluster errors of hospitals that are close to each other. Close hospitals are defined as the ones whose distance is smaller than one kilometer, which is the 25th percentile of the distribution of distances between hospitals.

4.2 Hospital Catchment Area

In the hospital-level analysis treatment is defined as whether the hospital experiences the opening of an UPA in its catchment area, i.e., the geographic region and population from which the establishment draws its patients. A good specification of hospital catchment area will capture a substantial part of the facility's patient activity and exclude areas whose contribution adds random variation (DC and Wang, 2015; Gilmour, 2010). Although perceived quality of care and waiting times do matter (Capps et al., 2003; Gowrisankaran et al., 2015; Ho, 2006; Raval et al., 2017), a dominant feature in patient choice of hospital is distance to closest facility, especially for ER. Gowrisankaran et al. (2015), for example, find that a five-minute increase in travel time to a hospital reduces demand in a range between 17% and 41% in the US. Thus it is common to define hospital catchment area based on distance and travel time.[15]

We define hospital catchment area based on circles of distance to its exact location in latitude and longitude. This approach has been used to reflect competition among health providers within an area since catchments overlap (Cooper et al., 2018). Our benchmark definition relies on a fixed radius of 4.5 kilometers, as this threshold reflects the median distance traveled by patients to the nearest emergency department before the introduction of the first UPA in RJ, but we examine robustness to varying this distance in Section 8. We geocoded the location of all hospitals with emergency services, and all UPA from 2005 to 2016, to calculate the median distance to the closest facility from each census tract, weighted by population size. To measure the routes (in kilometers) we used HERE maps.[16] Hospitals that opened and closed were taken into consideration. Appendix Section D provides further details. Figure 2 shows the 4.5km catchment area for each hospital in our sample, together with the location of UPAs, which may fall inside it or not. Figure 1b displays the evolution of the share of hospitals that received an UPA in their catchment areas, reaching 45% in 2016.

5 Results: Access to Emergency Services and Hospital Outcomes

5.1 Access to Emergency Health Services

Using the geocoded location of all UPAs and hospitals with emergency services, which we jointly refer to as ER, we calculated the mean and the median distance to the closest facility from each census tract, weighted by population size at the city-level. We estimate distance both in kilometers and in minutes, the latter estimated as travel time by car at midnight, when there is limited traffic.

We find that the opening of UPAs substantially improved access to emergency care in RJ, see Figures 3a and 3b. Figure 3c shows that, on average, UPAs became the closest ER facility for 50% of the population after the roll-out of the policy is complete. We provide these estimates separately for the city of Rio de Janeiro, which experienced the opening of 30 UPAs during the period of analysis and is the largest city in RJ. In line with this, we see larger impacts of UPAs on access to ER services in Rio city.

Table 1 displays OLS estimates of a regression of distance to an ER on a dummy indicating the presence of an UPA in a city. We use quarterly data at the city level for 2005-2016. Conditional upon city and quarter fixed-effects (column 3), the opening of an UPA is estimated to result in a decline in median distance to an ER of 2.1 km. Relative to the baseline mean of 7.7 km, this is a considerable

[15] DC and Wang (2015) review methods used to estimate catchment areas.

[16] Link: https://www.here.com/

decline of 27.3%. It corresponds to a decline in median time to the nearest ER of 3.3 minutes relative to a baseline mean of 14.4 minutes, which is 23%. The share of the population for whom the closest ER is an UPA increases, on average, to 35%.

5.2 Outpatient Procedures and Admissions

We now examine the effects of UPAs on outpatient procedures and inpatient admissions to test whether, consistent with policy intention, the opening of an UPA in the catchment area of a hospital lowers its caseload. Table 2 displays estimates of equation 1 conditional on a sequence of controls: hospital and quarter fixed-effects (column 1), time-varying controls (column 2), municipality-specific non-parametric trends (column 3), and all of them together (column 4). Unless otherwise specified, we henceforth discuss the richest specification. The opening of an UPA is associated with a decline of 20% in the number of outpatient procedures. This decline stems from a reduction in procedures of medium complexity, and it persists over time (see Figure 4a). Medium complexity cases constitute about 70% of all outpatient cases.

To verify that the decline in hospital outpatient procedures was picked up by UPAs, we use data on the number of ambulatory procedures per capita delivered by type of facility, and aggregated at the city-by-quarter level. Table A.4 displays estimates based on equation 1 with the richest set of controls. While the number of outpatient procedures per capita at hospitals declines by 0.31, the number at UPAs increases by 0.39. And this again is driven by medium complexity procedures, for which we see a 0.30 reduction in hospitals followed by an increase of 0.26 in UPAs. This is direct evidence of substitution, or that UPAs stepped in to share the hospital caseload. High complexity procedures (a small share of all procedures) remain channeled toward hospitals, low complexity procedures largely do not switch to hospitals, and UPAs take medium-complexity cases from hospitals.

The second panel of Table 2 shows a tendency for the total number of hospital admissions to decline, but the estimates are imprecise. However, once we break this down by causes of admission, we see a large and statistically significant decline of approximately 30% in admissions for causes amenable to ambulatory care only, with a further reduction of 21% for causes amenable to both ambulatory and emergency care. In contrast, admissions for cases that are not readily treated by ambulatory or emergency care show no change, consistent with these cases being the mainstay of hospital care. The table shows baseline caseload shares, revealing that these cases account for about 50% of all admissions.[17]

Flexible coefficient plots are displayed in Figures 4 and 5. In every case pre-trends for treated *versus* control hospitals are not significantly different through eight quarters previous to the opening of an UPA. The estimated declines persist through sixteen quarters after the UPA is opened. These results are stable across different specifications.

5.3 Patient Profile and Selection into Hospital

In the next section, we will examine whether the documented decline in outpatient and inpatient services and the consequent fall in hospital crowding led to improvements in hospital performance.

[17] An alternative classification of cases is also in line with this. We find that the decline in hospital admissions post-UPA is driven by clinical as opposed to surgical or other cases (results can be seen in Table A.7).

However any change in hospital performance may reflect endogenous selection. In particular, UPA opening may have changed the risk profile of patients attending hospitals. We examine compositional change using information on the age, gender, and income of patients (see Table 3, and Appendix Figure B.1 for the corresponding coefficient plots).[18] We see no meaningful or statistically significant changes across the board.

It remains possible that there is selection on severity of the condition and that this is not picked up by demographics and income. However, the direction of selection is likely to be negative for two reasons. First, individuals experiencing a severe or urgent need for care are eventually more likely to go direct to hospital, without stopping at an UPA, even if the UPA is closer. Second, UPAs have a triage system in place that is designed to direct severe or more complex cases to hospitals. For both reasons, after an UPA become available, hospitals should get the more severe cases. In this case, our estimates of improvements in hospital outcomes will be conservative.[19]

5.4 Hospital Deaths and Hospital Performance

The lower panel of Table 2, column 4, shows that total deaths in hospital decline by 21% after the opening of an UPA. This includes outpatient (with emergency room cases) and inpatient deaths. The decline in the death count occurs for all four categories of admission-causes and the event study style plots in Figures 4c and 6 show no pre-trends.

To account for the decrease in admissions and better assess performance, we now look at inpatient deaths normalized upon inpatient admissions (see Table 4). The inpatient death rate declines (by 1.5 percentage points) only for causes not amenable to either ambulatory or emergency care. This is the category that saw no decline in admissions, which suggests that reducing admissions for cases that do not need hospital care allowed hospitals to operate more effectively to reduce deaths for cases that did need hospital care. We will show evidence consistent with this in Section 7, in particular an increase in hospital resources dedicated to inpatient care. In addition, we assessed the death rate in the 24 hours following admission as a crude proxy for deaths of patients that are admitted in an emergency condition. This also shows a significant decline, of 0.54 percentage points (column 4). The companion coefficient plots are displayed in Figure 7.[20]

6 Results: Population-Level Health Outcomes

The hospital analysis revealed fewer outpatient procedures and inpatient admissions following the introduction of UPAs in hospital catchment areas. The cases that never arrived at hospital were largely administered by UPAs (as indicated by Table A.4). It is therefore relevant to investigate whether the deaths that did not occur in hospital were merely displaced, and occurred in UPA instead. Table 5 shows that UPA opening led to a not insubstantial 4% (7 point) decline in city-level

[18] The indicators are computed by averaging patients' socioeconomic characteristics at the hospital-by-quarter level. In particular, we compute average income by relying on the patient's zipcode of residence (available in SIH), which is matched to census-tract income per capita available from the 2010 Population Census.

[19] Medicine is not an exact science and there will be cases where neither the patient nor the UPA triage professional correctly understand the symptoms. For example, a patient may go to an UPA with abdominal or chest pains that they think represent digestive issues when in fact they are experiencing a heart attack. Similarly people often do not recognize that they have sepsis when they have a fever. In addition, some cases were going to result in fatalities no matter where they arrived.

[20] An alternative classification of cases is also in line with this: declines in deaths conditional upon hospitalization within 24h are primarily of cases in intensive care units, see Table A.7).

population mortality, albeit this is not statistically significant. The event-study plot in Figure 8 confirms this and supports our identification strategy insofar as it shows no evidence of differences in outcome trends before UPA-opening between cities that did and did not receive a UPA. When comparing the hospital level to the city-level results, it is relevant to note that hospital outcomes cover all hospitals in each city but that less than half of the hospitals in our data experienced the opening of an UPA in their catchment area.

So as to directly investigate displacement, we leveraged the fact that the vital statistics register in Brazil provides deaths by location. We assess the impacts of UPAs on deaths per 100,000 population at the city-quarter-location level in Table 6. We see compelling evidence of displacement here. At the city level, the number of deaths that occur in hospitals in general falls by 17.9 once the city has an UPA. However, the number of deaths in UPAs increases by 12.4.[21] So the net decline is 4.45 deaths per 100,000 inhabitants, which is 2.5% and represents a large share of the total reduction identified in Table 5. The results are sharp and clear in Figure 9, which also shows that the changes in hospital and UPA-located deaths are persistent through the four years for which we track outcomes.

The total population-level drop in mortality occurring inside hospitals comes mainly from conditions not sensitive to either ambulatory or emergency care: a marginally significant drop of 8.29 deaths per 100,000 inhabitants. This decline is not fully offset by the increase in UPA deaths of 3.85 deaths. The net decline of 5.59 deaths in this category represents 80% of the total net drop in deaths. The city level results are weak because not all hospitals are treated but the direction of these results is consistent with improvements in mortality emerging from hospitals treating better more complex conditions, as noted earlier in our hospital performance analysis.

Tables A.9 and A.10 also provide location-specific changes in death rates by specific cause, showing that the broad tendency for displacement is pervasive. It is important to note that this disaggregation challenges statistical power and should be interpreted cautiously. For nearly every cause, hospital deaths decline. Most of the increase in deaths outside hospitals occurs in UPAs. Since there were no deaths in UPAs before these units were created, we must emphasize that the figures for changes in the number of deaths in UPAs are necessarily positive, so column 3 on its own is only informative of the magnitudes and the distribution of UPA deaths by cause.

The only cause of death which shows a significant *net* decline, after adjusting for the increase in deaths in UPAs, is deaths from congestive heart failure. For this category, hospital deaths decline by 1.26, UPA deaths increase by 0.12 and so population level deaths decline by 1.44 deaths in 100,000. Relative to the baseline mean death rate of 2.62, this is a considerable 55% reduction. These results are in line with these deaths being sensitive to the speed with which medical care is accessible. The companion placebo and dynamic effects for congestive heart failure deaths rate are consistent and can be seen in Figure B.2.[22] The importance of policies that provide emergent care cannot be overstated given that cardiovascular disease is the leading global cause of death, causing 17.3 million deaths per year, expected to rise by 2030 to 23 million per year (WHO 2011), and it tends to be the most common

[21] The event study plot for deaths in other locations shows an initial blip which then reverts to the base level. Our informal conversations with local policymakers indicate that the initial blip might be a result of miscoding of facilities in the SIM and CNES registers in the first months after the creation of UPAs, as these were new units in the system records. If this is right, the transitory increase in deaths in other locations may be attributed to mortality in UPAs.

[22] Appendix Table A.11 shows estimates for cause-specific death rates by age, gender, race and education for the city-level population. We are underpowered but the first row shows that the population level decline in deaths favoured women and people with lower education. We also observe a tendency towards decline in every age group from 5 years and upward.

reason for hospitalization in OECD countries (Avdic, 2016).

7 Results: Hospital Resources and Local Health Systems

7.1 Reallocation of Hospital Resources

We now examine the impacts of the introduction of UPAs on hospital resources. Table 7 displays the richest specification from Table 2. The upper panel shows that there was no significant change in the number of health professionals at hospitals. Since UPAs were staffed with professionals, this implies an increase in professionals per capita, rather than a shift. We see a statistically significant increase in average hours worked by health professionals in inpatient services, alongside a decrease in hours worked in other activities, including administrative. Figure 10 shows that these changes are persistent. While, on its own, this re-assignment is not conclusive, it is consistent with the lower caseload in emergency departments releasing human resources and administrative overheads per patient and allowing medical staff to spend more time on inpatient care.

Turning to infrastructure, we see a significant decline in the number of hospital beds and an increase in hospital equipment. The decline in beds is driven by clinical and other cases, as opposed to surgical and intensive care beds. The increase in equipment implies more medical equipment per patient, reinforced by fewer admissions. Figures 11 and 12 provide coefficient plots for hospital beds and equipment, respectively. The bottom panel of Table 7 shows that occupancy rates increase, albeit these estimates are imprecise. Overall, these results suggest that there was an increase in both human and physical capital dedicated to hospital patients, specially related to inpatient services, which may have contributed to the observed decline in inpatient deaths.

7.2 Local Health Systems

We now examine whether the opening of UPAs affected primary care services and other layers of the health system. UPAs might have substituted or complemented basic healthcare services, impacted the opening/closure of hospitals, or changed access to ambulance services.

Table 8 and Figure B.3 display the results. The opening of an UPA does not lead to any statistically discernible change in primary care (FHP) coverage, routine and physician consultations, exams prescribed or diabetic patients registered and followed-up. It is also not associated with SAMU participation, which marks access to ambulance services, or with the probability of opening or closure of public hospitals.

8 Robustness Checks

We have already shown robustness of the point estimates to controls, and consistently found that we can reject pre-trends in the outcome variables. We now discuss a number of further specification checks, displayed in Appendix C. First, we investigate the concern that the capital city of Rio de Janeiro is driving the results for the state by dropping the 13 hospitals from Rio (in the hospital analysis) and the city of Rio (in the city analysis) from the state sample. Second, we check sensitivity of our estimates to varying the size of the catchment area from 4.5km (median distance) to 6.5km (mean distance). In another check, we exclude all hospitals with inadequate data in at least one dimension from our sample. Then, we include controls for health system variables: primary health care coverage, presence of ambulance services program, number of hospitals that opened, closed or had their ER expanded and private health insurance coverage. As these are potentially endogenous, we did not include these controls in the main analysis. Finally, we performed the conventional differences-and-differences analysis, using a two-way fixed effects regression. The robustness tests are provided for the hospital results (Tables C.1), the population-level results (Tables C.2 and C.3) and for the additional checks on health system changes (Table C.4). Overall, we observe statistically stable patterns.

9 UPA vs. Hospital Costs

We know from the volume-outcome literature that larger hospitals perform better because of learning by doing, scale effects and returns to specialization. So, a natural alternative to constructing UPAs might have been to expand existing hospitals. With the caveat that primary care facilities are not open 24/7, but acknowledging the burden on hospitals of cases amenable to ambulatory care, another alternative to UPAs might have been to strengthen primary care. In this section, we provide crude estimates of the costs of these alternatives that lend perspective to these policy choices.

We measured hospital costs using the System of Health Accounts (SHA) methodology developed by the OECD to enable international comparisons of health spending (**?**), which was recently adopted in Brazil. This provides public expenditures in each sphere of government, by type of care and provider. Information for 2014, the most recent detailed data available, indicates that total hospital expenses (under the government system SUS) were R$ 78.1 billion. In that same year, Brazil had a total of 349,512 hospital beds funded by SUS, which implies an expense of approximately R$223,583.17 per hospital bed.[23] To estimate how much RJ spent with its hospital system, we multiplied this ratio by the 28,982 SUS hospital beds available in the state and obtained a figure of R$ 6.5 billion. This assumes a constant spending per bed in the country, which is a strong assumption and most likely underestimates the spending per bed in RJ, since the state is one of the most urbanized and developed regions in Brazil. We therefore consider this number as a lower bound for hospital spending in the state. Informal conversations with hospital managers suggest that this figure could be five times higher and reach around R$ 1 million per bed per year. Thus, we obtain a second estimate based on the 2014 official Fiscal Transparency Bulletin from the Finance Secretary of Rio de Janeiro State, which reports the amount transferred to Social Organizations (OSSs), which manage some of the state hospitals and state UPAs.[24] According to that bulletin, R$1.15 billion was allocated to the management of 14 hospitals by OSSs. These establishments had 2,018 beds in 2014, leading to an average spending per bed of R$572,348.86. Multiplying this ratio by the 28,982 SUS hospital beds in the state, we obtain a much higher total spending of around R$ 16.6 billion. There is clearly considerable uncertainty in these estimates but they provide a benchmark.

To calculate the average cost of an UPA, we use the same 2014 official Fiscal Transparency Bulletin for RJ state. We observe that R$ 338.99 million were transferred to OSSs to manage 25 UPAs. This yields an average annual cost per UPA of R$ 13,559,825.28. Under the assumption that this average cost is the same for the 68 UPAs in operation by the end of 2014, this amounts to a total expenditure of R$ 922 million.

Finally, we estimate the total spending that would be needed to cover the whole population in RJ

[23] Data on beds obtained from CNES as of December/2014.

[24] Link: http://www.transparencia.rj.gov.br/transparencia/faces/sitios-transparencia-navigation/menu_sitios_analiseContas/BoletimTransparencia?_adf.ctrl-state=niazyas4g_1&_afrLoop=1363991001390663 7&_afrWindowMode=0&_afrWindowId=null

state with access to primary health services under the Family Health Program (FHP). We use the costs of a FHP team estimated by the Brazilian Institute of Applied Economic Research (IPEA) (**?**), which was R$ 40.755,25 per month in 2010. In 2014 reais, this amounts to R$625,189.68 per year. Second, according to the 2017 National Primary Care Policy (PNAB), the population covered by a FHP team should be between 2000 and 3500 people. Using the upper bound and considering that RJ had 16.46 million inhabitants in 2014, the state would need approximately 4,703 FHP teams to cover its entire population. Therefore, the total spending needed to universally supply primary care in the state would be approximately R$2.94 billion. Considering that FHP coverage was around 48% in 2014, to reach the entire population, an additional R$1.53 billion would be needed.

The estimates above imply that spending on UPAs in 2014 lies between 5.6% and 14.2% of total spending on hospitals, and it corresponds to around 60% of the additional investment that would be needed to obtain full primary care coverage in the state. Both estimates suggest that UPA creation incurs a significant cost. Although we found significant benefits from reduced hospital admissions and certain classes of cardiovascular deaths, it is important to reflect whether similar results could be obtained through a more cost-effective resource allocation.

10 Conclusion

We used uniquely rich data and techniques that leverage quasi-experimental variation to evaluate Brazil's recent experiment with provision of emergency and ambulatory care outside hospitals. We found a significant decline in outpatient (including emergency) care of medium-complexity at hospitals, which we show was absorbed by UPAs. We find a considerable (30%) decline in hospital admissions of cases amenable to ambulatory care. We also identified a decline in hospital deaths which, conditional upon admissions, is particularly of cases not amenable to either ambulatory or emergency care. Overall, UPAs succeeded in reducing over-crowding in hospital ER and inpatient departments. We show that this improved hospital performance. Hospital mortality fell, and we identify resource reassignment consistent with this. We find no evidence of selection of patients into hospital on observables, and we argue that any selection on unobservables is likely to be negative, making our results for hospital outcomes conservative.

Looking outside hospitals dims this positive picture. Using city-level administrative data on the location (and cause) of death, we identify evidence of a considerable degree of displacement of deaths from hospitals to UPAs. The population-level reduction in total deaths is smaller than the hospital-level reduction and it is imprecisely determined. This said, there is a considerable and statistically significant decrease in population-level deaths in hospitals and from conditions not amenable to either ambulatory or emergency care. Analysis of death causes reveals a significant net decline in mortality from congestive heart failure, a condition that UPAs are equipped to deal with.

Our results are topical for policymakers in Brazil, and relevant to contemporary debates on health care consolidation in other countries. In the US and other countries with unregulated health care markets, consolidation has been driven by competition leading to merger or exit of hospitals (**?**). In countries like Sweden with mainly publicly provided health, it has been driven by rapidly increasing medical costs and public budget deficits, along with general technological progress (Avdic, 2016). Consolidation has taken the shape of rural hospital closures and a corresponding growth in the size of urban hospitals.

A considerable literature in economics and medicine has investigated whether resource consolidation can improve health care quality by enhancing productivity (Luft et al., 1987; Hamilton and Ho, 1998). The results of these studies show that for the particular case of conditions that need emergency care, the effects of increasing distance to ER will tend to dominate any productivity gains. While potentially improving efficiency through scale, learning and specialization effects, such policies tend to reduce the distance to hospital services, which can adversely impact emergency health care. This creates a policy space for initiatives similar to the UPA. Our analysis underlines the importance of using administrative data that capture every case and the relevance of analysing not just hospital performance but also population-level health outcomes to allow for selection and displacement. With the caveat that the estimates are uncertain, we provide a crude analysis of the costs of UPAs relative to hospitals and primary care expansion, underlining the relevance of considering the most cost-effective way to improve population health outcomes.

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Main Tables

Table 1: Distance and Travel Time to Closer ER and % Population Closer UPA

	UPA			Mean at
	(1)	(2)	(3)	Baseline
Median Route (km)	-4.480***	-1.962***	-2.102**	7.73
	(0.805)	(0.661)	(0.852)	
Median Time (Min)	-6.108***	-3.423***	-3.320***	14.44
	(1.118)	(0.883)	(1.073)	
Mean Route (km)	-4.538***	-1.738***	-1.873**	9.17
	(0.751)	(0.592)	(0.772)	
Mean Time (Min)	-6.340***	-2.906***	-2.837***	16.46
	(1.055)	(0.753)	(0.952)	
% Population Closer to UPA	40.940***	43.650***	35.737***	0.00
	(4.081)	(3.973)	(4.373)	
Observations	4416	4416	4416	-
Munic FE	No	Yes	Yes	-
Time FE	No	No	Yes	-

Notes: This tables shows the results of regressing route and time measures (mean and median averaged at the municipality level) to the closest ER on the moment UPAs were introduced in each city. It also depicts the coefficients of a similar regression on the percentage of the population living closer to an UPA than to other ERs facilities. Municipality fixed effects were included in column (2) and quarter-year fixed effects in column (3). Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ. Routes are measured in kilometers and time in minutes. Standard errors clustered at the municipality level in all specifications. *** p<0.01, ** p<0.05, * p<0.1. We used HERE maps to calculate the distance/time from each census tract to the closest ER (weighted by population) by car at midnight.

Table 2: Hospital Demand and Total Mortality, Hospital-Level Estimates

	Specifications				Mean at
	(1)	(2)	(3)	(4)	Baseline
Ambulatory Procedures					
Total	-0.211***	-0.218**	-0.200***	-0.200***	109.82
	(0.072)	(0.085)	(0.073)	(0.072)	
Basic Health Care	0.213	0.256	0.275	0.275	38.36
	(0.363)	(0.319)	(0.348)	(0.360)	
Medium Complexity	-0.231***	-0.240**	-0.191*	-0.191*	68.98
	(0.084)	(0.111)	(0.098)	(0.104)	
High Complexity	0.449*	0.413	0.070	0.070	0.80
	(0.254)	(0.252)	(0.281)	(0.313)	
Hospital Admissions					
Total	-0.009	-0.016	-0.045	-0.045	768.05
	(0.056)	(0.064)	(0.058)	(0.068)	
Amenable to Ambulatory & Emergency Care	-0.170	-0.207	-0.212	-0.212	91.78
	(0.142)	(0.156)	(0.167)	(0.167)	
Amenable to Ambulatory Care Only	-0.297**	-0.317**	-0.297**	-0.297**	103.22
	(0.120)	(0.130)	(0.137)	(0.138)	
Amenable to Emergency Care Only	-0.033	-0.017	-0.074	-0.074	175.3
	(0.155)	(0.161)	(0.146)	(0.157)	
Non-Amenable to Ambulatory or Emergency Care	0.049	0.023	0.013	0.013	397.57
	(0.072)	(0.090)	(0.086)	(0.093)	
Total Deaths					
Total	-0.207***	-0.189**	-0.211***	-0.211***	172.59
	(0.076)	(0.078)	(0.075)	(0.073)	
Amenable to Ambulatory & Emergency Care	-0.300***	-0.312***	-0.292***	-0.292***	23.00
	(0.074)	(0.090)	(0.086)	(0.086)	
Amenable to Ambulatory Care Only	-0.164**	-0.130	-0.170*	-0.170**	29.28
	(0.082)	(0.088)	(0.090)	(0.076)	
Amenable to Emergency Care Only	-0.204***	-0.165**	-0.192**	-0.192***	50.17
	(0.076)	(0.082)	(0.076)	(0.058)	
Non-Amenable to Ambulatory or Emergency Care	-0.112	-0.125	-0.145	-0.145*	70.13
	(0.072)	(0.098)	(0.105)	(0.081)	
Hospital & Time FE	Yes	Yes	Yes	Yes	-
Controls	No	Yes	No	Yes	-
Trend	No	No	Yes	Yes	-

Notes: This table shows the weighted average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfoeuille (2022), giving to each estimator a weight proportional to the number of switchers. Controls introduced in columns (2) and (4) are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Municipality-specific time (quarter/year) trends were introduced in columns (3) and (4). Dependent variables are the IHS of hospitals' ambulatory procedures, hospital admissions and total deaths, so the coefficients are interpreted as (approximate) fractional changes. Sample is composed of 108 hospitals when analysing ambulatory procedures (SIA), 111 when looking at hospital admissions (SIH) and 114 when the outcome is hospitals' total deaths (SIM). We cluster the standard errors of hospitals that are close to each other (see Section 4 for details). ***p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in levels instead of IHS. The ambulatory procedures' baseline numbers are in thousands.

Table 3: UPA Effects on Inpatient Profile, Hospital-Level Estimates

	Average Income (R$) (1)	% Female (2)	Average Age (3)	% 0-4 Years (4)	% 5-14 Years (5)	% 15-24 Years (6)	% 25-44 Years (7)	% 45-64 Years (8)	% 65+ Years (9)	Avg. Age Mean at Baseline
Total	-3.885	-0.686	0.151	-0.064	-0.392	0.795	-0.496	-0.316	0.474	42.98
	(26.596)	(0.946)	(0.572)	(0.426)	(0.382)	(0.603)	(0.583)	(0.650)	(0.798)	
Amenable to Ambulatory/Emergency Care										
Amenable to Ambulatory & Emergency Care	-44.494	-0.673	0.061	0.614	0.112	-0.523	-0.091	-0.787	0.675	54.24
	(38.704)	(1.576)	(1.270)	(1.456)	(0.610)	(0.336)	(0.898)	(1.511)	(1.689)	
Amenable to Ambulatory Care Only	0.920	-1.290	0.434	-0.336	0.012	-0.276	-1.131	0.992	0.739	45.91
	(32.822)	(1.325)	(0.914)	(0.959)	(0.449)	(1.028)	(0.994)	(1.299)	(1.391)	
Amenable to Emergency Care Only	-17.563	-0.861	0.364	1.018	0.583	0.008	-3.569***	-0.478	2.438*	44.35
	(35.397)	(1.083)	(0.757)	(0.822)	(0.435)	(0.592)	(0.905)	(0.933)	(1.253)	
Non-Amenable to Ambulatory or Emergency Care	-2.986	-0.794	0.061	0.037	-0.890	1.136	-0.205	-0.030	-0.049	38.13
	(26.750)	(1.263)	(0.853)	(0.391)	(0.650)	(1.053)	(0.873)	(1.035)	(0.917)	
Hospital & Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Mean at Baseline	1166.01	55.24	42.98	8.6	5.23	13.81	24.18	23.95	24.23	-

Notes: This table shows the weighted average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfoeuille (2022), giving to each estimator a weight proportional to the number of switchers. Controls are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government, and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Municipality-specific time (quarter/year) trends were included. Dependent variables are related to inpatients' income gender and age. And they are displayed by causes amenable and non-amenable to Ambulatory and emergency care. Sample is composed of 111 hospitals. We cluster standard errors of hospitals that are close to each other (see Section 4 for details). *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and has the same metric as its corresponding variable. Average income was obtained by linking the patients zip-code to census tracts information in the 2010 Census.

Table 4: UPA Effects on Inpatient Outcomes, Hospital-Level Estimates

	Hospital Admissions	Inpatient Deaths	% Inpatient Deaths	%24h Inpatient Deaths	Hosp Adm Mean at
	(1)	(2)	(3)	(4)	Baseline
Total					
	-0.045	-0.224***	-0.845*	-0.363**	768.05
	(0.061)	(0.084)	(0.452)	(0.141)	
Amenable to Ambulatory/Emergency Care					
Amenable to Ambulatory & Emergency Care	-0.212	-0.247**	-0.323	-0.489	91.78
	(0.136)	(0.125)	(1.248)	(0.624)	
Amenable to Ambulatory Care Only	-0.297**	-0.317***	-0.833	-0.250	103.22
	(0.139)	(0.116)	(0.753)	(0.221)	
Amenable to Emergency Care Only	-0.074	-0.250**	-0.346	-0.514	175.3
	(0.134)	(0.116)	(0.920)	(0.323)	
Non-Amenable to Ambulatory or Emergency Care	0.013	-0.328***	-1.499**	-0.542**	397.57
	(0.085)	(0.098)	(0.656)	(0.247)	
Hospital & Time FE	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	-
Mean at Baseline	1144.52	93.1	8.62	1.5	-

Notes: This table shows the weighted average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfoeuille (2022), giving to each estimator a weight proportional to the number of switchers. Controls are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government, and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Municipality-specific time (quarter/year) trends were included. The first two dependent variables analysed are the IHS of admissions and inpatient deaths, so the coefficients are interpreted as (approximate) fractional changes. Note that column 1 repeats the information in the second panel (column 4) of Table 2. Then we have total inpatient deaths conditional on admissions and inpatient deaths that occurred within 24h also conditional on total admissions, both measured in percentages. Results are shown by causes amenable and non-amenable to ambulatory and emergency care. Sample is composed of 111 hospitals. We cluster standard errors of hospitals that are close to each other (see Section 4 for details). *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in levels instead of IHS.

Table 5: UPA Effects on Total Deaths per 100,000 Inhabitants, City-Level Estimates

	Treatment Effect				Mean at
	(1)	(2)	(3)	(4)	Baseline
UPA	-2.287 (3.039)	-2.256 (4.982)	-4.146 (4.039)	-7.023 (7.232)	176.63
Municipality & Time FE	Yes	Yes	Yes	Yes	-
Controls	No	Yes	No	Yes	-
Trend	No	No	Yes	Yes	-

Notes: This table shows the weighted average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfoeuille (2022), giving to each estimator a weight proportional to the number of switchers. Controls introduced in columns (2) and (4) are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government, and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Health region specific time (quarter/year) trends were introduced in columns (3) and (4). Dependent variable is deaths per 100,000 people. Sample is composed of 92 cities. Standard errors clustered at the city level in all specifications. *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in rates per 100,000 inhabitants.

Table 6: Deaths per 100,000 by Cause and Location
City-Level Estimates

		Location						
	Total (1)	Hospital (2)	UPA (3)	Other Health Facility (4)	Household (5)	Street (6)	Other (7)	Mean at Baseline
Total								
	-7.023	-17.942**	12.387***	0.152	-1.967	-1.037	1.107	176.63
	(7.061)	(8.380)	(2.903)	(1.719)	(2.354)	(1.466)	(2.076)	
Amenable to Ambulatory/Emergency Care								
Amenable to Ambulatory & Emergency Care	-1.475	-3.265	1.632***	0.082	-0.274	0.015	0.363	23.32
	(2.442)	(3.019)	(0.477)	(0.422)	(0.734)	(0.079)	(0.358)	
Amenable to Ambulatory Care Only	0.410	-2.823	2.610***	0.334	-0.363	0.099	0.452	27.2
	(2.546)	(2.784)	(0.717)	(0.635)	(1.095)	(0.250)	(0.551)	
Amenable to Emergency Care Only	-0.359	-3.561	4.294***	0.381	-0.759	-0.971	0.097	53.84
	(4.154)	(3.254)	(1.287)	(0.705)	(1.676)	(1.303)	(0.952)	
Non-Amenable to Ambulatory or Emergency Care	-5.599	-8.293*	3.851***	-0.645	-0.571	-0.180	0.195	72.26
	(4.542)	(4.363)	(1.128)	(0.790)	(1.548)	(0.425)	(0.879)	
City & Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Mean at Baseline	176.63	130.69	0	4.96	27.09	8.83	4.5	

Notes: This table shows the weighted average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfoeuille (2022), giving to each estimator a weight proportional to the number of switchers. Controls are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government, and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Health region specific time trends (quarter/year) were included. Dependent variables are the deaths per 100,000 people by causes and by six different locations: hospitals, UPAs, other health facilities, household, street, and other places. The city level results are not directly comparable with the hospital results shown earlier because the former include only hospital with an ER. Also the hospital analysis models impact of an UPA opening within 4.5km of the hospital whereas the city analysis involves an UPA opening anywhere in the city, so the "catchment" area is much broader. Sample is composed of 92 municipalities. Standard errors clustered at the city level in all specifications. *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in rates per 100,000 inhabitants.

Table 7: Human Resources, Infrastructure and Occupancy Measures, Hospital-Level Estimates

	Human Resources					
	No. Professionals (1)	No. Physicians (2)	No. Other Prof. (5)	Avg. Hrs Worked (6)	Avg Hrs Worked Inpatient (7)	Avg Hrs Worked Other (8)
UPA	-0.050	-0.030	-0.058	-1.819	1.213*	-3.032**
	(0.063)	(0.061)	(0.080)	(1.277)	(0.648)	(1.376)
Mean at Baseline	501.36	163.79	337.56	28.39	2.86	25.53
	Beds					
	Total Hosp Beds (9)	Surgical Hosp Beds (10)	Clinical Hosp Beds (11)	ICU Hosp Beds (12)	Other Hosp Beds (13)	Amb + Emerg Beds (14)
UPA	-0.069*	-0.023	-0.088	-0.077	-0.210***	-0.098
	(0.039)	(0.035)	(0.060)	(0.079)	(0.074)	(0.071)
Mean at Baseline	164.92	54.43	48.64	20.03	41.82	21.22
	Equipments					
	Total Equipments (15)	Diagnosis Equipments (16)	Graphics Methods (17)	Optical Methods (18)	Life Saving (19)	Other Equipments (20)
UPA	0.100**	0.015	0.105*	-0.033	0.082	0.167**
	(0.049)	(0.032)	(0.061)	(0.065)	(0.081)	(0.077)
Mean at Baseline	151.76	8.57	5.69	4.76	119.46	13.28
	Occupancy					
	Occupancy Rate (%) (21)	No. Days ≥ 85% Occup. (22)	No. Days ≥ 100% Occup. (23)	Bed Turnover Rate (24)	-	-
UPA	3.063	1.318	3.083	0.069		
	(2.854)	(3.269)	(2.058)	(0.115)	-	-
Mean at Baseline	55.69	13.34	3.28	2.8		
Hospital & Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Trend	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table shows the weighted average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfoeuille (2022), giving to each estimator a weight proportional to the number of switchers. Controls are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government, and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Municipality-specific time (quarter/year) trends were included. All variables are from CNES. Sample is composed of 114 hospitals. Average hours worked relate to all professionals in the establishment. Diagnosis equipment includes x-rays, mammographs, CT scanners, MRI, and ultrasound machines. Graphics method equipment comprises electrocardiographs and electroencephalographs. Optical methods incorporate endoscopes, laparoscopes, surgical microscopes, among others. Life-saving equipment involves defibrillators, ventilators, bag valve masks, among others. We used the IHS of all human resources, beds, and equipment variables, with the exception of the ones related to average hours worked, so results can be interpreted as (approximate) fractional changes. Occupancy rate, number of days hospital capacity is above 85%, number of days capacity is above 100% and bed turnover rate are constructed considering the total number of inpatient beds, the number of hospital admissions and their duration per quarter. We average the daily occupancy rate (number of inpatients divided by the number of beds) over each quarter. Bed turnover is the number of discharges (including deaths) divided by the number of beds in the hospital. We cluster standard errors of hospitals that are close to each other (see Section 4 for details). *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in levels instead of IHS

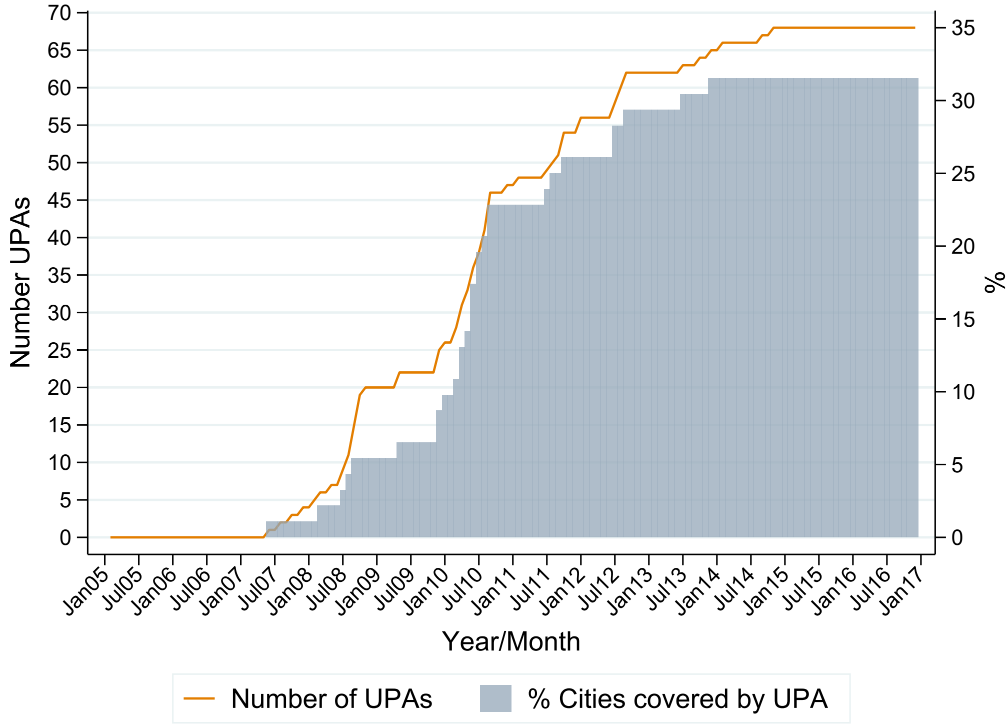
Table 8: UPA Effects on Local Health Systems

	Primary Care		
	% PSF Coverage (1)	Routine Consultations (2)	Physician Consultation (3)
UPA	-2.408	37.381	34.984
	(2.793)	(64.886)	(28.815)
Mean at Baseline	60.26	127.51	217.41
	Primary Care		
	Exams Prescribed (4)	Registered Diabetics (5)	% Diabetics Followed Up (6)
UPA	60.636	2.870	-1.025
	(100.944)	(9.397)	(1.572)
Mean at Baseline	83.94	63.14	94.47
	Other Health System Layers		
	Ambulance Program (7)	Net New Hospitals (8)	-
UPA	-0.003	-0.040	
	(0.017)	(0.104)	-
Mean at Baseline	0.20	0.00	
City & Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Trend	Yes	Yes	Yes

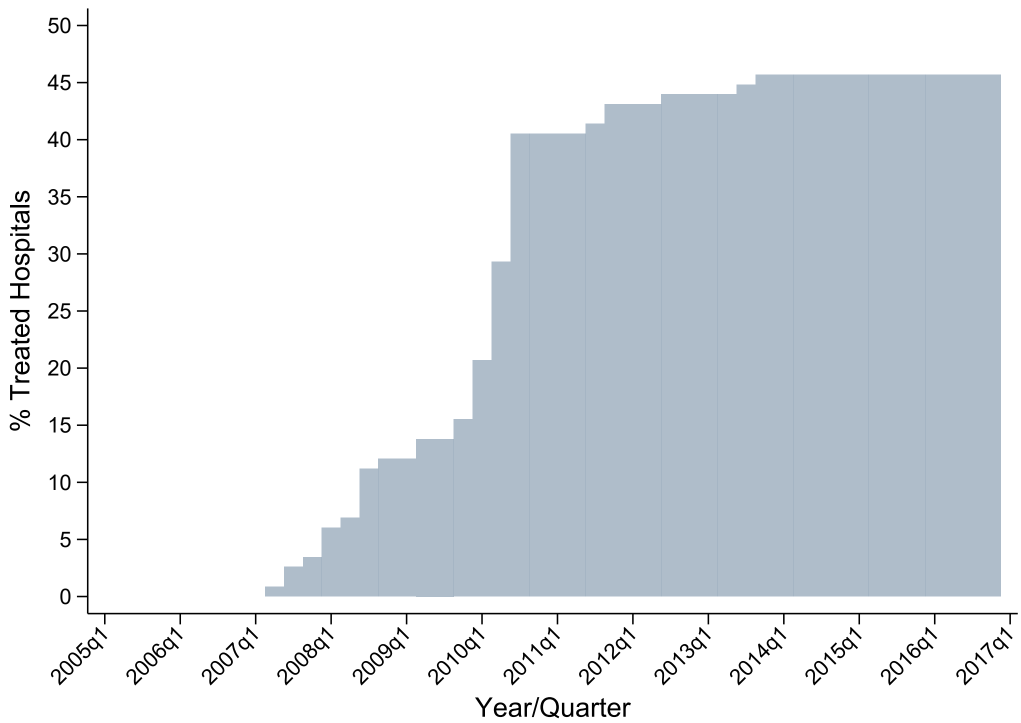
Notes: This table shows the weighted average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfoeuille (2022), giving to each estimator a weight proportional to the number of switchers. Controls are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains, and the collapse of hills in 2011. Health region specific time trends (quarter/year) were included. Dependent variables related to primary care sector are: (1) Family Health Program coverage; (2) routine consultations performed per 1,000 inhabitants; (3) consultations performed by physicians per 1,000 inhabitants; (4) exams prescribed per 1,000 inhabitants; (5) registered diabetics per 1,000 inhabitants; (6) percent of diabetics registered that are followed up. Dependent variables related to other health system layers: (7) presence of SAMU ambulatory program; (8) net number of new SUS general hospitals with ER (opened - closed). Sample is composed of 92 municipalities. Standard errors clustered at the city level in all specifications. *** p<0.01, ** p<0.05, *p<0.1.Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and has the same metric as the corresponding variable.

Main Figures

Figure 1: UPAs - RJ (2005-2016)



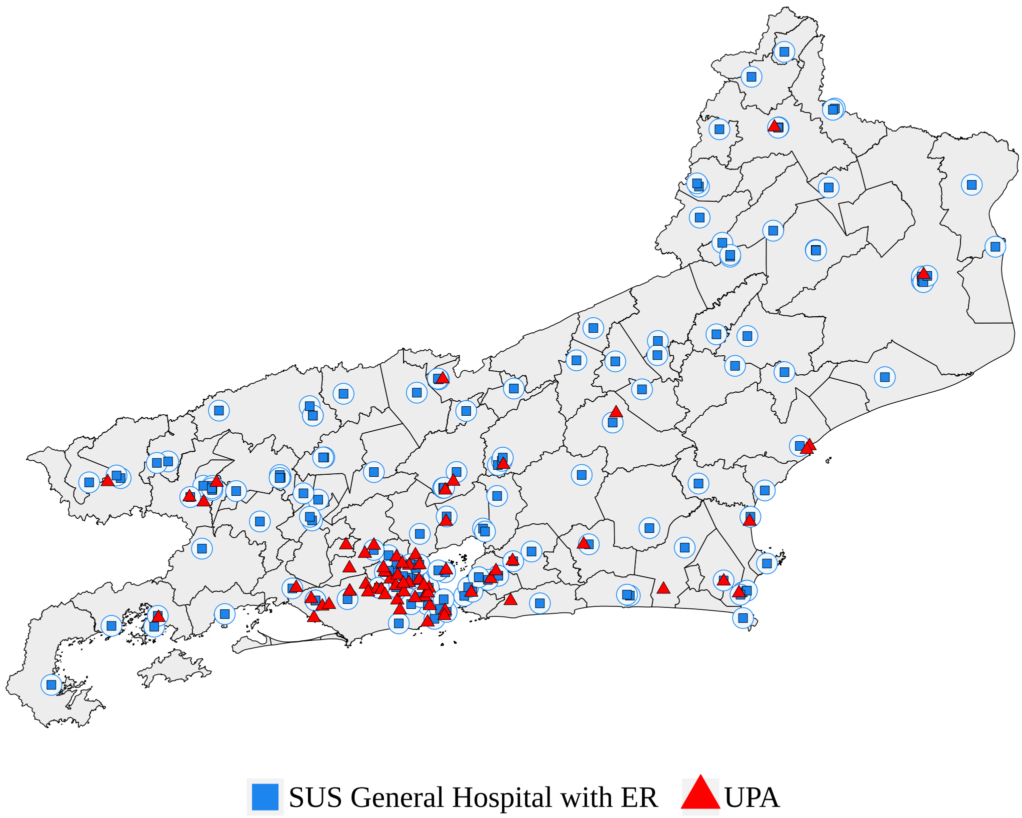
(a) Number of UPAs and % of Cities Covered by an UPA



(b) Percentage of Treated Hospitals

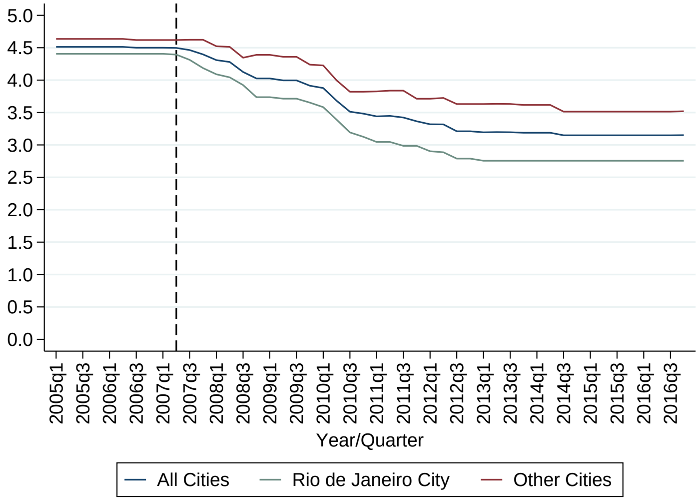
NOTES: Panel (a) shows the number of UPAs and the percentage of cities covered by an UPA in the state of Rio de Janeiro between 2005 and 2016. The state has 92 cities. Panel (b) shows the percentage of general SUS hospitals with ER that received an UPA inside its catchment area of 4.5km radius between 2005 and 2016. Total number hospitals in our sample is 115.

Figure 2: State of Rio de Janeiro: Cities, Emergency Care Providers and Hospital Catchment Areas

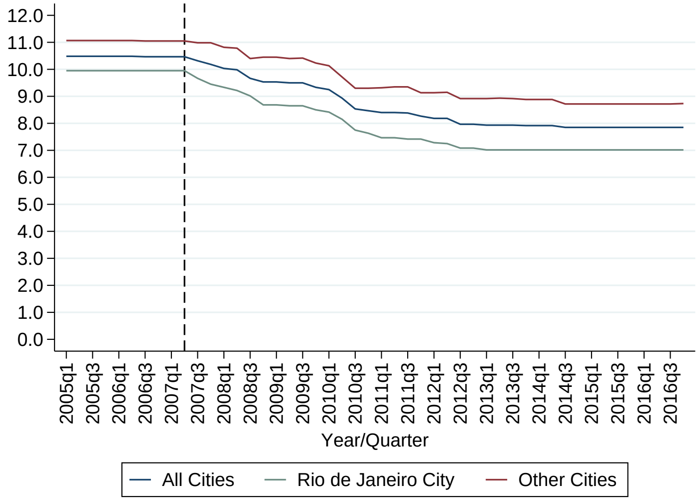


NOTES: Rio de Janeiro map in which blue squares represents SUS general hospitals with ER and red triangles represent UPAs. Hospitals' catchment area are the 4.5 kilometers circles in blue. Delimiters in this graph represent the municipalities' borders. The radius of 4.5 km was established based on the median distance traveled by patients to the closest ER before UPAs were implemented.

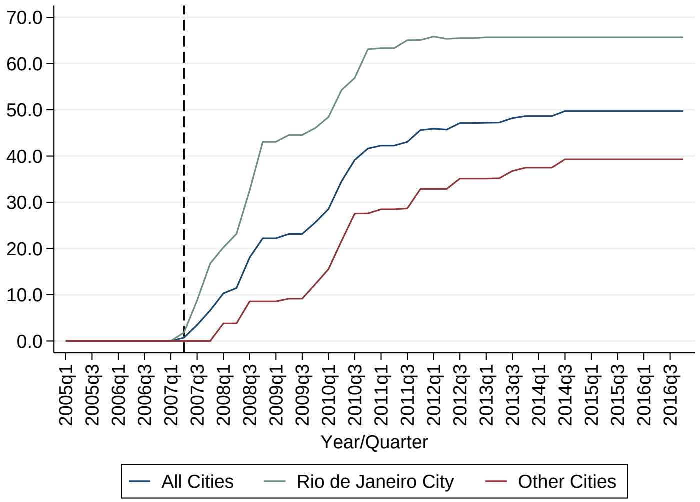
Figure 3: Distance and Travel Time to Closer ER and % Population Closer UPA



(a) Median Distance to Closest ER



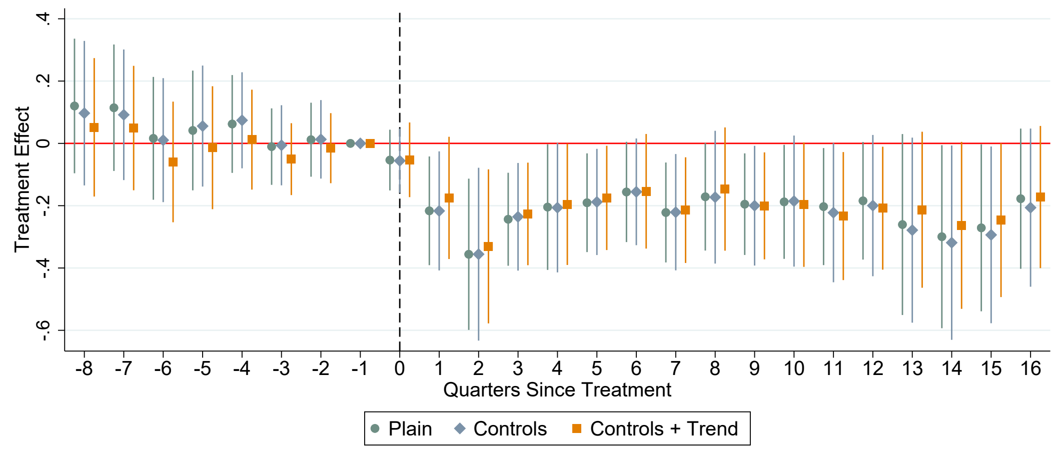
(b) Median Travel Time to Closest ER



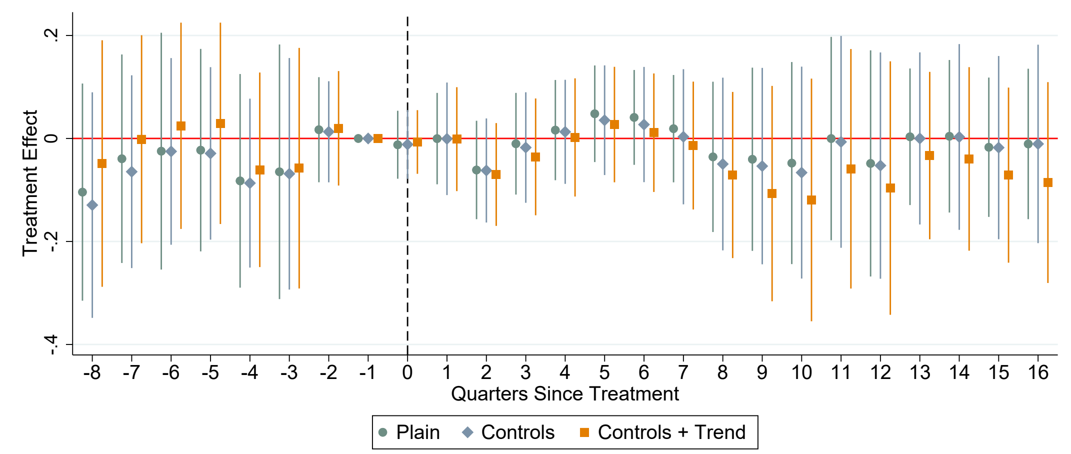
(c) % Population Closer to UPAs

Notes: This graph shows first how the (a) median distance and (b) median time travelled to the closest ER evolved from 2005 until 2016 in RJ State. Figure (c) reveals the percentage of the population that lives closer to an UPA over time. The dashed black line represents the quarter the first UPA was inaugurated in the state (2007-Q1). We used HERE maps to calculate the distance/time from each census tract to the closest ER (weighted by population) by car at midnight.

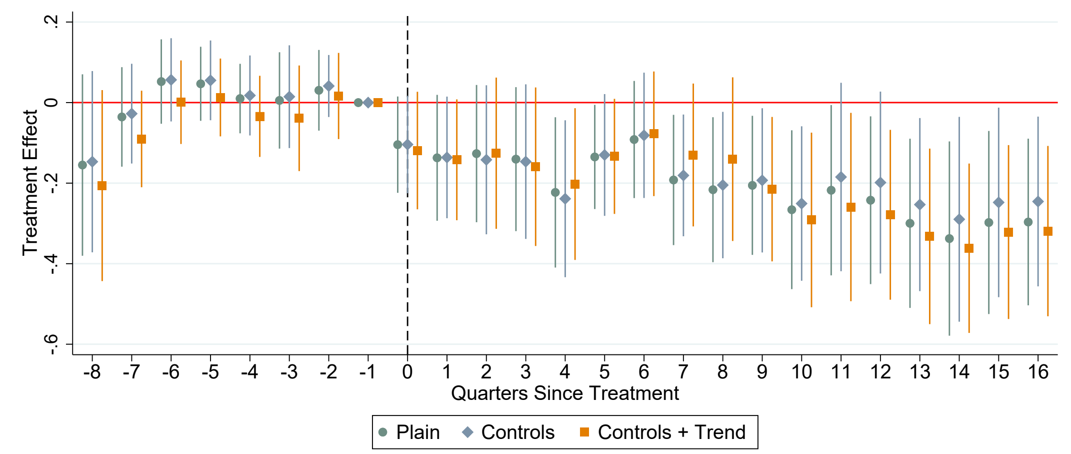
Figure 4: Event Study - Hospitals' Demand and Deaths



(a) Total Ambulatory Procedures



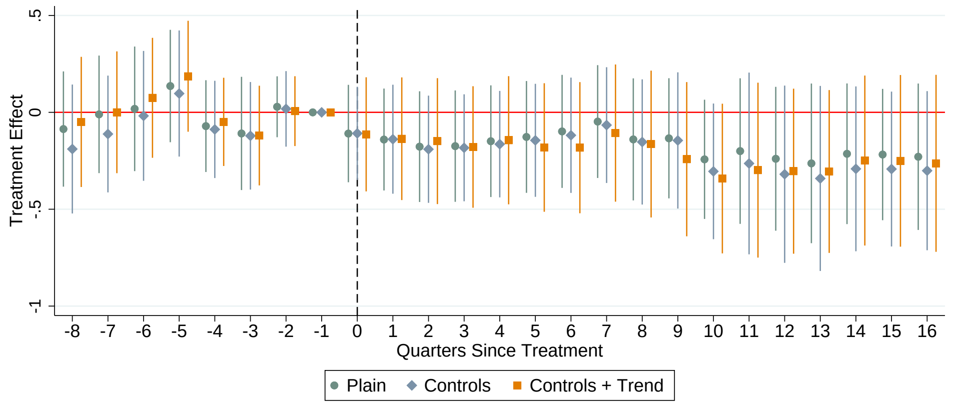
(b) Total Hospital Admissions



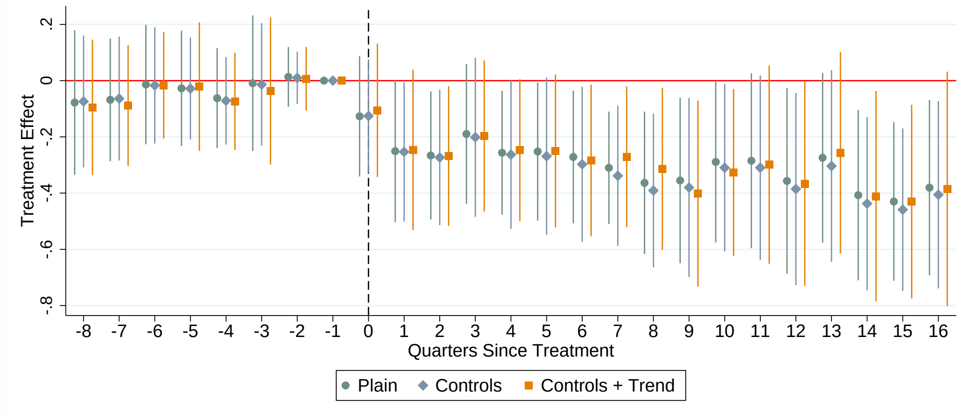
(c) Total Deaths

Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect on the IHS of hospitals' (a) total ambulatory procedures, (b) total hospital admissions and, (c) total deaths. The coefficients are interpreted as (approximate) fractional changes. Treatment is defined as the presence of an UPA inside the hospital's 4.5km catchment area. Vertical bars show 95% confidence intervals (CIs) around the coefficients. The results related to three different specifications are displayed. The first only has hospital and time fixed effects. The second adds the following controls: cities' GDP, Bolsa Família Program transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. In the third, non-parametric city specific time trends were included. Standard errors clustered at the hospital level.

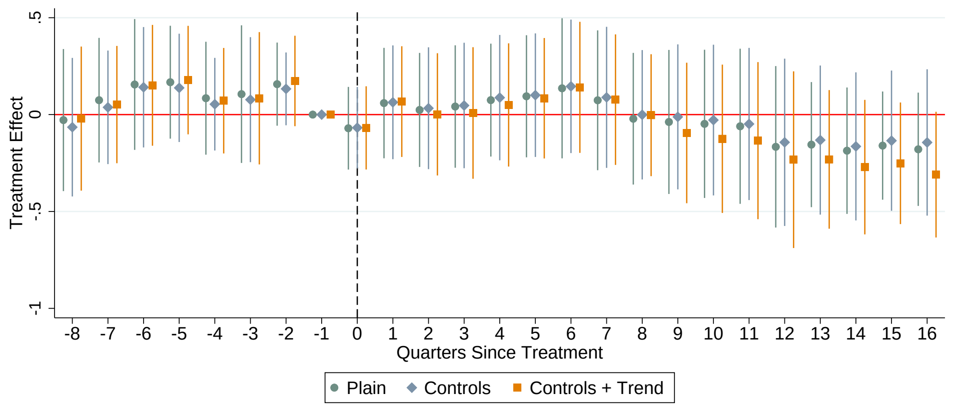
Figure 5: Event Study - Hospital Admission by Different Conditions



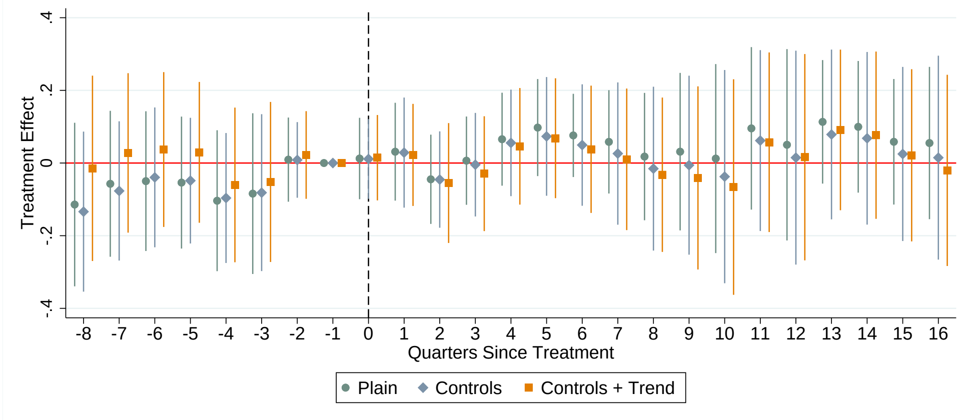
(a) Amenable to Ambulatory & Emergency Care



(b) Amenable to Ambulatory Care Only



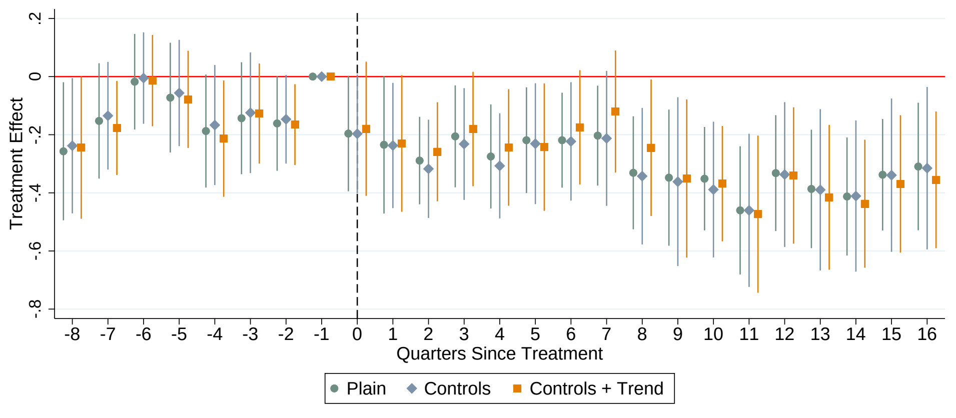
(c) Amenable to Emergency Care Only



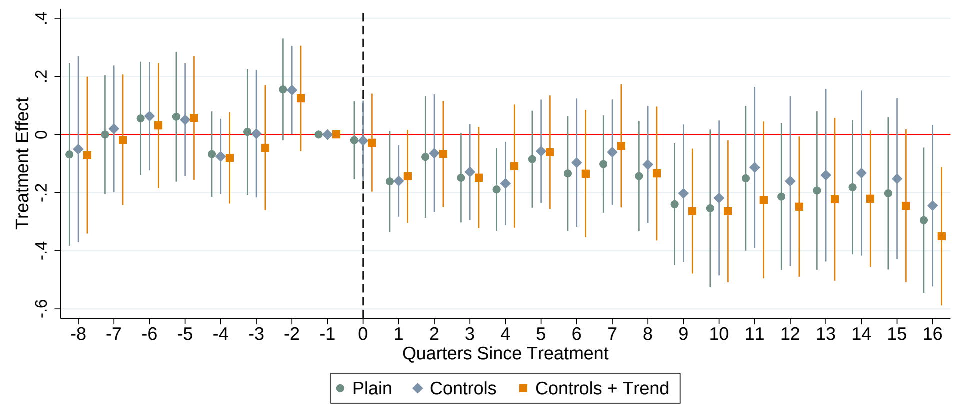
(d) Non-Amen. to Ambulatory or Emergency Care

Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect on the IHS of hospital admissions divided by different conditions: (a) amenable to ambulatory and emergency care, (b) amenable to ambulatory care only, (c) amenable to emergency care only and (d) non-amenable to ambulatory or emergency care. The coefficients are interpreted as (approximate) fractional changes. Treatment is defined as the presence of an UPA inside the hospital's 4.5km catchment area. Vertical bars show 95% confidence intervals (CIs) around the coefficients. The results related to three different specifications are displayed. The first only has hospital and time fixed effects. The second adds the following controls: cities' GDP, Bolsa Família Program transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. In the third, non-parametric city-specific time trends were included. We cluster errors of hospitals that are close to each other (see Section 4 for details).

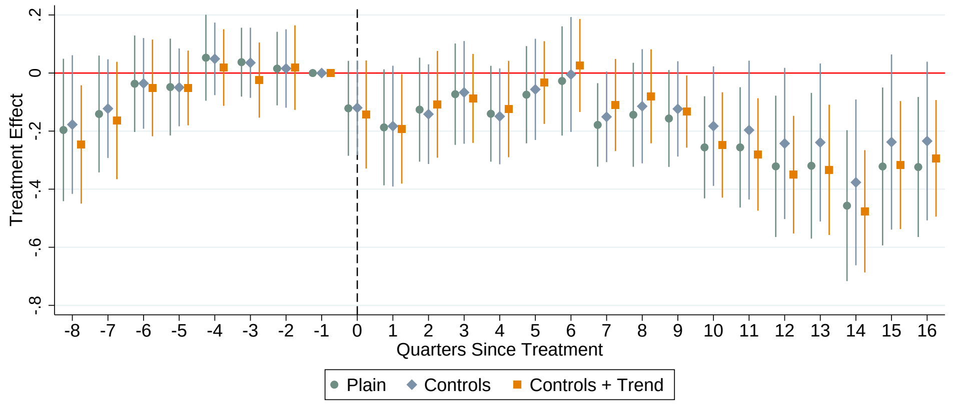
Figure 6: Event Study - Total Hospital Deaths by Different Conditions



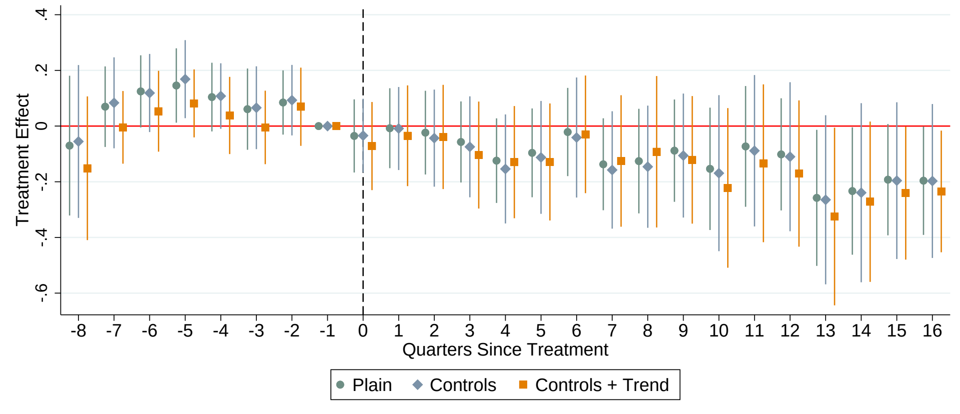
(a) Amenable to Ambulatory & Emergency Care



(b) Amenable to Ambulatory Care Only



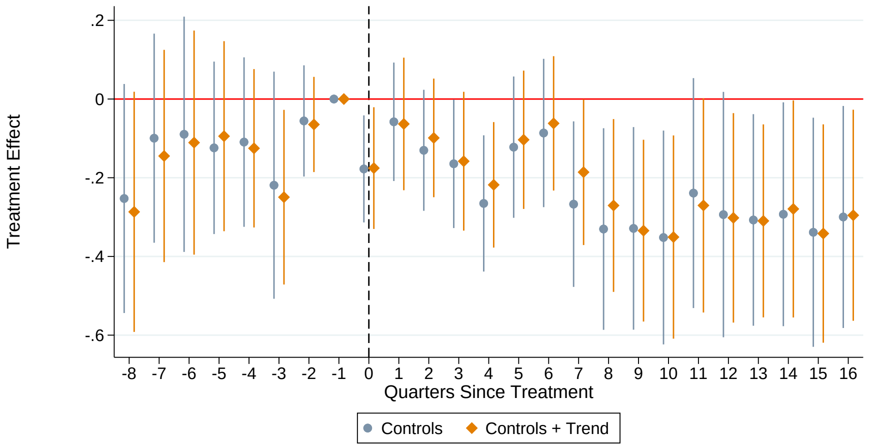
(c) Amenable to Emergency Care Only



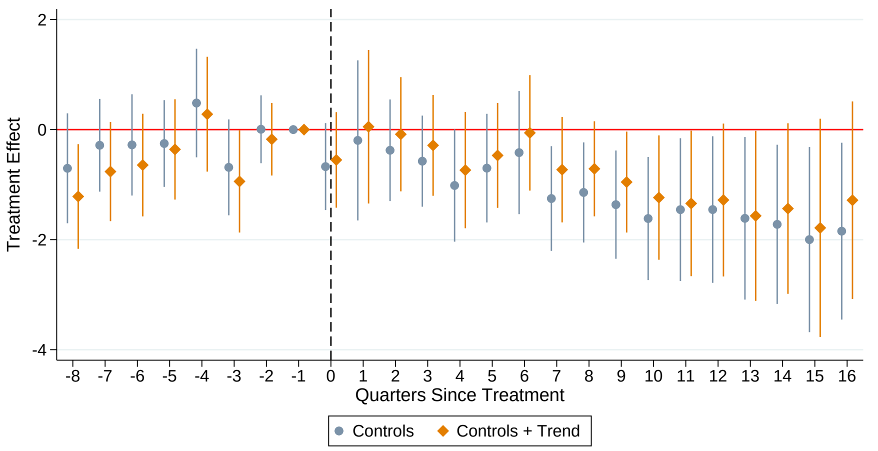
(d) Non-Amen. to Ambulatory or Emergency Care

Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect on the IHS of total hospital deaths divided by different conditions: (a) amenable to ambulatory and emergency care, (b) amenable to ambulatory care only, (c) amenable to emergency care only and (d) non-amenable to ambulatory or emergency care. The coefficients are interpreted as (approximate) fractional changes. Treatment is defined as the presence of an UPA inside the hospital's 4.5km catchment area. Vertical bars show 95% confidence intervals (CIs) around the coefficients. The results related to three different specifications are displayed. The first only has hospital and time fixed effects. The second adds the following controls: cities' GDP, Bolsa Família Program transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. In the third, non-parametric city-specific time trends were included. We cluster errors of hospitals that are close to each other (see Section 4 for details).

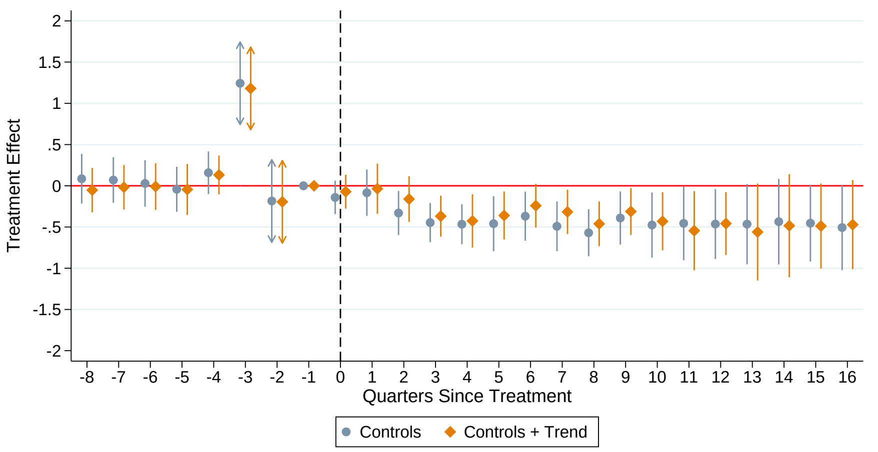
Figure 7: Event Study - Inpatient Measures



(a) Inpatient Deaths



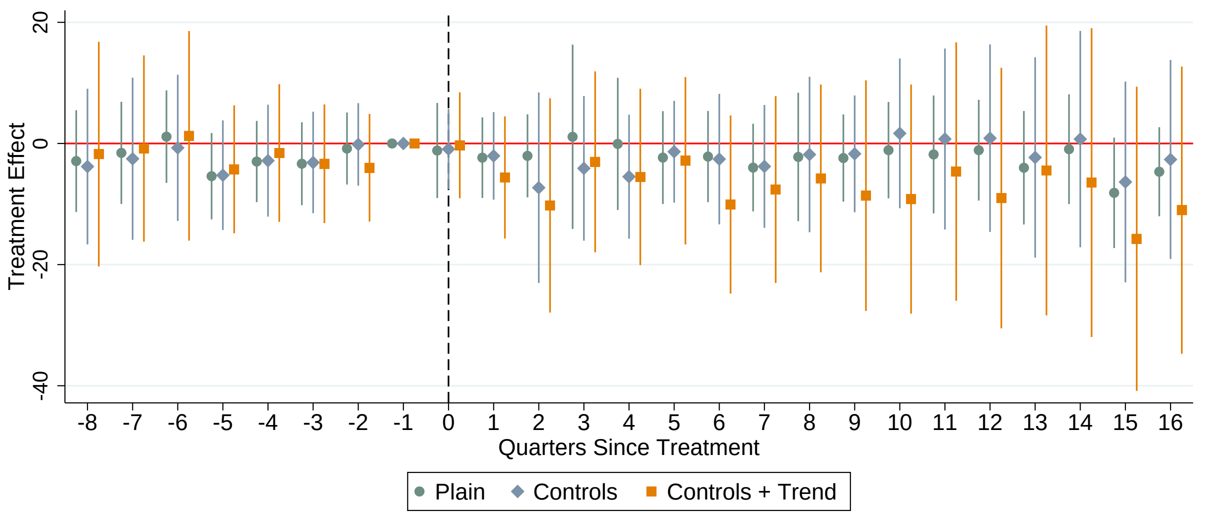
(b) % Inpatient Deaths



(c) % 24h Inpatient Deaths

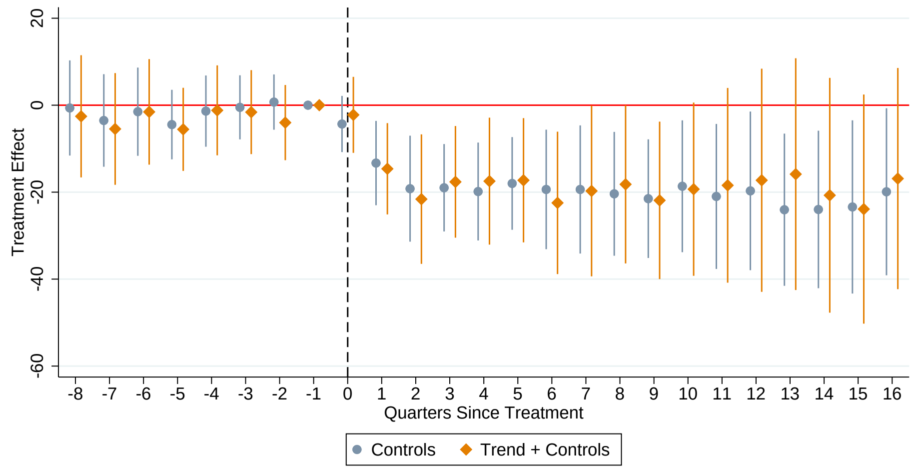
Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect on (a) the IHS of inpatient deaths, on (b) deaths conditional to admission (%) and on (c) deaths within 24h conditional on admission (%). Treatment is defined as the presence of an UPA inside the hospital's 4.5km catchment area. Vertical bars show 95% confidence intervals (CIs) around the coefficients. The results related to two different specifications are displayed. The first has hospital and time fixed effects as well as the following controls: cities' GDP, Bolsa Família Program transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. In the second, city specific time (quarter/year) trends were included. Standard errors clustered at the hospital level.

Figure 8: Event Study – Total Deaths per 100,000, Municipality-Level Estimates

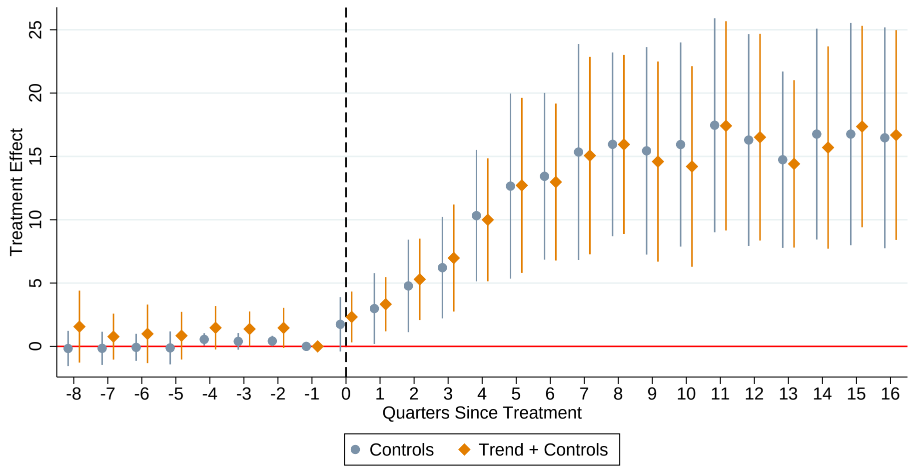


Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect on deaths per 100,000 people - measured at the municipality level. Treatment is defined as the presence of an UPA in the municipality. Vertical bars show 95% confidence intervals (CIs) around the coefficients. The results related to two different specifications are displayed. The first has municipality and time fixed effects as well as the following controls: cities' GDP, Bolsa Bolsa Família Program transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. In the second, health region specific time (quarter/year) trends were included. Standard errors clustered at the municipality level.

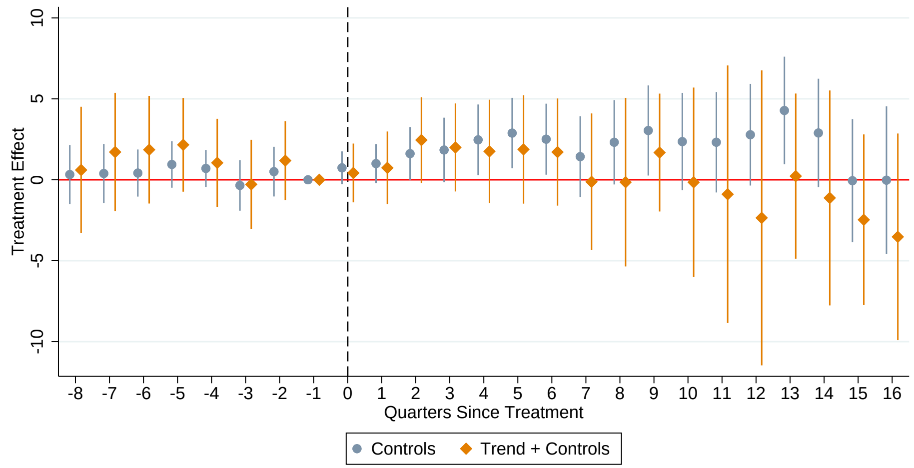
Figure 9: Event Study - Deaths per 100,000 by Location, Municipality-Level Estimates



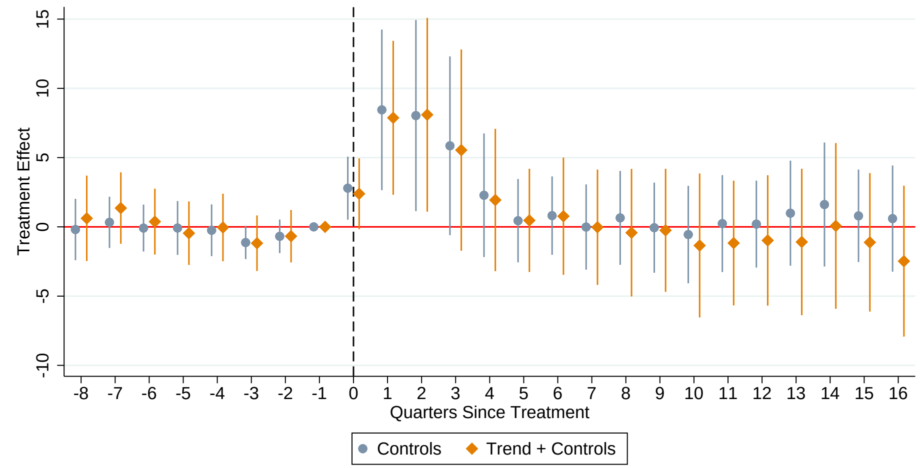
(a) Hospital



(b) UPA



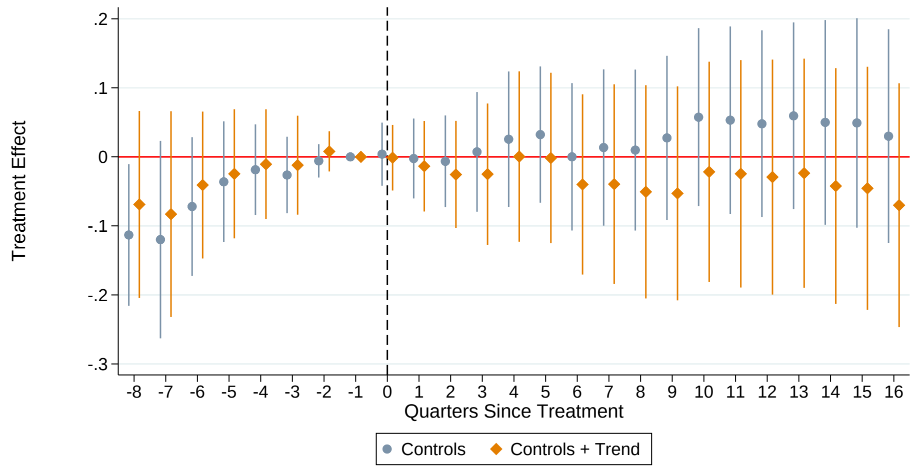
(c) Other Health Facility



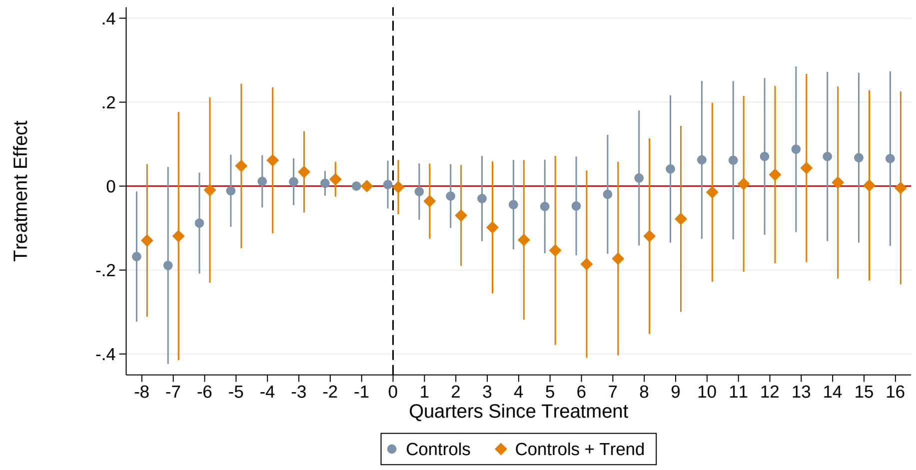
(d) Other Location

Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect on deaths per 100,000 people - measured at the municipality level - at four different locations: (a) Hospital, (b) UPA, (c) Other Heatlh Facilities and (d) Other Locations. Treatment is defined as the presence of an UPA in the municipality. Vertical bars show 95% confidence intervals (CIs) around the coefficients. The results related to two different specifications are displayed. The first has municipality and time fixed effects as well as the following controls: cities' GDP, Bolsa Família Program transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. In the second, health region specific time (quarter/year) trends were included. Standard errors clustered at the municipality level.

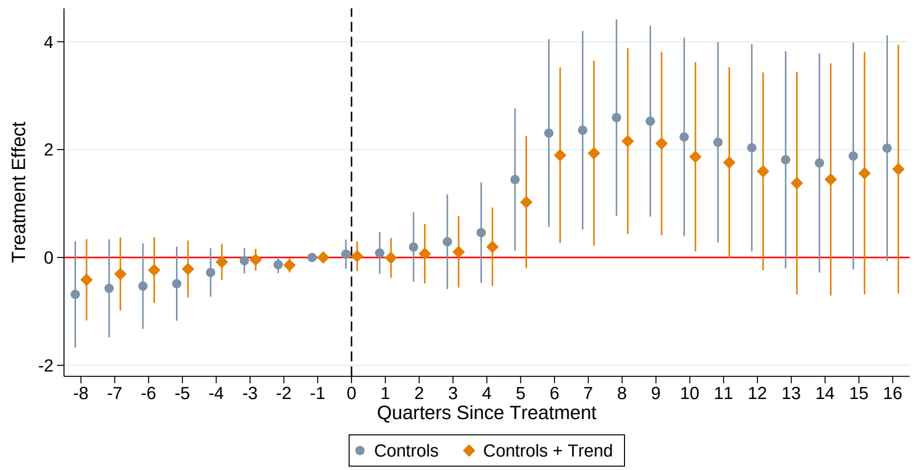
Figure 10: Event Study - Human Resources



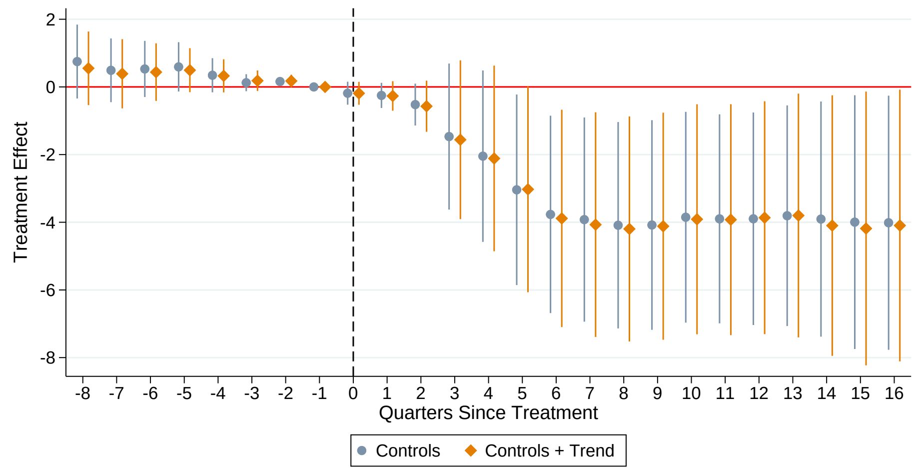
(a) N. Physicians



(b) N. Non-Physicians



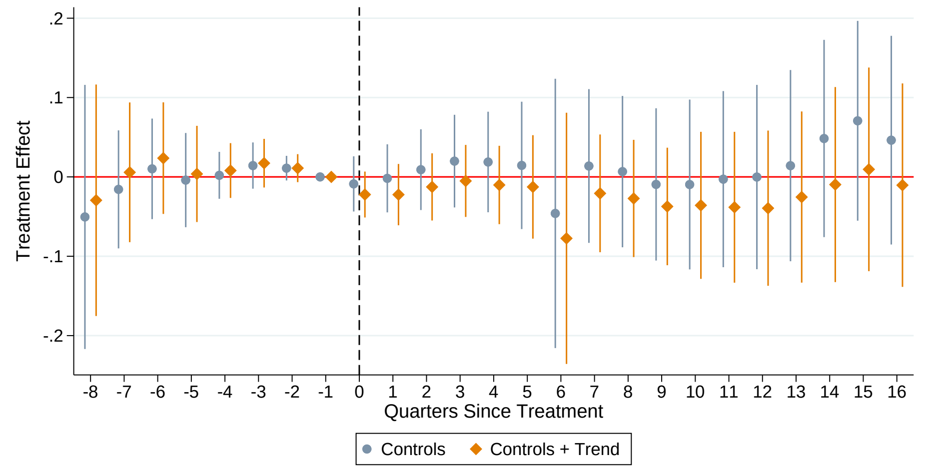
(c) Average Hours Worked - Inpatients



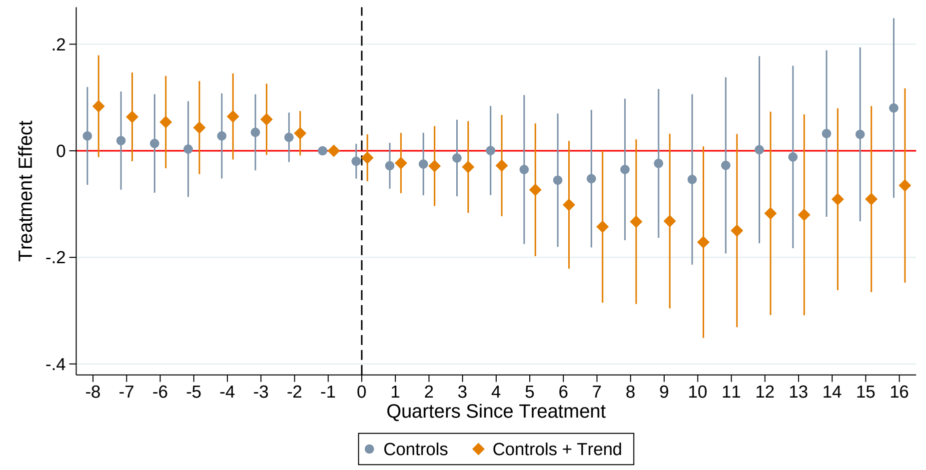
(d) Average Hours Worked - Other Activities

Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect on (a) the IHS number of physcians, (b) IHS number of non-physicians (c) on the average hours worked with inpatients and (d) on the average hours worked with other activities. Treatment is defined as the presence of an UPA inside the hospital's 4.5km catchment area. Vertical bars show 95% confidence intervals (CIs) around the coefficients. The results related to two different specifications are displayed. The first has hospital and time fixed effects as well as the following controls: cities' GDP, Bolsa Família Program transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. In the second, municipality-specific time (quarter/year) trends were included. Standard errors clustered at the hospital level.

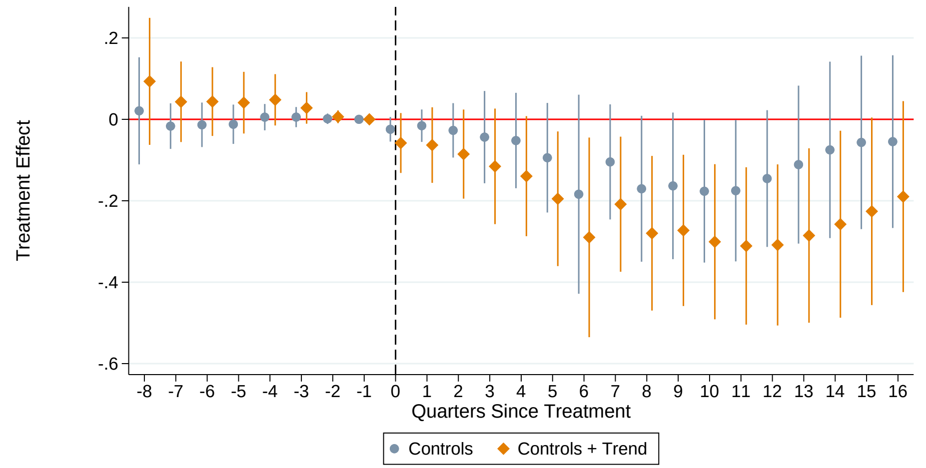
Figure 11: Event Study - Hospital Beds



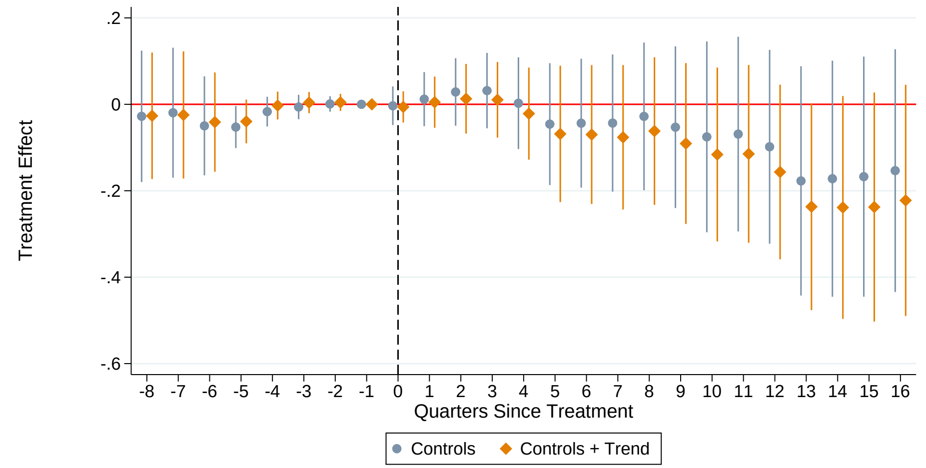
(a) Surgical Inpatient Beds



(b) Clinical Inpatient Beds



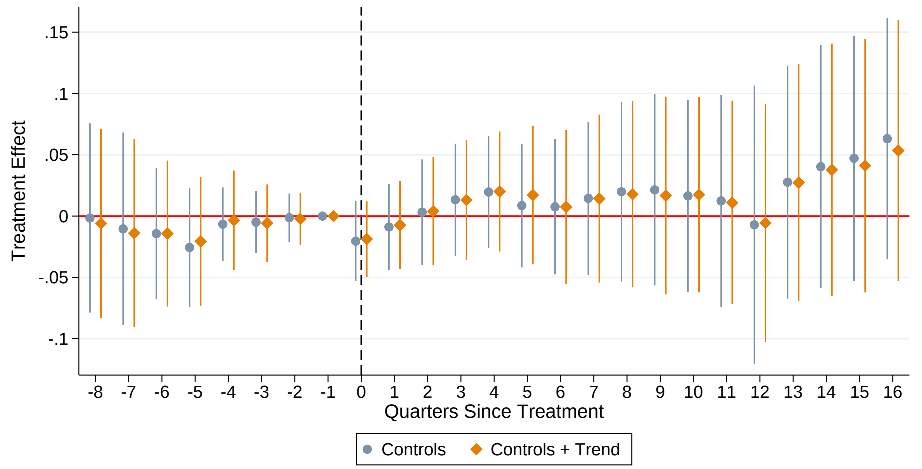
(c) Other Inpatient Beds



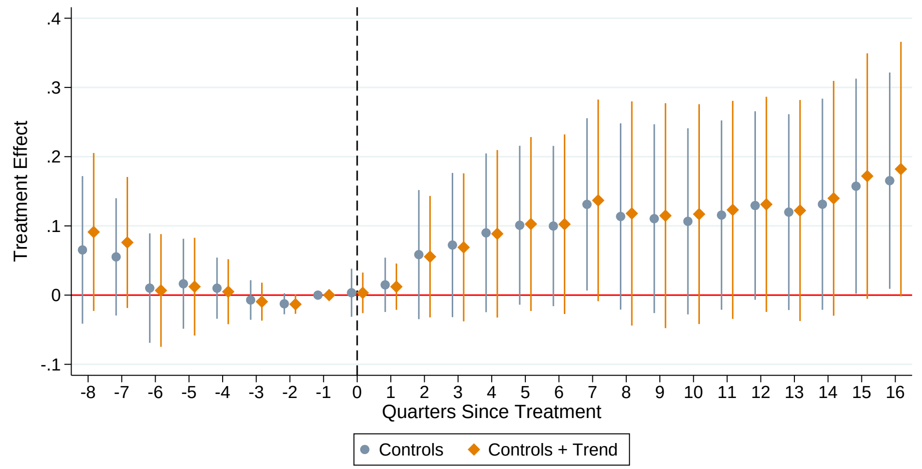
(d) Ambulatory and Emergency Beds

Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect on the IHS total number of (a) inpatient surgical beds, (b) inpatient clinical beds, (c) other inpatient beds and (d) ambulatory and emergency beds. Treatment is defined as the presence of an UPA inside the hospital's 4.5km catchment area. Vertical bars show 95% confidence intervals (CIs) around the coefficients. The results related to two different specifications are displayed. The first has hospital and time fixed effects as well as the following controls: cities' GDP, Bolsa Família Program transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. In the second, municipality-specific time (quarter/year) trends were included. Standard errors clustered at the hospital level.

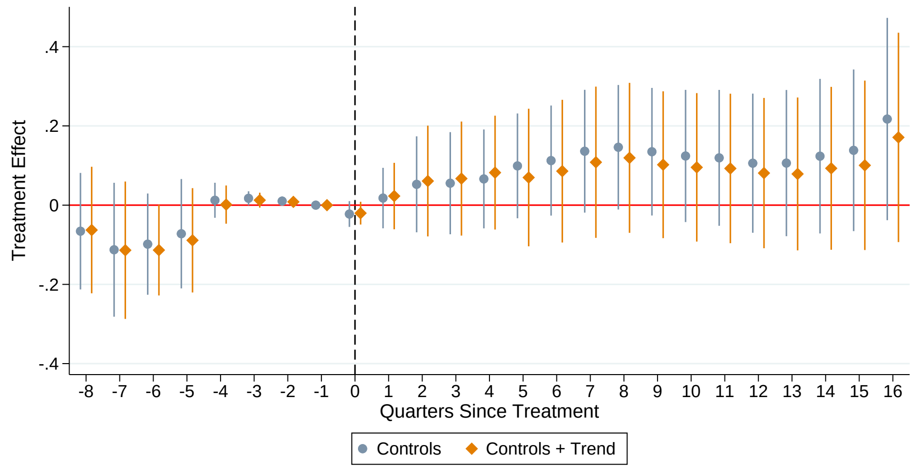
Figure 12: Event Study - Equipments



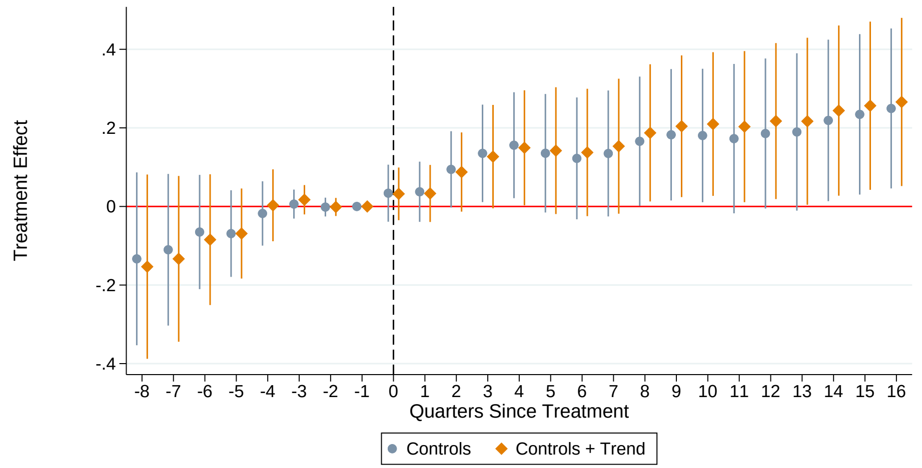
(a) Diagnosis Equipment



(b) Graphics Method Equipment



(c) Life Saving Equipment



(d) Other Equipments

Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect on the IHS total number of (a) diagnosis equipment, (b) graphics method equipment, (c) life-saving equipment, and (d) other equipment. Treatment is defined as the presence of an UPA inside the hospital's 4.5km catchment area. Vertical bars show 95% confidence intervals (CIs) around the coefficients. The results related to two different specifications are displayed. The first has hospital and time fixed effects as well as the following controls: cities' GDP, Bolsa Família Program transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. In the second, municipality-specific time (quarter/year) trends were included. Standard errors clustered at the hospital level.

Appendix Tables and Figures

A Supplementary Tables

Table A.1: Ambulatory Procedures - Hospital ER and Clinics vs. UPAs

	Number of Procedures			% of Total in Each Group/Subgroup		UPA % of Total 2016
	Hospital 2006 (1)	Hospital 2016 (2)	UPA 2016 (3)	Hospital 2006 (4)	UPA 2016 (5)	(3)/[(2)+(3)] (6)
1. Health Promotion Procedures	**121376**	**94937**	**18769**	**0.36**	**0.06**	**16.51**
2. Diagnostic Procedures	**11821358**	**18015941**	**5900762**	**34.87**	**20.01**	**24.67**
2.1. Extraction of sample cells/tissues (biopsy and other forms)	518919	679232	751381	1.53	2.55	52.52
2.2. Clinical laboratoy tests	7585947	13120114	3138328	22.38	10.64	19.30
2.3. Pathological Anatomy and Cytopathology	126705	58819	0	0.37	0.00	0.00
2.4. X-rays	2750007	2245108	720970	8.11	2.44	24.31
2.5. Ultrasound, Tomography & MRI exams	267332	554546	695	0.79	0.00	0.13
2.6. Nuclear Medicine in Vivo	604	2699	0	0.00	0.00	0.00
2.7. Endoscopy	40653	36561	0	0.12	0.00	0.00
2.8. Other diagnostic methods	531191	1318863	1289389	1.57	4.37	49.43
3. Clinic Procedures	**16058324**	**20081730**	**23415687**	**47.37**	**79.39**	**53.83**
3.1. Consultations & Follow Up Appointments	15622958	18974339	23384373	46.08	79.28	55.21
3.1.1. Appointment with doctors/college degree professionals	3863789	4644232	2936913	11.40	9.96	38.74
3.1.2. Worker's Health	1	5	0	0.00	0.00	0.00
3.1.3. Urgency Pre-Hospital Care	9454	2659	2731	0.03	0.01	50.67
3.1.4. Other consultations with doctors/college degree professionals	9	23973	3666	0.00	0.01	13.26
3.1.5. Home Care	7980	2391	272	0.02	0.00	10.21
3.1.6. Emergency (in general)	3961517	7181488	8137474	11.68	27.59	53.12
3.1.7. Rehabilitation	3945	13520	0	0.01	0.00	0.00
3.1.8. Psychosocial Care	0	4040	0	0.00	0.00	0.00
3.1.9. Elderly Care	0	0	0	0.00	0.00	-
3.1.10. Nursing Care	7776213	7101944	12303317	22.94	41.71	63.40
3.1.11. Burned Patients	50	81	0	0.00	0.00	0.00
3.1.12. Endocrine, metabolic and nutritional diseases	0	0	0	0.00	0.00	-
3.1.13. Consultation in other specialties	0	0	0	0.00	0.00	-
3.1.14. Palliative Care	0	8	0	0.00	0.00	0.00
3.2. Physiotherapy	0	458673	1103	0.00	0.00	0.24
3.3. Clinical Treatments (other specialties)	196413	326509	1364	0.58	0.00	0.42
3.4. Oncology	37296	167298	0	0.11	0.00	0.00
3.5. Nephrology	56426	48703	0	0.17	0.00	0.00
3.6. Hemotherapy	86302	85776	0	0.25	0.00	0.00
3.7. Dentistry	51435	14760	28841	0.15	0.10	66.15
3.8.Treatment of injuries, poisoning	0	0	0	0.00	0.00	-
3.9. Specialized Therapies	7494	5672	6	0.02	0.00	0.11
3.10. Birth	0	0	0	0.00	0.00	-
4. Surgical Procedures	**1302472**	**1021392**	**145089**	**3.84**	**0.49**	**12.44**
4.1 Small & Skin Surgeries	1043113	964305	122703	3.08	0.42	11.29
4.2. Other Surgeries	259359	57087	22387	0.77	0.08	28.17
5. Transplant Procedures	**2487**	**1776**	**0**	**0.01**	**0.00**	**0.00**
6. Medicines	**0**	**0**	**0**	**0.00**	**0.00**	**-**
7. Prostheses, Orthoses and Special Materials	**2351**	**25558**	**0**	**0.01**	**0.00**	**0.00**
8. Complimentary Ambulatory Health Actions Performed	**597**	**603**	**14932**	**0.00**	**0.05**	**96.12**
9. Not Defined	**4594188**	**0**	**0**	**13.55**	**0.00**	**-**
Total Ambulatory Procedures	**33903153**	**39241936**	**29495239**	**100.00**	**100.00**	**42.91**

Notes: This table shows the total number and the percentage distribution of ambulatory procedures performed in UPAs and SUS general hospitals with ER in Rio de Janeiro State. Total procedures were computed in 2006 and 2016 for hospitals and in 2016 for UPAs. Data comes from SIA-SUS and is divided by the eight major groups of procedures(health promotion, clinic, diagnostic, surgical, transplant, medicines, OPSM, and complimentary ambulatory health actions) plus a not defined category.The last column shows the share of total procedures in these establishments that was performed by UPAs in 2016.

Table A.2: Hospital Summary Statistics (baseline period 2005Q1-2007Q1)

	Mean (1)	Std Dev (2)	Min (3)	Max (4)	Data Source (5)
Ambulatory Procedures (in thousands)					
Total	74.6	90.9	0	650	SIA
Basic Health Care	36.0	154.8	0	2697	SIA
Medium Complexity	36.1	43.7	0	299	SIA
High Complexity	0.3	1.2	0	14	SIA
Hospital Admissions					
Total	761.8	736.0	10.8	4586	SIH
Amenable to Ambulatory & Emergency Care	91.2	82.1	0	508	SIH
Amenable to Ambulatory Care Only	102.4	89.7	0	505	SIH
Amenable to Emergency Care Only	173.8	214.3	0	1176	SIH
Non-Amenable to Ambulatory or Emergency Care	394.2	441.9	1.8	2783	SIH
Total Deaths					
Total	105.0	156.7	0	936	SIM
Amenable to Ambulatory & Emergency Care	14.6	20.3	0	105	SIM
Amenable to Ambulatory Care Only	17.2	26.9	0	173	SIM
Amenable to Emergency Care Only	30	49.4	0	258	SIM
Non-Amenable to Ambulatory or Emergency Care	43.2	65.7	0	429	SIM
Inpatient Deaths					
Total	55.1	79.4	0	534	SIH
Amenable to Ambulatory & Emergency Care	11.9	17.3	0	118	SIH
Amenable to Ambulatory Care Only	8.2	11.3	0	85	SIH
Amenable to Emergency Care Only	22.4	37.9	0	254	SIH
Non-Amenable to Ambulatory or Emergency Care	12.5	21.6	0	179	SIH
Other Hospital Measures					
% Hospital Inpatient Deaths	6.3	5.3	0	35.4	SIH
% Hospital inpatient deaths within 24h of admission	1.3	1.4	0	10.3	SIH
Bed Occupancy Rate (%)	45.3	25.0	2.2	149.4	SIH-CNES
No. of days when capacity is over 85%	15.3	26.1	0	92	SIH-CNES
Human Resources & Infrastructure					
No. Professionals	252.3	502.8	2	5682	CNES
No. Physicians	80.5	120.8	2	1290	CNES
Avg. hrs/week worked per SUS professional	26.9	9.1	8	99.2	CNES
No. Hospitalization Beds	118.6	117.0	0	942	CNES
No beds for obs in amb and emerg structure	16.3	19.4	0	116	CNES
Total Equipment	88.7	190.8	1	2338	CNES

Notes: Summary statistics for main variables used in the hospital-level analysis at the baseline period (2005Q1-2007Q1), together with their source. Sample is composed of 108 hospitals when analysing ambulatory procedures (SIA), 111 when looking at hospital admissions (SIH) and 114 when the outcome is hospitals' total deaths (SIM). Variables were measured at the hospital-quarter level. The data sources indicated in column 5 are elaborated in Appendix D.

Table A.3: City Summary Statistics (baseline period 2005-2007Q1)

	Mean (1)	Std Dev (2)	Min (3)	Max (4)	Data Source (5)
Local Deaths per 100,000 Inhabitants by Cause					
Total	176.6	38.7	49.2	379.6	SIM
Amenable to Ambulatory & Emergency Care	23.3	12.8	0.0	102.2	SIM
Amenable to Ambulatory Care Only	27.2	12.4	0.0	84.3	SIM
Amenable to Emergency Care Only	53.8	17.4	0.0	152.7	SIM
Non-Amenable to Ambulatory or Emergency Care	72.3	23.3	0.0	223.3	SIM
Local Deaths per 100,000 inhabitants by Location					
Hospital	130.7	35.0	36.0	290.3	SIM
UPA	0.0	0.0	0.0	0.0	SIM
Other Health Facility	5.0	11.7	0.0	110.0	SIM
Household	27.1	13.8	0.0	112.5	SIM
Street	8.8	6.6	0.0	40.0	SIM
Other	4.5	5.3	0.0	38.1	SIM
Health System					
% PSF Coverage	60.3	35.5	0.0	100.0	DAB
Routine Consultations	95.5	133.2	0.0	3111.8	SIAB
Physician Consultations	180.1	133.7	0.0	698.9	SIAB
Exams Prescribed	64.4	91.2	0.0	1763.0	SIAB
Diabetics Registered	42.1	25.0	0.0	114.4	SIAB
Diabetics Followed-up	95.6	6.5	32.5	100.0	SIAB
SAMU Coverage	0.2	0.4	0.0	1.0	INDE
Controls					
GDP Per Capita (2010 reais)	26.6	43.0	5.8	328.4	IBGE
Dummy if City Party = State Party	0.1	0.3	0.0	1.0	TSE
PBF: Value (R$) per 1,000 people	1958.2	1006.2	0.0	5322.4	MSD
% Health Insurance	13.6	11.1	1.4	61.0	ANS

Notes: Summary statistics for main variables used in the municipality-level analysis at the baseline period (2005Q1-2007Q1), together with their source. Sample is composed of 92 cities. Variables were measured at the city-quarter level. The data sources indicated in column 5 are elaborated in Appendix D.

Table A.4: Ambulatory Procedures Per Capita by Complexity and Location, City-Level Estimates

		Location				
	Total (1)	Hospital (2)	UPA (3)	FHP (4)	Other Health Fac (5)	Mean at Baseline
All	-0.800	-0.314*	0.386***	-0.850	-0.022	4.92
	(0.924)	(0.170)	(0.081)	(0.818)	(0.399)	
Basic Health Care	-0.899	-0.022	0.130***	-0.853	-0.153	2.15
	(0.770)	(0.092)	(0.039)	(0.675)	(0.319)	
Medium Complexity	0.031	-0.298**	0.256***	0.005	0.068	1.52
	(0.233)	(0.143)	(0.042)	(0.025)	(0.184)	
High Complexity	0.018	0.001	0.000	0.000	0.017	0,02
	(0.016)	(0.001)	(0.000)	(0.000)	(0.014)	
City & Time FE	Yes	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	Yes	-
Mean at Baseline	4.92	1.06	0.00	1.08	2.77	-

Notes: This table shows the weighted average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfoeuille (2022), giving to each estimator a weight proportional to the number of switchers. Controls are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government, and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Health region specific time trends (quarter/year) were included. Dependent variables are the ambulatory procedures performed by complexity (basic, medium, and high) and by four different locations: hospitals, UPAs, establishments with basic healthcare programs (FHP/ACS/NASF), and other health facilities. The city level results are not directly comparable with the hospital results shown earlier because the former include only hospital with an ER. Also the hospital analysis models impact of an UPA opening within 4.5km of the hospital whereas the city analysis involves an UPA opening anywhere in the city, so the "catchment" area is much broader. Sample is composed of 92 cities. Standard errors are clustered at the municipality level in all specifications. *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in per capita rates.

Table A.5: UPA Effects on Inpatient Outcomes: By Specific Causes (Part 1), Hospital-Level Estimates

	Hosp Admissions	Inpatient Deaths	% Inpatient Deaths	%24h Inpatient Deaths	Hosp Adm Mean at
	(1)	(2)	(3)	(4)	Baseline
Total					
	-0.045	-0.224***	-0.845*	-0.363**	768.05
	(0.061)	(0.084)	(0.452)	(0.141)	
Amenable to Ambulatory & Emergency Care					
Total	-0.212	-0.247**	-0.323	-0.489	91.78
	(0.136)	(0.125)	(1.248)	(0.624)	
Diabetes Mellitus-Acute	-0.226*	-0.201*	0.653	-0.047	15.93
	(0.134)	(0.109)	(1.862)	(0.566)	
Bacterial Pneumonia	0.150	0.136	5.249	0.319	14.94
	(0.233)	(0.152)	(3.225)	(0.858)	
Stroke/Cerebral Infarction	-0.262	-0.124	-1.332	0.404	19.06
	(0.201)	(0.146)	(4.006)	(0.767)	
Asthma & COPD	-0.262*	-0.032	3.803	1.809**	16.17
	(0.136)	(0.127)	(3.147)	(0.808)	
Other	-0.090	0.038	-2.783	-2.187	25.69
	(0.117)	(0.138)	(3.294)	(2.314)	
Amenable to Ambulatory Care Only					
Total	-0.297**	-0.317***	-0.833	-0.250	103.22
	(0.139)	(0.116)	(0.753)	(0.221)	
Gastroenteritis	-0.158	-0.108**	-3.786	-0.076	12.02
	(0.163)	(0.049)	(2.950)	(0.566)	
urinary tract infection	0.002	-0.108	-1.331	-0.407	12.1
	(0.125)	(0.117)	(1.992)	(0.666)	
Congestive heart failure	-0.146	-0.087	1.191	-1.133	16.81
	(0.210)	(0.116)	(2.915)	(0.832)	
Cellulitis & Erysipelas	-0.136	0.047	-0.444	0.148	9,37
	(0.154)	(0.061)	(1.419)	(0.701)	
Other	-0.373***	-0.357**	-1.227	-0.236	52.92
	(0.125)	(0.139)	(1.118)	(0.339)	
Hospital & Time FE	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	-
Mean at Baseline	1144.52	93.10	8.62	1.50	-

Notes: This table shows the weighted average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfoeuille (2022), giving to each estimator a weight proportional to the number of switchers. Controls are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains, and the collapse of hills in 2011. Municipality-specific time (quarter/year) trends were included. The first two dependent variables analysed are the IHS of hospital admissions and inpatient deaths Columns 3 and 4 show total inpatient deaths and inpatient deaths that occurred within 24h conditional on total admissions, both measured in percentages. Results are shown by specific causes inside each of the four emergency/ambulatory care groups constructed (see Appendix D for more details on how these groups and subgroups were selected/built). Sample is composed of 111 hospitals. We cluster standard errors of hospitals that are close to each other (see Section 4 for details). *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in levels instead of IHS

Table A.6: UPA Effects on Inpatient Outcomes: By Specific Causes (Part 2), Hospital-Level Estimates

	Hosp Admissions	Inpatient Deaths	% Inpatient Deaths	%24h Inpatient Deaths	Hosp Adm Mean at
	(1)	(2)	(3)	(4)	Baseline
Total					
	-0.045	-0.224***	-0.845*	-0.363**	768.05
	(0.061)	(0.084)	(0.452)	(0.141)	
Amenable to Emergency Care Only					
Total	-0.074	-0.250**	-0.346	-0.514	175.3
	(0.134)	(0.116)	(0.920)	(0.323)	
External Causes	-0.239*	-0.251***	-2.251***	-0.020	80.34
	(0.132)	(0.082)	(0.672)	(0.262)	
AMI	-0.209	-0.113	1.441	-1.999	9.56
	(0.152)	(0.116)	(2.604)	(1.843)	
Pneumonia (Except Bacterial)	0.126	-0.051	-2.052	-0.480	28.23
	(0.229)	(0.177)	(2.900)	(0.537)	
Other	-0.035	-0.156*	-1.615	-0.686	57.17
	(0.132)	(0.087)	(1.961)	(0.646)	
Non-Amenable to Ambulatory or Emergency Care					
Total	0.013	-0.328***	-1.499**	-0.542**	397.57
	(0.085)	(0.098)	(0.656)	(0.247)	
Cancer	-0.037	-0.147	-0.562	0.068	15.43
	(0.137)	(0.091)	(2.990)	(0.943)	
Digestive	0.113	0.029	-0.602	-0.146	54.7
	(0.128)	(0.121)	(0.825)	(0.276)	
Delivery	0.021	0.294**	-0.302	-0.325	116.47
	(0.276)	(0.118)	(0.780)	(0.377)	
Diseases of Veins & Arteries	0.241*	-0.080	-3.000*	-0.671	16.27
	(0.135)	(0.122)	(1.764)	(0.732)	
Other	-0.050	-0.368***	-1.174*	-0.349	194.71
	(0.092)	(0.112)	(0.630)	(0.228)	
Hospital & Time FE	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	-
Mean at Baseline	1144.52	93.10	8.62	1.50	-

Notes: This table shows the weighted average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfoeuille (2022), giving to each estimator a weight proportional to the number of switchers. Controls are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains, and the collapse of hills in 2011. Municipality-specific time (quarter/year) trends were included. The first two dependent variables analysed are the IHS of hospital admissions and inpatient deaths. Column 3 and 4 shows total inpatient deaths and inpatient deaths that occurred within 24h conditional on total admissions, both measured in percentages. Results are shown by specific causes inside each of the four emergency/ambulatory care groups constructed. Sample is composed of 111 hospitals. We cluster standard errors of hospitals that are close to each other (see Section 4 for details). *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in levels instead of IHS.

Table A.7: UPA Effects on Inpatient Outcomes by Type of Bed, Hospital-Level Estimates

	Hosp Admissions	Inpatient Deaths	% Inpatient Deaths	%24h Inpatient Deaths	Hosp Adm Mean at
	(1)	(2)	(3)	(4)	Baseline
Total					
	-0.045	-0.224***	-0.845*	-0.363**	768.05
	(0.061)	(0.084)	(0.452)	(0.141)	
Type of Bed					
Surgical + Obstetric	0.189*	0.025	-0.162	-0.092	391.7
	(0.108)	(0.124)	(0.383)	(0.110)	
Clinical	-0.216***	-0.222***	-0.916	-0.495	291.63
	(0.074)	(0.083)	(0.802)	(0.302)	
Other	-0.095	-0.192	-1.422*	-0.151	84,71
	(0.175)	(0.131)	(0.764)	(0.117)	
ITU	0.030	-0.052	-5.065	-2.197**	34.81
	(0.114)	(0.105)	(3.112)	(1.071)	
Hospital & Time FE	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	-
Mean at Baseline	768.05	55.57	6.37	1.35	-

Notes: This table shows the weighted average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfoeuille (2022), giving to each estimator a weight proportional to the number of switchers. Controls are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government, and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Municipality-specific time (quarter/year) trends were included. The first two dependent variables analysed are the IHS of admissions and inpatient deaths, so the coefficients are interpreted as (approximate) fractional changes. Then we have total inpatient deaths conditional on admissions and inpatient deaths that occurred within 24h also conditional on total admissions, both measured in percentages. Results are shown by different types of bed. Sample is composed of 111 hospitals. We cluster standard errors of hospitals that are close to each other (see Section 4 for details). *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in levels instead of IHS.

Table A.8: Hospital Admissions and Total Deaths by Day and Time, Hospital-Level Estimates

		Day/Time				
	Total (1)	Weekday (2)	Weekend (3)	Day (4)	Night (5)	Mean at Baseline
Hospital Admissions						
Total	-0.045 (0.061)	-0.056 (0.069)	-0.132 (0.088)	-	-	768,05
Amenable to Ambulatory & Emergency Care	-0.212 (0.136)	-0.235 (0.155)	-0.232* (0.132)	-	-	91.78
Amenable to Ambulatory Care Only	-0.297** (0.139)	-0.284** (0.137)	-0.279** (0.140)	-	-	103.22
Amenable to Emergency Care Only	-0.074 (0.134)	-0.080 (0.136)	-0.149 (0.110)	-	-	175.3
Non-Amenable to Ambulatory or Emergency Care	0.013 (0.085)	0.007 (0.089)	-0.124 (0.109)	-	-	397.57
Total Deaths						
Total	-0.211*** (0.079)	-0.182** (0.081)	-0.249*** (0.069)	-0.255*** (0.074)	-0.191** (0.090)	104.97
Amenable to Ambulatory & Emergency Care	-0.292*** (0.088)	-0.270*** (0.084)	-0.197** (0.085)	-0.277*** (0.087)	-0.213*** (0.082)	14.61
Amenable to Ambulatory Care Only	-0.170** (0.077)	-0.133* (0.080)	-0.199** (0.084)	-0.073 (0.107)	-0.233*** (0.077)	17.18
Amenable to Emergency Care Only	-0.192*** (0.061)	-0.143* (0.075)	-0.244*** (0.085)	-0.241*** (0.091)	-0.056 (0.084)	30
Non-Amenable to Ambulatory or Emergency Care	-0.145* (0.085)	-0.140 (0.090)	-0.168* (0.097)	-0.204** (0.082)	-0.118 (0.100)	43.18
Hospital & Time FE	Yes	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	Yes	-
Mean at Baseline - Admissions	1144.52	812.98	216.68	-	-	
Mean at Baseline - Total Deaths	172.59	122.96	49.63	84.08	78.03	-

Notes: This table shows the weighted average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfoeuille (2022), giving to each estimator a weight proportional to the number of switchers. Controls are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government, and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Municipality-specific time (quarter/year) trends were included. Dependent variables are the IHS of hospitals' admissions and total deaths by different time and day of the week, so the regression coefficients are interpreted as (approximate) fractional changes. Sample is composed of 111 when looking at hospital admissions (SIH) and 115 when analysing total deaths (SIM). We cluster standard errors of hospitals that are close to each other (see Section 4 for details). *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in levels instead of IHS. SIH database does not include information on the time of admission.

Table A.9: Deaths per 100,000 by Specific Causes and Location, City-Level Estimates (Part 1)

	Total (1)	Location: Hospital (2)	UPA (3)	Other Health Facility (4)	Household (5)	Street (6)	Other (7)	Mean at Baseline
Total								
	-7.023 (7.061)	-17.942** (8.380)	12.387*** (2.903)	0.152 (1.719)	-1.967 (2.354)	-1.037 (1.466)	1.107 (2.076)	176.63
Amenable to Ambulatory & Emergency Care								
Total	-1.475 (2.442)	-3.265 (3.019)	1.632*** (0.477)	0.082 (0.422)	-0.274 (0.734)	0.015 (0.079)	0.363 (0.358)	23.32
Diabetes Mellitus-Acute	-0.574 (1.251)	-0.792 (1.052)	0.145 (0.147)	0.140 (0.172)	-0.201 (0.236)	0.012 (0.030)	0.122 (0.107)	3.86
Bacterial Pneumonia	0.461 (0.444)	0.329 (0.341)	0.194 (0.137)	-0.056 (0.054)	-0.009 (0.104)	-0.006 (0.007)	0.008 (0.036)	0,56
Stroke/Cerebral Infarction	0.334 (1.212)	-0.474 (1.467)	0.583** (0.237)	-0.040 (0.303)	0.183 (0.407)	0.011 (0.017)	0.077 (0.226)	8,7
Asthma & COPD	-1.228 (1.184)	-1.315 (1.022)	0.403*** (0.151)	0.019 (0.141)	-0.401 (0.432)	-0.021 (0.026)	0.097 (0.082)	6.01
Other	-0.469 (0.868)	-1.013 (0.821)	0.306** (0.156)	0.020 (0.152)	0.153 (0.318)	0.019 (0.072)	0.058 (0.102)	4.2
Amenable to Ambulatory Care Only								
Total	0.410 (2.546)	-2.823 (2.784)	2.610*** (0.717)	0.334 (0.635)	-0.363 (1.095)	0.099 (0.250)	0.452 (0.551)	27.2
Gastroenteritis	0.458 (0.407)	0.236 (0.387)	0.005 (0.028)	0.122 (0.145)	0.070 (0.102)	0.011 (0.018)	0.013 (0.023)	0.35
Urinary tract infection	0.487 (1.029)	-0.256 (0.898)	0.624* (0.347)	0.062 (0.219)	-0.023 (0.107)	-0.011 (0.013)	0.092* (0.048)	1.16
Congestive heart failure	-1.440** (0.672)	-1.260** (0.523)	0.122 (0.177)	-0.022 (0.147)	-0.257 (0.258)	-0.020 (0.047)	-0.078 (0.114)	2.62
Cellulitis & Erysipelas	-0.039 (0.223)	-0.022 (0.218)	-0.020 (0.025)	-0.009 (0.018)	0.006 (0.009)	0.000*** (0.000)	0.006 (0.010)	0.17
Other	0.944 (2.509)	-1.521 (2.019)	1.880*** (0.543)	0.182 (0.515)	-0.158 (0.903)	0.119 (0.323)	0.418 (0.389)	22.9
City & Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Mean at Baseline	176.63	130.69	0.00	4.96	27.09	8.83	4.5	-

Notes: This table shows the weighted average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfoeuille (2022), giving to each estimator a weight proportional to the number of switchers. Controls are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government, and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Health region specific time trends (quarter/year) were included. Dependent variables are the deaths per 100,000 people by specific causes and by six different locations: hospitals, UPAs, other health facilities, household, street, and other places. The city level results are not directly comparable with the hospital results shown earlier because the former include only hospital with an ER. Also the hospital analysis models impact of an UPA opening within 4.5km of the hospital whereas the city analysis involves an UPA opening anywhere in the city, so the "catchment" area is much broader. Sample is composed of 92 municipalities. Standard errors clustered at the city level in all specifications. *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in rates per 100,000 inhabitants.

Table A.10: Deaths per 100,000 by Specific Causes and Location, City-Level Estimates (Part 2)

	Total (1)	Location: Hospital (2)	UPA (3)	Other Health Facility (4)	Household (5)	Street (6)	Other (7)	Mean at Baseline
Total								
	-7.023	-17.942**	12.387***	0.152	-1.967	-1.037	1.107	176.63
	(7.061)	(8.380)	(2.903)	(1.719)	(2.354)	(1.466)	(2.076)	
Amenable to Emergency Care Only								
Total	-0.359	-3.561	4.294***	0.381	-0.759	-0.971	0.097	53.84
	(4.154)	(3.254)	(1.287)	(0.705)	(1.676)	(1.303)	(0.952)	
External Causes	-2.064	-0.560	0.559***	0.079	-0.575	-1.045	-0.639	19.72
	(2.028)	(1.324)	(0.198)	(0.207)	(0.711)	(1.464)	(0.766)	
AMI	0.747	-2.038	1.788***	0.202	0.018	0.235	0.553	14.6
	(2.158)	(2.107)	(0.489)	(0.363)	(1.187)	(0.260)	(0.398)	
Pneumonia (Except Bacterial)	-0.217	-1.571	1.415***	0.006	-0.205	-0.067	0.193	5.93
	(1.525)	(1.160)	(0.452)	(0.259)	(0.233)	(0.042)	(0.129)	
Other	1.175	0.607	0.532	0.094	0.004	-0.094	-0.010	13.59
	(1.960)	(1.655)	(0.343)	(0.253)	(0.464)	(0.098)	(0.192)	
Non-Amenable to Ambulatory or Emergency Care								
Total	-5.599	-8.293*	3.851***	-0.645	-0.571	-0.180	0.195	72,26
	(4.542)	(4.363)	(1.128)	(0.790)	(1.548)	(0.425)	(0.879)	
Cancer	-0.610	-1.268	1.016***	-0.338	-0.123	0.005	0.092	24.13
	(2.615)	(2.543)	(0.327)	(0.382)	(0.836)	(0.051)	(0.194)	
Digestive System Diseases	-1.252	-1.242	0.162**	-0.070	0.098	-0.168	-0.036	4.7
	(1.219)	(1.114)	(0.080)	(0.122)	(0.272)	(0.146)	(0.086)	
Delivery	-0.061	-0.064*	0.001	0.001	0.000***	0.001	-0.001	.05
	(0.040)	(0.036)	(0.001)	(0.001)	(0.000)	(0.001)	(0.006)	
Diseases of Veins & Arteries	-0.282	-0.284	0.065*	-0.037	-0.055	0.013	0.035*	1.23
	(0.461)	(0.509)	(0.038)	(0.026)	(0.126)	(0.020)	(0.021)	
Other	-3.393	-5.436*	2.608***	-0.201	-0.491	-0.031	0.105	42.16
	(3.440)	(2.795)	(0.887)	(0.538)	(1.467)	(0.353)	(0.680)	
City & Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Mean at Baseline	176.63	130.69	0.00	4.96	27.09	8.83	4.5	-

Notes: This table shows the weighted average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfoeuille (2022), giving to each estimator a weight proportional to the number of switchers. Controls are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government, and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Health region specific time trends (quarter/year) were included. Dependent variables are the deaths per 100,000 people by specific causes and by six different locations: hospitals, UPAs, other health facilities, household, street, and other places. The city level results are not directly comparable with the hospital results shown earlier because the former include only hospital with an ER. Also the hospital analysis models impact of an UPA opening within 4.5km of the hospital whereas the city analysis involves an UPA opening anywhere in the city, so the "catchment" area is much broader. Sample is composed of 92 municipalities. Standard errors clustered at the city level in all specifications. *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in rates per 100,000 inhabitants.

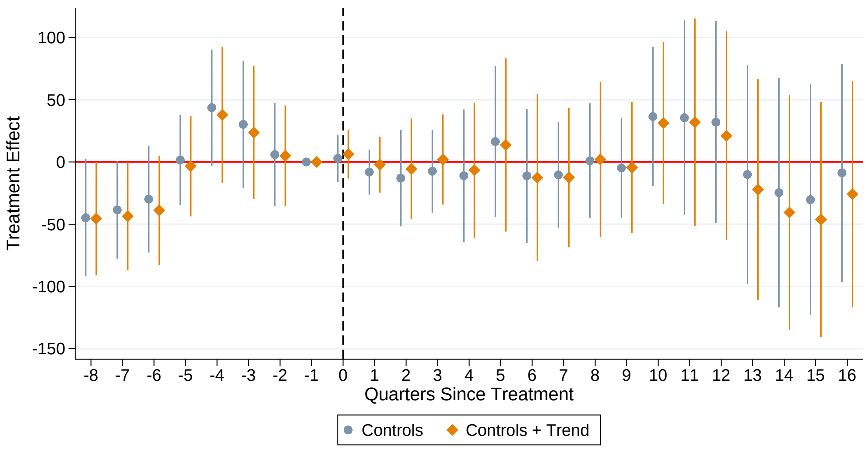
Table A.11: Deaths per 100,000 people by Specific Causes and Demographics

		Age						Gender		Race		Years of Schooling				
	Total (1)	0 to 4 (2)	5 to 14 (3)	15 to 24 (4)	25 to 44 (5)	45 to 64 (6)	65+ (7)	Female (8)	Male (9)	White (10)	Non-White (11)	0 to 3 (12)	4 to 7 (13)	8 to 11 (14)	12+ (15)	Mean at Baseline
Total																
	-7.023	0.538	-0.663	-0.338	-1.574	-0.731	-4.256	-4.310	-2.839	-4.353	-0.907	-4.870	-1.757	0.720	0.896	176.63
	(7.061)	(1.011)	(0.665)	(1.330)	(1.798)	(3.619)	(6.146)	(4.188)	(4.680)	(5.297)	(4.471)	(4.775)	(2.626)	(1.944)	(1.134)	
Amenable to Ambulatory/Emergency Care																
Amenable to Ambulatory & Emergency Care	-1.475	0.061	-0.101	-0.099	-0.032	-0.193	-1.111	-1.557	0.083	-0.824	-0.082	-0.088	-1.596*	-0.288	0.289	23.32
	(2.442)	(0.074)	(0.160)	(0.154)	(0.352)	(1.173)	(1.944)	(2.007)	(1.522)	(2.128)	(1.552)	(1.824)	(0.830)	(0.881)	(0.310)	
Amenable to Ambulatory Care Only	0.410	-0.133	0.074	0.240	0.312	0.314	-0.398	0.245	0.179	-0.269	0.902	-0.387	0.333	-0.476	-0.023	27.2
	(2.546)	(0.288)	(0.136)	(0.190)	(0.561)	(1.225)	(2.764)	(2.000)	(1.867)	(2.353)	(1.968)	(1.999)	(1.244)	(0.599)	(0.371)	
Amenable to Emergency Care Only	-0.359	0.196	-0.256	-0.155	-1.794	-0.144	1.795	0.557	-1.056	1.567	-1.770	0.347	-0.909	0.245	0.078	53.84
	(4.154)	(0.576)	(0.329)	(1.110)	(1.659)	(2.151)	(2.599)	(2.656)	(2.593)	(3.028)	(2.998)	(2.251)	(1.516)	(1.296)	(0.653)	
Non-Amenable to Ambulatory or Emergency Care	-5.599	0.415	-0.380	-0.324	-0.059	-0.707	-4.543	-3.555	-2.045	-4.827	0.043	-4.742*	0.415	1.240	0.552	72,26
	(4.542)	(0.779)	(0.419)	(0.532)	(1.041)	(2.080)	(3.704)	(3.571)	(3.467)	(3.461)	(3.003)	(2.858)	(2.205)	(1.123)	(0.686)	
City & Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Mean at Baseline	176.63	8,63	1.35	5.55	19.69	44.65	96.75	73,54	102.79	98.23	66,24	65,4	32.92	13.02	7.36	-

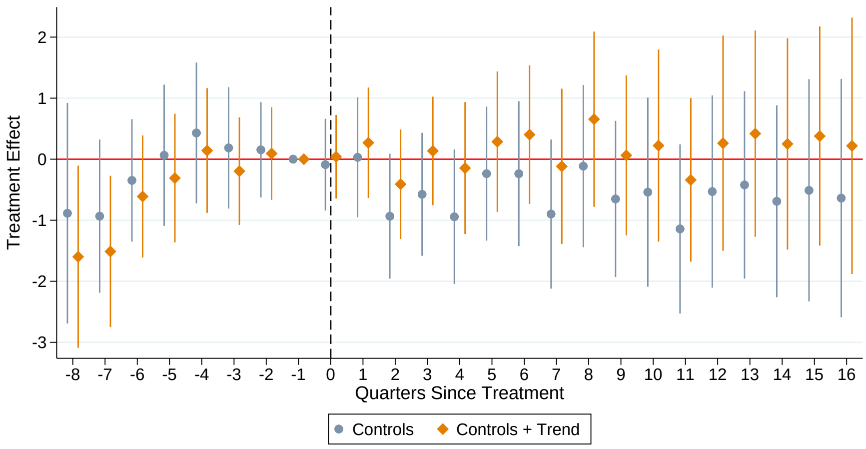
Notes: This table shows the weighted average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfoeuille (2022), giving to each estimator a weight proportional to the number of switchers. Controls are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government, and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Health region specific time trends (quarter/year) were included. Dependent variables are the deaths per 100,000 people by causes and the following demographics: age, gender, race, and years of schooling. Sample is composed of 92 cities. Standard errors clustered at the city level in all specifications. *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in rates per 100,000 inhabitants.

B Supplementary Figures

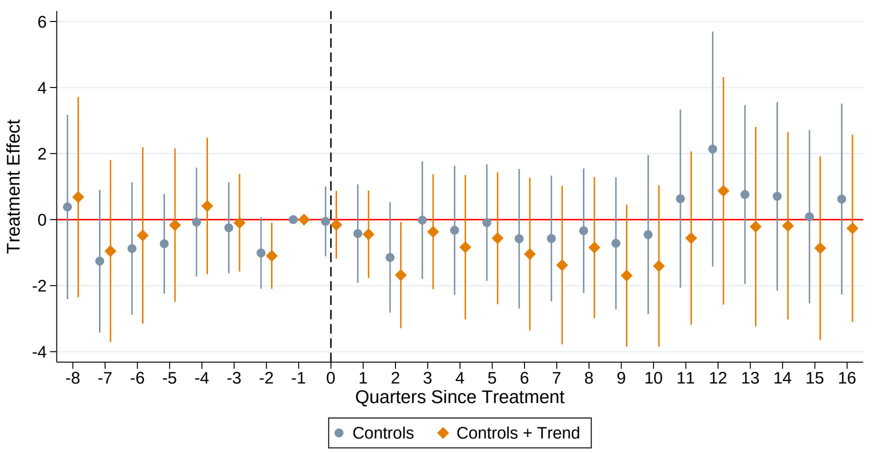
Figure B.1: Event Study - Inpatient Profile



(a) Mean Income



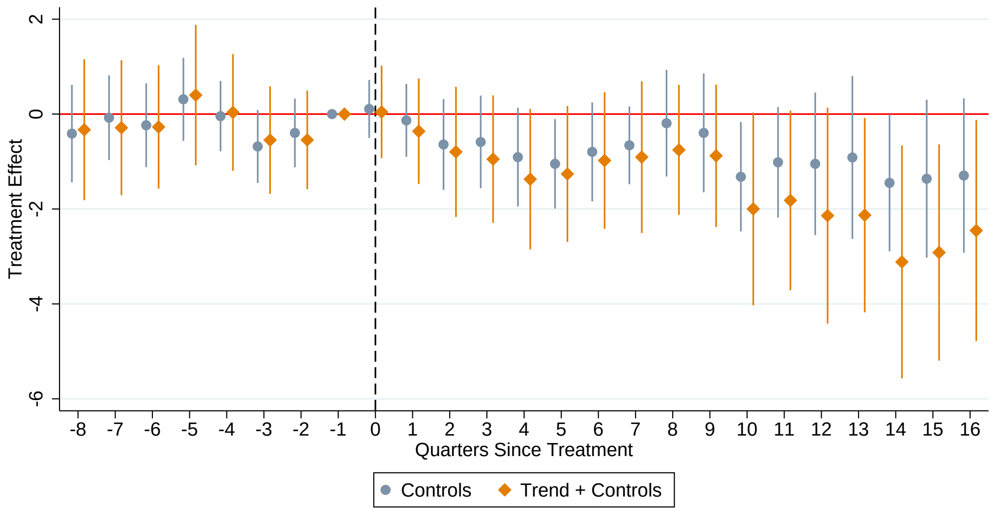
(b) Age



(c) % Female

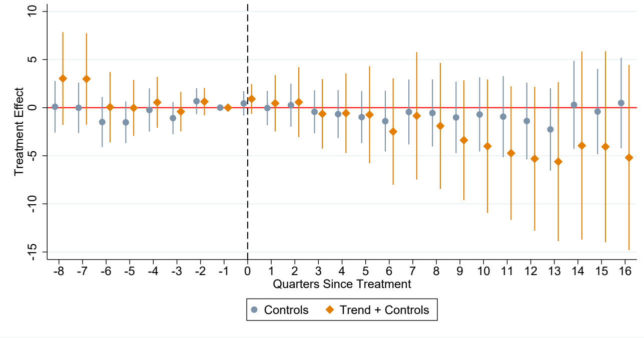
Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect on the average income, age and gender of hospitals' inpatients. Treatment is defined as the presence of an UPA inside the hospital's 4.5km catchment area. Vertical bars show 95% confidence intervals (CIs) around the coefficients. The results related to two different specifications are displayed. The first has hospital and time fixed effects as well as the following controls: cities' GDP, Bolsa Família Program transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. In the second, municipality-specific time (quarter/year) trends were included. Standard errors clustered at the hospital level.

Figure B.2: Event Study - Congestive Heart Failure per 100,000, City-Level Estimates

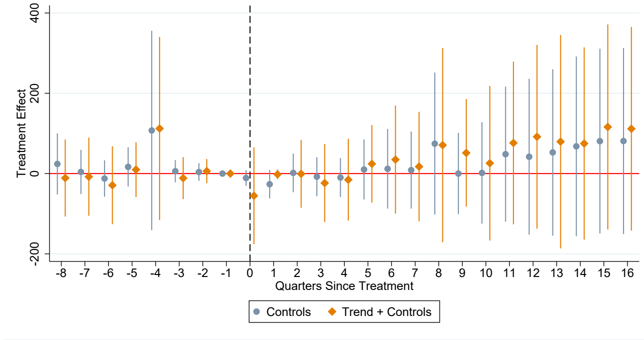


Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect on deaths per 100,000 people - measured at the municipality level. Treatment is defined as the presence of an UPA in the municipality. Vertical bars show 95% confidence intervals (CIs) around the coefficients. The results related to two different specifications are displayed. The first has municipality and time fixed effects as well as the following controls: cities' GDP, Bolsa Família Program transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. In the second, health region specific time (quarter/year) trends were included. Standard errors clustered at the municipality level.

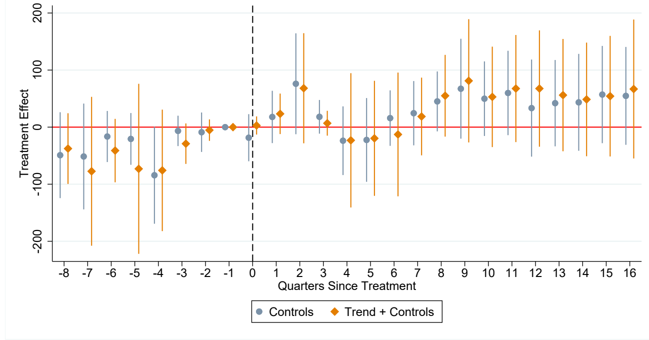
Figure B.3: Event Study - Health System, Municipality-Level Estimates



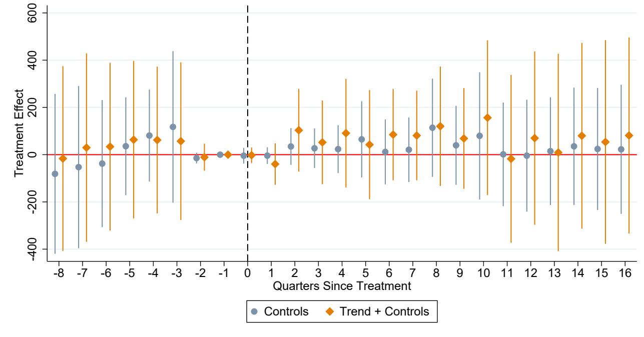
(a) FHP Coverage (%)



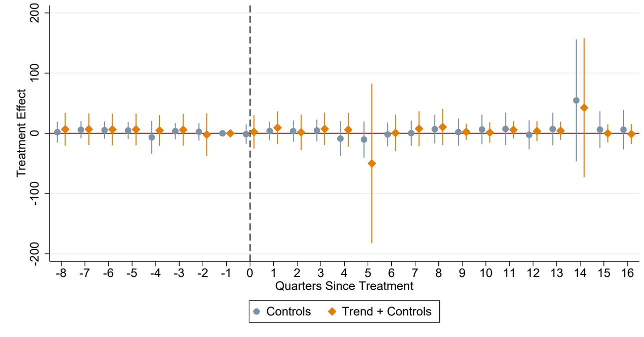
(b) Routine Consultations



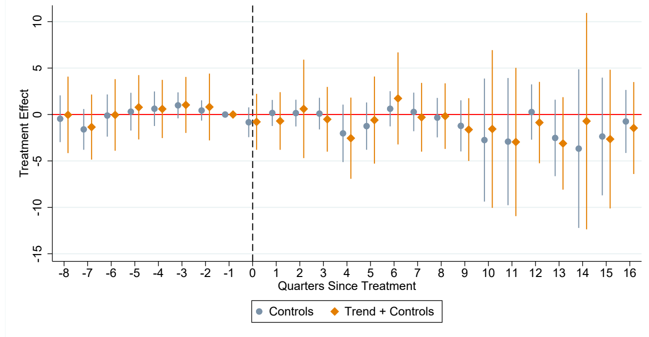
(c) Physician Consultation



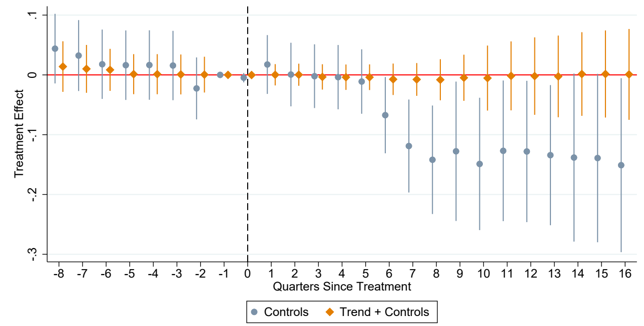
(d) Exams Prescribed



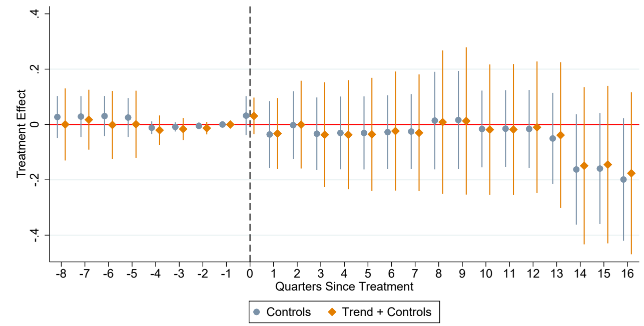
(e) Diabetics Registered



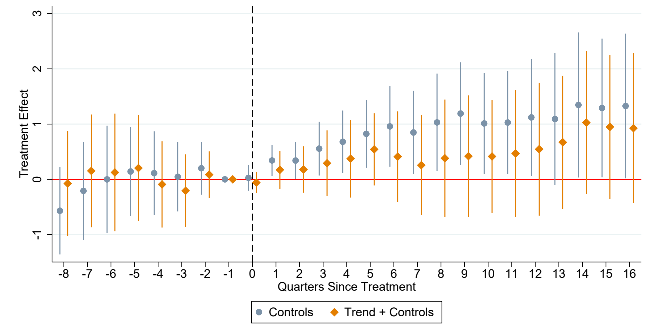
(f) Diabetics Followed Up (%)



(g) SAMU Ambulance Program



(h) Net New General Hospitals w/ ER



(i) Health Insurance Coverage (%)

Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect - measured at the municipality level - on many components of the primary care and on other layers of the health system: (a) Family Health Program coverage; (b) routine consultations performed per 1,000 inhabitants; (c) consultations performed by physicians per 1,000 inhabitants; (d) exams prescribed per 1,000 inhabitants; (e) registered diabetics per 1,000 inhabitants; (f) percent of diabetics registered that are followed up. Dependent variables related to other layers of the health system: (g) presence of SAMU ambulatory program; (h) net number of new SUS general hospitals with ER (opened - closed); (i) private health insurance coverage.

C Further Robustness Results

Table C.1: Hospitals' Outcomes, Hospital-Level Robustness Checks

	Main Sample (1)	Robustness: Excluding RJ City (2)	6.5km Catch Area. (3)	Hospitals w/ Adequate Data (4)	Health System Controls (5)	Traditional DD (6)	Mean at Baseline
Ambulatory Procedures							
Total	-0.200***	-0.243***	-0.179**	-0.188**	-0.213***	-0.314***	109,82
	(0.072)	(0.072)	(0.082)	(0.077)	(0.076)	(0.100)	
Basic Health Care	0.275	0.244	0.257	0.295	0.284	0.212	38,36
	(0.360)	(0.343)	(0.295)	(0.356)	(0.312)	(0.438)	
Medium Complexity	-0.191*	-0.246***	-0.226**	-0.185**	-0.208**	-0.413***	68,98
	(0.104)	(0.088)	(0.106)	(0.090)	(0.099)	(0.128)	
High Complexity	0.070	0.345	0.288	0.075	0.064	0.653*	0,80
	(0.313)	(0.336)	(0.268)	(0.317)	(0.332)	(0.342)	
Inpatient Measures: Amenable to Ambulatory Care & Emergency Care							
Hosp Admissions	-0.212	-0.237	-0.139	-0.195	-0.215	-0.247*	91.78
	(0.142)	(0.210)	(0.125)	(0.163)	(0.142)	(0.147)	
Total Deaths	-0.292***	-0.358***	-0.237**	-0.273***	-0.290***	-0.222***	23
	(0.092)	(0.097)	(0.097)	(0.087)	(0.080)	(0.058)	
Inpatient Deaths	-0.247**	-0.313**	-0.221**	-0.248**	-0.242**	-0.233*	7.03
	(0.112)	(0.153)	(0.106)	(0.121)	(0.118)	(0.122)	
% Inpatient Deaths	-0.323	-1.614	-0.575	-0.511	-0.203	-0.123	9,95
	(1.430)	(1.372)	(1.286)	(1.395)	(1.264)	(0.860)	
% 24h Inpatient Deaths	-0.489	-0.850	-0.365	-0.472	-0.510	-0.416*	1.92
	(0.535)	(0.776)	(0.434)	(0.690)	(0.661)	(0.250)	
Inpatient Measures: Amenable to Ambulatory Care Only							
Hosp Admissions	-0.297***	-0.342**	-0.257**	-0.297**	-0.297**	-0.379**	103.22
	(0.106)	(0.157)	(0.101)	(0.135)	(0.132)	(0.149)	
Total Deaths	-0.170**	-0.155	-0.151**	-0.188**	-0.168**	-0.211***	29.28
	(0.077)	(0.102)	(0.072)	(0.076)	(0.085)	(0.061)	
Inpatient Deaths	-0.317**	-0.373***	-0.329***	-0.292**	-0.300**	-0.226*	6.18
	(0.128)	(0.125)	(0.109)	(0.126)	(0.137)	(0.130)	
% Inpatient Deaths	-0.833	-0.918	-1.242*	-0.589	-0.734	0.055	6.77
	(0.778)	(0.903)	(0.741)	(0.935)	(0.908)	(0.649)	
% 24h Inpatient Deaths	-0.250	-0.338	-0.210	-0.224	-0.264	-0.327**	1.35
	(0.203)	(0.230)	(0.229)	(0.183)	(0.193)	(0.162)	
Inpatient Measures: Amenable to Emergency Care Only							
Hosp Admissions	-0.074	-0.029	-0.040	-0.072	-0.072	-0.234	175.3
	(0.150)	(0.179)	(0.129)	(0.134)	(0.137)	(0.143)	
Total Deaths	-0.192***	-0.199**	-0.157**	-0.179**	-0.192***	-0.182**	50.17
	(0.063)	(0.086)	(0.070)	(0.078)	(0.073)	(0.080)	
Inpatient Deaths	-0.250**	-0.236**	-0.258**	-0.251**	-0.245**	-0.243*	14.42
	(0.102)	(0.113)	(0.111)	(0.112)	(0.101)	(0.132)	
% Inpatient Deaths	-0.346	-0.039	-1.688	-0.303	-0.270	-1.121	9.93
	(0.925)	(1.005)	(1.086)	(0.985)	(0.981)	(1.090)	
% 24h Inpatient Deaths	-0.514*	-0.488	-0.228	-0.494	-0.495*	-0.870*	2.32
	(0.283)	(0.325)	(0.242)	(0.311)	(0.294)	(0.468)	
Inpatient Measures: Non-Amenable to Ambulatory or Emergency Care							
Hosp Admissions	0.013	0.116	-0.035	0.027	0.012	-0.012	397.57
	(0.098)	(0.073)	(0.096)	(0.081)	(0.082)	(0.104)	
Total Deaths	-0.145*	-0.119	-0.111	-0.116	-0.145	-0.192***	70.13
	(0.081)	(0.104)	(0.083)	(0.088)	(0.110)	(0.068)	
Inpatient Deaths	-0.328***	-0.410***	-0.293***	-0.295***	-0.338***	-0.163	10.01
	(0.088)	(0.112)	(0.094)	(0.100)	(0.081)	(0.119)	
% Inpatient Deaths	-1.499**	-2.327***	-1.204*	-1.262**	-1.519***	-0.681	3.57
	(0.635)	(0.590)	(0.617)	(0.558)	(0.541)	(0.495)	
% 24h Inpatient Deaths	-0.542**	-0.813***	-0.540**	-0.470*	-0.535**	-0.563**	.72
	(0.231)	(0.315)	(0.245)	(0.248)	(0.242)	(0.255)	
Hospital & Time FE	Yes	Yes	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	Yes	Yes	-

Notes: This table shows different robustness checks related to the main hospitals' outcomes studied. In the first column, we have our main specification, in which we excluded hospitals with bad SIA and/or SIH data. This means that we have 108 hospitals when looking at SIA outcomes, 111 when analysing SIH data and 114 (all) when looking at SIM data. The second column shows results when we exclude 13 hospitals from Rio de Janeiro City. Column 3 shows the results when we consider a 6.5km radius (mean distance traveled in the baseline to closest ER). Column 6 keeps only hospitals that have adequate data in both SIA and SIH, leaving us with 108 hospitals. Column 7 includes the following health-related controls: FHP coverage, the existence of SAMU ambulance program, number of general hospitals with ER that opened and closed inside the hospitals' catchment area, expansion of hospital ER through CER, and private health insurance coverage. Finally, column 8 shows the results using the traditional two-way fixed effect estimator. All results also include the following controls: cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government, and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Municipality-specific time (quarter/year) trends were also introduced (except for the traditional DD robustness). Dependent variables are the IHS, except for the % inpatient deaths. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and has the same metric as its corresponding variable.

Table C.2: Total Deaths per 100,000, City-Level Robustness Estimates

	Treatment Effect				Mean at
	(1)	(2)	(3)	(4)	Baseline
Main Specification	-2.287 (3.039)	-2.256 (4.982)	-4.146 (4.039)	-7.023 (7.232)	176.63
Robustness					
Excluding RJ City	-2.245 (3.077)	-2.456 (5.275)	-4.078 (3.529)	-7.702 (6.931)	176.28
Bad Controls	-2.287 (3.039)	-2.038 (5.119)	-4.146 (4.039)	-5.860 (7.921)	176.63
Traditional DD	-2.194 (2.483)	-2.711 (2.468)	-3.243 (2.356)	-2.986 (2.645)	176.63
City & Time FE	Yes	Yes	Yes	Yes	-
Controls	No	Yes	No	Yes	-
Trend	No	No	Yes	Yes	-

Notes: This table shows robustness checks related to the outcome total deaths per 100,000 inhabitants analysed at the city-level. In the first row, we have our main specification. The second excludes Rio de Janeiro city and the third includes the following health-related controls: PSF coverage, presence of SAMU ambulance program, number of general hospitals with ER that opened, closed expanded their ER thorough CER and private health insurance coverage. The fourth row shows the results using the traditional two-way fixed effect estimator. In all results, the following controls are introduced in columns (2) and (4): cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Health region specific time (quarter/year) trends were introduced in columns (3) and (4). Main sample is composed of 92 cities. Standard errors clustered at the city level in all specifications. *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in rates per 100,000 inhabitants.

Table C.3: Deaths per 100,000 by Cause and Location
City-Level Robustness Estimates

		Location						
	Total (1)	Hospital (2)	UPA (3)	Other Health Facility (4)	Household (5)	Street (6)	Other (7)	Mean at Baseline
Main Specification								
Total	-7.023	-17.942**	12.387***	0.152	-1.967	-1.037	1.107	176.63
	(7.061)	(8.380)	(2.903)	(1.719)	(2.354)	(1.466)	(2.076)	
Amenable to Ambulatory & Emergency Care	-1.475	-3.265	1.632***	0.082	-0.274	0.015	0.363	23.32
	(2.442)	(3.019)	(0.477)	(0.422)	(0.734)	(0.079)	(0.358)	
Amenable to Ambulatory Care Only	0.410	-2.823	2.610***	0.334	-0.363	0.099	0.452	27.2
	(2.546)	(2.784)	(0.717)	(0.635)	(1.095)	(0.250)	(0.551)	
Amenable to Emergency Care Only	-0.359	-3.561	4.294***	0.381	-0.759	-0.971	0.097	53.84
	(4.154)	(3.254)	(1.287)	(0.705)	(1.676)	(1.303)	(0.952)	
Non-Amenable to Ambulatory or Emergency Care	-5.599	-8.293*	3.851***	-0.645	-0.571	-0.180	0.195	72,26
	(4.542)	(4.363)	(1.128)	(0.790)	(1.548)	(0.425)	(0.879)	
Excluding RJ City								
Total	-7.702	-18.790**	12.727***	0.226	-2.291	-1.015	1.204	176.28
	(6.931)	(8.136)	(3.345)	(1.829)	(2.474)	(1.558)	(1.850)	
Amenable to Ambulatory & Emergency Care	-1.690	-3.476	1.671***	0.079	-0.310	0.012	0.362	23.34
	(2.704)	(2.635)	(0.473)	(0.401)	(0.824)	(0.097)	(0.310)	
Amenable to Ambulatory Care Only	0.162	-3.024	2.681***	0.325	-0.482	0.112	0.450	27.21
	(3.075)	(2.673)	(0.692)	(0.625)	(1.022)	(0.281)	(0.486)	
Amenable to Emergency Care Only	-0.576	-3.954	4.407***	0.381	-0.771	-0.963	0.171	53.71
	(3.957)	(2.960)	(1.105)	(0.709)	(1.542)	(1.420)	(1.046)	
Non-Amenable to Ambulatory or Emergency Care	-5.598	-8.337*	3.967***	-0.559	-0.728	-0.176	0.220	72.02
	(5.203)	(4.696)	(0.972)	(0.826)	(1.452)	(0.342)	(0.977)	
Health System Controls								
Total	-5.860	-16.462*	12.438***	0.349	-2.396	-1.287	1.233	176.63
	(7.311)	(8.534)	(2.883)	(1.852)	(2.564)	(1.703)	(2.011)	
Amenable to Ambulatory & Emergency Care	-1.329	-3.005	1.655***	0.047	-0.315	-0.031	0.363	23.32
	(2.486)	(3.160)	(0.475)	(0.482)	(0.798)	(0.094)	(0.351)	
Amenable to Ambulatory Care Only	0.561	-2.539	2.655***	0.341	-0.599	0.119	0.489	27.2
	(2.595)	(2.819)	(0.724)	(0.709)	(1.221)	(0.271)	(0.569)	
Amenable to Emergency Care Only	-0.321	-3.297	4.283***	0.478	-0.991	-1.219	0.235	53.84
	(4.374)	(3.426)	(1.289)	(0.714)	(1.805)	(1.381)	(0.965)	
Non-Amenable to Ambulatory or Emergency Care	-4.771	-7.621*	3.846***	-0.518	-0.492	-0.156	0.146	72,26
	(4.703)	(4.283)	(1.129)	(0.783)	(1.639)	(0.469)	(0.948)	
Traditional DD								
Total	-2.986	-17.183***	11.494***	-1.558	2.070**	-0.639	2.675*	176.63
	(2.645)	(3.860)	(2.547)	(1.215)	(0.911)	(0.425)	(1.622)	
Amenable to Ambulatory & Emergency Care	-0.018	-2.200***	1.358***	0.034	0.380*	0.009	0.401***	23.32
	(0.652)	(0.667)	(0.321)	(0.162)	(0.206)	(0.027)	(0.149)	
Amenable to Ambulatory Care Only	0.003	-3.896***	2.519***	-0.030	0.801**	-0.014	0.605*	27.2
	(0.745)	(0.808)	(0.582)	(0.282)	(0.322)	(0.059)	(0.314)	
Amenable to Emergency Care Only	-0.528	-4.514***	3.707***	-0.586	0.548	-0.503	0.732	53.84
	(1.139)	(1.342)	(0.763)	(0.406)	(0.405)	(0.399)	(0.552)	
Non-Amenable to Ambulatory or Emergency Care	-2.443	-6.573***	3.910***	-0.977**	0.342	-0.132	0.937	72,26
	(1.541)	(1.689)	(0.930)	(0.474)	(0.560)	(0.143)	(0.689)	
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
Mean at Baseline	176.63	130.69	0	4.96	27.09	8.83	4.5	-

Notes: This table shows robustness checks related to deaths per 100,000 inhabitants for different causes and locations at the city level. The first block shows results for our main specification. The second excludes Rio de Janeiro city and the third includes the following health related controls: PSF coverage, presence of SAMU ambulance program, number of general hospitals with ER that opened, closed expanded their ER thorough CER and private health insurance coverage. The fourth panel shows the results using the traditional two-way fixed effect estimator. All results also include the following controls: cities' GDP, Bolsa Família Program transfer (R$) per 1,000, political party in government, political alignment with the State government and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Health region specific time trends (quarter/year) were included (except for the traditional DD robustness). The city level results are not directly comparable with the hospital results shown earlier because the former include only hospital with an ER. Also the hospital analysis models impact of an UPA opening within 4.5km of the hospital whereas the city analysis involves an UPA opening anywhere in the city, so the "catchment" area is much broader. Main sample is composed of 92 cities. Standard errors clustered at the city level in all specifications. *** p<0.01, ** p<0.05, *p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in rates per 100,000 inhabitants.

Table C.4: Health System, City-Level Robustness Estimates

	% PSF Coverage (1)	Ambulance Program (2)	Net New Hospitals (3)
Main Specification	-2.408	-0.003	-0.040
	(2.793)	(0.017)	(0.104)
Robustness			
Excluding RJ City	-2.457	-0.003	-0.032
	(2.601)	(0.014)	(0.087)
Traditional DD	-4.152	-0.024*	0.096
	(2.752)	(0.012)	(0.179)
City & Time FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
Trend	Yes	Yes	Yes
Mean at Baseline	60.26	0.20	0.00

Notes: This table shows robustness checks related to the health system analysis at the city level. The first block shows results for our main specification. The second one excludes Rio de Janeiro city and the third shows the results using the traditional two-way fixed effect estimator. Controls are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, political alignment with the State government, and a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. Health region specific time trends (quarter/year) were included in the first robustness, but not in the traditional DD. Dependent variables are: (1) Family Health Program coverage; (2) presence of SAMU ambulatory program; (3) number of new SUS general hospitals with ER (opened - close). The main sample is composed of 92 cities. Standard errors clustered at the city level in all specifications. *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period 2005/Q1-2007/Q1, before the introduction of the first UPA in RJ, and is measured in rates per 100,000 inhabitants.

D Data Appendix

D.1 Conditions Amenable to Ambulatory and Emergency Care

The division of deaths and hospital admissions by conditions amenable and non-amenable to ambulatory and emergency care follow Alfradique et al. (2009) and Vashi et al. (2019), respectively. Alfradique et al. (2009) adapts the international ICD-10 list of conditions amenable to ambulatory care to the Brazilian context. These are conditions for which the need for hospitalization could have been avoided with adequate ambulatory and non-specialized care. High rates of admissions and deaths related to such conditions usually indicate the failure of the antecedent primary care and are used as an indirect indicator of its effectiveness. The description and codes related to these conditions can be found in Table D.1.

Table D.1: List of Conditions Amenable to Ambulatory Care

Condition Group	ICD-10 Codes
Preventable diseases due to immunization	A37; A36; A33 to A35; B26; B06; B05; A95; B16; G00.0; A17.0 A19; A15.0 to A15.3; A16.0 to A16.2, A15.4 to A15.9, A16.3 to A16.9, A17.1 to A17.9; A18; I00 to I02; A51 to A53; B50 to B54
Infectious Gastroenteritis and Complications	E86; A00 to A09
Anemia	D50
Nutritional deficiencies	E40 to E46; E50 to E64
Ear, nose, and throat infections	H66; J00; J01; J02; J03; J06; J31
Bacterial pneumonias	J13; J14; J15.3, J15.4; J15.8, J15.9; J18.1
Asthma	J45, J46
Pulmonary diseases	J20, J21; J40; J41; J42; J43; J47; J44;
Hypertension	I10; I11
Angina	I20
Heart Failure	I50; J81
Cerebrovascular diseases	I63 to I67; I69, G45 to G46
Diabetes mellitus	E10.0, E10.1, E11.0, E11.1, E12.0, E12.1; E13.0, E13.1; E14.0, E14.1; E10.2 to E10.8, E11.2 to E11.8; E12.2 to E12.8;E13.2 to E13.8; E14.2 to E14.8; E10.9, E11.9; E12.9, E13.9; E14.9
Epilepsies	G40, G41
Infection of the kidney and urinary tract	N10; N11; N12; N30; N34; N39.0
Infection of skin and subcutaneous tissue	A46; L01; L02; L03; L04; L08
Female pelvic organs inflammatory disease	N70; N71; N72; N73; N75; N76
Gastrointestinal ulcer	K25 to K28, K92.0, K92.1, K92.2
Diseases related to prenatal and delivery	O23; A50; P35.

Notes: Source for conditions amenable to ambulatory care: Ministry of Health Ordinance 221/2008. Link: https://bvsms.saude.gov.br/bvs/saudelegis/sas/2008/prt0221_17_04_2008.html

Vashi et al. (2019) provides a set of emergency care-sensitive conditions that are treated in most EDs, and represent common reasons for seeking emergency care. These are conditions for which timely, high-quality emergency care is expected to impact mortality and morbidity. However, contrary to conditions amenable to ambulatory care, higher rates of emergency care admissions are not an indicator of poor emergency care. Many acute illnesses and acute manifestations of chronic diseases are inevitable, and when they occur, the emergency care system should be able to rapidly identify and treat these episodes efficiently.

This classification was adapted to the Brazilian data by Isaacson et al. (2021), where the admissions selected for analysis were associated with at least one of the ICD-10 codes specified in Vashi et al. (2019). We follow the same procedure to classify deaths and hospitalizations sensitive to emergency care. Since the list is very comprehensive and detailed we reproduced only Vashi et al. (2019)'s main condition groups in Table D.2. Details about related ICD-10-CM codes can be found in their supplemental material.

Table D.2: List of Conditions Amenable to Emergency Care

Condition Group	
Abdominal, Lower Back, Pelvic & External Genitalia Injuries	Infectious Fasciitis
Acute Angle Closure Glaucoma	Stroke, not specified
Acute Appendicitis	Intracranial Injury
Acute Pancreatitis	Meningitis
Acute Respiratory Distress Syndrome	Moderate-Severe Burns and Corrosions
Alcohol Withdrawal	Myocardial Infarction
Anaphylaxis	Neck Injuries
Angina and Other Acute Ischemic Heart Disease	Other Cardiac Arrhythmia
Aortic Aneurysm and Dissection	Other Diseases of Intestine
Arterial Embolism and Thrombosis	Other Tachyarrhythmias
Asthma	Overdose/Poisonings
Chronic Obstructive Pulmonary Disease	Paralytic Ileus and Intestinal Obstruction wo Hernia
Cardiac Arrest and Severe Arrhythmias	Pericardial Disease, Endocarditis, and Myocarditis
Cerebral Infarction	Peritonitis
Cholecystitis and Perforation of the Gallbladder	Pneumonia
Complications of Cardiac & Vascular Prosthetic Devices/Grafts	Pneumothorax
Complications of Procedures	Postpartum Hemorrhage
Diabetes Mellitus-Acute	Pre-eclampsia/Eclampsia
Disorders of the Brain	Pulmonary Embolism
Early Complications of Trauma	Respiratory Failure
Ectopic Pregnancy	Sepsis & Systemic Inflammatory Response Syndrome
Encephalitis, Myelitis and Encephalomyelitis	Septic Arthritis
Environmental Exposures	Shock
Femur Fracture	Thoracic Injuries
Gastrointestinal Tract Bleeding and/or Perforation	Volume Depletion
Heart Failure	Intracranial Hemorrhage

Notes: Source for conditions amenable to emergency care: Vashi et al. (2019), supplemental material.

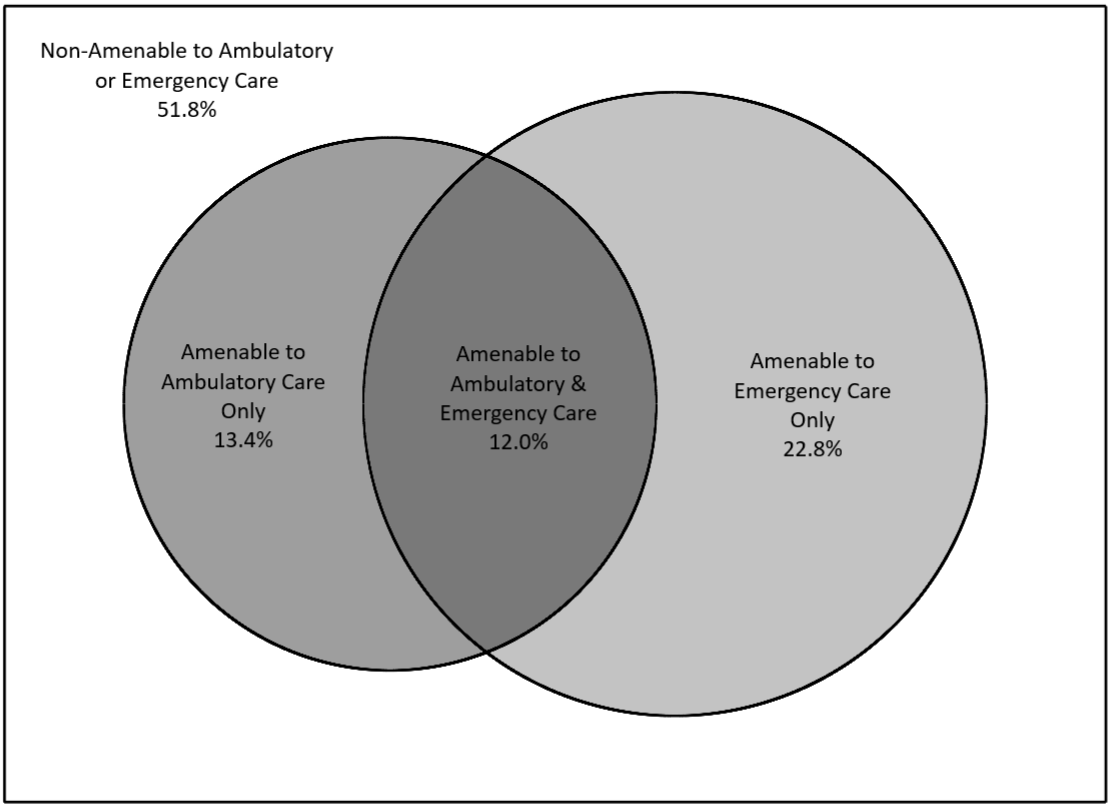
In this paper, we merged these two classifications and generated four categories that guided our analysis: (a) conditions amenable to both ambulatory and emergency care; (b) conditions sensitive only to ambulatory care; (c) conditions sensitive only to emergency care; (d) conditions that are not amenable to either ambulatory or emergency care. This division and the percentage of hospitalizations associated with them in the baseline (2005/Q1-2007/Q1) can be found in Figure D.1.

The first category, (a), includes conditions amenable to both ambulatory and emergency care such as acute complications in diabetes, bacterial pneumonia, stroke, asthma, and chronic obstructive pulmonary disease (COPD). This group is supposed to capture conditions that could usually be treated or prevented by good ambulatory care but, once unattended, lead to severe situations in which emergency care is needed.

The second group, (b), involves conditions that are amenable to ambulatory care but not emergent. These include infectious gastroenteritis, urinary tract infection, congestive heart failure, and cellulitis, among others. These are urgent and non-urgent situations that could be dealt with or prevented by appropriate basic healthcare.

The third group, (c), incorporates situations that are only sensitive to emergency care such as heart attacks, accidents, poisoning, and viral or unidentified pneumonia. These are mainly inevitable and severe conditions for which emergency care is needed.

Figure D.1: Venn Diagram

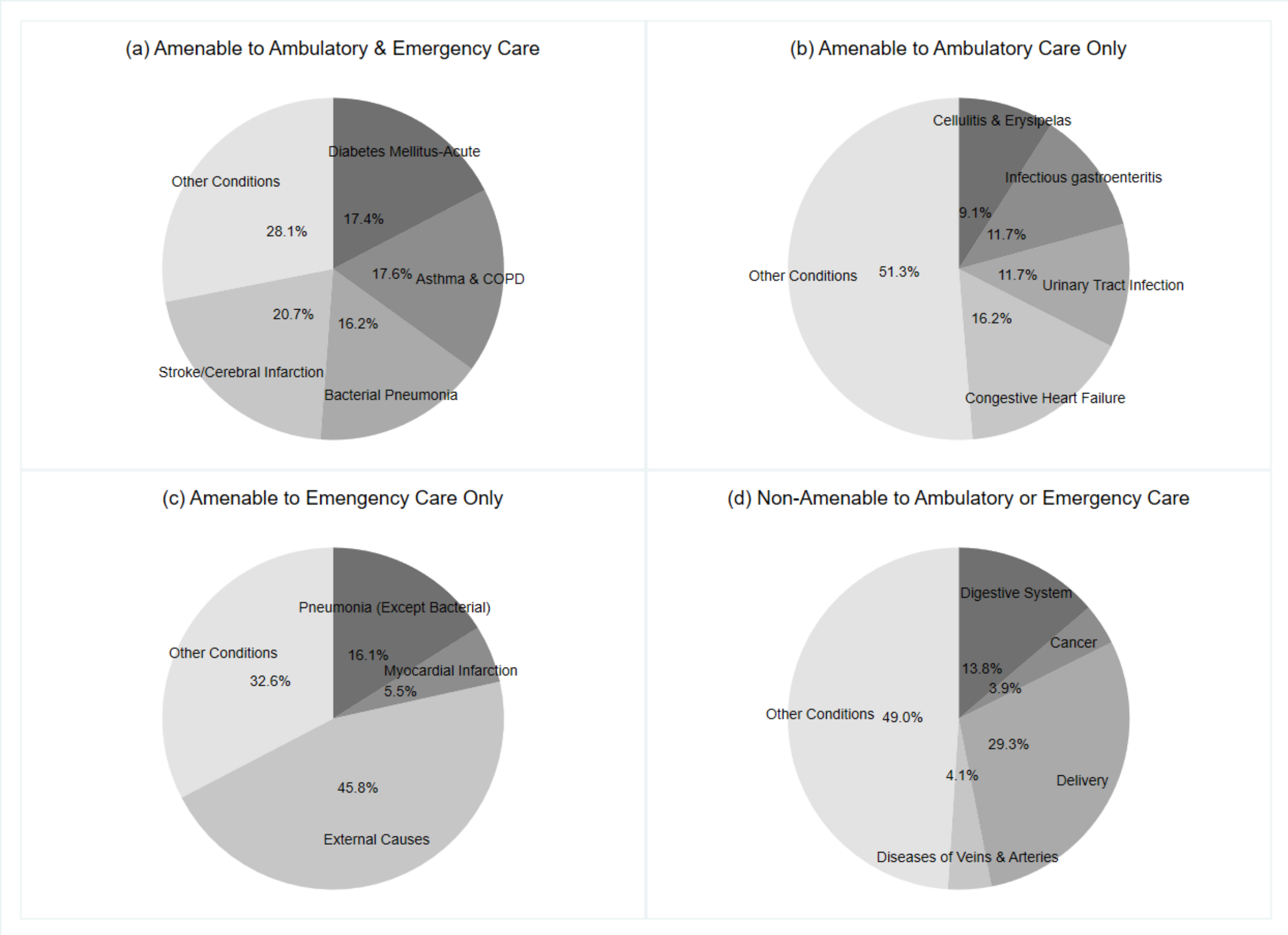


Notes: Percentage of hospitalizations (SIH) according to conditions amenable to ambulatory and/or emergency care in the baseline period (2005/Q1 - 2007/Q1). We merged the conditions sensitive to ambulatory care from Alfradique et al. (2009) with the conditions sensitive to emergency care from Vashi et al. (2019) to create the four categories displayed in the Venn Diagram.

Finally, the fourth category, (d), is a group of conditions that could neither be treated in an ER nor prevented by good ambulatory care. For them, we expect hospital and specialized care to be more appropriate. This category includes, but is not limited to, the following conditions: (i) childbirth; (ii) cancer; (iii) digestive system diseases (diverticulitis, hernia, Crohn's disease, cirrhosis, and others); (iv) diseases of veins and arteries (atherosclerosis, aneurysm, thrombophlebitis, varicose veins, and others).

UPAs were designed as a free-standing emergency department and an intermediate point of access within local health systems, in between the primary and the hospital care layers. They are equipped to handle conditions of basic to intermediate complexity and are particularly designed to provide: i) qualified and resolutive care for acute or chronic clinical conditions; ii) first aid to surgical and trauma cases, and; iii) medical consultations for cases of lower severity (Konder and O'Dwyer, 2016). Therefore, since UPAs were designed to treat conditions sensitive to both ambulatory and emergency care, the proposed division will be particularly convenient to analyse our setting. Figure D.2 depicts these four categories and the main conditions that constitute them, considering hospitalizations in the baseline period (2005/Q1-2007/Q1).

Figure D.2: Conditions Distribution Within Each Group



Notes: Percentage of hospitalizations (SIH) according to specific causes within each group of conditions amenable to ambulatory and/or emergency care in the baseline period (2005/Q1 - 2007/Q1). We merged the conditions sensitive to ambulatory care from Alfradique et al. (2009) with the conditions sensitive to emergency care from Vashi et al. (2019) to create the four categories displayed above.

D.2 Hospital and City Databases

The primary sample used to analyze hospitals' performance contains all UPAs and SUS general hospitals with a 24h walk-in emergency department in Rio de Janeiro between 2005 and 2016. These facilities and their geographical location were identified with the help of two data sources: the National Register of Health Establishments (CNES) and the Brazilian Open Data Portal (dados.gov.br). CNES has information on every Brazilian health facility and their human resources, installed capacity, location and type of services provided, regardless of whether or not they provide care to SUS users. It is available since 2003 on a monthly basis, but gained a new version in 2005. The portal, on the other hand, started with the Access to Information Act in 2011 and aims to provide data and transparency on the most varied themes of public administration.

To identify the hospitals needed for this study, we started from the sample of all establishments in CNES that, at least once between 2005-2016, were classified as a general hospital and had hospitalization and urgency services. Through CNES and dados.gov.br, we also identified all UPAs inaugurated in the period and obtained the latitude and longitude of all establishments. Then, we double-checked the classification and operational status of each facility with the support of phone calls to managers and searches online, and by inspecting whether there existed interruption of service production based on information from SIH and SIA administrative datasets. Also, the location of some facilities were not accurate, so we inspected them using Google maps and fixed the ones that were not correct.

We observe that, between 2005 and 2016, there were 139 general hospitals with ER and SUS care in Rio de Janeiro and 68 UPAs started operating. One UPA was exclusively pediatric and removed from our analysis. Among the hospitals, 25 opened and/or closed in the period. These facilities were not included as units of analysis in our main specifications, but the opening or closure of hospitals was controlled for in robustness checks performed at the hospital and city-level analyses (Appendix Section C). Therefore, our main database comprises 114 hospitals. Treatment was defined by an UPA falling within a 4.5km radius of the hospital - the median distance traveled by patients to the closest ER before the inauguration of the first UPA in 2007. We also checked the sensitivity of our estimates to a catchment area with a 6.5km radius, which represents the mean distance traveled by patients before UPAs (Appendix Section C).

Not all the 114 SUS general hospitals with 24h emergency services in RJ had consistent records throughout the entire 2005-2016 period in SIA and/or SIH. Three hospitals in SIH had missing data in sequence for more than a year, even though records were being filled into SIA and SIM and we could not find any information that they were closed or interrupted their services during the same period. Therefore we excluded these hospitals from the sample used in the analyses on SIH outcomes. The same happened with six hospitals in SIA, and we followed a similar protocol. In Appendix Section C we provide robustness checks in which we exclude hospitals with problems of data in either SIH or SIA and keep an homogeneous sample of 108 hospitals in all analyses. Results remain very similar.

In the second part of this study, we investigated the effects that UPAs had on the local mortality rate as well as on local health systems. In this analysis we relied on the 92 cities of RJ, in a quarterly panel from 2005 to 2016. Treatment was defined by the introduction of an UPA in the city.

D.3 Distance to the Nearest ER

We used the geocoded location of all UPAs and hospitals with emergency services, to calculate the mean and the median distance to the closest facility from each census tract, weighted by population size, at the municipality-level. We estimated distance both in kilometers and in minutes, taken by car at midnight, when there is limited traffic. We were also able to estimate the share of inhabitants for whom the closest ER is an UPA. To measure the routes (in kilometers) we used HERE maps.[25] Hospitals that opened and closed were taken into consideration, and routes were recalculated once they started or stopped operating. The median and mean distance travelled by patients before the first UPA is introduced was 4.5km and 6.5km, respectively.

D.4 Outcome and Control Variables

Hospital-Level Outcome Variables. In the study of hospitals' production and performance, we focus on four groups of outcomes available from the Brazilian Ministry of Health information systems (MS/Datasus). The first one involves the ambulatory procedures performed at hospitals' ER and clinics. The goal is to see whether UPAs had the desired effect of reducing the pressure on hospi-

[25] Link: https://developer.here.com/

tals' emergency departments. This data comes from the National Ambulatory Information System (SIA/Datasus), which contains administrative information on all outpatient care funded by SUS, including: diagnosis, observation, consultation, treatment, intervention, and rehabilitation services. SIA provides microdata at the procedure level, but many procedure codes have changed over time. Because of severe compatibility issues, we analysed the total number of procedures and also examined them subdivided as basic, medium, and high-complexity procedures.

Then we investigate outcomes related to hospitalizations from the National System of Information on Hospitalizations (Datasus/SIH). Less congestion in hospitals' ERs might increase relative resources and improve hospital performance towards its inpatients. However, this depends on patient selection and hospital response. SIH contains administrative information at the hospitalization level. This data is managed by the Ministry of Health, which receives information about hospitalizations from public and private hospitals through standardized inpatient forms - AIHs (Autorização de Internação Hospitalar). It includes all hospital admissions funded by SUS. SIH provides us with many inpatient information such as cause (ICD-10) and type (clinical, surgical, other) of admission to the hospital, duration of stay, final outcome (discharge or death), and patient socioeconomic characteristics (municipality and zip code of residence, gender, and date of birth).

Third, we analyze if the introduction of UPAs produced any restructuring in hospitals' human resources and infrastructure. Data comes from CNES and comprises information on the total number of professionals, the average number of hours worked in ambulatory and inpatient services, the number of beds by type, and equipment available.

Finally, we examine hospitals' total mortality (not only inpatient) and rely on microdata from vital statistics collected by the National System of Mortality Records (SIM/Datasus). SIM contains data on every death registered in Brazil and includes the deceased's age, gender, municipality of residence, cause of death (ICD-10), and location of death. In SIM, the establishments' CNES codes were implemented only in 2006, so all our total mortality analyses at the hospital level started in 2006 instead of 2005.

All variables were organized quarterly and at the hospital-level from 2005Q1 to 2016Q4. Details on how they were defined and constructed can be found in Tables D.3 and D.4. With the exception of mortality conditional on admission, occupation and average hours worked, we apply the inverse hyperbolic sine to all hospital outcomes, so the coefficients are interpreted as (approximate) fractional changes. The classification of hospital admissions and deaths by conditions amenable and non-amenable to primary and emergency care followed the Alfradique et al. (2009) and Vashi et al. (2019), respectively. For more information on these two classifications and on how they were merged in our setting, see Appendix A.

City-Level Outcome Variables. We used microdata from the National Register of Health Establishments (CNES/Datasus) and the National System of Mortality Records (SIM/Datasus) to build a balanced panel of quarterly data at the city level. Our sample covered all of the 92 cities of RJ from 2005Q1 to 2016Q4. CNES enabled us to identify the exact timing of UPAs' opening in each city and to compute the number of hospital inpatient beds not funded by SUS. SIM allowed us to identify whether the death occurred at home, in the street or in different types of health facilities. We used this information, together with ICD for the cause of death, to compute mortality rates by cause and location. For more information on how conditions were classified into amenable to primary and emergency care, see Appendix A.

To study the effects on the primary healthcare system, we first computed the Family Health Program (FHP) coverage from data provided by the Ministry of Health's Primary Health Care Department (SAPS). Then, we worked with data from SIAB which provides information on primary care routine consultations, exams prescribed and measures of patients registered and followed up. Data in SIAB goes only until 2015. As for information related to other layers of the health system, we collected the presence of ambulance services (SAMU) on the Brazilian Open Data Portal[26] and tracked the opening and closure of hospitals using SIH and CNES.

All city outcomes, with the exception of the FHP and the SAMU presence, are measured in per capita rates. Population data used to construct these rates at the city level comes from the Brazilian Institute of Geography and Statistics (IBGE). Details on how each variable was defined and constructed can be found in Table D.5.

Control Variables. Control variables used in both the hospital and city-level analyses are: (i) the amount transferred by the Bolsa Família Program per 1,000 inhabitants, which is the main conditional cash transfer program in Brazil implemented by the federal government and with data available from the Ministry of Citizenship (former Ministry of Social Development, MDS); (ii) dummies indicating the political party of the incumbent mayor and whether the mayor and the state governor were aligned in the same party for each period. These are from data provided by the Superior Electoral Court (TSE); (iii) annual city GDP per capita, from the Brazilian Institute of Geography and Statistics (IBGE); (iv) a dummy indicating cities that suffered from heavy rains and the collapse of hills in 2011. The share of the population covered by private health insurance from the National Supplementary Health Agency (ANS) is also used as a control in robustness checks. They were all computed at the municipality-year level. More details on how they were defined and constructed can be found in Table D.6

[26]More specifically on `http://dados.gov.br/dataset/samu_cobertura`.

D.5 Data Sources and Download Links

CNES: ftp://ftp.datasus.gov.br/dissemin/publicos/CNES/
SIH: ftp://ftp.datasus.gov.br/dissemin/publicos/SIHSUS/
SIA: ftp://ftp.datasus.gov.br/dissemin/publicos/SIASUS/
SIM: ftp://ftp.datasus.gov.br/dissemin/publicos/SIM/
UPA: https://dados.gov.br/dataset/upa_funcionamento_cnes
TSE Data: https://cepesp.io/consulta/tse
SAMU: https://dados.gov.br/dataset/samu_cobertura
Family Health Program Coverage: https://egestorab.saude.gov.br/paginas/acessoPublico/relatorios/relHistoricoCoberturaAB.xhtml
GDP Data: https://sidra.ibge.gov.br/pesquisa/pib-munic/tabelas
Bolsa Família Coverage: https://dados.gov.br/dataset/bolsa-familia-misocial
Population Data: https://sidra.ibge.gov.br/tabela/6579
Health Insurance Data: http://www.ans.gov.br/anstabnet/cgi-bin/dh?dados/tabnet_02.def
2010 Census: https://www.ibge.gov.br/estatisticas/sociais/habitacao/9662-censo-demografico-2010.html?=&t=microdados
Lat/Lon CNES: https://dados.gov.br/dataset/cadastro-nacional-de-estabelecimentos-de-saude-cnes1/resource/b5a7acba-f3db-448c-a29e-ec9e48563a08?inner_span=True
Lat/Lon UPA: http://i3geo.saude.gov.br/i3geo/ogc.htm?temaOgc=upa_funcionamento_cnes](http://i3geo.saude.gov.br/i3geo/ogc.htm?temaOgc=upa_funcionamento_cnes
Shapefile - RJ Municipalities: ftp://geoftp.ibge.gov.br/organizacao_do_territorio/malhas_territoriais/malhas_de_setores_censitarios__divisoes_intramunicipais/censo_2010/setores_censitarios_shp/rj/
Shapefile - RJ Census Tract: ftp://geoftp.ibge.gov.br/organizacao_do_territorio/malhas_territoriais/malhas_de_setores_censitarios__divisoes_intramunicipais/censo_2010/
2010 Household Income Data at the Census Tract Level: https://www.ibge.gov.br/estatisticas/sociais/trabalho/9662-censo-demografico-2010.html?=&t=downloads

Table D.3: Hospital Outcomes - Definitions

Hospital-Level Outcomes	Definition/Observations	Source
Ambulatory Procedures	**IHS(Number of ambulatory procedures performed)** Complexity was defined based on variable PA_NIVCP. Procedures' code changed in 2008 from SIA Table to SIGTAP and were made compatible.	SIA
Hospital Admissions	**IHS(Number of hospital admissions)** ICD-10 codes related to each cause examined are explained in Appendix D.1. Weekday: Monday-Friday; Weekend: Saturday & Sunday, variable DT_INTER.	SIH
Inpatient Deaths	**IHS(Number of inpatient deaths)** ICD-10 codes related to each cause examined are explained in Appendix D.1.	SIH
Deaths Conditional on Hospital Admission	**(# Inpatient deaths / # hospital admissions) x 100** ICD-10 codes related to each cause examined are explained in Appendix D.1.	SIH
Deaths w/n 24h Conditional on Hospital Admission	**(# Inpatient deaths within 24h / # hospital admissions) x100** ICD-10 codes related to each cause examined are explained in Appendix D.1	SIH
Total Deaths	**IHS(Number of total deaths)** ICD-10 codes related to each cause examined are explained in Appendix D.1. Weekday: Monday-Friday; Weekend: Saturday & Sunday. Day: between 7am-18pm; Night: 19pm-6am, variable HORAOBITO.	SIM
Inpatient Income	**Average Inpatient Income** Information comes from linking inpatient zipcode with census tracts' average household income from the 2010 Census.	SIH & 2010 Census
Inpatient Age and Gender	**% female inpatients; average inpatient age; % inpatients in different age categories** Age categories created: 0-4years, 5-14yrears, 15-24years, 25-44years, 45-64years and 65+ years. ICD-10 codes related to each cause examined are are explained in Appendix D.1.	SIH
Professionals	**IHS(Number of professionals); IHS(Number of physicians); IHS(Number of non-physicians)** Information comes from CNES professionals' database (PF). This database has information on all health workers jobs per establishment on a monthly basis. Variable PF_CBO contains the professional's occupation code (CBO) and allow us to identify physicians and non-physicians. CBO 2002 with the description of each code can be found here: http://tabnet.datasus.gov.br/cgi/cnes/CBO%202002.htm	CNES - PF
Average Hours Worked	**Average Hours Worked by SUS professionals** Information comes from CNES professionals database (PF). This database has information on all health workers jobs per establishment on a monthly basis Variables NUMHR_H, NUMHR_A and NUMHR_O have the number of hours/week worked in hospital, ambulatory and other services, respectively. They are filled for SUS professionals. We investigate time spent with hospital services (NUMHR_H) against the other two categories merged together (NUMHR_A+NUMHR_O). This information is then averaged over the number of SUS professionals in the establishment.	CNES - PF
Inpatient Beds	**IHS(Number of total inpatient beds); IHS(Number of inpatient beds by type)** Information comes from CNES inpatient beds database (LT). Variables QT_EXIST and TP_LEITO were used. The first one contains the number of existing inpatient beds (SUS and non-SUS) and the second has the type of bed (surgical, clinical, ITU/ICU, obstetric, pediatric, other specialties and hospital-day). We look at the total number of inpatient beds and also by the following types: surgical, obstetric, clinical, ITU/ICU, and we aggregate pediatric, other specialties, and hospital-day into an "other" category.	CNES - LT

Notes: All variables were calculated at the hospital-quarter level.

Table D.4: Hospital Outcomes - Definitions

Hospital-Level Outcomes	Definition/Observations	Source
Ambulatory and Emergency Beds	**IHS(Number of ambulatory and emergency beds)** Information comes from CNES establishment database (ST). The number of beds for children and adult observation in emergency and ambulatory structure is provided by the sum of variables: QTLEIT05 + QTLEIT06 + QTLEIT07 + QTLEIT08 + QTLEIT19 + QTLEIT20 + QTLEIT21 + QTLEIT22.	CNES - ST
Equipments	**IHS(Number of total equipments); IHS(Number of equipments by type)** Information comes from CNES equipment database (EQ). We look at the total number of equipment available for use: QT_USO Variable TIPEQUIP characterizes equipment in eight groups: diagnostic imaging; optical methods; graphics methods; life saving; infrastructure, dentistry, audiology and other. We aggregate infrastructure, dentistry, audiology and other in an "other" category. Diagnostic imaging equipment includes x-rays, mammographs, CT scanner, MRI and ultrasound machines. Optical methods incorporates endoscopes, laparoscopes, surgical microscope, among others. Graphics method equipment comprises electrocardiograph and electroencephalograph. Life saving equipment involves defibrillators, ventilators, bag valve mask, among others.	CNES - EQ
Occupancy Rate (%)	**(# inpatients / # inpatient beds) x 100, calculated for each day and then averaged over the quarter** Number of inpatients comes from SIH and number of inpatient beds comes from CNES (LT).	SIH & CNES - LT
Number of days occupancy is $\geq$ 85%	**# days in the quarter-year in which the occupancy rate is above 85%** Occupancy is define as above and calculated for each day. Then the number of days in which we see a value above or equal to 85% is calculated.	SIH & CNES - LT
Number of days occupancy is $\geq$ 100%	**# days in the quarter-year in which the occupancy rate is above 100%** Occupancy is define as above and calculated for each day. Then the number of days in which we see a value above or equal to 100% is calculated.	SIH & CNES - LT
Bed Turnover Rate	**(# inpatient discharges (including deaths) / # inpatient beds)** Number of inpatients comes from SIH and number of inpatient beds comes from CNES (LT).	SIH & CNES - LT

Notes: All variables were calculated at the hospital-quarter level.

Table D.5: City Outcomes - Definitions

Municipality-Level Outcomes	Definition/Observations	Source
Ambulatory Procedures Per Capita	**(Number of ambulatory procedures performed / Population)** Complexity was defined based on variable PA_NIVCP. Procedures' code changed in 2008 from SIA Table to SIGTAP and were made compatible.	SIA
Total Deaths per 100,000 Inhabitants	**(Number of Deaths / Population) x 100,000** Population data comes from IBGE. ICD-10 codes related to each cause examined are in Table **??** Location was mainly defined based on variable LOCOCOR from SIH, with the exception of deaths that occurred in UPAs. This location category was added by identifying UPAs CNES numbers.	SIM & IBGE
FHP Coverage (%)	**% Population covered in the municipality by the Family Health Program** Data on population coverage at the municipality level is provided by the Ministry of Health's Primary Health Care Department (SAPS)	SAPS
SAMU Ambulance Program	**Presence of SAMU Ambulance Program in the municipality** Dummy variable indicating if the municipality had SAMU in that period.	Brazilian Open Data Portal
Routine Consultations per 100,000 inhabitants	**(Number of Routine Consultations Performed in Primary Care / Population) x 100,000** Routine consultations come from SIAB and involve pre-natal and pediatric care and the following conditions: diabetes, hypertension, sexually transmitted diseases, leprosy, and tuberculosis. Population Data comes from IBGE.	SIAB & IBGE
Physician Consultations per 100,000 inhabitants	**(Number of Physician Consultations Performed in Primary Care / Population) x 100,000** Consultations performed by physicians in primary care. Information comes from SIAB. Population Data comes from IBGE.	SIAB & IBGE
Exams Prescribed per 100,000 inhabitants	**(Exams Prescribed in Primary Care / Population) x 100,000** Includes clinical pathology, radiodiagnostic, and cytopathological exams, ultrasounds, and other exams prescribed in primary care. Data comes from SIAB. Population Data comes from IBGE.	SIAB & IBGE
Diabetics Registered per 100,000 inhabitants	**(Number of registered people with diabetes in primary care / Population) x 100,000** Number of registered people with diabetes in primary care comes from SIAB. Population Data comes from IBGE.	SIAB & IBGE
Diabetics Followed-up (%)	**(Number of people with diabetes followed-up in primary care / Number of registered people with diabetes in primary care) x 100** Percent of registered people with diabetes in primary care that are regularly followed up. Data comes from SIAB.	SIAB

Notes: All variables were calculated at the city-quarter level.

Table D.6: Control Variables - Definitions

Controls	Definition/Observations	Source
Municipality Gross Domestic Product Per Capita	**Annual Municipality GDP / Population** Annual municipality GDP, GDP price deflator and population data are from IBGE. We computed the municipality GDP in 2010 reais and divided it by its population.	IBGE
Political Alignment	**Indicators of cities' political parties and state-city alignment** Data is from the Superior Electoral Court data repository, which was organized and made available by the Center for Politics and Economics in the Public Sector Studies (CEPESP/FGV). Through this database we constructed dummies indicating the political party of the incumbent mayor and whether the mayor and the state governor were aligned in the same party for each period.	TSE / CEPESP
Bolsa Família Program	**(Value of Bolsa Familia Program transfer (R$) per quarter / Population) x 1,000** This data is made available by the Ministry of Citizenship (former Ministry of Social Development, MDS) through the Brazilian Open Data Portal.	Brazilian Open Data Portal
Health Insurance Coverage (%)	**(Number of private health insurance beneficiaries / Population) x 100** Number of beneficiaries comes from the National Agency of Supplementary Health (ANS) Population Data comes from IBGE.	ANS & IBGE

Notes: All variables are defined at the city-year level.