# Curative vs Preventive Pre-Hospital Care: Effects on Hospital Demand and Patient Outcomes

Sonia Bhalotra [U. Essex] Letícia Nunes [FGV] Rudi Rocha [FGV]

Public Health and Development Workshop
U. of Gothenburg – August 28, 2018

# Introduction

- Countries and health systems have moved towards Universal Health Coverage (UHC), but under increasingly financial constraints:
  - How to achieve cost-effective UHC? It involves expansion and/or redesign of health systems → many possible pathways.
- In particular, hospital care is a cornerstone of any health system: resolutive capacity but costly solution.
  - Not by coincidence, hospitals are under stress all over the world: chronic shortage of hospital resources in (nearly all developed) countries.
  - Correlational evidence: ER overcrowding + bed shortage → increased in-hospt mortality (eg. Australia and Denmark); increased patient turnover and early discharge (US).
- Public health guidelines suggest the strengthening of pre-hospital care as a mean of enhancing system efficiency. However:
  - To what extent and how does the provision of pre-hospital care lower hospital demand, thus enhancing hospital performance and patient outcomes?
  - There is scant and mixed evidence from primary care programs. Overall, little systematic evidence on what works and what doesn't work.

# Introduction

- In this paper we examine the effects of a unique pre-hospital care policy on hospital performance and patient outcomes in Rio de Janeiro:
  - Rio is a forerunner in the expansion of UPAs in Brazil: fixed Emergency Care Units 24/7 (fully-equiped ERs, scattered across the state).
  - Intermediate point of access to health care, between primary and hospital care.
- DiD on a quarterly panel of 100 hospitals 2005-2015: we examine effects on ER use, hospital admissions and hospital resources. Preview of results:
  - We find great reduction in hospitals' ER use (about 30%); nothing else.
  - The same reduction is achieved with $> 61\%$ of coverage in primary care.
- Contribution to literature:
  - What are the effects of pre-hospital care on utilization, health outcomes and hospital performance $\rightarrow$ mixed evidence from primary care, scant on other interventions.
  - How do hospitals cope with demand pressure $\rightarrow$ scant evidence, mostly from developed countries.

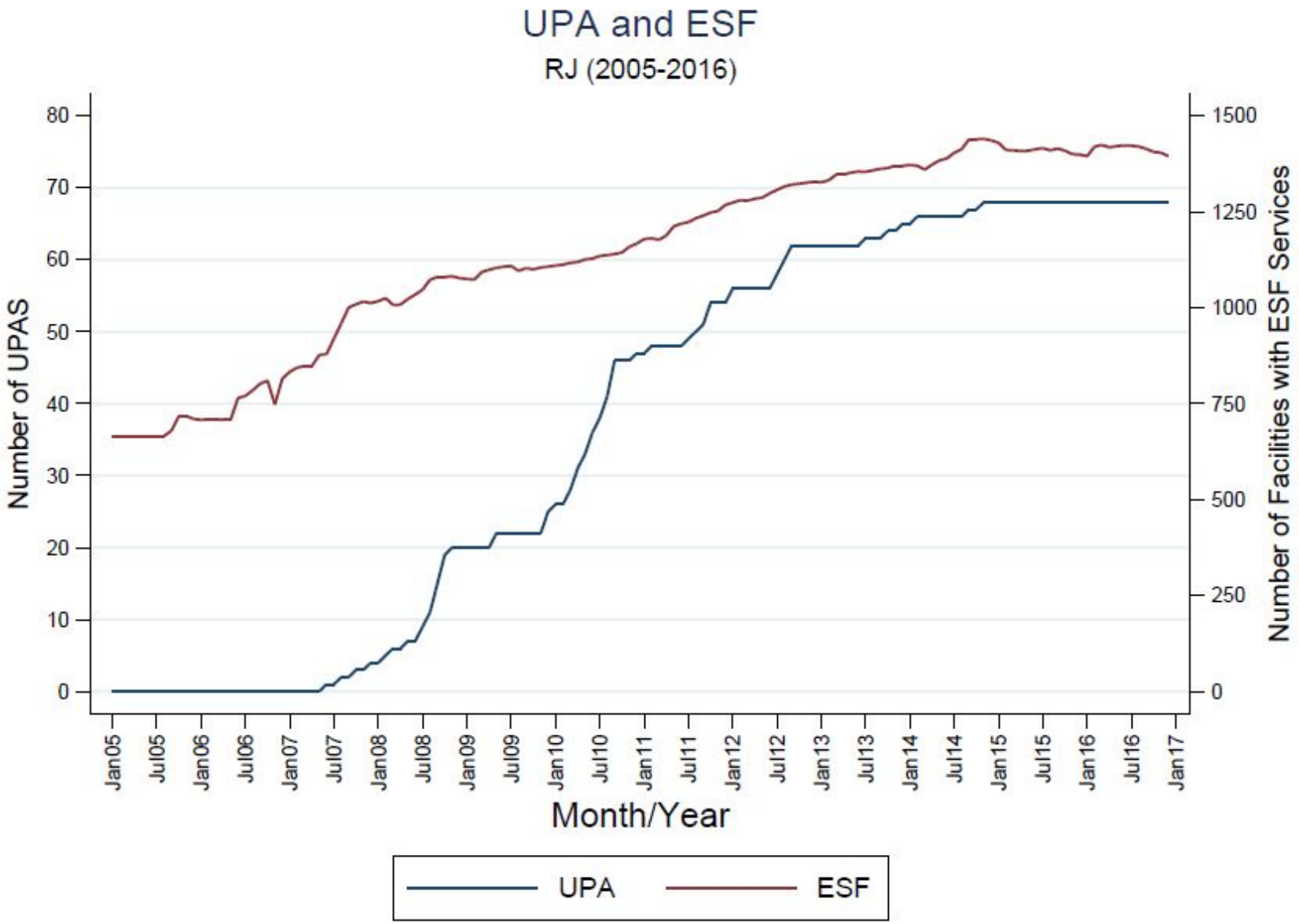
# Context: Health System in Brazil

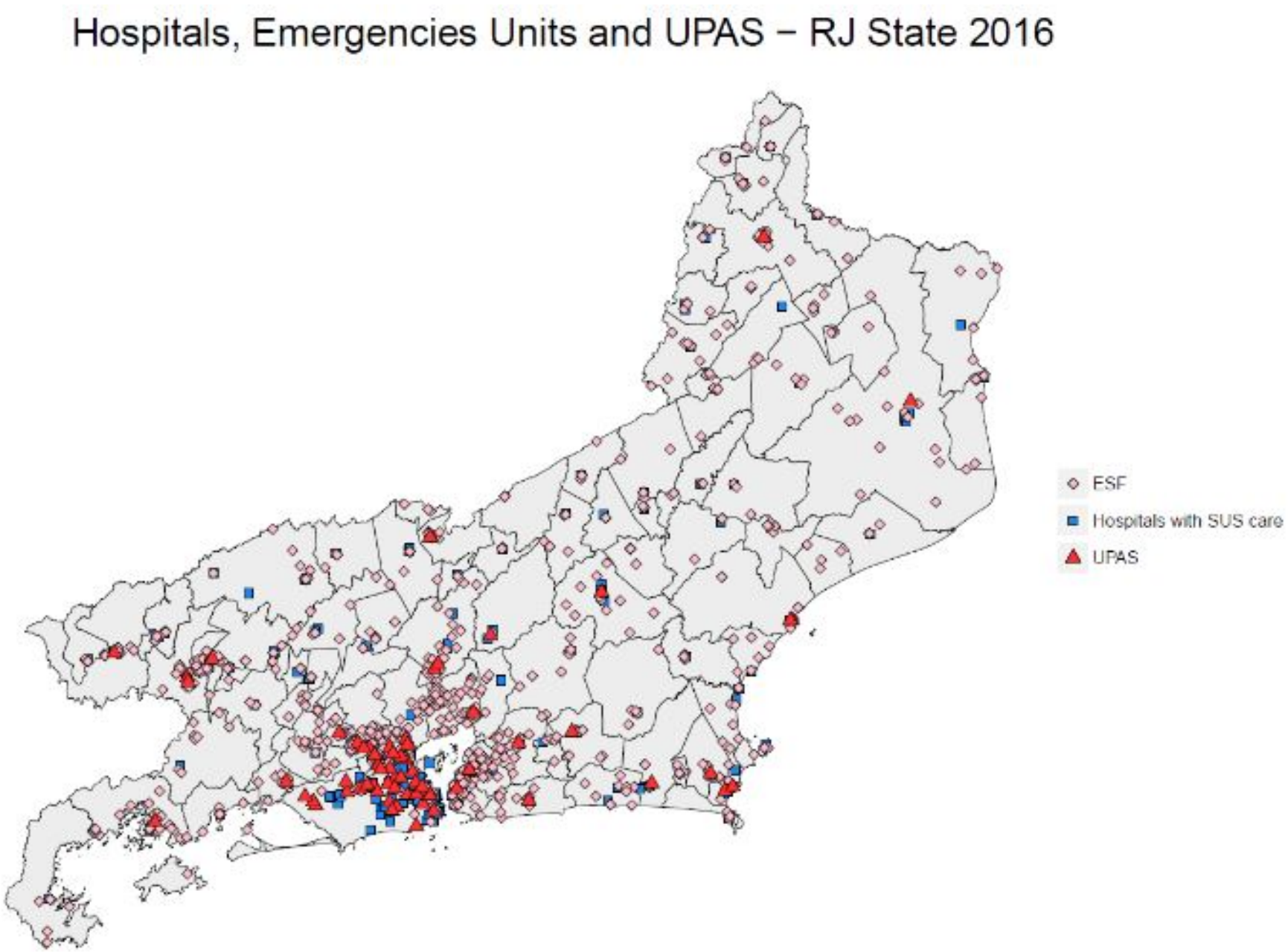
- The 1988 Constitution established right to free, universal and equal access to health care, enforceable in court. Legislation in 1990 established the SUS.
  - SUS: typical single-payer NHS, grants free-of-charge access to outpatient, inpatient and pharmaceutical services.
  - Legislation also allowed the provision of health services by the private sector (contracted-out by SUS and/or directly to patients via OOPE/insurance).
  - Bottom line: mixed public/private in both provision and financing (segmentation by SES).
- The Brazilian health system progressed towards UHC and public health guidelines:
  - Mid-1990s, the Family Health Program (PSF): now the largest community health program in the world, covering around 100 million people or half the population. Expands outpatient care towards outreach and prevention.
  - Mid-2000s, the National Emergency Policy reinforced SUS towards pre-hospital care services: expansion of fixed Emergency Care Units (UPA).

# Context: UPAs in Rio

- UPA: fixed Emergency Care Units 24/7, equipped with X-ray, electrocardiography, simpler exam labs, observation beds.
  - Provides emergency care of low/medium complexity: intermediary point of access between primary and hospital care, should accept all cases.
  - Policy goals: UPAs should compensate for the shortfall in primary care and alleviate congestion in hospitals' ERs.
- Main hypotheses:
  - Less congestion expected to increase relative resources and hospital performance. But effect depends on hospital response to variation in demand.
  - It also depends on patient selection. Acute cases should reach hospitals within the golden hour; UPAs are not expected to be effective in this case.
- Rio de Janeiro, unique empirical setting:
  - A forerunner in UPA: more than 60 over the late 2000s.
  - Fine-grained variation across regions, over time, within a totally geo-coded system.
  - A latecomer in PSF, the number of teams doubled over the same period of time. PSF generally struggles to advance in big cities.

# Context: PSF and UPA in Rio

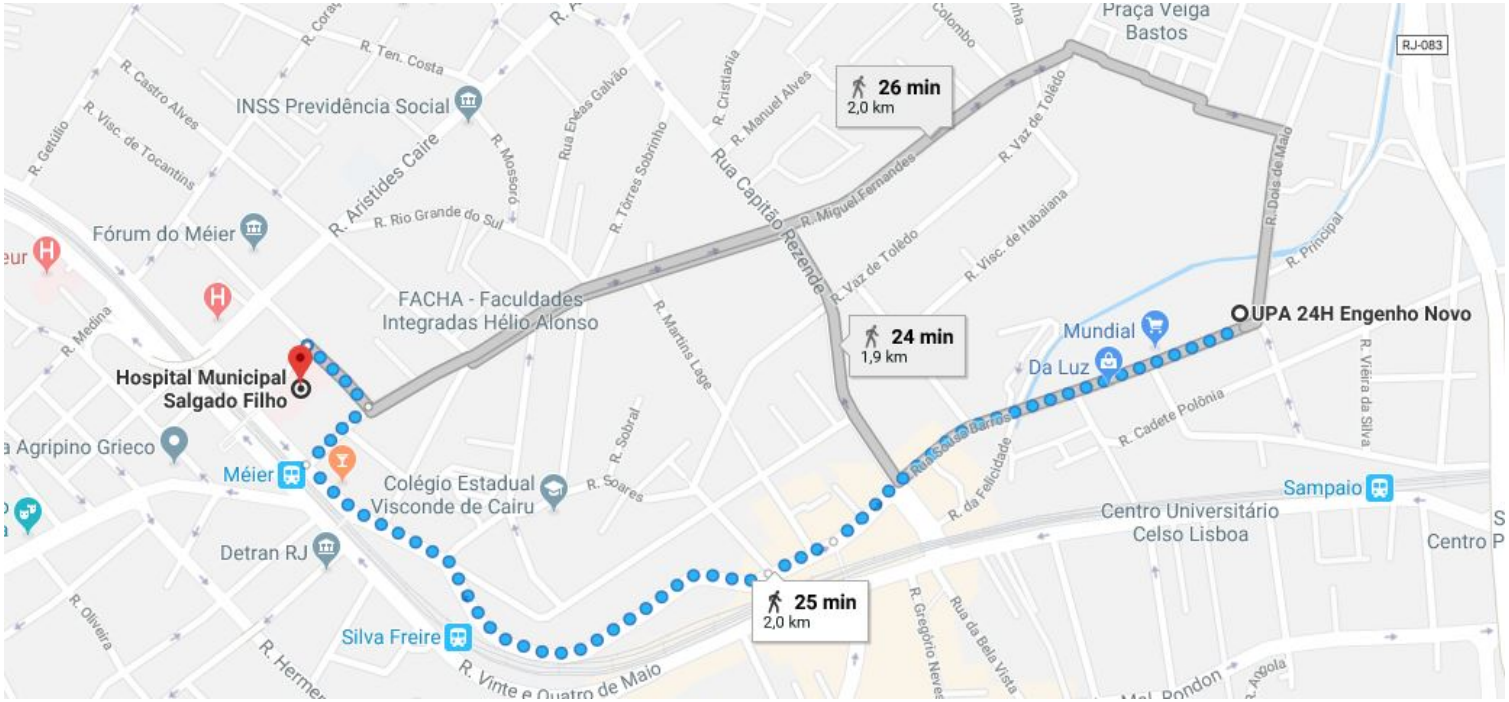



Hospitals, Emergencies Units and UPAS – RJ State 2016
ESF
Hospitals with SUS care
UPAS

# Context: UPA in Rio

# Data

- Sample: panel of 104 hospitals at the quarter level, RJ 2005-2016.
- Variable of interest:
  - Dummy for UPA located within 2km-buffer from hospital ($\backsim$ 20% treated).
- Outcome variables, at the hospital level:
  1. ER use: SIA, the National Ambulatory Information System: (big) microdata, containing all ambulatory and exams procedures in SUS.
  2. Hospital admission: SIH, the Hospital Admission Information System: (big) microdata containing all admissions in SUS (ICD10, outcome, lenght of stay, costs, patient's zipcode).
  3. Hospital resources: CNES, the National Register of Health Establishments: monthly records, containing lat/long, HR, number of beds, equipments.
- PSF: % municipality coverage.
- Other control: 2010 Census containing demographic information at the census tract level for geocoding and controls; CER, UPPs and expansion of public transport.


Praça Veiga Bastos
RJ-083
26 min
2,0 km
INSS Previdência Social
R. Aristides Caire
R. Rio Grande do Sul
Fórum do Méier
FACHA - Faculdades Integradas Hélio Alonso
Rua Capitão Rezende
R. Miguel Fernandes
R. Vaz de Toledo
R. Visc. de Itabaiana
R. Dois de Maio
R. Principal
UPA 24H Engenho Novo
24 min
1,9 km
Mundial
Da Luz
Hospital Municipal Salgado Filho
Méier
Colégio Estadual Visconde de Cairu
R. Sobral
R. Martins Lage
R. Cadete Polônia
R. Vieira da Silva
Sampaio
Centro Universitário Celso Lisboa
R. da Felicidade
Detran RJ
25 min
2,0 km
Silva Freire
R. Vinte e Quatro de Maio
R. Gregório Neves
Rua da Bela Vista

- We exploit the staggered rollout of UPA in Rio:

$$\ln(\text{outcome}_{\text{ht}}) = \theta_{\text{h}} + \alpha_{\text{t}} + \beta \text{UPA}_{\text{ht}} + \text{X}'_{\text{ht}}\gamma + \epsilon_{\text{ht}}$$

- Additional tricks: clustering at the hospital level, weighting by baseline hospital scale.

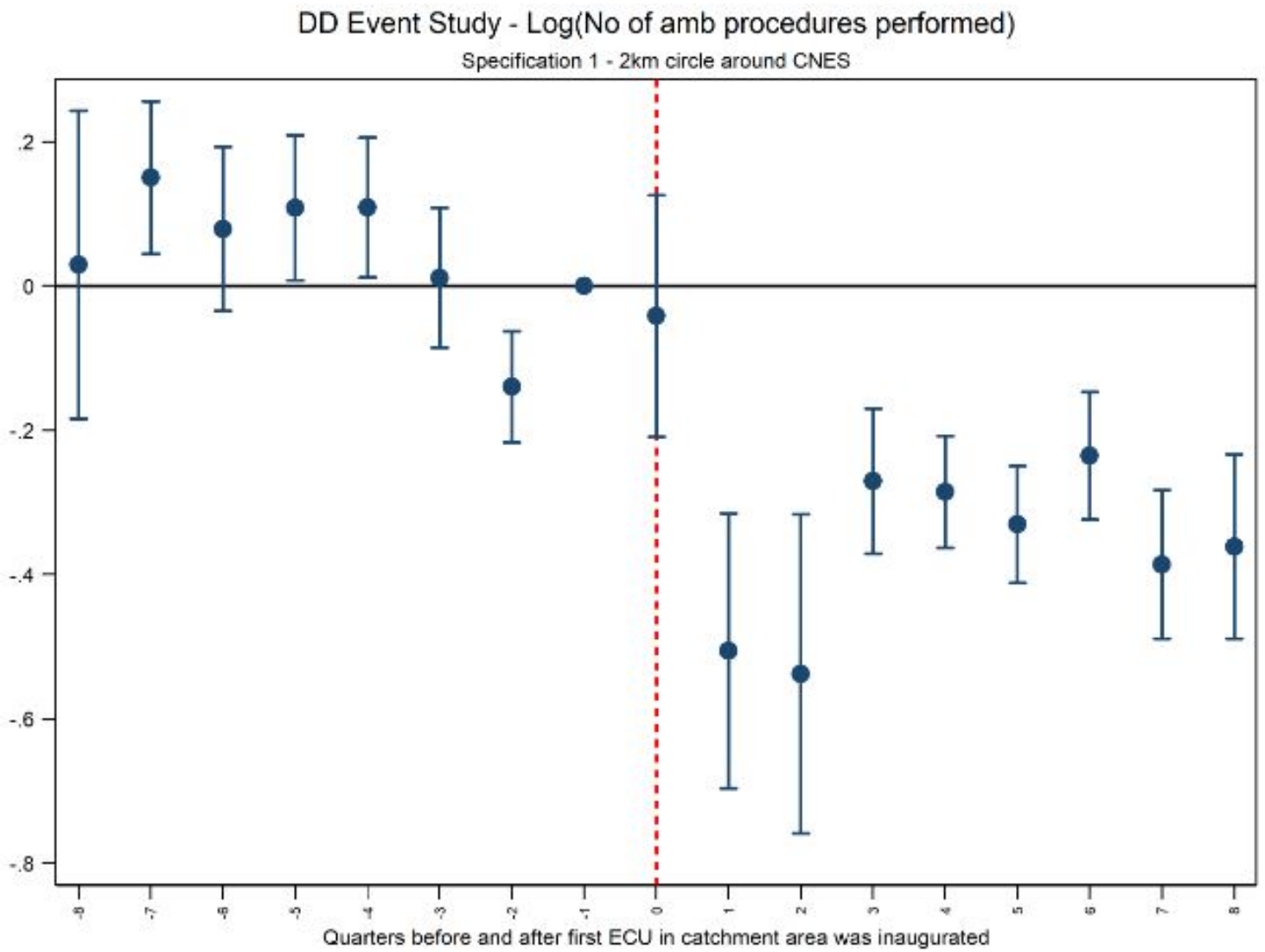
- Identification hypothesis in our empirical setting:
  - Idiosyncratic location of facilities based on available pre-existing idle public areas, absorbed by $\theta_{\text{h}}$.
  - Identification is supported by event study: no pre-trends.

# Results: Effects on Ambulatory Procedures

| | Log(N. of Ambulatory Procedures) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| UPA | -0.384*** | -0.357** | -0.360** | -0.305** | -0.286** |
| | (0.139) | (0.137) | (0.140) | (0.143) | (0.119) |
| Observations | 4,974 | 4,974 | 4,974 | 4,974 | 4,974 |
| R-squared | 0.821 | 0.824 | 0.824 | 0.826 | 0.826 |
| Hospital & Time FE | Yes | Yes | Yes | Yes | Yes |
| Weighted | No | Yes | Yes | Yes | Yes |
| Controls | No | No | Yes | Yes | Yes |
| Control Primary Care | No | No | No | Yes | Yes |
| Buffer of distance | 2km | 2km | 2km | 2km | 3km |

Standard errors clustered at the hospital level: *** p<0.01, ** p<0.05, * p<0.1

# Results: Effects on Ambulatory Procedures



# Results: Effects on Ambulatory Procedures

| | Log(N. of Ambulatory Procedures) | | | | |
|---|---|---|---|---|---|
| | Total | Health Prevention | Diagnostic | Clinic | Surgical |
| | (1) | (2) | (3) | (4) | (5) |
| UPA | -0.305** | -0.796 | -0.346* | -0.391* | -0.448 |
| | (0.143) | (0.592) | (0.187) | (0.229) | (0.293) |
| Observations | 4,974 | 4,974 | 4,974 | 4,974 | 4,974 |
| R-squared | 0.826 | 0.738 | 0.843 | 0.729 | 0.759 |

Standard errors clustered at the hospital level: *** p<0.01, ** p<0.05, * p<0.1

# Results: Effects on Hospital Admission

| | Hospital Admissions -- Log(Total) and % of Total*100 by Type | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Log(Total) | Elective | Emergency | Amenable to Primary Care | Cancer | CVD | Diabetes | Respiratory |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| UPA | 0.012 | -0.657 | 6.028 | 0.108 | -0.219 | 1.425 | 0.066 | 0.123 |
| | (0.054) | (2.422) | (5.020) | (1.418) | (0.653) | (1.104) | (0.189) | (0.718) |
| Obs | 4,969 | 4,969 | 4,969 | 4,969 | 4,969 | 4,969 | 4,969 | 4,969 |
| R-squared | 0.894 | 0.742 | 0.669 | 0.871 | 0.975 | 0.906 | 0.619 | 0.858 |

Standard errors clustered at the hospital level: *** p<0.01, ** p<0.05, * p<0.1

# Results: Effects on Patient Outcomes and Hospital Performance

| | Hospital Admissions - Outcomes and Hospital Performance (LogTotal) | | | |
|---|---|---|---|---|
| | in-Hospt Deaths | in-Hospt Deaths (24h) | Log(Avg Length of Stay) | Log(Avg Length of Stay ITU) |
| | (1) | (2) | (3) | (4) |
| UPA | 0.047 | 0.101 | -0.015 | -0.115 |
| | (0.117) | (0.107) | (0.043) | (0.076) |
| Observations | 4,969 | 4,969 | 4,969 | 4,969 |
| R-squared | 0.924 | 0.833 | 0.793 | 0.744 |

Standard errors clustered at the hospital level: *** p<0.01, ** p<0.05, * p<0.1

# Results: Effects on Hospital's Human Resources

| | Human Resources -- Log(N) | | | | | |
|---|---|---|---|---|---|---|
| | Total Professionals | Physicians | Nurses | Avg hrs/week per professional | Avg hrs/week in hospt activity | Avg hrs/week in ambulatory activity |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| UPA | 0.029 | -0.026 | -0.032 | -0.069 | 0.085 | 0.138 |
| | (0.120) | (0.103) | (0.211) | (0.066) | (0.249) | (0.156) |
| Observations | 4,992 | 4,992 | 4,992 | 4,992 | 4,992 | 4,992 |
| R-squared | 0.944 | 0.949 | 0.891 | 0.579 | 0.790 | 0.643 |

Standard errors clustered at the hospital level: *** p<0.01, ** p<0.05, * p<0.1

# Results: Effects on Hospital Beds and Physical Resources

| | Hospital Beds & Equipments -- in Log(N) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Hospt Beds | Surgical Beds | Clinical Beds | UTI/UCI Beds | Beds for Amb Obs | Beds for Emergency Obs | Diagn Imaging Equip | Life Saving Equip |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (7) |
| UPA | 0.087* | -0.181 | -0.082 | 0.196 | 0.019 | -0.155 | 0.054 | 0.116 |
| | (0.050) | (0.138) | (0.183) | (0.123) | (0.105) | (0.120) | (0.056) | (0.129) |
| Observations | 4,992 | 4,992 | 4,992 | 4,992 | 4,992 | 4,992 | 4,992 | 4,992 |
| R-squared | 0.978 | 0.934 | 0.909 | 0.881 | 0.880 | 0.925 | 0.949 | 0.935 |

Standard errors clustered at the hospital level: *** p<0.01, ** p<0.05, * p<0.1

# Results: Curative vs Preventive Pre-Hospital Care

| | Log(N. of Ambulatory Procedures) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| UPA | -0.384*** | -0.357** | -0.360** | -0.305** |
| | (0.139) | (0.137) | (0.140) | (0.143) |
| Primary Care Coverage (% PSF*100) | | | | -0.005** |
| | | | | (0.002) |
| Observations | 4,974 | 4,974 | 4,974 | 4,974 |
| R-squared | 0.821 | 0.824 | 0.824 | 0.826 |
| Hospital & Time FE | Yes | Yes | Yes | Yes |
| Weighted | No | Yes | Yes | Yes |
| Controls | No | No | Yes | Yes |
| Control Primary Care | No | No | No | Yes |
| Buffer of distance | 2km | 2km | 2km | 2km |

Standard errors clustered at the hospital level: *** p<0.01, ** p<0.05, * p<0.1

Breakeven: 61*0,005 = 0,305

# Final Comments

- To what extent and how does the provision of pre-hospital care lower hospital demand, thus enhancing hospital performance and patient outcomes?
  - The answer to this question is key to health system design and system efficiency.
- Brazil has tried with UPAs, which should compensate for the shortfall in primary care and alleviate congestion in hospitals' ERs.
  - Preliminary evidence suggests that cost-effectiveness is far from clear.
  - UPAs help contain demand from simple conditions; hospital performance unchanged.
- Next steps:
  - Cost-effectiveness: primary care vs ERs $\rightarrow$ curative vs preventive health care?
  - Improve hospital indicators and heterogeneity across periods of higher/lower bed occupancy.