IZA Institute of Labor Economics
Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 13992

Urgent Care Centers, Hospital Performance and Population Health

Sonia Bhalotra
Letícia Nunes
Rudi Rocha

DECEMBER 2020

IZA Institute of Labor Economics

Initiated by Deutsche Post Foundation

DISCUSSION PAPER SERIES

IZA DP No. 13992

Urgent Care Centers, Hospital Performance and Population Health

Sonia Bhalotra
Essex University and IZA

Letícia Nunes
IEPS

Rudi Rocha
FGV EAESP and IEPS

DECEMBER 2020

ISSN: 2365-9793

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Urgent Care Centers, Hospital Performance and Population Health*

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, indicated by a decline in inpatient mortality. This does not appear to derive from a change in the risk profile of cases going to hospital but rather from hospital resources being re-focused. In a significant departure from related research, we identify displacement by investigating population-level outcomes. Our most striking result is that a large share of the decline in hospital mortality is offset by deaths in UPAs, though there remains a net decline in deaths from cardiovascular conditions that are typically amenable to primary care.

JEL Classification: I11, I15, I18

Keywords: urgent care centers, hospital performance, displacement effects, health outcomes

Corresponding author:
Sonia Bhalotra
ISER & Department of Economics
University of Essex
Wivenhoe Park
Colchster CO4 3SQ
United Kingdom
E-mail: srbhal@essex.ac.uk

* We thank, without implicating, Daniel Avdic, Liang Bai, Luis Braido, Adriana Camacho, Francisco Costa, Gabriel Facchini, Tom Hone, Mudit Kapoor, Cecilia Machado, Nick Papageorge, Marcelo Santanna, Molly Schnell, André Trindade, and seminar participants at FGV/EPGE, UFMG, at the Public Health and Development Workshop (U. Gothenburg), at the 40th Meeting of the Brazilian Econometric Society and at the Special Session of Health Economics of the 41st Meeting of the Brazilian Econometric Society, at Brookings India, and at the 2020 Meeting of the LACEA Health Economics Network (LAHEN). Rudi Rocha and Sonia Bhalotra acknowledge funding from the British Academy for a Newton Advanced Fellowship (AF160082). Sonia Bhalotra acknowledges additional support for her time from ESRC grant ESM010236-1 awarded to the Human Rights, Big Data and Technology project at the Human Rights Centre in Essex.

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 cover. 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, but there is still fairly limited evidence of the extent to which this lowers the pressure on hospitals and 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 Urgent 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. The existing evidence on access to urgent care centers and hospital emergency rooms focuses on facility-level outcomes, typically hospital outcomes. We provide a more comprehensive analysis of hospital outcomes, but our our main contribution is that we assess displacement by investigating service diversion and by analysing population-level outcomes by facility type and at the regional level. Therefore we are able to uncover displacement and characterize effects through local health systems.

UPAs are health care facilities that provide an intermediate layer of services within health systems, between primary and hospital care. Like walk-in centres in the UK, and like 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 (general hospitals with emergency departments and UPAs) in the state.

We geo-coded the locations of all hospitals and UPAs, and obtained the exact date of opening of every UPA in RJ during 2005-2016. We obtained administrative data from several sources to investigate the role of intermediate emergency centers in unprecedented detail.

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

In the first part of the analysis, hospitals are the unit of analysis, and treatment is defined as opening of an UPA in their catchment area. Our empirical strategy involves comparing the evolution of outcomes between treated and untreated hospitals. In the second part, the city (municipality) is the unit of analysis and we compare treated with untreated cities over time. We track outcomes for eight quarters before to analyse pre-trends, and through sixteen quarters after UPA opening to determine persistence or fading of any immediate impacts. We use the estimator of de Chaisemartin and D'Haultfœuille (2020), which provides consistent estimates, allowing for heterogeneous treatment effects. Identification relies upon the assumption that the timing of opening of an UPA is quasi-random. Event study plots and placebo tests provide support for this assumption. The main threat to identification is then that, even if UPA opening was quasi-random, it may have coincided with other health policy changes. We assemble data on a range of public and private sector health system changes and are able to undermine this concern.

In examining hospital outcomes, in contrast to many existing studies, we provide evidence on outpatient and inpatient admissions. We further examine hospital deaths as a marker of hospital performance, and assess whether any performance differences might arise from endogenous selectivity in the profile of admissions. We classify all admissions and deaths by whether or not they were amenable to primary care. This is useful in assessing the role of UPAs as these are expected to prevent hospitalization of cases that could have been addressed with primary care. We then use data on hospital infrastructure to investigate how changes in resource allocation within hospitals might have underpinned improved performance. In these ways we provide a more fine-grained analysis of the mechanisms.

We present results not only for hospital-level outcomes but also for institutional responses and population-level health at the city level, which averts selection concerns. We address potential bias and illuminate potential mechanisms by investigating whether public and private providers respond to the opening of UPAs (supply response), and by examining diversion of outpatient procedures and deaths to non-hospital facilities (demand response). If the opening of urgent care centres like the Brazilian UPA improves hospital performance by displacing patients, then evaluations restricted to hospital performance will be upward biased. We address this by investigating location of death using population-level mortality rates in treated and untreated cities. Our use of rich administrative data allows us to drill down to the exact location, cause and time of death.[2]

Our main results are as follows. First, we establish the degree 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. Second, hospital register analysis shows that the opening of an UPA in the catchment area of a hospital

[2] Crépon et al. (2013), for example, highlight the common neglect of displacement effects in labour market policy evaluation, demonstrating that accounting for displacement effects of job placement assistance policies mutes their effectiveness.

is associated with an 18% decline in the number of hospital outpatient procedures. There is a 31% decline in hospital admissions for cases amenable to primary care, alongside no change in admissions for cases not amenable to primary care. Using administrative data on procedures delivered by all health facilities, we find that UPAs are almost entirely picking up the medium-complexity cases that do not go to hospital. These results suggest that UPAs fulfilled their purpose of taking the pressure off hospital outpatient services, including ER, with a potentially positive spillover to hospital inpatient departments.

We find improvements in hospital performance. Following the opening of an UPA, there is a decline in the total number of hospital deaths of 21% and in the number of inpatient deaths of 24%. This includes declines of 27% and 17% in deaths from conditions amenable and not amenable to primary care. Since fewer inpatient deaths may mechanically reflect fewer admissions, we examined deaths conditional on hospital admission. This rate only shows a decline in deaths from conditions not amenable to primary care, of 1.4 percentage points. Since these are conditions for which we did not see a decline in hospital admissions, this suggests that hospitals were able to direct the resources saved on account of having fewer outpatients and fewer admissions for primary care cases towards saving lives for those that genuinely required hospital care. To examine this conjecture more closely, we analysed 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, which is consistent with 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, in line with the observed performance improvements.

Since a decline in hospital deaths could alternatively reflect endogenous selection, we examined the profile of inpatient cases by age, gender and socioeconomic status. We find no evidence of selection on these observables. 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, and UPAs have a triage system designed to direct severe or urgent cases to hospitals. If this is right, then our estimates of improvements in hospital outcomes are conservative.

In a significant departure from the literature, using city vital statistics and breaking down by location, we confirm a significant decline in deaths in hospitals but also find that this is largely offset by a sharp and statistically significant increase in deaths in UPAs. In that sense, analyses of hospital-level outcomes may overstate the benefits of urgent care centers. For conditions amenable to primary care, hospital deaths decline by 6 in 100,000 people, and UPA deaths rise by 4. For conditions not amenable to primary care, hospital deaths decline by 13 and UPA deaths rise by 8. On balance, there is a net decline of 2.6% in total deaths, but this estimate is not precisely determined.[3] Disaggregating by cause of death, we

[3] UPAs operate triage, designed to redirect to hospitals cases that they do not have the facilities or personnel to deal with. However, information frictions often imply that patients do not perfectly observe nor assess risk and severity of their own condition prior to choice of health provider. UPAs absorb part of the spontaneous

observe a statistically significant decline of 15.2% in population-level mortality from a set of cardiovascular conditions amenable to primary care. These include essential (primary) hypertension, hypertensive heart disease, and chronic angina, a prevalent manifestation of cardiovascular disease that requires continuous monitoring and, eventually, urgent care as it can lead to recurrent myocardial infarction and death.

So as to increase our confidence that the results we identify flow directly from access to UPAs rather than from UPAs leading to other policy changes, we tested whether the introduction of UPAs was associated with changes in local health systems at other relevant margins. We observe no significant changes in public primary care coverage, access to ambulance services, private insurance coverage, or private beds per capita. We also observe no significant association with the opening or closure of hospitals.

Investigating dynamic effects, we find that the identified effects at both the hospital and city level persist through the years following the opening of UPAs. 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, and to city-quarter fixed effects in the hospital analysis and health region-quarter fixed effects in the city analysis. 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.

As discussed, our main contribution to a cognate literature is that we provide the first analysis of medium-complexity urgent care services outside hospitals that investigates not only hospital outcomes but also population-level outcomes and access to other services, identifying sharp displacement effects. Also, 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.

Possibly the closest related studies are Alexander et al. (2019) and Hollingsworth (2014), who find that retail clinics in the US lead to fewer hospital emergency room (ER) visits; and Allen et al. (2019), who show that establishment of urgent care centers in the US also leads to lower ER use but primarily by privately insured people who were their main target. 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 18% decline in outpatient procedures (which include ER). We additionally investigate a broader set of health system indicators and hospital outcomes, including hos-

demand, including cases that may not get to hospital on time to receive more specialized care. 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.

pital admissions and deaths, and identify a new concentration of deaths in UPAs, a dark side that is only visible when we investigate the diversion of cases to the new facilities.[4]

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. Our finding that the opening of UPAs providing many ER services led to a decrease in hospital and population-level deaths from cardiovascular causes resonates with this. We advance this literature by additionally examining changes in inpatient admissions, and death rates for all causes both inside and outside hospitals. Finally, in contrast to studies analysing short term fluctuations in hospital demand (Sharma and Stano, 2008; Schwierz et al., 2012; Johar et al., 2013), we look at the effects of a structural policy change in demand, also expanding the analysis to outcomes outside the hospital setting.

For countries considering the opening or closing of urgent care facilities, our results demonstrate that they have the potential to generate substantial improvements in ER crowding and hospital outcomes, but that it is important to investigate selection, to account for diversion, and to test for any other contemporaneous changes in the health system. Our finding that some of the decline in hospital deaths is counter-balanced by an increase in deaths in UPAs suggests a role for information, triage and coordination. We estimate that expenditures on UPAs are between 5.6% and 14.2% of total spending on public hospitals in RJ, and that this expenditure corresponds to around 60% of the additional investment that would be needed to obtain full primary care coverage in the state. This makes it relevant to consider whether the documented gains could be obtained through expanding primary health coverage, bearing in mind that services provided in primary care are not perfect substitutes for the services of urgent care centers, and they are not open 24/7.[5]

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 and its experience offers a potential model to other developing countries. The provision of timely treatment during 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

[4]While we make an important and general point of principle regarding displacement, we recognize that the remit of intermediate urgent care facilities may vary across contexts. Retail clinics in the US are strict about what they will and will not treat, and are not integrated with the hospital system. UPAs in Brazil are equipped to deal with a more comprehensive set of conditions and are part of the national public health system (SUS), allowing any citizen to walk in at no charge for any condition they deem fit. As discussed earlier in this section, UPAs operate triage.

[5]Based on a randomized control trial in Virginia, Bradley et al. (2017) conclude that primary care facilities offer an alternative to ER for non-emergent conditions. However, they find that expanding primary care does not bring down total costs because any savings from avoiding ER visits were offset by increased outpatient utilization.

myocardial infarction (Razzak and Kellermann, 2002). Our results are directly relevant to policy in Brazil as the RJ experience is now being extended to other states.

Our results are no less 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 also 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, implying a commitment to provide coverage for the entire population and across all health services. 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 and that 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 the scale-up of the Brazilian Family Health Program (FHP), which emerged as the primary care arm of SUS and was designed to shift 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, however, inequalities in access to health care persist, with many populations underserved, many regions experiencing scarcity of physical and human resources, 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).[6] 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 and the model started to be experimented by 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, in between the primary and the hospital care layers. UPAs are open 24/7 and count on a simple physical structure, which includes X-ray, 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 exact scale and amount of physical and human resources available in each UPA vary according to the expected demand and its location.[7] Administratively UPAs are public fa-

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

[7] Smaller facilities may occupy an area of 700m^2, have at least 2 doctors per shift and 7 beds, and are expected to cover at least an average of 150 visits per day. Larger facilities may occupy an area size greater than 1,300m^2, count on at least 6 doctors and 15 beds, and are expected to cover, on average, more than 350

cilities, operated under the responsibility of municipalities or states. 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. 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. In the Brazilian public health system, facilities do not compete over funding or patients in order to keep case volumes high and stay relevant within their catchment areas. In that sense, UPAs are not expected to compete over patients with hospitals in their catchment areas and, as shown in Section 7, we do not observe crowding out of physical or human resources in hospitals after the introduction of UPAs.[8]

Upon arrival at 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.[9] In that sense, UPAs are expected to absorb part of the demand for ambulatory services and cases of basic to intermediate complexity, then potentially helping 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 relatively 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 relatively 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 delivered by hospitals as well. In 2016, UPAs delivered approximately 42.9% of all ambulatory procedures performed in RJ should we consider the total number of procedures in UPAs and hospitals with emergency departments combined.

The State of Rio de Janeiro was a forerunner in the introduction of UPAs. A possible reason

visits per day. These parameters have changed over time, but in general correlate with expected demand. More recently, for instance, Ordinance No. 10/2017 established eight size categories.

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

[9]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.

is that, in the mid-2000s, it had among the lowest primary (FHP) 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). Political opportunism may have contributed as well, as UPAs could potentially attract visibility and electoral return in the short-term (O'Dwyer, 2010).

By 2016, when our period of analysis ends, there were 459 UPAs operating in Brazil, 68 of which in RJ. Figure 1 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, compared with 6% in the rest of the country.[10] Appendix Table A.1 shows that, in 2016, UPAs delivered approximately 30 million ambulatory procedures in RJ.

3 Data

In this paper we assess the impacts of UPAs on hospital performance as well as on population health and local health system indicators in RJ. 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 geocoded hospital and UPA data by linking four administrative data sets publicly available from the Brazilian Ministry of Health (MS/Datasus).

The National Register of Health Establishments (CNES) allows us to geocode hospitals and UPAs, identify the timing of opening of UPAs, and create indicators for hospital resources. We start the analysis in 2005 as there was a new and more extensive version of CNES from that year. To gain accuracy in geocoding, we double-checked the exact location and the operational status of each facility with the support of phone calls to managers and searches online, interviews with policymakers, and by inspecting whether there existed interruption of service production based on information from other administrative datasets. We also performed geocoding refinements on Google Maps and on the Brazilian Open Data Portal.[11] We were able to identify and precisely geocode all the 115 general hospitals with 24h emergency

[10] Percentage obtained from CNES data.
[11] Available at `http://dados.gov.br/dataset/cnes`.

services available in the public health system (SUS) and in operation in RJ over the 2005-2016 period. We also identified all the 68 UPAs inaugurated in RJ in the same period.[12,13]

The CNES data cover the location, type of services provided, and human and physical resources available in each facility including total number of professionals, average number of hours worked in ambulatory and inpatient services, the number of beds by type and equipment available. We construct indicators for hospital production and performance by relying on three additional sources of data.

First, we use administrative data on hospital admissions from the National System of Information on Hospitalizations (Datasus/SIH). This includes all hospital admissions covered by the public health system (SUS), both in public facilities and private hospitals accredited by the government, and provides information on patients' 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. Using a classification by the Ministry of Health Ordinance 221/2008,[14] we classify every case by whether or not the cause of hospitalization was amenable to primary care. This classification followed a methodology proposed and adapted to the Brazilian context by Alfradique et al. (2009).

Second, we use data from the National Ambulatory Information System (SIA/Datasus), which contains administrative information on all outpatient care services funded by SUS, to examine ambulatory procedures performed in health facilities including hospital emergency departments. The data cover procedures related to diagnosis, observation, consultation, treatment, intervention, and rehabilitation services. SIA provides microdata at the procedure level but in fact many procedure codes have changed over time. As it proved difficult to harmonize the codes over time, we analysed the total number of procedures and then examined them sub-divided as basic, medium and high-complexity procedures.

To examine mortality in hospitals by cause and time of death conditional on admission to inpatient services we use SIH/Datasus. We complement these data with microdata from vital statistics collected by the National System of Mortality Records (SIM/Datasus). SIM collects 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.[15]

Not all the 115 SUS general hospitals with 24h emergency services in RJ had consistent records throughout the entire 2005-2016 period in SIA and/or SIH. Four hospitals in SIH had missing data in sequence for more than a year, even though records were being filled

[12]One UPA was exclusively pediatric and removed from our analysis.

[13]Twenty-five other SUS general hospitals with ER officially opened and/or closed in the same period. These facilities were not included in our sample, but the opening or closure of hospitals is controlled for in robustness checks.

[14]Link: https://bvsms.saude.gov.br/bvs/saudelegis/sas/2008/prt0221_17_04_2008.html

[15]In the analysis related to SIM data at the hospital-level, our sample starts in 2006 instead of 2005 because the establishments' codes in SIM records changed in 2006. Therefore, we are not able to match them to identify the specific hospital where it happened before 2006.

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 D 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.

The microdata from CNES, SIH, SIA and SIM allow us to aggregate information and compute resource and production indicators as well as health outcomes at the hospital-by-quarter level. 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 Data on Population Health and on Local Health Systems

We use microdata from the health establishments register (CNES), the ambulatory system (SIA), the hospitalization system (SIH), and the vital statistics records (SIM) to build a balanced panel of quarterly data at the city level.[16] Our sample covers all of the 92 cities of RJ from 2005Q1 to 2016Q4. SIM allows 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.[17] CNES enables us to identify at the city level the exact timing of opening of UPAs as well as to map health facilities and health systems infrastructure. We use it to compute the number of hospital inpatient beds in the private sector. We compute Family Health Program coverage from data provided by the Ministry of Health's Primary Health Care Department (SAPS), and the presence of ambulance services (SAMU) from data available on the Brazilian Open Data Portal.[18] We also collect the share of the population covered by private health insurance from the National Supplementary Health Agency (ANS).

3.3 Auxiliary Data

As control variables in both the hospital and city-level analyses we use (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

[16]We use the terms city and municipality interchangeably.

[17]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).

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

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. Table A.3 presents summary statistics of all variables.

Appendix Section E provides further details on how exactly each variable used in our analysis was constructed and the original sources of information.

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 time and location 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'Haultffuille (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'Haultffuille (2020), 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'Haultffuille (2020) 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 $\ell \geq 0$:

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

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.[19] Notice that 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).[20] 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).[21] 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 100 replications.[22]

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. We show that our coefficients are robust to the inclusion of covariates and trends, mitigating 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'Haultfœuille (2020) to directly assess the plausibility of the underlying parallel trends as-

[19] 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 outcomes are measured in per capita rates.

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

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

[22] 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.

sumption. Notably 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 (Abraham and Sun, 2018). 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 address this by identifying a number of health system variables, and test whether they are orthogonal to UPA opening and whether controlling for them modifies the UPA coefficient.

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 proper specification of hospital catchment area will capture a substantial part of the facility's patient activity and exclude areas whose contribution adds random variation (Wheeler and Wang, 2015; Gilmour, 2010). A dominant feature in patient choice of hospital is distance to closest facility, especially for ER, though perceived quality of care and waiting times also matter (Capps et al., 2003; Gowrisankaran et al., 2015; Ho, 2006; Raval et al., 2017). 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.[23]

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.[24] We used the geocoded location of all hospitals with emergency services, and the geocoded location of all UPAs 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.[25] Hospitals that opened and closed were taken into consideration. Appendix Section E 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 3 displays the evolution of the share of hospitals that received an UPA in their catchment areas, reaching 45% in 2016.

[23]Wheeler and Wang (2015) review methods used to estimate catchment areas.
[24]We examine robustness of our results to varying this distance in Section 8.
[25]Link: https://www.here.com/

5 Access to Emergency Services and Hospital Outcomes

5.1 Access to Emergency Health Services

The opening of UPAs substantially improved access to emergency care in RJ. Using the geocoded location of all UPAs and general 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, estimated as travel time by car at midnight, when there is limited traffic.

Figures 4a and 4b show a substantial improvement in access to ER just after the introduction of the first UPA in the state. Figure 4c shows that, on average, UPAs become 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.

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 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 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 17.8% in the number of outpatient procedures. This decline stems from a reduction in procedures of medium complexity (-13.9%) and it persists over time (see Figure 5a).

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 3 displays estimates based on equation 1 with the richest set of controls. While the number of outpatient procedures per capita at hospitals declines by 0.32, the number at UPAs increases by 0.39. And this seems to be driven mainly by medium complexity procedure, where we see a -0.26 reduction in hospitals followed by an exact increase of 0.26 in UPAs. This is direct evidence that UPAs stepped in to share the hospital caseload. All of this shift is of medium complexity procedures. This is exactly what we would expect: high complexity procedures remain consistently channeled toward hospitals, basic procedures largely do not switch to hospitals, while UPAs take medium-complexity cases from hospitals.[26]

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 that are and are not amenable to primary care, we see a large and statistically significant decline of approximately 31% in admissions for causes amenable to primary care. The coefficient for causes not amenable to primary care is close to zero. We will show later (Table 7) that this aggregate veils a decline in admissions for external causes. Overall, the results from Table 2 are consistent with UPAs absorbing precisely the lower complexity cases amenable to primary care that were otherwise burdening hospitals. Coordinated and structured pre-hospital care can prevent unnecessary hospitalizations, which in our setting are captured by such conditions. Early intervention by UPAs can potentially prevent complications and aggravation of such diseases. Also, one of the purposes of UPAs was to compensate for the shortfall in primary care.[27]

Flexible coefficient plots are displayed in Figure 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. And, in every case, 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 principle, a reduced flow of both outpatient and inpatient services should imply that hospitals are less crowded, potentially leading to improvements in their overall performance in terms of patient outcomes. In practice, the extent to which outcomes improve will be moderated by selection. In Table 4 we examine changes in the age, gender and socioeconomic composition of hospital inpatients following UPA-openings.[28] We see no meaningful or statistically significant changes across the board – except for a few and small statistically significant coefficients, specifically for gender and age related to conditions amenable to

[26] Although not precisely estimated, we observe a reduction in basic procedures performed at primary health care (FHP) units, in line with UPAs sharing that load too.

[27] An alternative classification of cases is also in line with this – the decline in hospital admissions post-UPA is driven by clinical as opposed to surgical or other cases (results upon request).

[28] See Appendix Figure B.1 for the corresponding coefficient plots. 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.

primary care.

It remains possible that there is selection on severity of the condition that is uncorrelated or only weakly correlated with demographics and socioeconomic characteristics. 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 urgent cases to hospitals. If this is right, then our estimates of improvements in hospital outcomes will be conservative. While this is what we expect in principle, there will still be cases where either or both of the patient and the UPA triage professional do not correctly understand the symptoms. These cases will occasionally include high risk conditions.

5.4 Hospital Performance

We use in-hospital deaths to measure hospital performance. We report deaths from conditions amenable and not amenable to primary care so as to identify where any improvements lie. See the lower panel of Table 2, column 4. Total deaths decline by approximately 21%, and this result is remarkably stable across specifications. Figure 6 shows a structural break in trend coincident with UPA opening that persists for the four years for which we track outcomes. There is a broadly similar decline in the number of deaths from causes amenable (27%) and not amenable to primary care (18%). Units dealing with conditions amenable to primary care (including the outpatients department) will directly have more resources per admission following a decline in admissions. Units dealing with conditions not amenable to primary care (including the inpatients department and some emergency room cases) plausibly enjoyed spillovers from the total caseload being smaller. We will show evidence consistent with this in Section 7, in particular, an increase in hospital resources dedicated to inpatient care.

As we have more detailed information on inpatient deaths, which constitute 62% of all hospital deaths, we examined them further in Table 5. Inpatient deaths decline by 24% on average and, again, cases amenable and not amenable to primary care decline by similar proportions. The important new information in Table 5 relates to death rates defined as the number of inpatient deaths divided by the number of inpatient admissions. It is only for causes not amenable to primary care that we see a decline (of 1.4 percentage points) in inpatient death rates (column 4). Since there was no decline in admissions for this category, the result suggests inpatient departments benefited from reduced admission of cases amenable to primary care that were deflected to UPAs. We investigated the death rate in the 24 hours following admission as this is a crude proxy for deaths of patients that are admitted in an emergency condition and this also shows a significant decline, of 0.58 percentage points (column 5). The companion coefficient plots are displayed in Figure 7.

5.5 Timing and Causes of Death and Admission in Hospitals

Timing. So as to strengthen attribution of the decline in hospital deaths to the opening of UPAs, we broke them down by whether admission and death were on a weekday or weekend. Since a distinguishing feature of UPAs relative to baseline services provided by primary health facilities is that they are open 24/7, our expectation is that the decrease in cases going to hospital was larger on weekends. The results in Table 6 (columns 1-3) are consistent with this expectation. The decline in admissions is larger on weekends (15.3 *versus* 6.6 percent), and this is driven by admissions for causes not amenable to primary care (15.6 *versus* 0.7 percent).[29] It is notable that deaths decline on both weekdays and weekends but that the decline is larger on weekends (26.2 *versus* 18.1 percent) and, again, that this is driven by deaths from conditions not amenable to primary care (24.5 *versus* 15.6 percent). The mortality results are consistent with a decline in admissions on weekends releasing capacity which was used to raise performance.[30]

For deaths although not for admissions, we have additional information on the time of death (columns 4-5 of Table 6). We observe significant declines in both daytime and nighttime deaths. The day-night differences are not statistically significant and it is only for conditions amenable to primary care that there is a larger decline in death at night. Although the declines in both admissions and deaths on weekends are statistically significant, the confidence intervals are large enough that the weekend-weekday *differences* we describe are not statistically significant.

Hospital admissions and deaths by cause. Using the richest specification (column 4) from Table 2, we now examine effects on hospital admissions, deaths and inpatient outcomes by cause. We report the results on Table 7. Among conditions amenable to primary care, we observe declines in the number of admissions and deaths for every listed cause (columns 1-2). These declines are statistically significant for cardiovascular and respiratory diseases, and we also see a significant decline in deaths from diabetes. Inpatient deaths conditional on admissions (column 4) do not display a significant response in any category but as the disaggregation challenges statistical power we note that the coefficients are sizeable. Cardiovascular conditions amenable to primary care encompass cerebrovascular diseases and a remaining category that includes cases of essential (primary) hypertension, hypertensive heart disease, angina pectoris and heart failure. These are prevalent manifestations of cardiovascular disease that require continuous monitoring and management of treatment and, eventually, urgent care as it may lead to increased risk of death and recurrent myocardial infarction.

[29] Although the decline in admissions for this category is not statistically significant, admissions for the sub-category external causes (not amenable to primary care) did show a statistically significant fall, see Table 7.

[30] The additional capacity on weekends is likely to be particularly helpful as hospitals are typically understaffed on weekends. Fitzsimons and Vera-Hernández (2015) and Facchini (2020) provide evidence of this for the UK.

Among conditions not amenable to primary care, there is a significant decline in admissions for external causes (such as injuries). We see a significant decline in deaths from external causes conditional and unconditional on admissions. Although there is no drop in cardiovascular admissions in this category, we observe a significant decline in deaths from acute myocardial infarction (AMI) that includes outpatient/ER unit deaths, and a significant decline in inpatient deaths from other CVD related causes, which encompasses chronic and other acute ischaemic heart diseases; diseases of arteries, arterioles and capillaries; and diseases of veins, lymphatic vessels and lymph nodes. Here we also observe a significant decline in the death rate (column 4).

6 Population-Level Health Outcomes

The hospital analysis revealed that there were fewer outpatients and fewer inpatient admissions following the introduction of UPAs in hospital catchment areas. Thus, cases that never arrived at hospital were largely administered by UPAs, as indicated by Table 3. We found that this redistribution of cases led to better patient outcomes (death numbers and death rates) in hospitals. So, overall, the analysis suggests UPAs improved health outcomes. There are two potential caveats to this conclusion. The first is selection, which the preceding analysis suggests is not driving our results. The second is that even if there were genuine improvements in hospital performance indicated by a decline in hospital deaths, to gain a full picture of the benefits flowing from UPAs we need to assess outcomes of patients who went to UPAs instead of hospitals for treatment.

The first step we take in this direction is to analyse population-level mortality at the city level. Table 8 displays average estimates based on equation 1 for the effects of UPAs on total mortality rates across different specifications. Column 4 reports our most complete specification and shows a negative point estimate of -4.92. The coefficient is not small, indicating a 2.6% decline in total mortality, but it is not statistically significant. The event-study plot in Figure B.2 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.

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 9. Dependent variable means are displayed in the last column. We see compelling evidence of displacement here. At the city level, the number of deaths that occur in hospitals in general falls by 19.41 once the city has an UPA. However, the number of deaths in UPAs increases by 12.49 and by 2.14 in other places – which we argue are wrongly coded UPAs.[31] So the net decline is 4.87 deaths per

[31]Changes in deaths in other locations show 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

100,000 inhabitants, which is 2.6% and similar to the total reduction identified in Table 8. The results are sharp and clear in Figure 9, which also shows that the changes in hospital and UPA-located deaths are persistent through four years.

Population deaths by cause. Table 9 also provides location-specific changes in death rates by cause, showing that the broad tendency for displacement is pervasive. 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 cardiovascular causes amenable to primary care, other than cerebrovascular causes. For this category, hospital deaths decline by 3.36, UPA deaths increase by 1.14 and so population level deaths decline by 2.23 deaths in 100,000. Relative to the baseline mean death rate of 14.67, this is a considerable 15.2% reduction. These results are in line with these deaths being sensitive to the speed with which specialized medical care is accessible.[32]

When analysing population-level impacts, it is relevant to note that less than half of the hospitals in our data experienced the opening of an UPA in their catchment areas, and hospital outcomes cover all hospitals in each city. We nevertheless see a population-level decline in hospital deaths across causes, albeit this is only statistically significant for CVDs (declines of 3.32 deaths in 100,000 noted earlier) and respiratory (1.42 deaths), among causes amenable to primary care. Among causes not amenable to primary care, there is a significant decline in hospital deaths from AMI (2.45) and the residual category "other" (8.44), which includes mental disorders, deliveries, influenza and pneumonia not amenable to primary care. After adjusting for the increase in UPA deaths, there is a net decline in all of these cases, but it is not statistically significant.

Appendix Table A.4 shows estimates for cause-specific death rates by age and gender for the city-level population. We see no statistically significant differences in general. This is not surprising as we obtained an imprecise estimate for total deaths at the city level and the data are now cut into smaller slices. Although the differences are imprecise, the first row shows that the population level decline in deaths favoured women. We also observe a tendency towards decline in every age group from 5 years and upward. Appendix Table A.5 shows cause-specific changes in the death rate by race and education. Again the estimates are too imprecise to discern clear patterns.

in UPAs.

[32]These results are robust to other specifications, as shown in Appendix Table D.4, and are driven mainly by hypertension and heart failure conditions.

7 Hospital Resources and Local Health Systems

In this section we extend the analysis to investigate the impacts of the introduction of UPAs on hospital resources in particular, and on local health system resources in general.

7.1 Reallocation of Hospital Resources

We investigate here how the allocation of hospital resources responded to UPAs. See Table 10, which uses the richest specification of 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 also 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 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 document coefficient plots for human resources and hospital equipment, respectively. The bottom panel of Table 10 shows that occupancy rates, a measure of productivity, 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 hospital deaths.

7.2 Effects on Local Health Systems

The introduction of UPAs might have affected the allocation of resources and the functioning of local health systems at other relevant margins as well. Table 11 displays average estimates from our most complete municipality-level specification, in which we examine whether the opening of UPAs is associated with changes to the allocation of competing health policies and public health system resources as well as to private sector behavior. The event study graphs can be found in Figure 13.

The opening of an UPA does not lead to statistically significant changes in primary care (FHP) coverage, nor in SAMU participation, which marks access to ambulance services. We find no evidence that the opening of an UPA is significantly associated with the probability of opening or closures of public hospitals, the share of the population covered by private insurance, and the size of the private sector measured as the number of private beds per capita.

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 main outcomes. In Appendix Section C we present the placebo estimates proposed by de Chaisemartin and D'Haultfœuille (2020) averaged over the eight quarters previous to the implementation of UPA near a hospital or in a city. The results consistently provide support for our assumption that the timing of opening of an UPA is quasi-random.

We now discuss a number of further specification checks, displayed in Appendix D. 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, while the hospital-level analysis has so far defined the catchment area using a baseline distance of 4.5 km, we check the sensitivity of our estimates to varying the size of the catchment area around the vicinity of our benchmark by $\pm 10\%$. In another check we exclude all hospitals with inadequate data from our sample. Finally, 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. The robustness tests are provided for the hospital results (Tables D.1), the population-level results (Tables D.2, D.3, D.4) and for the additional checks on health system changes (Table D.5). Overall, we observe statistically stable patterns.

9 UPA vs. Hospitals' 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 they are not open 24/7, but acknowledging the burden on hospitals of cases amenable to primary care, another alternative to UPAs might have been to strengthen primary care facilities. In this section, we provide crude estimates of the costs of these alternatives that lend perspective to this discussion.

We measured hospital costs using the System of Health Accounts (SHA) methodology developed by the OECD to enable international comparisons of health spending (Ministry of Health, 2018), 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$223,583.17 per hospital bed.[33] To estimate how much RJ spent with its hospital system, we multiplied this ratio by the 28,982 SUS hospital beds available in the state and obtained a figure of R$ 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.[34] 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 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) (Vieira, 2013), 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 sug-

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

[34] Link: http://www.transparencia.rj.gov.br/transparencia/faces/sitios-transparencia-navigation/menu_sitios_analiseContas/BoletimTransparencia?_adf.ctrl-state=niazyas4g_1&_afrLoop=13639910013906637&_afrWindowMode=0&_afrWindowId=null

gest 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 primary 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 primary care (and of external cause conditions such as accidents). We also identified a decline in hospital deaths which, conditional upon admissions, is particularly of cases not amenable to primary care. Overall, UPAs succeeded in reducing over-crowding in hospital ER and inpatient departments, and to have thereby improved hospital performance. 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.

However 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 statistically significant decrease in population-level deaths from certain cardiovascular conditions. Deaths from CVD account for a third of the decline in all hospital deaths in our data and for 40% of the increase in deaths in UPAs. UPAs are in fact equipped to deal with a range of the less demanding CVD cases, but clearly not with the more complex cases.

Academic and policy discussion of emergency care capacity often uses deaths from AMI or, more generally, from CVD as a metric because they are more sensitive to delay, and often require specialized personnel or equipment (Gujral and Basu, 2019; Buchmueller et al., 2006; Mcclellan et al., 1994; Cutler, 2007; Herr, 2009). The importance of policies that provide emergent care cannot be overstated given that CVD 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 reason for hospitalization in OECD countries (Avdic, 2016).

Our results are topical for policymakers in Brazil, and also 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 (Cuellar and Gertler, 2003). In countries with mainly public provision of health, such as in Sweden, 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 both 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.

References

Abraham, S. and L. Sun (2018). Estimating Dynamic Treatment Effects in Event Studies With Heterogeneous Treatment Effects. *SSRN Electronic Journal*.

Alexander, D., J. Currie, and M. Schnell (2019). Check up before you check out: Retail clinics and emergency room use. *Journal of Public Economics 178*, 104050.

Alfradique, M. E., P. F. Bonolo, I. Dourado, M. F. Lima-Costa, and M. C. O. V. S. L. S. C. T. M. Macinko, J (2009). Internações por Condições Sensíveis à Atenção Primária: A Construção da Lista Brasileira como Ferramenta para Medir o Desempenho do Sistema de Saúde (Projeto ICSAP–Brasil). *Cadernos de Saúde Pública 25*(6), 1337–1349.

Allen, L., J. R. Cummings, and J. Hockenberry (2019). Urgent Care Centers and the Demand for Non-Emergent Emergency Department Visits. *NBER Working Paper Series*.

Autor, D. H. (2003). Outsourcing at Will: The Contribution of Unjust Dismissal Doctrine to the Growth of Employment Outsourcing. *Journal of Labor Economics 21*(1), 1–42.

Avdic, D. (2016). Improving efficiency or impairing access ? Health care consolidation and quality of care : Evidence from emergency hospital closures in. *Journal of Health Economics 48*, 44–60.

Bhalotra, S., R. Soares, and R. Rocha (2019). Does Universalization of Healthwork? Evidence from Health Systems Restructuring and Expansion in Brazil.

Bittencourt, R. J. and V. A. Hortale (2009). Intervenções para Solucionar a Superlotação nos Serviços de Emergência Hospitalar: Uma Revisão Sistemática. *Cadernos de Saúde Pública 25*(7), 1439–1454.

Bradley, C. J., D. Neumark, and L. S. Walker (2017). The Effect of Primary Care Visits on Health Care Utilization: Findings from a Randomized Controlled Trial. Technical report, National Bureau of Economic Research.

Brasil (2002). Portaria N.2048/GM de 5 de Novembro de 2002.

Buchmueller, T. C., M. Jacobson, and C. Wold (2006). How far to the hospital?. The effect of hospital closures on access to care. *Journal of Health Economics 25*(4), 740–761.

Capps, C., D. Dranove, and M. Satterthwaite (2003). Competition and market power in option demand markets. *RAND Journal of Economics 34*(4), 737–763.

Castro, M., A. Massuda, N. Menezes-Filho, M. Andrade, K. De Souza Noronha, R. Rocha, J. Macinko, T. Hone, R. Tasca, L. Giovanella, et al. (2019). Brazilian unified health system-the first 30 years and prospects for the future: modelling study.

Cooper, Z., S. Craig, M. Gaynor, and J. Reenen (2018). The Price Ain't Right? Hospital Prices and Health Spending on the Privately Insured. *NBER Working Paper Series 21815*.

Cowling, T. E., E. V. Cecil, M. A. Soljak, J. T. Lee, C. Millett, A. Majeed, R. M. Wachter, and M. J. Harris (2013). Access to Primary Care and Visits to Emergency Departments in England: A Cross-Sectional, Population-Based Study. *PLoS ONE 8*(6), 6–11.

Crépon, B., E. Duflo, M. Gurgand, R. Rathelot, and P. Zamora (2013). Do labor market policies have displacement effects? evidence from a clustered randomized experiment. *The Quarterly Journal of Economics 128*(2), 531–580.

Cuellar, A. E. and P. J. Gertler (2003). Trends in Hospital Consolidation: The Formation of Local Systems. *Health Affairs 22*(6), 77–87.

Currie, J. and D. Slusky (2020). Does the Marginal Hospitalization Save Lives? The Case of Respiratory Admissions for the Elderly. *NBER Working Paper Series* (26618).

Cutler, D. M. (2007). The lifetime costs and benefits of medical technology. *Journal of Health Economics 26*(6), 1081–1100.

de Chaisemartin, C. and X. D'Haultffuille (2020). Double Fixed Effects Estimators With Heterogeneous Treatment Effects. *SSRN Electronic Journal 110*(17), 2964–2996.

Facchini, G. (2020). Low Staffing in the Maternity Ward: Keep Calm and Call the Surgeon. Technical report, Univ Autonoma Barcelona.

Fitzsimons, E. and M. Vera-Hernández (2015). Breastfeeding and Child Development. Technical report, University College London and Institute for Fiscal Studies.

Gilmour, J. (2010). Identification of Hospital Catchment Areas Using Clustering : An Example from the NHS. (Folland 1983), 497–513.

Goodman-bacon, A., I. M. Anderson, M. Bailey, M. Bitler, B. Callaway, K. Carpenter, E. Chyn, B. Collins, J. Dinardo, A. Dustan, F. Gutierrez, B. Kovak, D. Miller, S. Nikpay, P. S. Anna, J. Shapiro, G. Solon, and I. Sorkin (2018). No Title.

Gowrisankaran, G., A. Nevo, and R. Town (2015). Mergers When Prices Are Negotiated: Evidence from the Hospital Industry. *American Economic Review 105*(1), 172–203.

Gujral, K. and A. Basu (2019). Impact of Rural and Urban Hospital Closures on Inpatient Mortality. *NBER Working Paper Series 26182*, 1–39.

Hamilton, B. H. and V. Ho (1998). Does practice make perfect?: Examining the relationship between hospital surgical volume and outcomes for hip fracture patients in quebec. *Medical Care*, 892–903.

Herr, A. (2009). On Hospital Competition: Quality, Efficiency, and Ownership.

Ho, K. (2006). The Welfare Effects of Restricted Hospital Choice in the US Medical Care Market. *Journal of Applied Econometric 1079*(November), 1039–1079.

Hollingsworth, A. (2014). Retail Health Clinics : Endogenous Location Choice and Emergency Department Diversion.

Hsia, R. Y., A. L. Kellermann, and Y.-C. Shen (2011). Factors Associated with Closures of Emergency Departments in the United States. *JAMA 305*(19), 1978–1985.

Hsia, R. Y. and Y. C. Shen (2019). Emergency department closures and openings: Spillover effects on patient outcomes in bystander hospitals. *Health Affairs 38*(9), 1496–1504.

Johar, M., G. S. Jones, and E. Savage (2013). Emergency Admissions and Elective Surgery Waiting Times. *Health Economics 756*(June 2012), 749–756.

Keeler, T. E. and J. S. Ying (1996). Hospital Costs and Excess Bed Capacity: A Statistical Analysis. *The Review of Economics and Statistics 78*(3), 470–481.

Konder, M. and G. O'Dwyer (2016). The integration of the Emergency Care Units (UPA) with healthcare services in the city of Rio de Janeiro, Brazil. *Interface 20*(59), 879–892.

Luft, H. S., S. S. Hunt, and S. C. Maerki (1987). The volume-outcome relationship: practice-makes-perfect or selective-referral patterns? *Health Services Research 22*(2), 157.

Mcclellan, M., B. J. Mcneil, and J. P. Newhouse (1994). Does More Intensive Treatment of Acute Myocardial Infarction in the Elderly Reduce Mortality?: Analysis Using Instrumental Variables. *JAMA: The Journal of the American Medical Association 272*(11), 859–866.

Ministry of Health (2018). Brazilian Public Health System (SUS) Accounts from an international accounting (SHA) perspective. Brazil: 2010-2014. *Ministério da Saúde and Fiocruz*.

NCSL (2016). Retail Health Clinics: State Legislation and Laws. Technical report, National Conference of State Legislatures.

O'Dwyer, G. (2010). A Gestão da Atenção às Urgências e o Protagonismo Federal. *Ciência & Saúde Coletiva 15*, 2395–2404.

O'Dwyer, G., M. Konder, C. Machado, C. Alves, and R. Alves (2013). The current scenario of emergency care policies in Brazil. *BMC health services research*.

Raval, D., T. Rosenbaum, and N. E. Wilson (2017). Using Disaster Induced Closures to Evaluate Discrete Choice Models of Hospital Demand .

Razzak, J. A. and A. L. Kellermann (2002). Emergency Medical Care in Developing Countries: Is It Worthwhile? *Bulletin of the World Health Organization 80*(01).

Rocha, R. and R. R. Soares (2010). Evaluating the Impact of Community-Based Health Interventions: Evidence from Brazil's Family Health Program. *Health Economics 19*, 126–158.

Schwierz, C., B. Augurzky, A. Focke, and J. Wasem (2012). Demand, selection and patient outcomes in German acute care hospitals. *Health Economics 21*(3), 209–221.

Sharma, R. and M. Stano (2008). Short-term fluctuations in hospital demand : implications for admission , discharge , and discriminatory behavior. *39*(2), 586–606.

Sousa, M. F. d. and E. M. Hamann (2009). Programa Saúde da Família no Brasil: Uma Agenda Incompleta? *Ciência & Saúde Coletiva 14*, 1325–1335.

Torjesen, I. (2013). Monitor investigates reasons behind closure of "popular" Darzi walk-in centres. *BMJ (Clinical research ed.) 346*(May), 2010–2011.

Vieira, S. (2013). Estimativas de custos dos recursos humanos em atenção básica: Equipes de Saúde da Família (ESF) e Equipes de Saúde Bucal (ESB). *IPEA Technical Note* (16), 1–51.

Wheeler, D. and A. Wang (2015). Catchment Area Analysis Using Generalized Additive Models. *Austin Biometrics and Biostatistics 2*(3).

WHO (2010). Health Systems Financing and the Path to Universal Coverage.

Main Tables

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

	UPA (1)	UPA (2)	UPA (3)	Mean at Baseline
Median Route (km)	-4.491***	-1.963***	-2.118**	7.73
	(0.806)	(0.661)	(0.852)	
Median Time (Min)	-6.006***	-3.399***	-3.320***	14.37
	(1.114)	(0.879)	(1.066)	
Mean Route (km)	-4.545***	-1.747***	-1.881**	9.17
	(0.750)	(0.591)	(0.769)	
Mean Time (Min)	-6.245***	-2.902***	-2.830***	16.37
	(1.047)	(0.751)	(0.938)	
% Population Closer to UPA	41.051***	43.696***	35.761***	0.00
	(4.067)	(3.960)	(4.363)	
Observations	4416	4416	4416	-
Municipality 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. Routes are measures 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

	Specifications				Mean at
	(1)	(2)	(3)	(4)	Baseline
IHS(Amb Procedures)					
Total	-0.211***	-0.195**	-0.200**	-0.178**	59.79
	(0.076)	(0.085)	(0.079)	(0.085)	
Basic Health Care	0.214	0.301	0.277	0.364	16.70
	(0.366)	(0.340)	(0.376)	(0.342)	
Medium Complexity	-0.231**	-0.199*	-0.191**	-0.139	41.19
	(0.109)	(0.111)	(0.092)	(0.107)	
High Complexity	0.453*	0.336	0.071	0.071	0.24
	(0.263)	(0.284)	(0.302)	(0.232)	
IHS(Hospital Adm)					
Total	-0.009	-0.062	-0.045	-0.062	579.86
	(0.057)	(0.060)	(0.061)	(0.059)	
Amenable to Primary Care	-0.277**	-0.307**	-0.287**	-0.311**	146.44
	(0.135)	(0.137)	(0.134)	(0.128)	
Non-Amenable to Primary Care	0.043	-0.023	0.000	-0.014	433.4
	(0.068)	(0.071)	(0.069)	(0.074)	
IHS(Total Deaths)					
Total	-0.208**	-0.194***	-0.212***	-0.210***	76.28
	(0.082)	(0.065)	(0.079)	(0.081)	
Amenable to Primary Care	-0.267***	-0.272***	-0.260***	-0.268***	23.18
	(0.080)	(0.087)	(0.077)	(0.074)	
Non-Amenable to Primary Care	-0.171**	-0.154*	-0.184**	-0.180**	53.1
	(0.083)	(0.082)	(0.088)	(0.078)	
Hospital & Time FE	Yes	Yes	Yes	Yes	-
Controls	No	Yes	No	Yes	-
Trend	No	No	Yes	Yes	-

Notes: This table shows the simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfœuille (2020) over four years after an UPA is introduced in the 4.5km hospital's catchment area. Related UPA placebo effects can be found in Table C.1. 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' demand and mortality, so the coefficients are interpreted as (approximate) fractional changes. Sample is composed of 109 hospitals when analysing ambulatory procedures (SIA), 111 when looking at hospital admissions (SIH) and 115 when the outcome is hospitals' total deaths (SIM). We cluster 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 of two years before the introduction of an UPA near the hospital, is measured in levels instead of IHS and its ambulatory procedures' numbers are in thousands.

Table 3: Ambulatory Procedures Per Capita by Complexity and Location: Municipality-Level Estimates

		Location				
	Total (1)	Hospital (2)	UPA (3)	FHP (4)	Other Health Fac (5)	Mean at Baseline
All	-0.502	-0.316	0.389***	-0.592	0.017	5.68
	(0.642)	(0.209)	(0.076)	(0.522)	(0.363)	
Basic Health Care	-0.501	-0.062	0.131***	-0.568	-0.002	2.98
	(0.671)	(0.091)	(0.042)	(0.494)	(0.226)	
Medium Complexity	-0.017	-0.257	0.258***	0.009	-0.027	2.34
	(0.215)	(0.166)	(0.039)	(0.038)	(0.208)	
High Complexity	0.019	0.001	0.000	0.000	0.018	0.01
	(0.017)	(0.001)	(0.000)	(0.000)	(0.016)	
City & Time FE	Yes	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	Yes	-
Mean at Baseline	5.68	1.26	0.01	1.82	2.60	-

Notes: This table shows the simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfœuille (2020) over four years after an UPA is introduced in a municipality. 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 four different locations: hospitals, UPAs, establishments with basic healthcare program (FHP/ACS/NASF) and other health facilities. Sample is composed of 92 cities. Standard errors clustered at the municipality level in all specifications. *** p<0.01, ** p<0.05, * p<0.1. Baseline refers to the period of two years before the introduction of an UPA in the municipality and is measured in per capita rates.

Table 4: UPA Effects on Inpatient Profile

	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										
	-0.377	-0.774	0.101	0.073	-0.374	0.688	-0.455	-0.374	0.442	45.4
	(27.992)	(1.087)	(0.732)	(0.495)	(0.411)	(0.738)	(0.548)	(0.642)	(0.914)	
By Causes Amenable to Primary Care										
Amenable	-15.090	-2.612**	0.808	0.051	0.174	-1.106	-1.364**	0.875	1.370	51.49
	(24.377)	(1.190)	(0.962)	(0.998)	(0.297)	(1.008)	(0.668)	(1.117)	(1.425)	
Non-Amenable	1.675	-0.572	0.127	0.267	-0.714	0.728	-0.438	-0.267	0.425	42.65
	(31.386)	(1.352)	(0.755)	(0.389)	(0.552)	(0.842)	(0.777)	(0.905)	(1.055)	
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	1064.94	54.04	45.4	7.41	4.87	12.24	22.94	25.3	27.24	-

Notes: This table shows the simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfœuille (2020) over four years after an UPA is introduced in the 4.5km hospital's catchment area. 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 primary care. Sample is composed of 111 hospitals. We cluster 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 of two years before the introduction of an UPA near the hospital 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 5: UPA Effects on Inpatient Outcomes

	Hospital Admissions (1)	Total Deaths (2)	Inpatient Deaths (3)	% Inpatient Deaths (4)	%24h Inpatient Deaths (5)	Hosp Adm Mean at Baseline
Total						
	-0.062	-0.210***	-0.241***	-0.858*	-0.359**	579.86
	(0.063)	(0.068)	(0.079)	(0.463)	(0.150)	
By Causes Amenable to Primary Care						
Amenable	-0.311***	-0.268***	-0.303**	-0.139	-0.192	146.44
	(0.119)	(0.082)	(0.122)	(0.845)	(0.246)	
Non-Amenable	-0.014	-0.180**	-0.262***	-1.384**	-0.581***	433.40
	(0.078)	(0.079)	(0.085)	(0.616)	(0.206)	
Hospital & Time FE	Yes	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	Yes	-
Mean at Baseline	579.86	76.28	41.91	6.41	1.37	-

Notes: This table shows the simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfuille (2020) over four years after an UPA is introduced in the 4.5km hospital's catchment area. Related UPA placebo effects can be found in Table C.2. 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 causes amenable and non-amenable to primary care. Sample is composed of 111 hospitals. We cluster 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 of two years before the introduction of an UPA near the hospital and is measured in levels instead of IHS.

Table 6: Hospital Admissions and Total Deaths by Day and Time

		Day/Time				
	Total (1)	Weekday (2)	Weekend (3)	Day (4)	Night (5)	Mean at Baseline
Hospital Admissions						
Total	-0.062	-0.066	-0.153*	-	-	579.86
	(0.063)	(0.069)	(0.082)	-	-	
Amenable to Primary Care	-0.311***	-0.308**	-0.302**	-	-	146.44
	(0.119)	(0.138)	(0.139)	-	-	
Non-Amenable to Primary Care	-0.014	-0.007	-0.156	-	-	433.40
	(0.078)	(0.074)	(0.100)	-	-	
Total Deaths						
Total	-0.210***	-0.181**	-0.262***	-0.251***	-0.198**	76.28
	(0.068)	(0.072)	(0.075)	(0.074)	(0.083)	
Amenable to Primary Care	-0.268***	-0.224***	-0.266***	-0.212**	-0.277***	23.18
	(0.082)	(0.078)	(0.085)	(0.094)	(0.081)	
Non-Amenable to Primary Care	-0.180**	-0.156*	-0.245***	-0.257***	-0.127	53.10
	(0.079)	(0.085)	(0.086)	(0.064)	(0.101)	
Hospital & Time FE	Yes	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	Yes	-
Admissions: Mean at Baseline	579.86	429.92	114.24	-	-	-
Deaths: Mean at Baseline	76.28	54.18	22.1	38.09	35.54	-

Notes: This table shows the simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfœuille (2020) over four years after an UPA is introduced in the 4.5km hospital's catchment area. 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, 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 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 of two years before the introduction of an UPA near the hospital and is measured in levels instead of IHS. SIH database does not include information on the time of admission.

Table 7: UPA Effects on Inpatient Outcomes: By Admission Cause

	Hospital Admissions	Total Deaths	Inpatient Deaths	% Inpatient Deaths	%24h Inpatient Deaths	Hosp Adm Mean at
	(1)	(2)	(3)	(4)	(5)	Baseline
Total						
	-0.062	-0.210***	-0.241***	-0.858*	-0.359**	579.86
	(0.063)	(0.068)	(0.079)	(0.463)	(0.150)	
Amenable to Primary Care						
Total	-0.311***	-0.268***	-0.303**	-0.139	-0.192	146.44
	(0.119)	(0.082)	(0.122)	(0.845)	(0.246)	
Cardiovascular Diseases	-0.197	-0.190**	-0.168	0.007	-0.516	49.78
	(0.135)	(0.078)	(0.123)	(1.250)	(0.521)	
Cerebrovascular	-0.316**	-0.167	-0.170	2.034	0.358	17.71
	(0.148)	(0.115)	(0.168)	(2.427)	(0.602)	
Other CVD	-0.212	-0.215***	-0.114	-0.246	-0.578	32.07
	(0.132)	(0.075)	(0.138)	(1.426)	(0.669)	
Repiratory Diseases	-0.262*	-0.138*	-0.175	0.191	-0.815	25.79
	(0.140)	(0.083)	(0.149)	(1.911)	(0.869)	
Diabetes	-0.181	-0.389***	-0.200	-0.184	0.391	13.41
	(0.154)	(0.085)	(0.122)	(1.613)	(0.631)	
Other	-0.283**	-0.085	-0.328**	-1.367	-0.136	57.45
	(0.112)	(0.094)	(0.135)	(0.918)	(0.259)	
Non-Amenable to Primary Care						
Total	-0.014	-0.180**	-0.262***	-1.384**	-0.581***	433.4
	(0.078)	(0.079)	(0.085)	(0.616)	(0.206)	
Cardiovascular Diseases	0.004	-0.062	-0.284**	-3.441**	-1.524*	33.02
	(0.145)	(0.094)	(0.141)	(1.514)	(0.802)	
AMI	-0.182	-0.184*	-0.073	2.542	-1.513	6.97
	(0.157)	(0.106)	(0.138)	(3.047)	(1.964)	
Other CVD	0.038	-0.009	-0.319**	-5.346***	-0.948	26.05
	(0.133)	(0.084)	(0.132)	(1.753)	(0.624)	
External Causes	-0.280**	-0.294***	-0.265***	-2.107***	0.009	63.86
	(0.121)	(0.083)	(0.090)	(0.735)	(0.240)	
Digestive System Diseases	-0.032	-0.233*	-0.072	-0.827	-0.271	57.93
	(0.121)	(0.128)	(0.103)	(0.650)	(0.234)	
Pregnancy Complications	-0.144	-0.028	-0.041	2.215	0.176	43.22
	(0.177)	(0.121)	(0.166)	(1.449)	(0.217)	
Other	-0.014	-0.154*	-0.212**	-1.105	-0.594*	235.37
	(0.080)	(0.079)	(0.095)	(1.064)	(0.343)	
Hospital & Time FE	Yes	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	Yes	-
Mean at Baseline	579.86	76.28	41.91	6.41	1.37	-

Notes: This table shows the simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfœuille (2020) over four years after an UPA is introduced in the 4.5km hospital's catchment area. Related UPA placebo effects can be found in Table C.2. 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 total deaths (including deaths in outpatient/ER units). Then we have the IHS of total inpatient deaths in column 3. Column 4 shows total inpatient deaths and inpatient deaths that occurred within 24h conditional on total admissions, both measured in percentages. Results are shown by causes amenable and non-amenable to primary care. Sample is composed of 111 hospitals. We cluster 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 of two years before the introduction of an UPA near the hospital and is measured in levels instead of IHS.

Table 8: UPA Effects on Total Deaths per 100,000 Inhabitants
City-Level Estimates

	Treatment Effect				Mean at
	(1)	(2)	(3)	(4)	Baseline
UPA	-2.319 (3.074)	-3.048 (3.493)	-4.186 (4.054)	-4.925 (5.118)	188.99
Municipality & Time FE	Yes	Yes	Yes	Yes	-
Controls	No	Yes	No	Yes	-
Trend	No	No	Yes	Yes	-

Notes: This table shows the simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultffuille (2020) over four years after an UPA is introduced a city. Related UPA placebo effects can be found in Table C.3. 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 of two years before the introduction of an UPA in the city and is measured in rates per 100,000 inhabitants.

Table 9: Deaths per 100,000 by Cause and Location
City-Level Estimates

	Total	Location						Mean at
		Hospital	UPA	Other Health Facility	Household	Street	Other	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	Baseline
Total								
	-4.925	-19.408***	12.489***	0.591	-0.212	-0.781	2.137	188.99
	(4.770)	(5.726)	(2.912)	(1.726)	(2.037)	(1.302)	(1.441)	
Amenable to Primary Care								
Total	-0.725	-6.322***	4.384***	0.708	-0.403	-0.064	0.946*	53.97
	(2.357)	(2.259)	(1.158)	(0.820)	(0.888)	(0.197)	(0.496)	
Cardiovascular Diseases	-0.997	-3.317**	1.974***	-0.027	0.193	-0.030	0.166	27.67
	(1.688)	(1.542)	(0.604)	(0.435)	(0.667)	(0.173)	(0.253)	
Cerebrovascular	1.237	0.040	0.836***	-0.098	0.317	0.009	0.147	13.01
	(1.121)	(1.133)	(0.251)	(0.236)	(0.332)	(0.038)	(0.118)	
Other CVD	-2.234**	-3.357***	1.138***	0.071	-0.124	-0.038	0.019	14.67
	(1.131)	(1.165)	(0.395)	(0.302)	(0.498)	(0.170)	(0.188)	
Repiratory Diseases	-0.744	-1.419*	0.668**	-0.026	-0.078	-0.004	0.116	8.13
	(0.835)	(0.830)	(0.263)	(0.165)	(0.305)	(0.024)	(0.095)	
Diabetes	0.047	-0.860	0.720***	0.326	-0.446	-0.019	0.322**	10.61
	(1.222)	(0.928)	(0.204)	(0.253)	(0.372)	(0.091)	(0.145)	
Other	0.970	-0.727	1.021**	0.435	-0.072	-0.011	0.342***	7.55
	(0.941)	(0.750)	(0.462)	(0.287)	(0.231)	(0.030)	(0.112)	
Non-Amenable to Primary Care								
Total	-4.200	-13.086***	8.105***	-0.118	0.191	-0.717	1.191	135.02
	(5.047)	(4.516)	(2.162)	(1.023)	(1.608)	(1.193)	(1.111)	
Cardiovascular Diseases	0.536	-3.031**	3.017***	-0.069	-0.044	0.089	0.543	32.82
	(1.943)	(1.502)	(0.649)	(0.438)	(0.906)	(0.217)	(0.401)	
AMI	-0.377	-2.452*	1.908***	-0.009	-0.275	0.147	0.322	16.63
	(1.702)	(1.325)	(0.496)	(0.373)	(1.039)	(0.195)	(0.292)	
Other CVD	0.913	-0.579	1.109***	-0.060	0.231	-0.058	0.221	16.19
	(0.935)	(0.948)	(0.318)	(0.239)	(0.369)	(0.152)	(0.153)	
External Causes	-1.072	-0.782	0.518**	0.110	-0.426	-0.538	-0.076	19.12
	(1.631)	(0.891)	(0.204)	(0.204)	(0.766)	(1.055)	(0.596)	
Digestive System Diseases	-0.722	-0.743	0.191**	-0.031	-0.079	-0.054	-0.009	6.59
	(0.782)	(0.743)	(0.098)	(0.095)	(0.217)	(0.070)	(0.076)	
Pregnancy Complications	-0.023	-0.086	0.030**	-0.037	-0.027	0.031	-0.001	7.16
	(0.989)	(0.986)	(0.014)	(0.052)	(0.096)	(0.057)	(0.046)	
Other	-2.919	-8.445**	4.348***	-0.090	0.765	-0.244	0.734	69.33
	(2.940)	(3.304)	(1.296)	(0.759)	(1.118)	(0.189)	(0.567)	
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	188.99	141.03	1.88	6.05	27.37	7.63	4.68	-

Notes: This table shows the simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfœuille (2020) over four years after an UPA is introduced in a municipality. Related placebo estimates can be found in Table C.4. 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. 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 of two years before the introduction of an UPA in the municipality and is measured in rates per 100,000 inhabitants.

Table 10: Human Resources, Infrastructure and Occupancy Measures

	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	-0.064	-0.049	-0.064	-1.792	1.356**	-3.148**
	(0.068)	(0.054)	(0.103)	(1.435)	(0.658)	(1.524)
Mean at Baseline	242.14	83.63	158.51	24.95	6.49	18.46
	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	-0.060	-0.003	-0.104*	-0.081	-0.192***	-0.088
	(0.040)	(0.050)	(0.063)	(0.092)	(0.067)	(0.089)
Mean at Baseline	92.88	24.94	32.36	8.67	26.92	13.71
	Equipments					
	Total Equipments (15)	Diagnosis Equipments (16)	Graphics Methods (17)	Optical Methods (18)	Life Saving (19)	Other Equipments (20)
UPA	0.100*	0.012	0.113*	-0.020	0.081	0.180**
	(0.059)	(0.029)	(0.058)	(0.058)	(0.085)	(0.076)
Mean at Baseline	76.45	5.21	3.6	2.65	56.36	8.63
	Occupancy					
	Occupancy Rate (%) (21)	No. Days ≥ 85% Occup. (22)	No. Days ≥ 100% Occup. (23)	Bed Turnover Rate (24)	-	-
UPA	2.264	0.848	2.873	0.029	-	-
	(2.775)	(3.532)	(2.353)	(0.144)	-	-
Mean at Baseline	37.53	6.01	2.25	2.23	-	-
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 simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfœuille (2020) over four years after an UPA is introduced in the 4.5km hospital's catchment area. 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 115 hospitals. Average hours worked relate to all professionals in the establishment. Diagnosis equipment includes x-rays, mammographs, CT scanner, MRI and ultrassound machines. Graphics method equipment comprises electrocardiograph and electroencephalograph. Optical methods incorporates endoscopes, laparoscopes, surgical microscope, among others. Life saving equipment involves defibrillators, ventilators, bag valve mask, amont others. We used the IHS of all human resources, beds and equipment variables, with the exception 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 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 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 of two years before the introduction of an UPA near the hospital and is measured in levels instead of IHS.

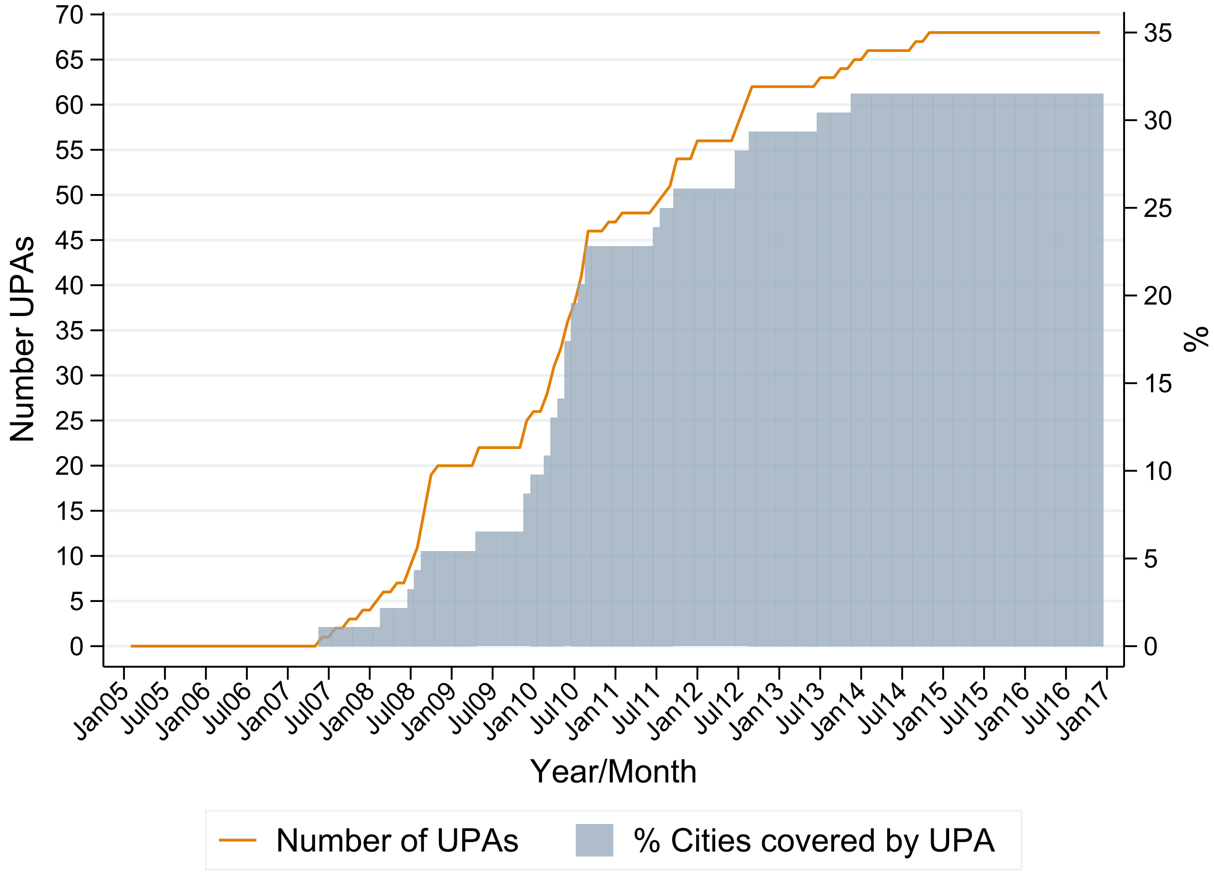
Table 11: UPA Effects on Local Health Systems

	Public System			Private System	
	% PSF Coverage (1)	Ambulance Program (2)	Net New Hospitals (3)	% Health Ins. Coverage (4)	Private Beds per 100,000 (5)
UPA	-1.254	-0.010	-0.074	0.455	5.469
	(2.755)	(0.022)	(0.085)	(0.655)	(11.202)
City & Time FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Trend	Yes	Yes	Yes	Yes	Yes
Mean at Baseline	74.42	0.27	0.02	14.34	53.48

Notes: This table shows the simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultffuille (2020) over four years after an UPA is introduced in an municipality. Related UPA placebo estimates can be found in table C.5. 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 the public sector are: (1) Family Health Program coverage; (2) presence of SAMU ambulatory program; (3) net number of new SUS general hospitals with ER (opened - closed). Dependent variables related to the private sector are: (4) private health insurance coverage; (5) number of non-SUS inpatient beds per 100,000 inhabitants. 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 of two years before the introduction of an UPA in the municipality and has the same metric as the corresponding variable.

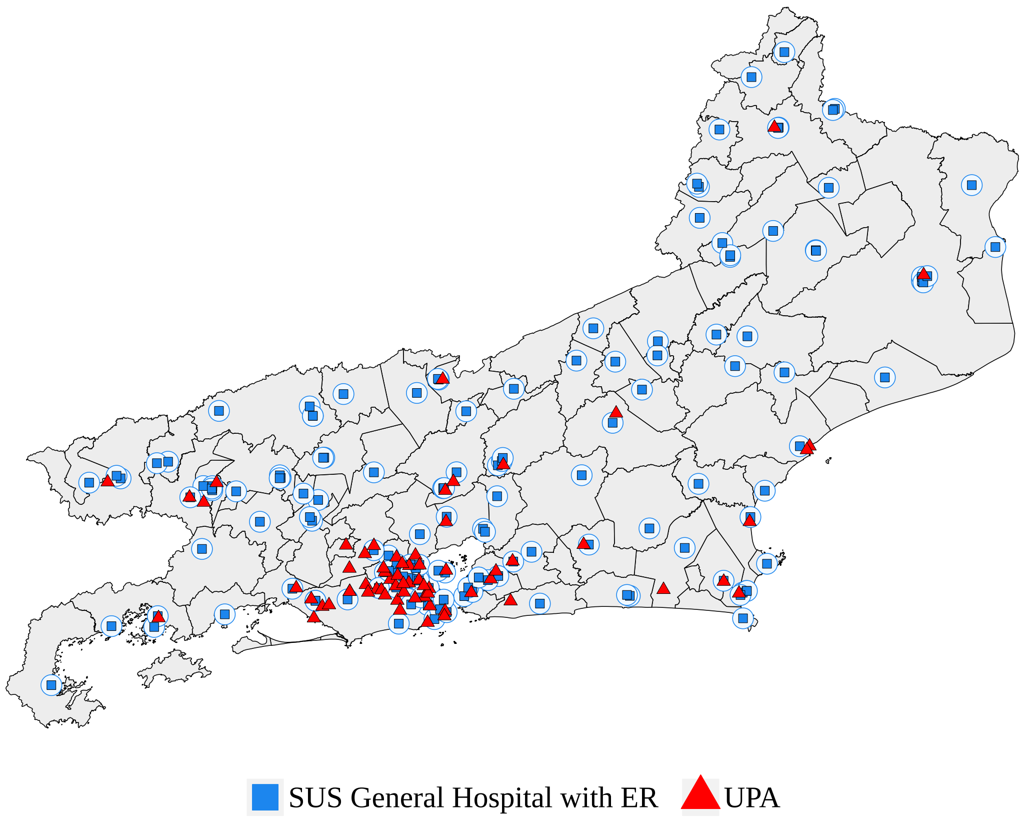
Main Figures

Figure 1: Number of UPAs - RJ (2005-2016)



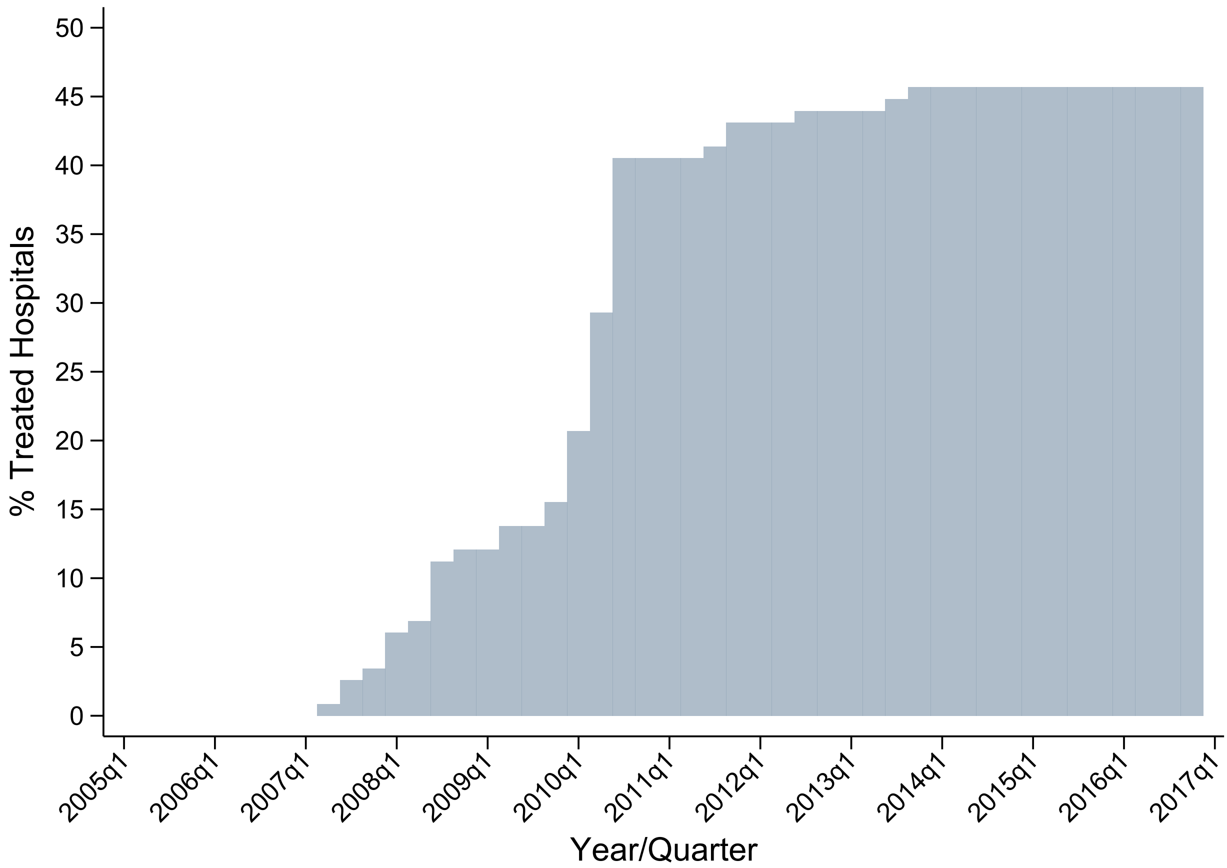
NOTES: Number of UPAs and percentage of cities covered by an UPA in the state of Rio de Janeiro between 2005 and 2016. The state has 92 cities.

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



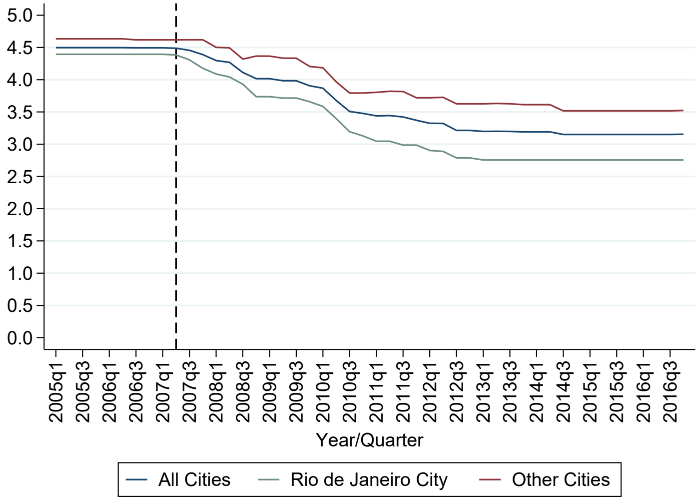
NOTES: Rio de Janeiro map in which blue squares represents SUS general hospitals with ER and red triangles represent UPAs. Hospitals' catchment area are the 4.5 kilometers circles in blue. Delimiters in this graph represent the municipalities' borders. The radius of 4.5 km was established based on the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

Figure 3: Percent of Treated Hospitals - RJ (2005-2016)

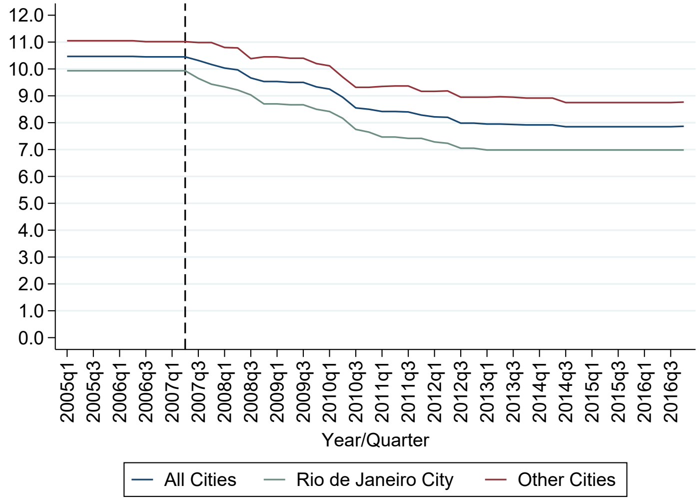


NOTES: Percent of general SUS hospitals with ER that received an UPA inside its catchment area of 4.5km radius between 2005 and 2016. Total number hospitals in our sample is 115.

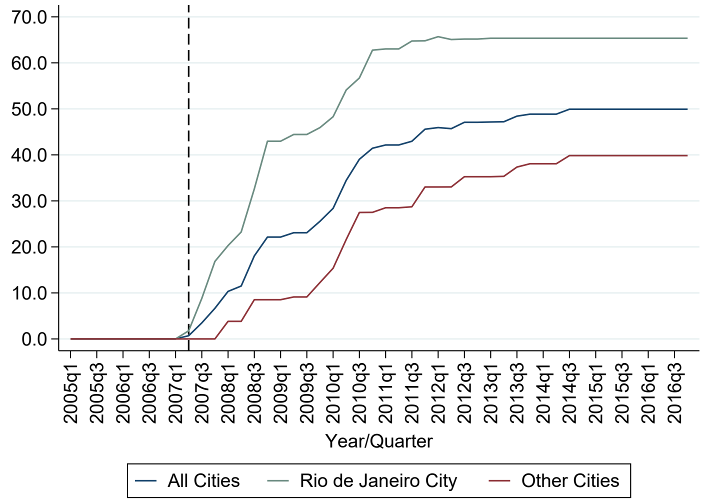
Figure 4: Distance and Travel Time to Closer ER and % Population Closer UPA



(a) Median Distance to Closest ER



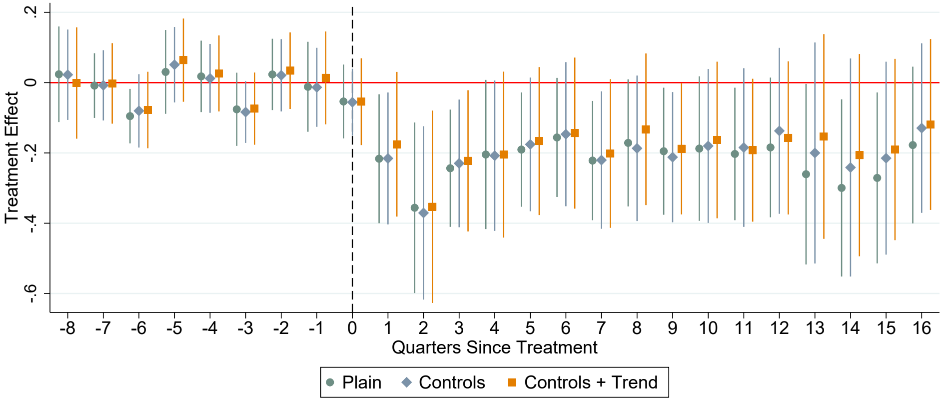
(b) Median Travel Time to Closest ER



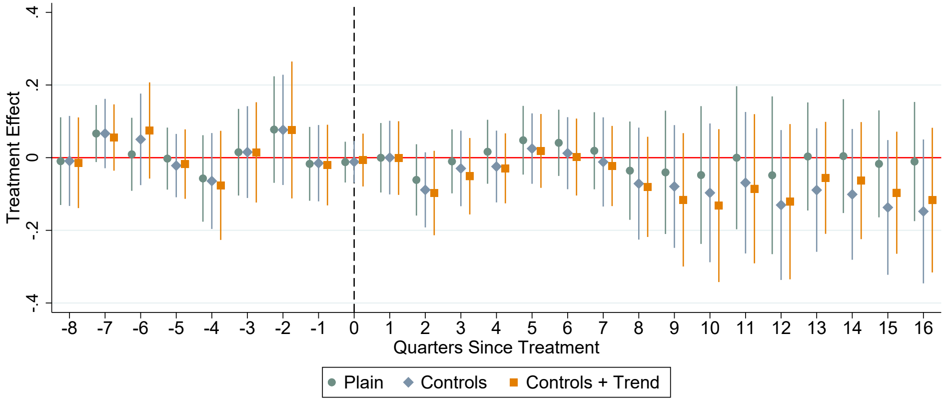
(c) % Population Closer to UPAs

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.

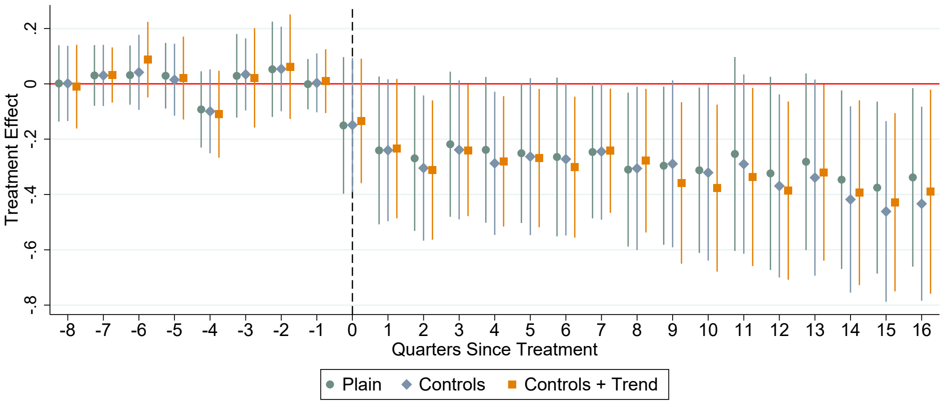
Figure 5: Event Study - Hospital Demand and Total Deaths



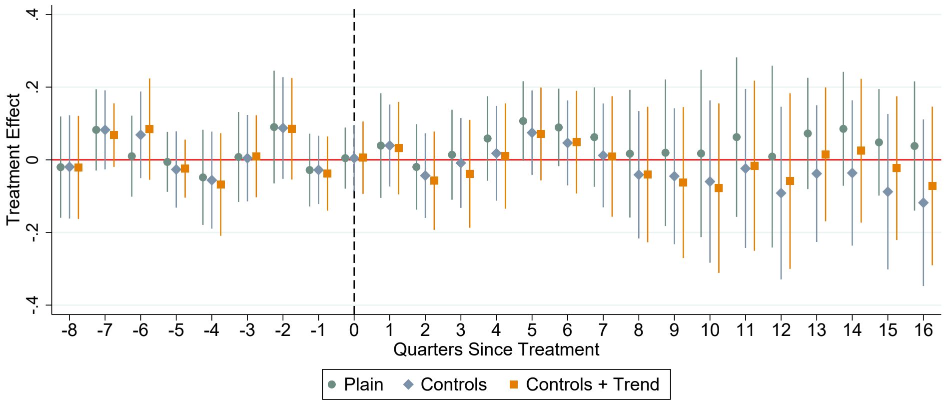
(a) Total Ambulatory Procedures



(b) Total Hospital Admissions



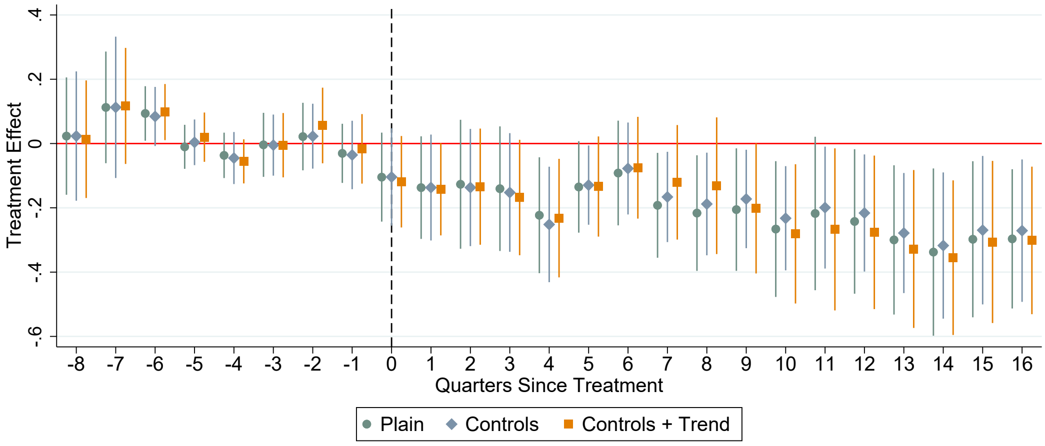
(c) Hospital Admissions Amenable to Primary Care



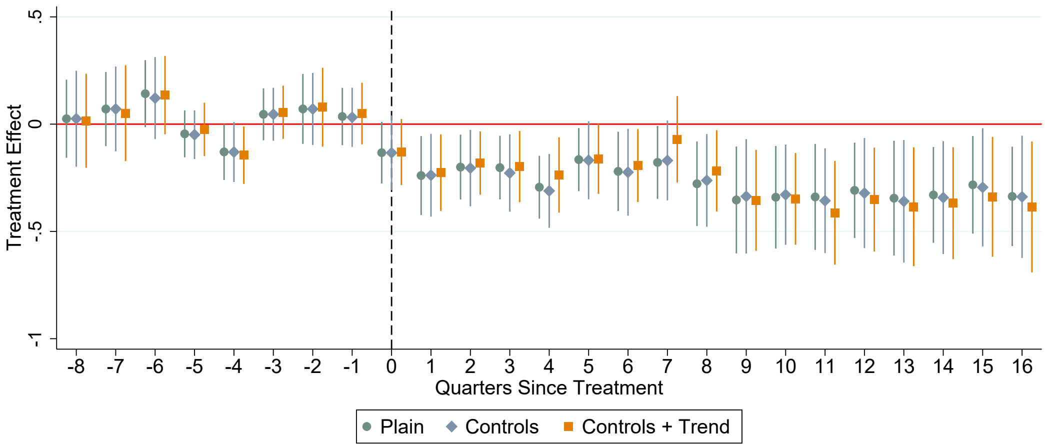
(d) Hospital Admissions Non-Amenable to Primary Care

Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect on the IHS of (a) total ambulatory procedures performed, (b) total hospital admissions, (c) hospital admissions amenable to primary care and (d) hospital admissions non-amenable to primary 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).

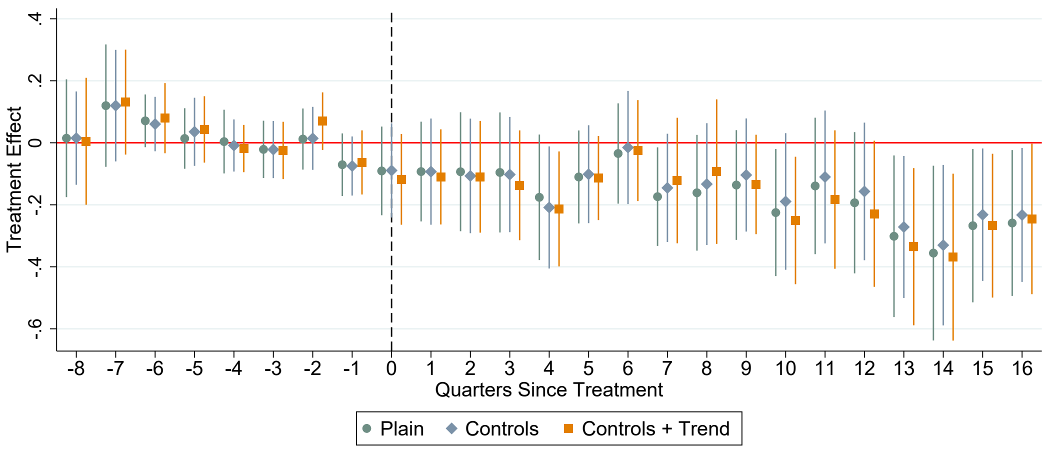
Figure 6: Event Study - Hospitals' Deaths



(a) Total Deaths



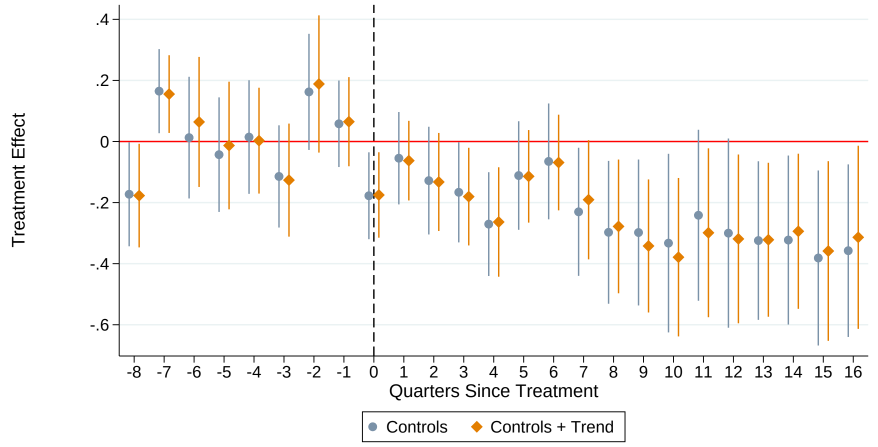
(b) Deaths Amenable to Primary Care



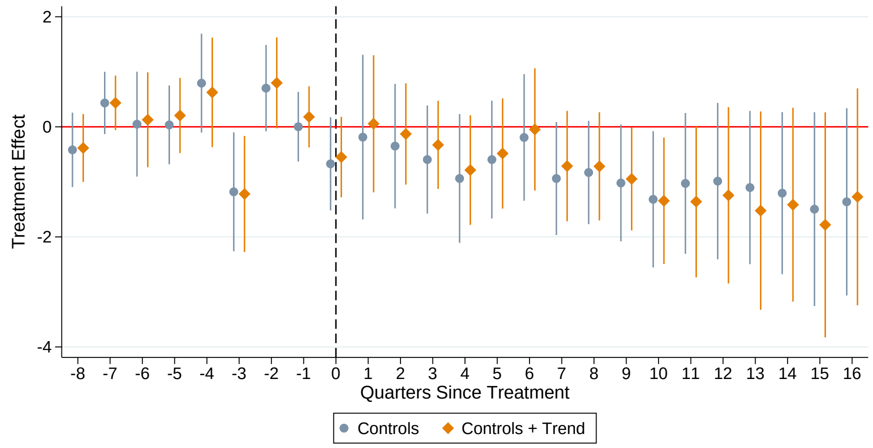
(c) Deaths Non-Amenable to Primary Care

Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect on the IHS of hospitals' (a) total deaths, (b) deaths amenable to primary care and, (c) deaths non-amenable to primary 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. Standard errors clustered at the hospital level.

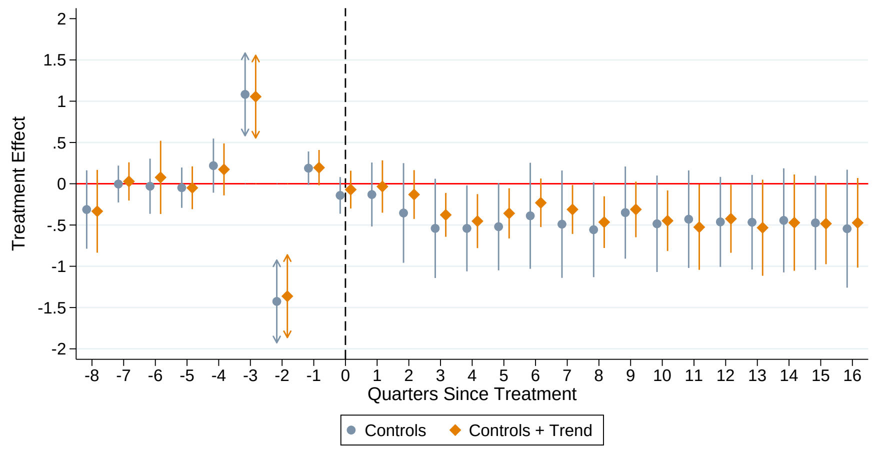
Figure 7: Event Study - Inpatient Measures



(a) Inpatient Deaths



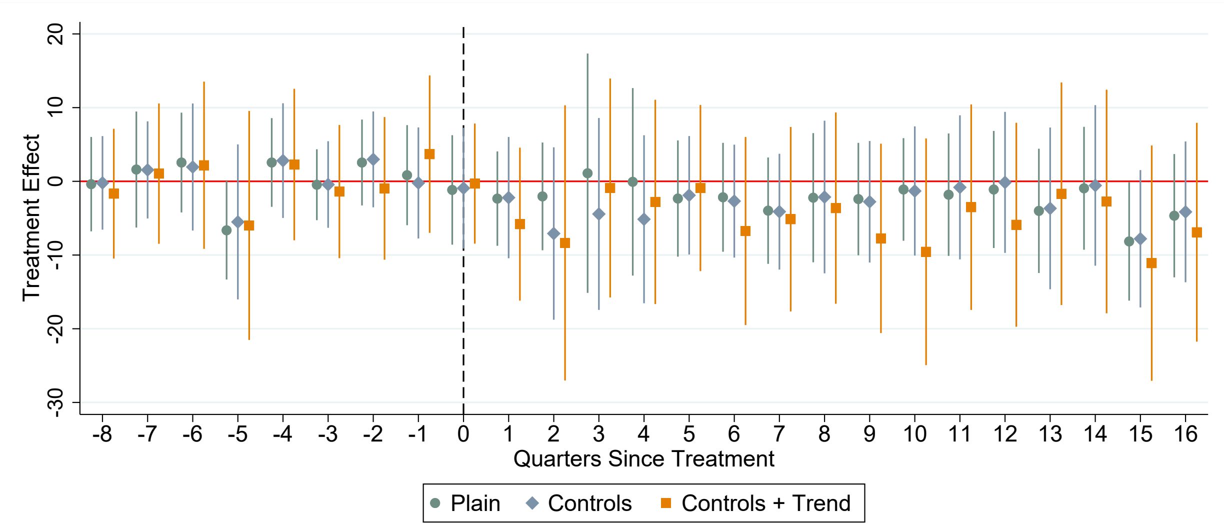
(b) % Inpatient Deaths



(c) % 24h Inpatient Deaths

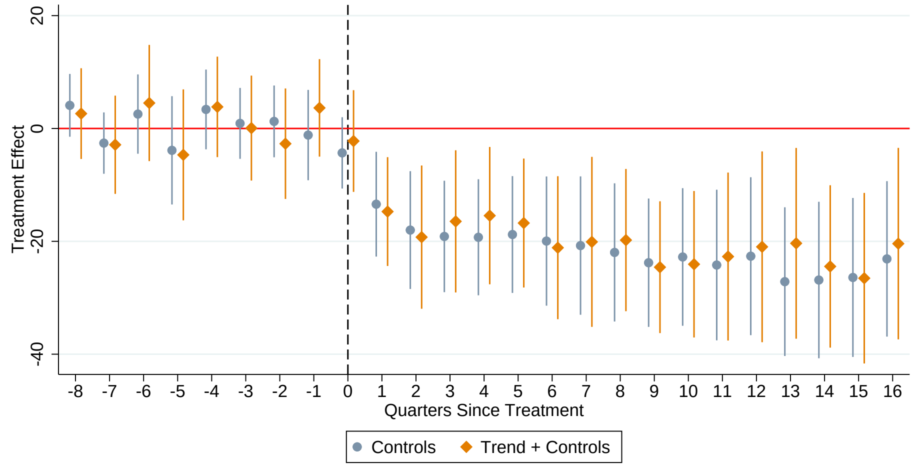
Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect on (a) the IHS of inpatient deaths, on (b) deaths conditional to admission (%) and on (c) deaths within 24h conditional on admission (%). Treatment is defined as the presence of an UPA inside the hospital's 4.5km catchment 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

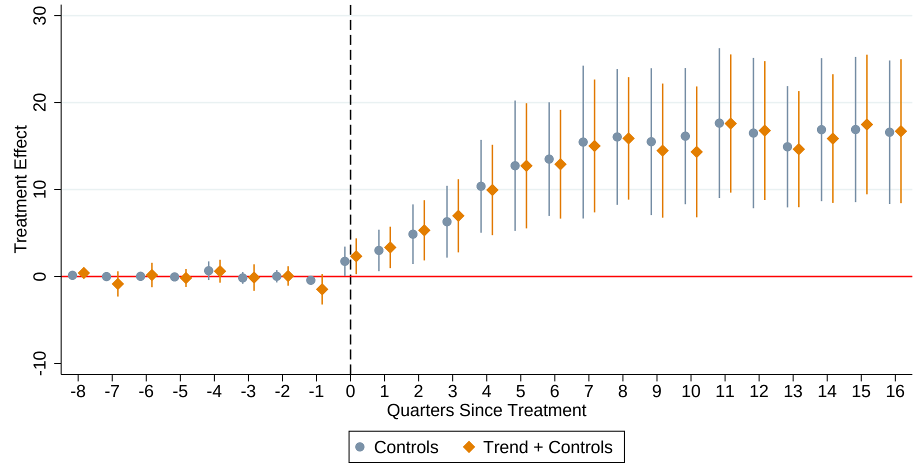


Notes: This graph shows the dynamic and placebo DID estimators for the UPA effect on deaths per 100,000 people - measured at the municipality level. Treatment is defined as the presence of an UPA in the municipality. Vertical bars show 95% confidence intervals (CIs) around the coefficients. The results 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.

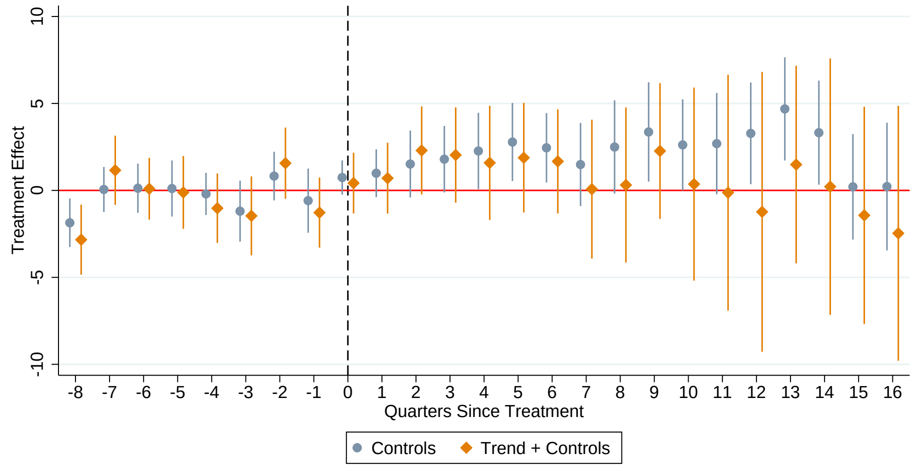
Figure 9: Event Study - Deaths per 100,000 by Location, Municipality-Level Estimates



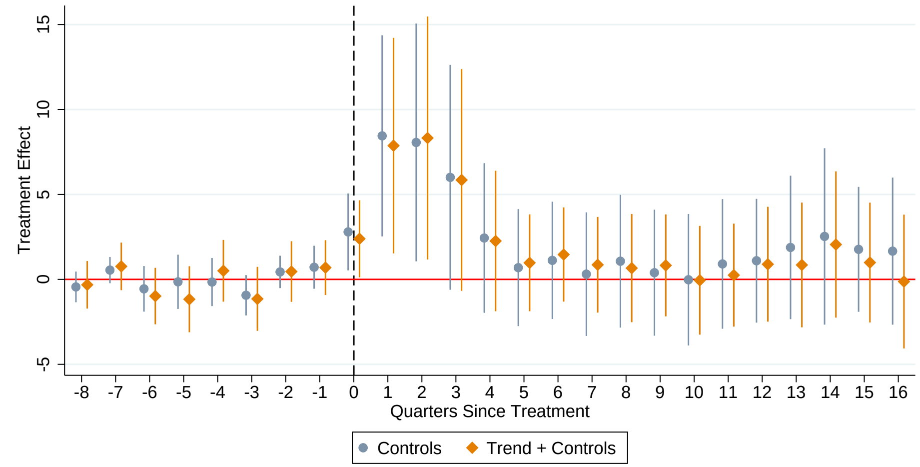
(a) Hospital



(b) UPA



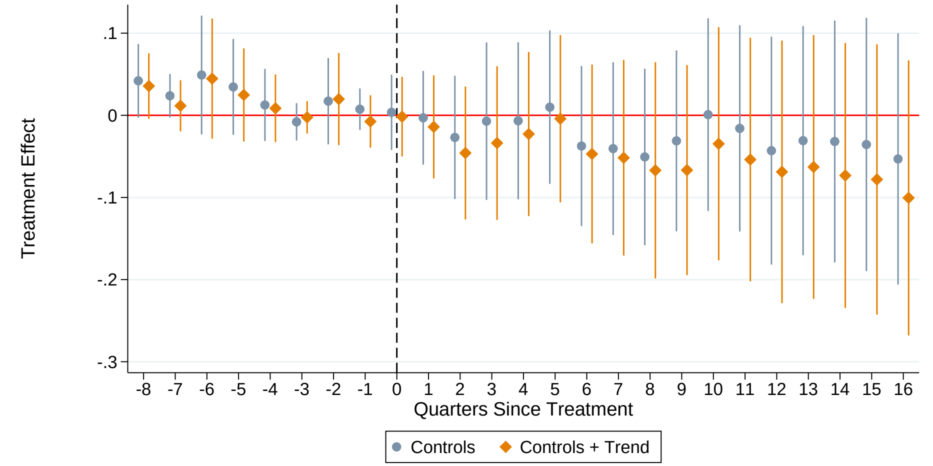
(c) Other Health Facility



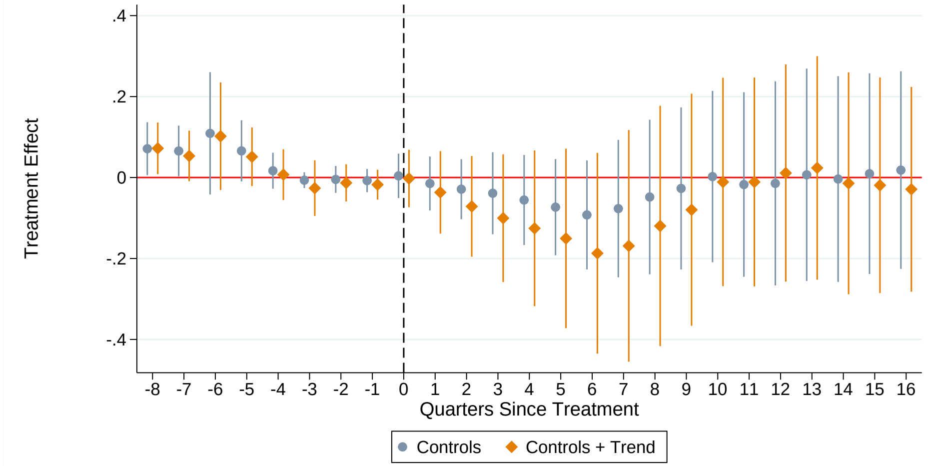
(d) Other Location

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.

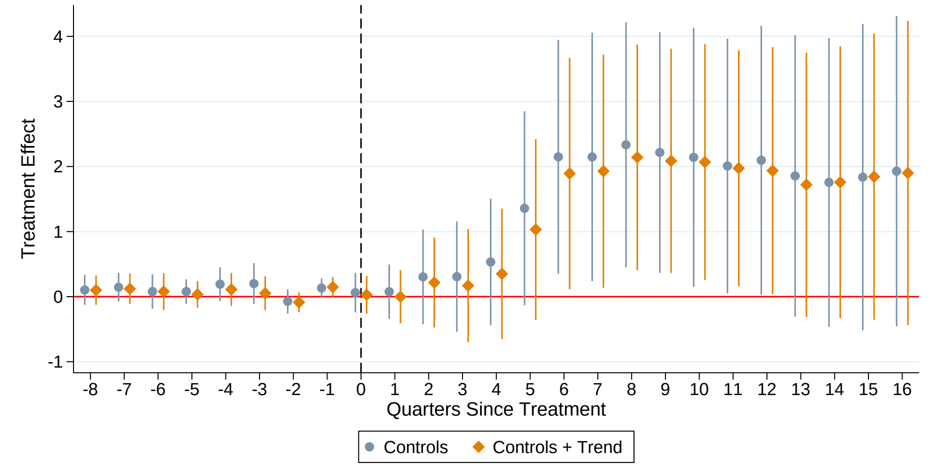
Figure 10: Event Study - Human Resources



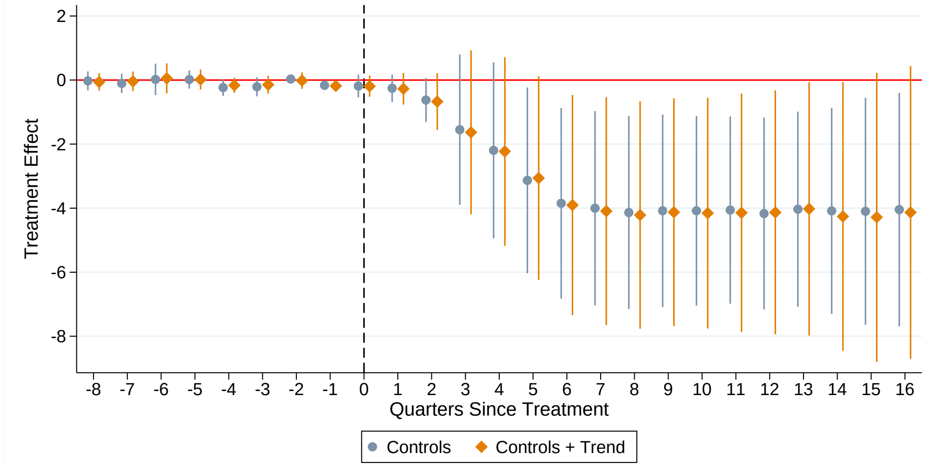
(a) N. Physicians



(b) N. Non-Physicians



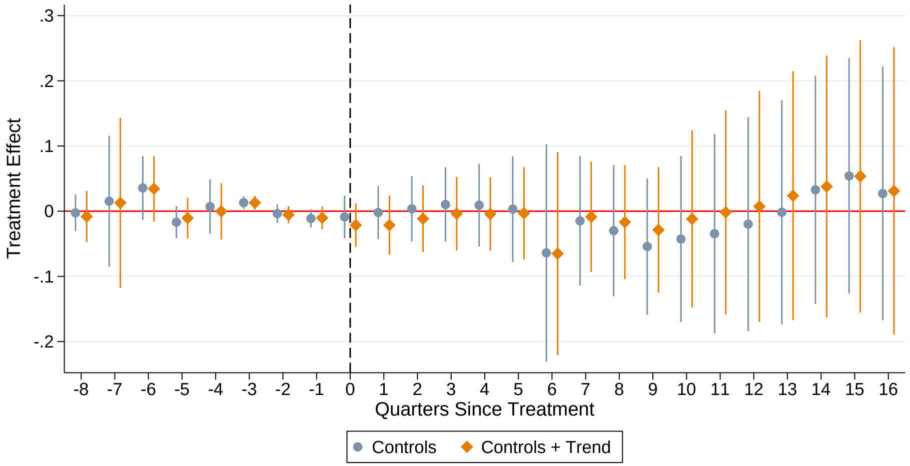
(c) Average Hours Worked - Inpatients



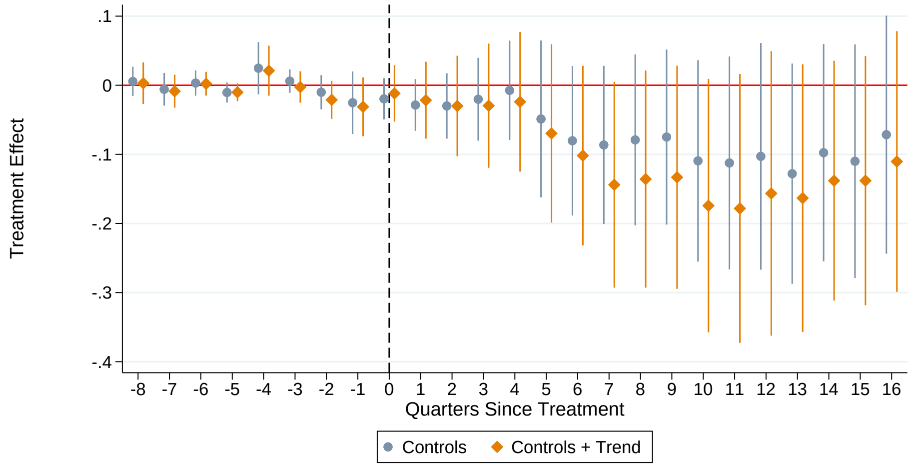
(d) Average Hours Worked - Other Activities

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.

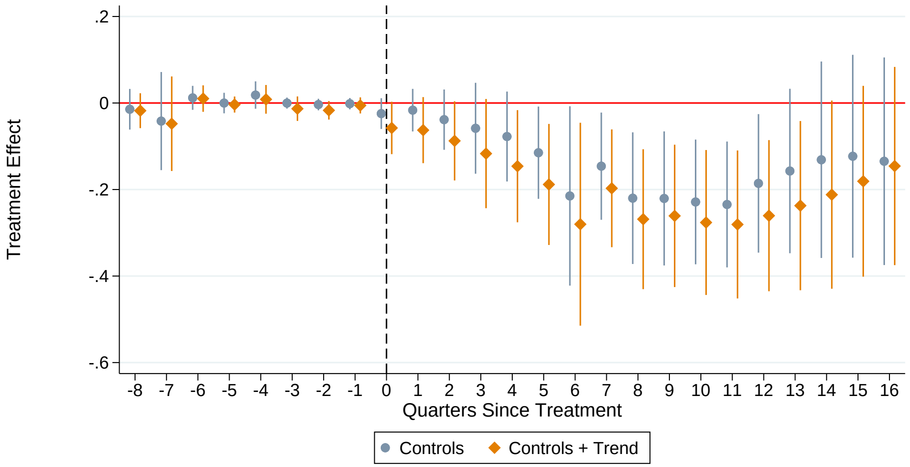
Figure 11: Event Study - Hospital Beds



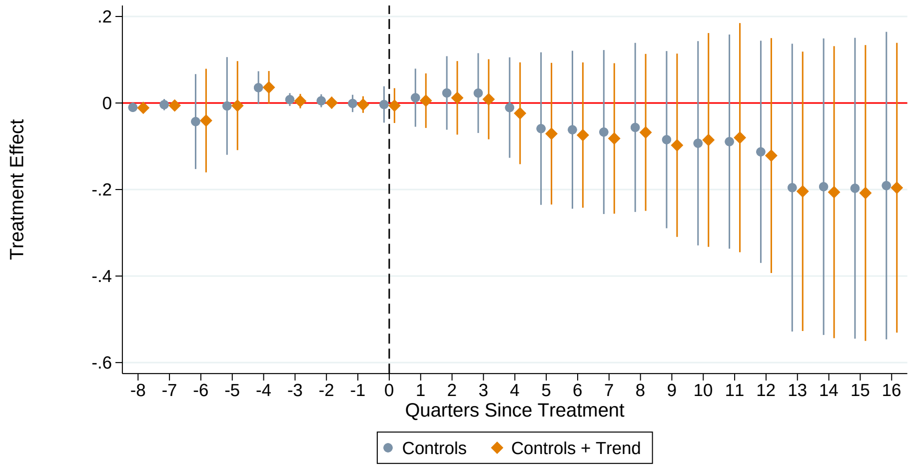
(a) Surgical Inpatient Beds



(b) Clinical Inpatient Beds



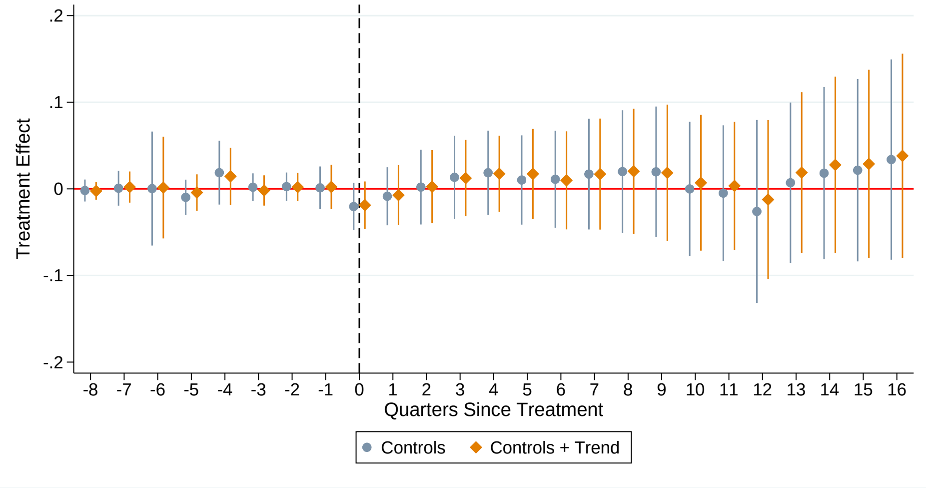
(c) Other Inpatient Beds



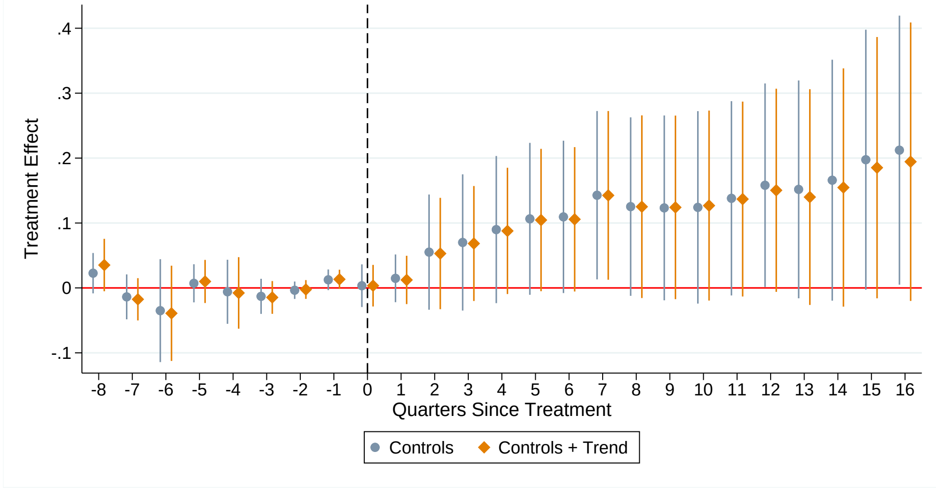
(d) Ambulatory and Emergency Beds

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.

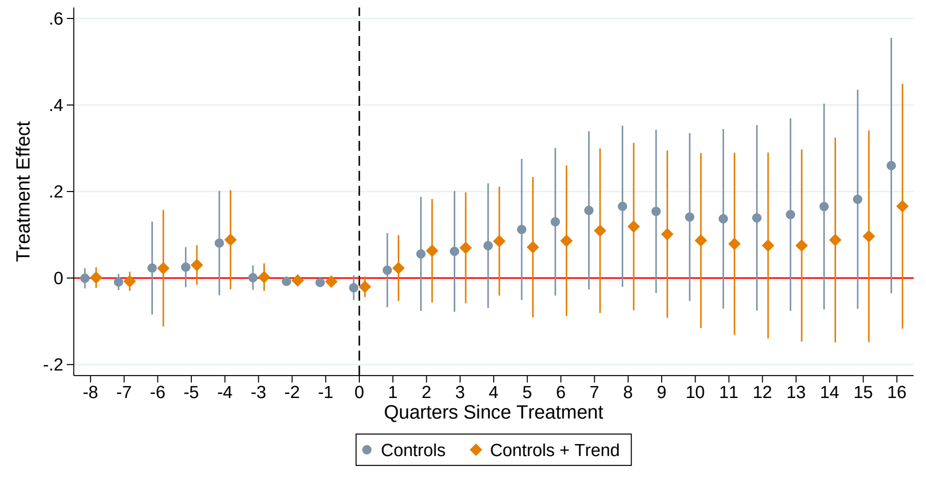
Figure 12: Event Study - Equipments



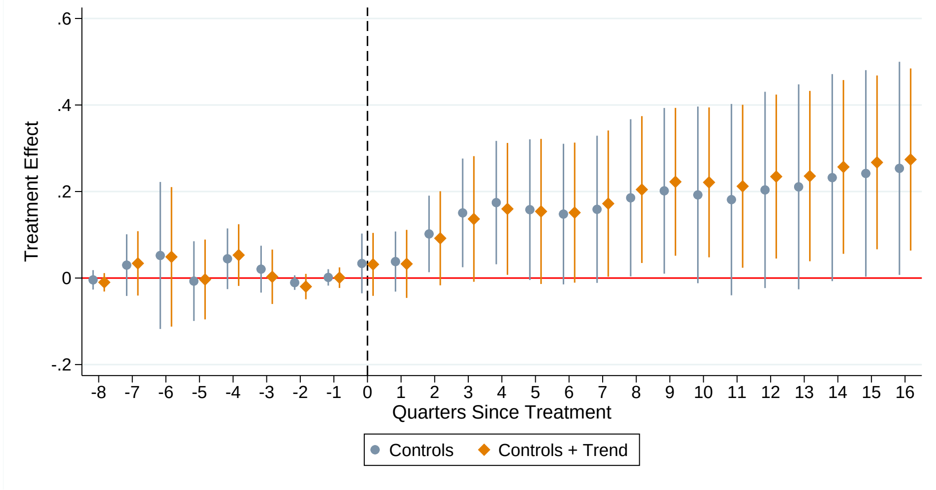
(a) Diagnosis Equipment



(b) Graphics Method Equipment



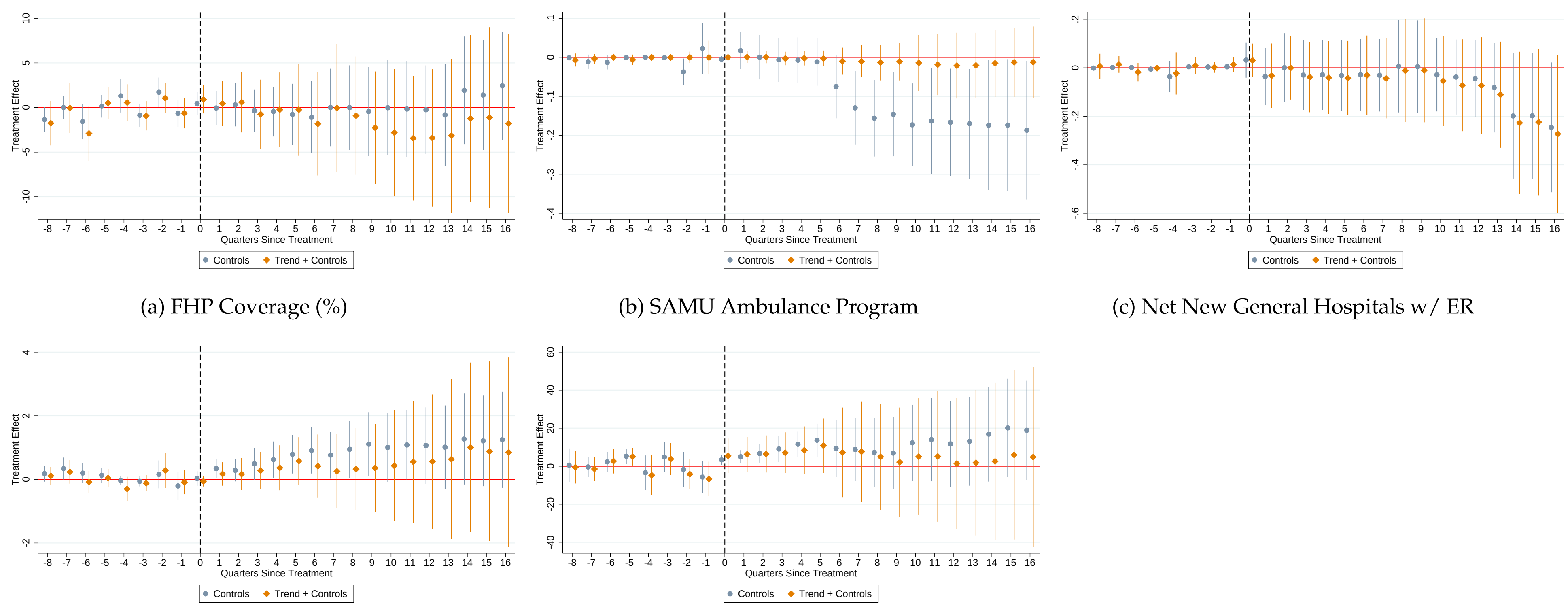
(c) Life Saving Equipment



(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.

Figure 13: Event Study - Health System, Municipality-Level Estimates



(a) FHP Coverage (%)

(b) SAMU Ambulance Program

(c) Net New General Hospitals w/ ER

(d) Health Insurance Coverage (%)

(e) Private Beds per 100,000

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 three components of the health system: (a) the Family Health Program coverage (%), (b) the presence of SAMU Ambulance Program, (c) net number of new general hospitals with ER (opened - closed), (d) the private health insurance coverage (%) and (e) private beds per 100,000 inhabitants. 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.

A Appendix

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	11	4586	SIH
Amenable to Primary Care	193.6	160.9	3	848	SIH
Non-Amenable to Primary Care	568.0	612.7	3	3854	SIH
Total Deaths					
Total	105.0	156.7	0	936	SIM
Amenable to Primary Care	31.8	46.4	0	275	SIM
Non-Amenable to Primary Care	73.2	112.1	0	667	SIM
Inpatient Deaths					
Total	55.1	79.4	0	534	SIH
Amenable to Primary Care	20.1	27.2	0	190	SIH
Non-Amenable to Primary Care	35.0	56.2	0	368	SIH
Other Hospital Measures					
% Hospital Inpatient Deaths	6.3	5.3	0	35.8	SIH
% Hospital Inpatient Deaths within 24h	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	80.6	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 109 hospitals when analysing ambulatory procedures (SIA), 111 when looking at hospital admissions (SIH) and 115 when the outcome is hospitals' total deaths (SIM). Variables were measured at the hospital-quarter level.

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 Primary Care	50.5	19.2	0.0	136.2	SIM
Non-Amenable to Primary Care	126.1	30.6	39.3	290.3	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					
% FHP Coverage	60.3	35.5	0.0	100.0	DAB
SAMU Ambulance Program (dummy)	0.2	0.4	0.0	1.0	INDE
Private Beds per 100,000 inhabitants	69.2	123.6	0.0	776.8	CNES
% Health Insurance	13.6	11.1	1.4	61.0	ANS
Controls					
GDP Per Capita (2010, in thousand 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
Bolsa Família Program: Transfer (R$) per 1,000	1958.2	1006.2	0.0	5322.4	MSD

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.

Table A.4: Deaths per 100,000 people by Specific Causes and Demographics

		Age						Gender		
	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)	Mean at Baseline
Total										
	-4.925	0.133	-0.551	-0.641	-1.281	-0.811	-1.773	-4.266	-0.800	188.99
	(4.770)	(0.711)	(0.351)	(0.693)	(1.234)	(2.287)	(3.454)	(2.781)	(3.644)	
Amenable to Primary Care										
Total	-0.725	0.016	0.032	0.121	0.165	-0.203	-0.857	-1.368	0.635	53.97
	(2.357)	(0.208)	(0.115)	(0.147)	(0.438)	(1.132)	(1.693)	(1.373)	(1.745)	
Cardiovascular Diseases	-0.997	0.000	-0.001	0.007	-0.266	-0.551	-0.187	-1.504	0.498	27.67
	(1.688)	(0.025)	(0.022)	(0.050)	(0.246)	(0.743)	(1.423)	(1.006)	(1.169)	
Cerebrovascular	1.237	0.002	-0.004	0.013	-0.052	0.068	1.209	-0.076	1.311	13.01
	(1.121)	(0.010)	(0.009)	(0.022)	(0.154)	(0.594)	(0.854)	(0.745)	(0.868)	
Other CVD	-2.234**	-0.002	0.002	-0.006	-0.215	-0.619	-1.396	-1.427	-0.813	14.67
	(1.131)	(0.025)	(0.023)	(0.047)	(0.234)	(0.541)	(1.020)	(0.878)	(0.877)	
Repiratory Diseases	-0.744	-0.029	-0.027	-0.019	0.137	-0.388	-0.418	0.107	-0.850	8.13
	(0.835)	(0.086)	(0.050)	(0.050)	(0.113)	(0.356)	(0.880)	(0.556)	(0.674)	
Diabetes	0.047	0.002	-0.009	0.000	0.099	0.404	-0.449	0.026	0.019	10.61
	(1.222)	(0.011)	(0.018)	(0.056)	(0.192)	(0.573)	(0.874)	(0.728)	(0.809)	
Other	0.970	0.044	0.069	0.132	0.196	0.332	0.198	0.003	0.968	7.55
	(0.941)	(0.171)	(0.119)	(0.134)	(0.244)	(0.405)	(0.689)	(0.525)	(0.679)	
Non-Amenable to Primary Care										
Total	-4.200	0.116	-0.583*	-0.762	-1.446	-0.609	-0.916	-2.898	-1.434	135.02
	(5.047)	(0.590)	(0.341)	(0.756)	(1.254)	(1.986)	(3.083)	(2.374)	(2.851)	
Cardiovascular Diseases	0.536	-0.024	-0.012	0.098	-0.167	0.328	0.313	0.583	-0.058	32.82
	(1.943)	(0.089)	(0.051)	(0.103)	(0.366)	(0.938)	(1.420)	(0.964)	(1.219)	
AMI	-0.377	0.001	0.000	0.011	-0.207	-0.455	0.273	0.054	-0.441	16.63
	(1.702)	(0.001)	(0.000)	(0.058)	(0.257)	(0.895)	(1.092)	(0.788)	(1.384)	
Other CVD	0.913	-0.025	-0.012	0.087	0.040	0.783	0.039	0.529	0.383	16.19
	(0.935)	(0.083)	(0.060)	(0.112)	(0.338)	(0.582)	(0.777)	(0.633)	(0.758)	
External Causes	-1.072	0.027	-0.119	-0.636	-0.742	-0.145	0.543	-0.492	-0.607	19.12
	(1.631)	(0.185)	(0.243)	(0.627)	(0.931)	(0.975)	(0.673)	(0.868)	(1.153)	
Digestive System Diseases	-0.722	-0.053	0.041	-0.027	-0.129	-0.273	-0.279	-0.484	-0.234	6.59
	(0.782)	(0.039)	(0.083)	(0.053)	(0.270)	(0.488)	(0.511)	(0.547)	(0.582)	
Pregnancy Complications	-0.023	-0.053	0.007	0.042	-0.014	-0.006	0.001	-0.292	0.353	7.16
	(0.989)	(0.594)	(0.022)	(0.084)	(0.139)	(0.013)	(0.682)	(0.684)	(0.675)	
Other	-2.919	0.219	-0.501**	-0.238	-0.394	-0.512	-1.494	-2.213	-0.889	69.33
	(2.940)	(0.439)	(0.194)	(0.296)	(0.887)	(1.121)	(2.055)	(1.765)	(2.384)	
Municipality & 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	188.99	5.68	1.06	4.98	17.97	47.81	111.49	81.08	107.68	-

Notes: This table shows the simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfœuille (2020) over four years after an UPA is introduced in a municipality. 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 two demographics: age and gender. 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 of two years before the introduction of an UPA in the municipality and is measured in rates per 100,000 inhabitants.

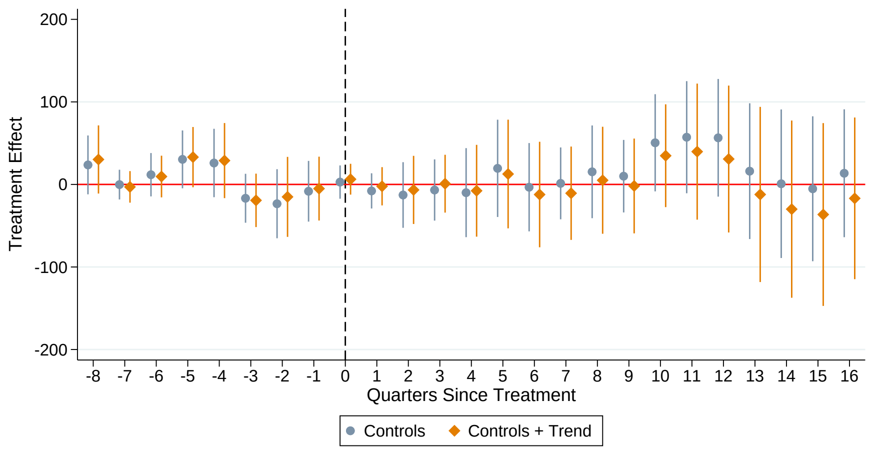
Table A.5: Deaths per 100,000 people by Specific Causes and Demographics

		Race		Years of Schooling				
	Total (1)	White (2)	Non-White (3)	0 to 3 (4)	4 to 7 (5)	8 to 11 (6)	12+ (7)	Mean at Baseline
Total								
	-4.925	-3.921	1.004	-0.614	-1.196	0.516	0.891	188.99
	(4.770)	(3.337)	(2.776)	(3.585)	(2.835)	(1.566)	(0.800)	
Amenable to Primary Care								
Total	-0.725	-1.087	0.780	0.270	-0.657	-0.147	0.161	53.97
	(2.357)	(1.592)	(1.545)	(1.698)	(1.072)	(0.726)	(0.335)	
Cardiovascular Diseases	-0.997	-0.936	0.385	-0.027	-0.868	0.282	-0.144	27.67
	(1.688)	(1.077)	(1.017)	(1.054)	(0.711)	(0.412)	(0.256)	
Cerebrovascular	1.237	-0.087	1.584**	0.886	-0.051	-0.194	-0.119	13.01
	(1.121)	(0.780)	(0.697)	(0.651)	(0.440)	(0.280)	(0.215)	
Other CVD	-2.234**	-0.849	-1.199	-0.913	-0.818**	0.476	-0.025	14.67
	(1.131)	(0.865)	(0.991)	(0.878)	(0.407)	(0.306)	(0.136)	
Repiratory Diseases	-0.744	-0.737	-0.084	0.152	-0.519	0.046	0.091	8.13
	(0.835)	(0.630)	(0.512)	(0.569)	(0.339)	(0.206)	(0.108)	
Diabetes	0.047	-0.077	0.207	-0.518	0.404	-0.477	0.340*	10.61
	(1.222)	(0.722)	(0.716)	(0.861)	(0.565)	(0.292)	(0.196)	
Other	0.970	0.663	0.272	0.664	0.326	0.002	-0.125	7.55
	(0.941)	(0.746)	(0.615)	(0.607)	(0.503)	(0.209)	(0.116)	
Non-Amenable to Primary Care								
Total	-4.200	-2.835	0.224	-0.884	-0.539	0.663	0.729	135.02
	(5.047)	(2.766)	(2.570)	(3.051)	(2.347)	(1.237)	(0.665)	
Cardiovascular Diseases	0.536	-0.029	1.299	1.890	0.056	0.222	-0.252	32.82
	(1.943)	(1.626)	(1.344)	(1.309)	(0.616)	(0.553)	(0.388)	
AMI	-0.377	0.326	-0.131	1.062	0.128	-0.313	-0.226	16.63
	(1.702)	(1.068)	(0.848)	(0.983)	(0.565)	(0.435)	(0.283)	
Other CVD	0.913	-0.355	1.430*	0.828	-0.072	0.535*	-0.026	16.19
	(0.935)	(0.787)	(0.828)	(0.758)	(0.432)	(0.321)	(0.263)	
External Causes	-1.072	-0.518	-0.701	-0.934	-0.652	-0.088	0.588	19.12
	(1.631)	(1.238)	(1.209)	(0.883)	(0.949)	(0.523)	(0.458)	
Digestive System Diseases	-0.722	-0.185	-0.540	-0.367	0.063	-0.109	-0.035	6.59
	(0.782)	(0.571)	(0.487)	(0.518)	(0.407)	(0.204)	(0.162)	
Pregnancy Complications	-0.023	0.335	-0.154	0.013	0.024	0.000	0.043	7.16
	(0.989)	(0.310)	(0.454)	(0.036)	(0.108)	(0.069)	(0.130)	
Other	-2.919	-2.438	0.319	-1.486	-0.031	0.638	0.385	69.33
	(2.940)	(2.104)	(2.242)	(1.973)	(1.925)	(0.918)	(0.475)	
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	188.99	106.59	73.15	82.06	33.86	16.42	7	-
Municipality & 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	188.99	106.59	73.15	82.06	33.86	16.42	7.00	-

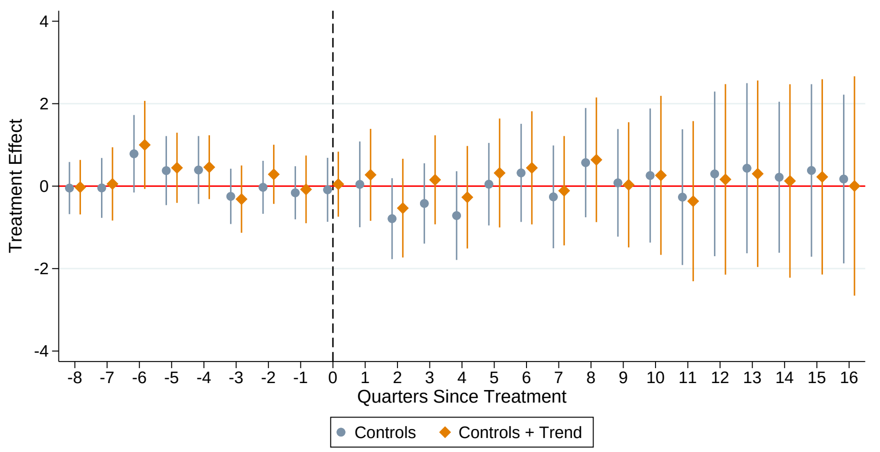
Notes: This table shows the simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultffuille (2020) over four years after an UPA is introduced in a municipality. Controls are cities' GDP, Bolsa Família transfer (R$) per 1,000, political party in government, 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 two demographics: 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 of two years before the introduction of an UPA in the municipality and is measured in rates per 100,000 inhabitants.

B Supplementary Figures

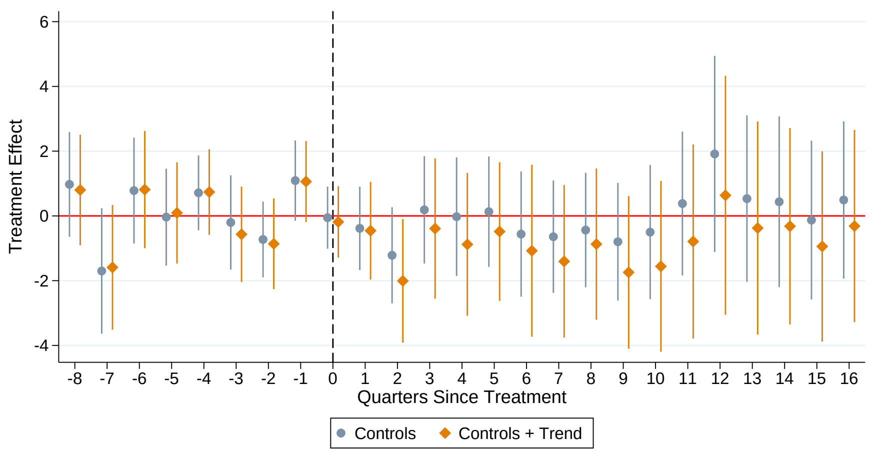
Figure B.1: Event Study - Inpatient Profile



(a) Mean Income



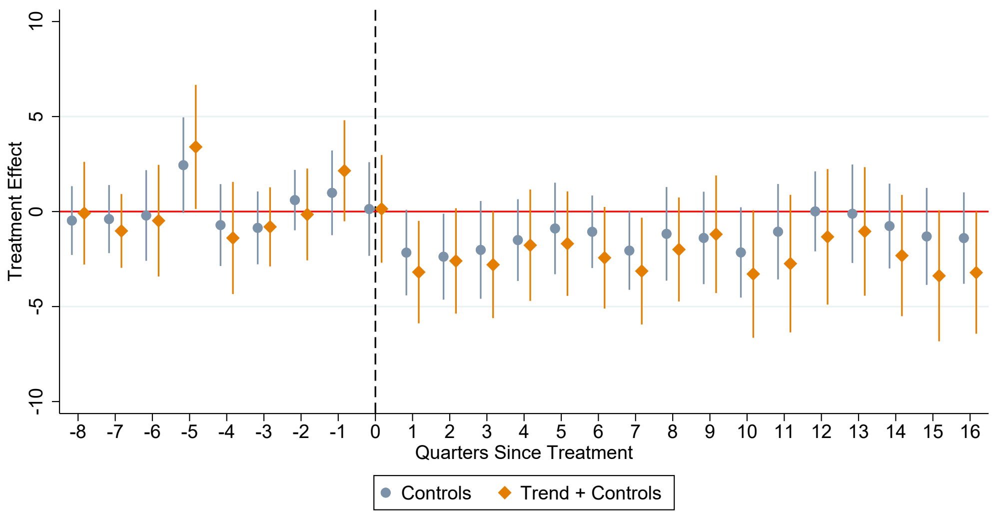
(b) Age



(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 - Other CVD Amenable to Primary Care Deaths 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.

C Placebo Estimates

Table C.1: Hospital Demand and Total Mortality
Placebo Estimates

	Specifications				Mean at
	(1)	(2)	(3)	(4)	Baseline
Ambulatory Procedures					
Total	-0.012	-0.010	-0.004	-0.002	59.79
	(0.012)	(0.014)	(0.014)	(0.016)	
Basic Health Care	0.001	-0.002	-0.009	-0.015	16.70
	(0.049)	(0.062)	(0.066)	(0.060)	
Medium Complexity	-0.035*	-0.035*	-0.014	-0.013	41.19
	(0.019)	(0.018)	(0.021)	(0.023)	
High Complexity	0.029	0.029	-0.020	-0.023	0.24
	(0.029)	(0.034)	(0.042)	(0.043)	
Hospital Admissions					
Total	0.010	0.012	0.007	0.012	579.86
	(0.014)	(0.015)	(0.013)	(0.015)	
Amenable to Primary Care	0.010	0.010	0.012	0.014	146.44
	(0.014)	(0.017)	(0.012)	(0.014)	
Non-Amenable to Primary Care	0.011	0.014	0.006	0.012	433.4
	(0.016)	(0.017)	(0.015)	(0.015)	
Total Deaths					
Total	0.021	0.020	0.029	0.028	76.28
	(0.017)	(0.021)	(0.018)	(0.019)	
Amenable to Primary Care	0.027*	0.023	0.031*	0.027	23.18
	(0.015)	(0.019)	(0.019)	(0.019)	
Non-Amenable to Primary Care	0.018	0.017	0.027	0.028*	53.1
	(0.018)	(0.017)	(0.019)	(0.016)	
Hospital & Time FE	Yes	Yes	Yes	Yes	-
Controls	No	Yes	No	Yes	-
Trend	No	No	Yes	Yes	-

Notes: This table shows the simple average of the placebo two-way fixed effects estimators proposed by de Chaisemartin and D'Haultffuille (2020) over two years before an UPA is introduced in the 4.5km hospital's catchment area. Related UPA treatment effects can be found in Table 2. 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' demand (ambulatory procedures and hospital admissions) and mortality, so the coefficients are interpreted as (approximate) fractional changes. Sample is composed of 109 hospitals when analysing ambulatory procedures (SIA), 111 when looking at hospital admissions (SIH) and 115 when the outcome is hospitals' total deaths (SIM). We cluster 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 of two years before the introduction of an UPA near the hospital and is measured in levels instead of IHS and its ambulatory procedures' numbers are in thousands.

Table C.2: UPA Effects on Inpatient Outcomes by Specific Cause Placebo Estimates

	Hosp Admissions (1)	Total Deaths (2)	Inpatient Deaths (3)	% Inpatient Deaths (4)	%24h Inpatient Deaths (5)	Hosp Adm Mean at Baseline
Total						
	0.012	0.028	0.020	0.096	-0.027	579.86
	(0.014)	(0.017)	(0.019)	(0.067)	(0.037)	
Amenable to Primary Care						
Total	0.014	0.027	0.020	0.014	-0.039	146.44
	(0.014)	(0.021)	(0.023)	(0.153)	(0.055)	
Cardiovascular Diseases	0.024	0.017	0.011	-0.090	-0.155	49.78
	(0.019)	(0.018)	(0.022)	(0.268)	(0.109)	
Cerebrovascular	0.012	0.016	0.001	-0.131	-0.219	17.71
	(0.031)	(0.021)	(0.033)	(0.732)	(0.257)	
Other CVD	0.027	0.024	0.004	-0.219	-0.264	32.07
	(0.018)	(0.023)	(0.017)	(0.372)	(0.249)	
Repiratory Diseases	0.029	0.008	0.007	0.392	0.208	25.79
	(0.022)	(0.020)	(0.025)	(0.493)	(0.273)	
Diabetes	0.032	0.048**	0.000	-0.349	-0.564	13.41
	(0.027)	(0.023)	(0.025)	(0.400)	(0.433)	
Other	0.014	-0.017	0.034	0.262	0.014	57.45
	(0.017)	(0.025)	(0.031)	(0.173)	(0.077)	
Non-Amenable to Primary Care						
Total	0.012	0.028	0.020	0.135	-0.035	433.4
	(0.016)	(0.019)	(0.022)	(0.091)	(0.052)	
Cardiovascular Diseases	0.028	0.013	0.028	0.054	0.156	33.02
	(0.024)	(0.022)	(0.028)	(0.306)	(0.190)	
AMI	0.036	0.028	0.004	-0.688	0.275	6.97
	(0.025)	(0.022)	(0.023)	(1.031)	(0.720)	
Other CVD	0.015	-0.003	0.022	0.150	0.041	26.05
	(0.028)	(0.017)	(0.028)	(0.321)	(0.196)	
External Causes	0.001	0.055**	0.033*	0.333	-0.233	63.86
	(0.033)	(0.022)	(0.019)	(0.384)	(0.187)	
Digestive System Diseases	0.006	0.004	-0.007	-0.184	-0.074	57.93
	(0.023)	(0.026)	(0.023)	(0.253)	(0.092)	
Pregnancy Complications	-0.054	-0.012	-0.026	-0.446	0.014	43.22
	(0.039)	(0.023)	(0.018)	(0.400)	(0.206)	
Other	0.013	0.028	0.030	0.330*	-0.023	235.37
	(0.015)	(0.022)	(0.024)	(0.188)	(0.084)	
Hospital & Time FE	Yes	Yes	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	Yes	Yes	-
Mean at Baseline	579.86	76.28	41.91	6.41	1.37	-

Notes: This table shows the simple average of the placebo two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfœuille (2020) over two years before an UPA is introduced in the 4.5km hospital's catchment area. Related UPA treatment effects can be found in Table 7. 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 three dependent variables analysed are the IHS of admissions and total 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 causes amenable and non-amenable to primary care. Sample is composed of 111 hospitals. We cluster 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 of two years before the introduction of an UPA near the hospital and is measured in levels instead of IHS.

Table C.3: UPA Effects on Total Deaths per 100,000 Inhabitants, City-Level Placebo Estimates

	Placebo Effect				Mean at
	(1)	(2)	(3)	(4)	Baseline
UPA	0.326 (0.529)	0.364 (1.007)	-0.155 (0.664)	-0.102 (1.357)	188.99
Municipality & Time FE	Yes	Yes	Yes	Yes	-
Controls	No	Yes	No	Yes	-
Trend	No	No	Yes	Yes	-

Notes: This table shows the simple average of the placebo two-way fixed effects estimators proposed by de Chaisemartin and D'Haultffuille (2020) over two years before an UPA is introduced in a municipality. Related UPA treatment effects can be found in Table 8. 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 (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 of two years before the introduction of an UPA in the municipality and is measured in rates per 100,000 inhabitants.

Table C.4: Deaths per 100,000 by Cause and Location, City-Level Placebo Estimates

		Location						
	Total (1)	Hospital (2)	UPA (3)	Other Health Facility (4)	Household (5)	Street (6)	Other (7)	Mean at Baseline
Total								
	-0.102	0.553	-0.172	-0.487**	0.309	-0.165	-0.149	188.99
	(1.299)	(1.129)	(0.193)	(0.242)	(0.330)	(0.229)	(0.181)	
Amenable to Primary Care								
Total	-0.086	0.115	-0.068	-0.183	0.105	-0.006	-0.052	53.97
	(0.647)	(0.443)	(0.094)	(0.124)	(0.156)	(0.035)	(0.087)	
Cardiovascular Diseases	-0.001	-0.017	0.014	-0.094	0.107	0.014	-0.029	27.67
	(0.423)	(0.292)	(0.050)	(0.069)	(0.139)	(0.030)	(0.077)	
Cerebrovascular	-0.202	-0.194	-0.015	-0.018	0.026	0.006	-0.008	13.01
	(0.246)	(0.275)	(0.029)	(0.035)	(0.058)	(0.008)	(0.023)	
Other CVD	0.201	0.177	0.029	-0.076	0.081	0.008	-0.021	14.67
	(0.235)	(0.215)	(0.030)	(0.052)	(0.103)	(0.026)	(0.064)	
Repiratory Diseases	0.013	0.071	-0.035	-0.015	-0.006	-0.006	0.005	8.13
	(0.197)	(0.190)	(0.032)	(0.031)	(0.089)	(0.006)	(0.015)	
Diabetes	0.019	0.115	-0.006	-0.048	-0.017	-0.010	-0.014	10.61
	(0.196)	(0.207)	(0.019)	(0.037)	(0.073)	(0.020)	(0.025)	
Other	-0.117	-0.054	-0.041	-0.026	0.021	-0.004	-0.014	7.55
	(0.252)	(0.231)	(0.051)	(0.045)	(0.050)	(0.004)	(0.014)	
Non-Amenable to Primary Care								
Total	-0.017	0.438	-0.104	-0.304	0.204	-0.159	-0.097	135.02
	(1.006)	(0.941)	(0.122)	(0.186)	(0.278)	(0.205)	(0.162)	
Cardiovascular Diseases	0.095	0.127	-0.044	-0.059	0.078	-0.001	-0.009	32.82
	(0.402)	(0.298)	(0.055)	(0.112)	(0.160)	(0.054)	(0.063)	
AMI	0.318	0.250	-0.034	-0.021	0.104	0.016	0.000	16.63
	(0.254)	(0.225)	(0.032)	(0.082)	(0.128)	(0.043)	(0.056)	
Other CVD	-0.224	-0.123	-0.010	-0.038	-0.026	-0.017	-0.009	16.19
	(0.278)	(0.258)	(0.035)	(0.038)	(0.094)	(0.035)	(0.034)	
External Causes	-0.088	0.162	-0.005	-0.051	0.136	-0.196	-0.136	19.12
	(0.313)	(0.211)	(0.015)	(0.044)	(0.115)	(0.197)	(0.127)	
Digestive System Diseases	-0.010	0.062	-0.001	-0.036	-0.023	-0.015	0.002	6.59
	(0.186)	(0.202)	(0.012)	(0.023)	(0.043)	(0.024)	(0.015)	
Pregnancy Complications	0.089	0.052	0.001	0.009	0.018	0.000	0.001	7.16
	(0.230)	(0.283)	(0.001)	(0.020)	(0.028)	(0.007)	(0.010)	
Other	-0.102	0.034	-0.055	-0.167	-0.005	0.053	0.044	69.33
	(0.714)	(0.805)	(0.113)	(0.120)	(0.188)	(0.040)	(0.082)	
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	188.99	141.03	1.88	6.05	27.37	7.63	4.68	-

Notes: This table shows the simple average of the placebo two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfœuille (2020) over two years before an UPA is introduced in a municipality. Related UPA treatment effects can be found in Table 9. 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 conditions amenable and non-amenable to primary care and by six different locations: hospitals, UPAs, other health facilities, household, street and other places. 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 of two years before the introduction of an UPA in the municipality and is measured in rates per 100,000 inhabitants.

Table C.5: UPA Effects on Local Health Systems, , City-Level Placebo Estimates

	Public System			Private System	
	% PSF Coverage (1)	Ambulance Program (2)	Net New Hospitals (3)	% Health Ins. Coverage (4)	Private Beds per 100,000 (5)
UPA	-0.521	-0.002	0.000	0.009	-0.776
	(0.327)	(0.003)	(0.007)	(0.070)	(1.252)
City & Time FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Trend	Yes	Yes	Yes	Yes	Yes
Mean at Baseline	74.42	0.27	0.02	14.34	53.48

Notes: This table shows the simple average of the placebo two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfœuille (2020) over two years before an UPA is introduced in a municipality. Related UPA treatment effects can be found in Table 11. 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 the public sector are: (1) Family Health Program coverage; (2) presence of SAMU ambulatory program; (3) number of new SUS general hospitals with ER (opened - closed); Dependent variables related to the private sector are: (4) private health insurance coverage; (5) number of private inpatient beds per 100,000 inhabitants. 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 of two years before the introduction of an UPA in the municipality and has the same metric as the corresponding variable.

D Further Robustness Results

Table D.1: Hospital's Demand and Total Mortality Robustness Checks

		Robustness					
	Main Specification (1)	Excluding RJ City (2)	-10% Catch. Area (3)	+10% Catch. Area (4)	Hospitals w/ Adequate Data (5)	Health System Controls (6)	Mean at Baseline
Ambulatory Procedures							
Total	-0.178**	-0.218**	-0.205**	-0.196**	-0.168**	-0.180**	59.79
	(0.084)	(0.087)	(0.089)	(0.093)	(0.077)	(0.080)	
Basic Health Care	0.364	0.359	0.337	0.376	0.394	0.367	16.70
	(0.356)	(0.413)	(0.372)	(0.416)	(0.395)	(0.359)	
Medium Complexity	-0.139	-0.183*	-0.075	-0.183*	-0.144	-0.146	41.19
	(0.117)	(0.103)	(0.160)	(0.107)	(0.116)	(0.100)	
High Complexity	0.071	0.351	0.016	0.220	0.072	0.131	0.24
	(0.262)	(0.302)	(0.280)	(0.302)	(0.297)	(0.324)	
Inpatient Measures - Amenable to Primary Care							
Hosp Admissions	-0.311**	-0.368**	-0.300**	-0.331**	-0.296**	-0.327***	146.44
	(0.140)	(0.187)	(0.144)	(0.135)	(0.125)	(0.117)	
Total Deaths	-0.268***	-0.300***	-0.213***	-0.261***	-0.270***	-0.254***	23.18
	(0.077)	(0.099)	(0.080)	(0.077)	(0.092)	(0.078)	
Inpatient Deaths	-0.303**	-0.375**	-0.225*	-0.309**	-0.281**	-0.341***	14.24
	(0.140)	(0.167)	(0.122)	(0.127)	(0.133)	(0.130)	
% Inpatient Deaths	-0.139	-0.795	0.305	0.040	-0.129	-0.209	8.32
	(0.779)	(0.853)	(0.940)	(0.913)	(0.944)	(0.868)	
% 24h Inpatient Deaths	-0.192	-0.399	-0.160	-0.127	-0.159	-0.222	1.61
	(0.234)	(0.305)	(0.248)	(0.231)	(0.254)	(0.260)	
Inpatient Measures - Non-Amenable to Primary Care							
Hosp Admissions	-0.014	0.069	-0.016	-0.035	-0.005	-0.009	433.4
	(0.078)	(0.056)	(0.077)	(0.069)	(0.078)	(0.079)	
Total Deaths	-0.180**	-0.175*	-0.150	-0.180***	-0.172**	-0.164**	53.1
	(0.082)	(0.100)	(0.092)	(0.066)	(0.073)	(0.078)	
Inpatient Deaths	-0.262***	-0.288***	-0.214**	-0.266***	-0.249***	-0.269***	27.66
	(0.083)	(0.099)	(0.102)	(0.095)	(0.095)	(0.094)	
% Inpatient Deaths	-1.384**	-2.264***	-1.246*	-1.225*	-1.298**	-1.391**	5.82
	(0.561)	(0.667)	(0.656)	(0.692)	(0.661)	(0.696)	
% 24h Inpatient Deaths	-0.581***	-0.838***	-0.518**	-0.541***	-0.544**	-0.569***	1.3
	(0.224)	(0.266)	(0.212)	(0.203)	(0.260)	(0.201)	
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 simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfœuille (2020) over four years after an UPA is introduced near a hospital using five different specifications. 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 109 hospitals when looking at SIA outcomes, 111 when analysing SIH data and 115 (all) when looking at SIM data. The second column shows results when we exclude 13 hospitals from Rio de Janeiro City. Column 3 and 4 show the results when we vary in 10% the circle area of the catchment area. Column 5 keep only hospitals that have adequate data in both SIA and SIH, leaving us with 108 hospitals. Finally, column 6 include the following health-related controls: FHP coverage, 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. 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. Dependent variables are the IHS, except for

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

	Treatment Effect				Mean at
	(1)	(2)	(3)	(4)	Baseline
Main Specification	-2.319 (3.074)	-3.048 (3.493)	-4.186 (4.054)	-4.925 (5.118)	188.99
Robustness					
Excluding RJ City	-2.275 (3.526)	-3.004 (3.486)	-4.116 (3.988)	-4.872 (4.700)	188.93
Health System Controls	-2.319 (3.074)	-3.885 (3.762)	-4.186 (4.054)	-5.201 (5.402)	188.99
City & Time FE	Yes	Yes	Yes	Yes	-
Controls	No	Yes	No	Yes	-
Trend	No	No	Yes	Yes	-

Notes: This table shows the simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfœuille (2020) over four years after an UPA is introduced in a municipality for two robustness specifications. The first one excludes Rio de Janeiro city and the second 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. 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). Dependent variable is deaths per 100,000 people. 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 of two years before the introduction of an UPA in the municipality and is measured in rates per 100,000 inhabitants.

Table D.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	-4.925	-19.408***	12.489***	0.591	-0.212	-0.781	2.137	188.99
	(4.770)	(5.726)	(2.912)	(1.726)	(2.037)	(1.302)	(1.441)	
Amenable to Primary Care	-0.725	-6.322***	4.384***	0.708	-0.403	-0.064	0.946*	53.97
	(2.357)	(2.259)	(1.158)	(0.820)	(0.888)	(0.197)	(0.496)	
Non-Amenable to Primary Care	-4.200	-13.086***	8.105***	-0.118	0.191	-0.717	1.191	135.02
	(5.047)	(4.516)	(2.162)	(1.023)	(1.608)	(1.193)	(1.111)	
Excluding RJ City								
Total	-4.872	-19.419***	12.793***	0.553	-0.435	-0.854	2.224	188.93
	(4.884)	(5.748)	(3.055)	(1.852)	(1.873)	(1.107)	(1.685)	
Amenable to Primary Care	-0.832	-6.403***	4.504***	0.693	-0.549	-0.071	0.966*	53.98
	(2.271)	(2.316)	(0.976)	(0.802)	(0.943)	(0.226)	(0.533)	
Non-Amenable to Primary Care	-4.040	-13.016***	8.290***	-0.140	0.114	-0.783	1.258	134.95
	(4.252)	(4.414)	(2.304)	(1.363)	(1.731)	(1.205)	(1.279)	
Heatlh System Controls								
Total	-5.201	-18.916***	12.561***	0.179	-0.460	-0.866	2.055	188.99
	(5.801)	(5.945)	(3.054)	(1.599)	(1.849)	(1.314)	(1.846)	
Amenable to Primary Care	-0.690	-5.975***	4.410***	0.513	-0.547	-0.056	0.937*	53.97
	(2.272)	(2.053)	(1.102)	(0.777)	(0.944)	(0.213)	(0.527)	
Non-Amenable to Primary Care	-4.511	-12.941***	8.151***	-0.334	0.086	-0.810	1.118	135.02
	(4.983)	(4.385)	(2.077)	(1.195)	(1.619)	(1.140)	(1.174)	
Municipality & 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 (Main Spec & Bad Controls)	188.99	141.03	1.88	6.05	27.37	7.63	4.68	-
Mean at Baseline (No RJ City)	188.93	140.97	1.89	6.05	27.37	7.63	4.68	-

Notes: This table shows the simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfuille (2020) over four years after an UPA is introduced in a municipality for two robustness specifications. The first one excludes Rio de Janeiro city and the second 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. 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. Dependent variables are the deaths per 100,000 people by conditions amenable and non-amenable to primary care and by six different locations: hospitals, UPAs, other health facilities, household, street and other places. 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 of two years before the introduction of an UPA in the municipality and is measured in rates per 100,000 inhabitants.

Table D.4: Other CVD Amenable to Primary Care Deaths per 100,000, City-Level Robustness Estimates

	Main Specification (1)	Excluding RJ City (2)	Health System Controls (3)	Mean at Baseline
Other CVD Amenable to Primary Care				
Total	-2.234**	-2.409*	-2.461**	14.67
	(1.131)	(1.360)	(1.171)	
Hypertension & Heart Failure	-2.354**	-2.535**	-2.580*	14.52
	(1.132)	(1.271)	(1.369)	
Angina Pectoris	0.050	0.052	0.052	.02
	(0.046)	(0.054)	(0.053)	
Rheumatic Fever	0.070	0.074	0.067	.13
	(0.197)	(0.194)	(0.222)	
City & Time FE	Yes	Yes	Yes	-
Controls	Yes	Yes	Yes	-
Trend	Yes	Yes	Yes	-
Mean at Baseline (Total)	14.67	10.46	14.67	-

Notes: This table shows the simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultffuille (2020) over four years after an UPA is introduced in a municipality for two robustness specifications. The first one excludes Rio de Janeiro city and the second 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. 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. Dependent variables are the deaths per 100,000 people by cardiovascular diseases amenable to primary care. 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 of two years before the introduction of an UPA in the municipality and is measured in rates per 100,000 inhabitants.

Table D.5: Health System, City-Level Robustness Estimates - Exclusion of RJ City

	Public System			Private System	
	% PSF Coverage (1)	Ambulance Program (2)	Net New Hospitals (3)	% Health Ins. Coverage (4)	Private Beds per 100,000 (5)
UPA	-1.344	-0.011	-0.060	0.520	4.361
	(3.117)	(0.024)	(0.088)	(0.678)	(9.597)
City & Time FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Trend	Yes	Yes	Yes	Yes	Yes
Mean at Baseline	74.6	0.27	0.02	14.24	53.25

Notes: This table shows the simple average of the dynamic two-way fixed effects estimators proposed by de Chaisemartin and D'Haultfœuille (2020) over four years after an UPA is introduced in a municipality when the city of Rio de Janeiro is excluded from the sample. 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 the public sector are: (1) Family Health Program coverage; (2) presence of SAMU ambulatory program; (3) number of new SUS general hospitals with ER (opened - close). Dependent variables related to the private sector are: (4) private health insurance coverage; (5) number of private inpatient beds per 100,000 inhabitants. 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 of two years before the introduction of an UPA in the municipality and is measured in rates per 100,000 inhabitants.

E Data Appendix

E.1 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 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 140 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 D). Therefore, our main database comprises 115 hospitals. Treatment was defined by an UPA falling within a 4.5km radius of the hospital - the median distance travelled by patients to the closest ER before the inauguration of the first UPA in 2007. We checked the sensitivity of our estimates to varying the size of the catchment area around the vicinity of our benchmark one by $\pm 10\%$.

Not all the 115 SUS general hospitals with 24h emergency services in RJ had consistent records throughout the entire 2005-2016 period in SIA and/or SIH. Four 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 D 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.

E.2 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.[35] Hospitals that opened and closed were taken into consideration, and routes were recalculated once they started or stopped operating. The median distance travelled by patients before the first UPA is introduced was 4.5km.

E.3 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 (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 hospitals' 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

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

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 E.2 and E.3. 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 care followed the Ministry of Health Ordinance 221/2008. This classification is based on the methodology proposed and adapted to the Brazilian context by Alfradique et al. (2009). Table E.1 below shows the ICD-10 codes used in each condition analyzed.

City-Level Outcome Variables. We used microdata from the health establishments register (CNES) and the vital statistics records (SIM) 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. SIM allowed us to identify whether the death occurred at home, in the street or in different types of health facility. We used this information, together with ICD for cause of death to compute mortality rates by cause and location. CNES enabled us to identify at the city level the exact timing of opening of UPAs as well as to map health facilities and health systems infrastructure. We used it to compute the number of hospital inpatient beds not funded by SUS. We computed the Family Health Program coverage from data provided by the Ministry of Health's Primary Health Care Department (SAPS), and the presence of the ambulance programme (SAMU) from data available on the Brazilian Open Data Portal. We also collected the share of the population covered by private health insurance from the National Supplementary Health Agency (ANS).

All city outcomes, with the exception of FHP and health insurance coverage 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 E.4.

Control Variables. Controls introduced in both analyses are cities' GDP per capita, Bolsa Família coverage, 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. They were computed at the municipality-year level. More details on how they were defined and constructed can be found in Table E.5

E.4 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-misocial1

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/cnes](https://dados.gov.br/dataset/cnes

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 E.1: List of conditions examined and their ICD-10 codes

Diseases	**ICD-10 Codes**
1. Amenable to Primary Care	**A00-A09; A33-A37; A15-A19; A46; A50-A53; A95; B05; B06; B16; B26; B50-B54; B77; D50; E10-E14; E40-E46; E50-E64; E86; G00.0, G40; G41; G45-G46; H66; I00-I02; I10-I11; I20; I50; I63-I67; I69; J00-J03; J06; J13-J14; J15.3; J15.4; J15.8; J15.9; J18.1; J20-J21; J31; J40-J47; J81; K25-K28; K92.0; K92.1; K92.2; L01-L04; L08; N10-N12; N30; N34; N39.0; N70-N73; N75; N76; O23; P35.0**
1.1. Cardiovascular Diseases	G45-G46; I00-I02; I10-I11; I20; I50; I63-I67; I69
1.1.1. Cerebrovascular Diseases	I63-I67, I69; G45-G46
1.1.2. Other CVD Diseases	I00-I02; I10-I11; I20; I50
1.2. Respiratory Diseases	J00-J03; J06; J13-J14; J15.3; J15.4; J15.8; J15.9; J18.1; J20-J21; J31; J40-J47; J81
1.3. Diabetes	E10-E14
1.4. Other Amenable to Primary Care	Remaining conditions in amenable to primary care which were not encompassed by the categories above (cerebrovascular, other CVD, respiratory and diabetes)
2. Non-Amenable to Primary Care	**ICD-10 codes not specified in (1)**
2.1. Cardiovascular Diseases	Conditions in Chapter I not mentioned in (1.1)
2.1.1. Acute Myocardial Infarction (AMI)	I21-I23
2.1.2. Other CVD	Conditions in Chapter I not mentioned in (1.1) and (2.1.1)
2.2. External Causes	Chapters S,T, V, W, X and Y
2.3. Pregnancy and Puerperium Complications	Chapters O and P, excluding O84-O85 (deliveries) and O23 and P35.0
2.4. Digestive System Conditions	Chapter K, excluding K25-K28; K92.0; K92.1; K92.2
2.5. Other Non-Amenable to Primary Care	Remaining conditions in non-amenable to primary care which were not encompassed by the categories above (AMI, other CVD, external causes, pregnancy/puerperium complications, digestive system). Note that deliveries (O80-O84) are included in this category.

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

Table E.2: 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 in Table E.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 in Table E.1	SIH
Deaths Conditional on Hospital Admission	**(# Inpatient deaths / # hospital admissions) x 100** ICD-10 codes related to each cause examined are in Table E.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 in Table E.1	SIH
Total Deaths	**IHS(Number of total deaths)** ICD-10 codes related to each cause examined are in Table E.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 in Table E.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, clinical, ITU/ICU and we aggregate obstetric, pediatric, other specialties and hospital-day into an "other" category.	CNES - LT

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

Table E.3: 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 ≥ 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 ≥ 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 E.4: 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 E.1 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 muncipality 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** This variable is simply a dummy if the municipality had or not SAMU in that period	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
Private Inpatient Beds per 100,000 inhabitants	**(Number of non-SUS inpatient beds / Population) x 100,000** Private inpatients beds are defined as the difference between total and SUS inpatient beds (QT_EXIST - QT_SUS), variables that come from CNES - LT. Population Data comes from IBGE.	CNES - LT & IBGE

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

Table E.5: Control Variables - Definitions

Controls	Definition/Observations	Source
Municipality GDP 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 Transfer	**(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)	SAPS

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