Outcomes and Spending from VA vs. Non-VA Care:

Evidence from Ambulance Rides

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Poll Question #1

How would you primarily describe yourself?

1. Clinician
2. Researcher
3. Policymaker, manager, or administrator
4. Veteran
5. Other

Motivation and Question

- Veterans Health Administration (VHA) is the nation's largest health care delivery system

- Policy issues
  - Substantial growth in federal spending
  - Legislative proposals to privatize the VA (Choice Act of 2014, MISSION Act of 2018)

- Prior literature
  - Medical literature: VA care is better on hundreds of process measures; mixed results on outcomes (e.g., O'Hanlon et al 2017)
  - Usually compare veterans in the VA with non-veterans in non-VA hospitals; differences in patient populations

- **Question: What is the causal effect of receiving VA vs. non-VA care on health outcomes and spending?**

This Paper: Design

- Population: Veterans above age 65 who may use either VA or non-VA care (paid by Medicare)
- Setting: Emergency department care, for Veterans transported by ambulances
- Design: Instrumental variables (IV) using ambulances (Doyle et al. 2015)

Poll Question #2

What do you think we will find for VA, on the whole, relative to non-VA hospitals?

1. The VA saves lives and saves money
2. The VA saves lives but costs more money
3. The VA costs lives but saves money
4. The VA costs lives and costs more money
5. It is a mixed picture, depending on the station

This Paper: Findings

- VA reduces 28-day mortality by 46%
  - Effect arises in first week, persists through one year
  - Equivalent to non-VA hospital effect associated with 1 s.d. increase in spending (c.f., Doyle et al. 2015)

- Results hold for *all* VA stations

- Mechanisms:
  - Effects larger for vulnerable veterans, those with greater VA attachment $\Rightarrow$ continuity of care, specialization
  - VA *reduces* spending (more productive), very different patterns of reported care $\Rightarrow$ inefficiency of fee-for-service in non-VA care
  - Suggestive benefits of IT and integrated care

Outline

Setting and Background

Instrumental Variables

Study Design and Main Results

Mechanisms

Public vs. Private Delivery

- In the US, we have a mixed system of health care financing and delivery

	Public Financing	Private Financing
Public Delivery	VA Safety net hospitals	
Private Delivery	Medicare Medicaid	Employer insurance

- VA vs. non-VA comparison for dually eligible Veterans sheds light public vs. private delivery

What Are We Comparing?

	VA	Non-VA Hospitals
Patient population	Well defined, constituency	Less defined, patient choice
Contracting	Population-based	Mostly fee-for-service
Integrated care	Explicitly integrated	Mostly fragmented
Health IT	Adopted in 1990s	Very low until HITECH Act (2009)

- Some private-sector organizations can resemble the VA (e.g., Kaiser)
- Recent federal legislation (for private sector): HITECH Act of 2009 for IT, ACA for Accountable Care Organizations

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Poll Question #3

How familiar are you with instrumental variables (IV)?

1. I have used them in analysis.
2. I have been taught them but not used them in analysis.
3. I have heard of them but have no formal training.
4. I have never heard of them.

Instrumental Variables (IV)

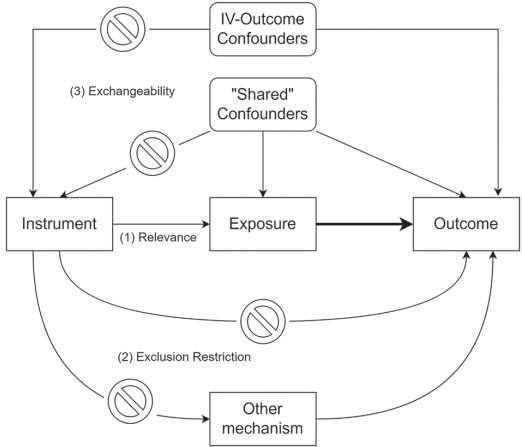
Strong analogy with randomized trials: IV akin to assignment to different trial arms

- Drives treatment (**first stage**)
- [Quasi-]randomly assigned (**independence**)
- Does not otherwise influence outcomes (**exclusion**)

Compliers: patients affected by the instrument

- Importantly, IV allows for non-compliers
- IV scales intention-to-treat (**reduced form**) effects by the first-stage complier share

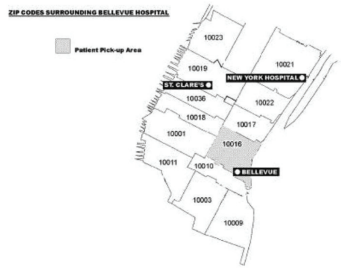
Instrumental Variables (IV)



Source: Hui et al. (2024) *Brain Behav*. 14:e3371.

Ambulance Instrument

- Doyle et al (2015): Ambulance providers have different propensities to send to different hospitals. In New York:



Destination of Patients Picked Up In The Bellevue Hospital Zip Code Area

Destination	All Voluntary Hospital Ambulances	Fire Department Ambulances
Bellevue Hospital (HHC)	25%*	61%**
Any Voluntary Hospital	75%	39%

*157 taken to Bellevue/632 total. **815 taken to Bellevue/1,346 total

Ambulance Instrument

- **First Stage:** Ambulances affect probability of Veteran being sent to the VA
  - Ambulance may be affiliated with certain hospitals
  - Ambulance may have different degrees to which they ascertain whether patient is a Veteran
  - Ambulance may have base of operation that is closer to VA or non-VA ED
- **Independence:** Ambulance needs to be randomly assigned, *conditional* on zip code
- **Exclusion:** Ambulance cannot directly affect patient health

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Mechanisms

Quasi-Experiment

- Veterans above age 65
- Ambulance instrument (Doyle et al. 2015; Hull 2018)
  - Some ambulance companies are more likely to send patients to some hospitals (i.e., VA)
  - Ambulance company assigned is plausibly quasi-random
- Baseline controls: zip code + source (e.g., residential) + ambulance type (ALS/BLS) + time categories + prior utilization Controls

Data

- VHA administrative records (VINCI) and Medicare claims
  - Ambulance rides, ED visits in VA and non-VA from 2000 to 2014
  - Veteran characteristics (diagnoses, utilization) prior to ED visit
  - Utilization outcomes post ED visit
- Mortality outcomes (Medicare, VHA, VBA, SSA)
- Characteristics of VA and non-VA hospitals from AHA, government sources (e.g., `healthit.gov`)

Study Sample

- Dual-eligible (VHA and Medicare) veterans brought by ambulance: 9.4 million ED visits for 3 million veterans

- Further restrictions:
  1. Zip codes with VA and non-VA alternatives within 20 miles
  2. Zip codes with 2+ ambulance companies with $\geq$ 20 rides
  3. Veterans with some VA utilization in past year (for main specifications)
  4. Veterans with no ride in prior month

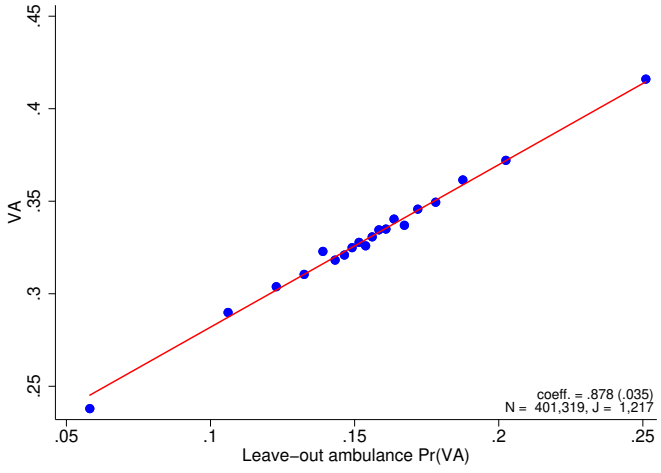
- 28-day mortality rate around 10 p.p., weekend share around 2/7 regardless of restrictions

Study Sample

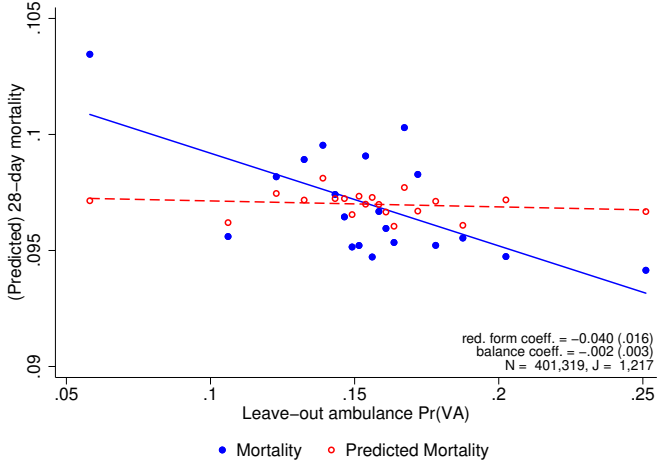
	Dual eligibles	+ zip x hospital	+ zip x company	+ VA-attached	+ no ride last month
Male	0.90	0.88	0.86	0.96	0.96
Age	77.0	76.9	76.1	75.6	76.0
Share black	0.11	0.16	0.19	0.20	0.19
Prior VA ED	0.14	0.20	0.26	0.57	0.53
Prior Medicare ED	0.70	0.68	0.63	0.54	0.48
Count comorbidities	6.53	6.69	6.44	6.54	6.14
Weekend rate	0.27	0.27	0.27	0.27	0.27
28-day mortality	0.12	0.11	0.10	0.10	0.10
Present at VA ED	0.04	0.09	0.17	0.34	0.33
Number of rides	8,828,997	3,465,588	1,051,093	491,193	401,319

First Stage

- Instrument: ambulance propensity to send patients to VA (patient-weighted, leave-out)



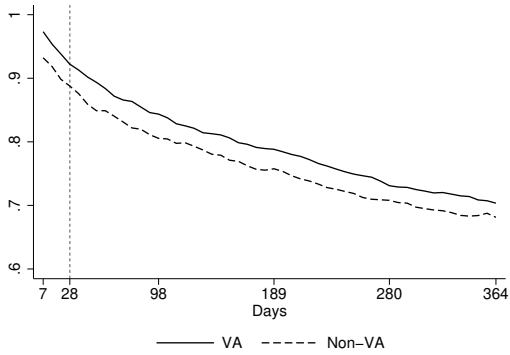
Balance and Reduced Form



Note: controls for zip code + ambulance source + ALS/BLS + time categories + prior utilization ▸ Robustness

Complier Survival Curves

- VA advantage arises in week 1 after ED visit, relatively constant thereafter



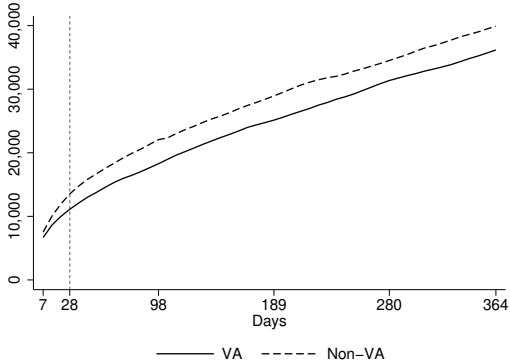
Notes: (1) controls for zip code + ambulance source + ALS/BLS + time categories + prior utilization; (2) sample excludes rides with prior ride within last year; (3) potential mortality outcomes $E[Y_{i1} | C]$ and $E[Y_{i0} | C]$ calculated by 2SLS regressions with outcomes $Y_i D_i$ and $Y_i (D_i - 1)$, respectively

Other Key Outcomes

- Fewer admissions: IV effect -0.090 (s.e. 0.032), outcome mean 0.589
- More outpatient visits: IV effect 0.379 (s.e. 0.174), outcome mean 1.443
- No significant effect on ED revisits: 0.029 (s.e. 0.044), outcome mean 0.318

Complier Spending Curves

- VA results in *lower* cumulative spending among compliers (suggesting higher productivity):



- $2,500 less spending by 28 days (20% reduction); *twice as large* when we apply the same prices (Finkelstein et al. 2016) ▸ Conditional Spending Rate

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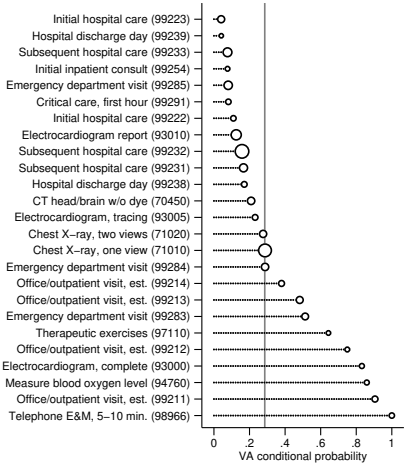
Mechanisms Overview

1. VA vs. non-VA reported utilization
2. Heterogeneity by hospital and patient characteristics
3. Compliers, selection
4. Health IT and integrated care

Reported Utilization

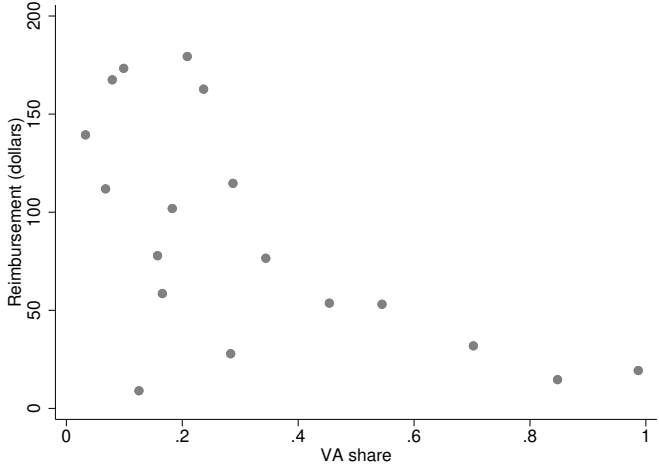
Top 25 HCPCS Codes



Notes: VA conditional probability = Pr(VA | HCPCS code in 28 days). Circle sizes denote relative frequency in combined VA and Medicare utilization.

Reported Utilization

Relationship with Medicare Reimbursement



Notes: The figure is a binned scatter plot of the top 50 HCPCS codes. VA conditional probability = Pr(VA | HCPCS code).

Evaluation and Management Codes

- Complexity of evaluation and management (E&M) services varies widely, yet difficult to verify

TABLE 1—EXAMPLE OF CODES WITH VARYING INTENSITY AND TIME NEEDED FOR THE SAME SERVICE

	Coding requirement					
HCPCS	History	Exam	MDM	Typical time needed	Work RVU	2012 price ($)
99201	PF	PF	Straightforward	10 minutes	0.48	31.09
99202	EPF	EPF	Straightforward	20 minutes	0.93	53.54
99203	Detailed	Detailed	Low	30 minutes	1.42	77.47
99204	Comprehensive	Comprehensive	Moderate	45 minutes	2.43	118.18
99205	Comprehensive	Comprehensive	High	60 minutes	3.17	145.81

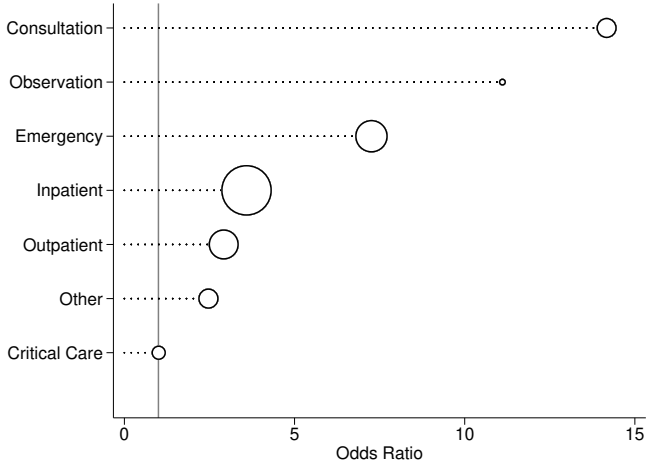
Notes: All five codes are for office or other outpatient visits for new patients. The 2012 prices are for services furnished in office settings prior to the adjustment using geographic practice cost indices (GPCI). History refers to the process of asking about a patient's health history; Exam refers to the physical examinations; MDM refers to the complexity of medical decision making. To file a certain code, all three elements of the service must meet the required level. PF (problem-focused) is limited to the affected area or organ system; EPF (expanded problem-focused) also includes related areas. CMS provides very detailed definitions of each level of service intensities in (Centers for Medicare and Medicaid Services 2015b), to which we refer the interested reader.

Source: Fang and Gong (2017)

visits for new patients." But the lowest intensity code, 99201, only needs 10 minutes to furnish per the AMA guidelines, and generates $31.09 of revenue, whereas the highest intensity code, 99205, needs 60 minutes and generates $145.81.[10] Note that, incentive issues aside, if a physician were to overstate the service intensity by one level, revenue would increase by at least $20.

The second category is codes selected in a 2014 CMS survey that directly measures the time needed for certain services (Zuckerman et al. 2014). The survey tar-

E&M Code Categories



Notes: Odds ratio = $Q^{high}_{VA=0}/Q^{lowh}_{VA=0}$ / $Q^{high}_{VA=1}/Q^{low}_{VA=1}$. Circle sizes denote relative frequency in combined VA and Medicare utilization.

Heterogeneity by Hospitals and Patients

- VA advantage holds across locations ▸ Station Variation
- Few consistent patterns for hospital characteristics ▸ Heterogeneity
- Some intuitive heterogeneity for patient characteristics ▸ Heterogeneity
  - Larger for minority patients, patients with mental illness/substance abuse, prior VA attachment

Compliers

- Complier characteristics ▸ Characteristics
  - more prior VA visits
  - more disadvantaged (Black, lower income, mental illness/substance abuse)
    - Note: VA investments to treat mental health
- Compliers have larger treatment effects
- Greater benefits for veterans more likely to use VA
  - However, no evidence that VA harms veterans least likely to use it

Health IT and Integrated Care

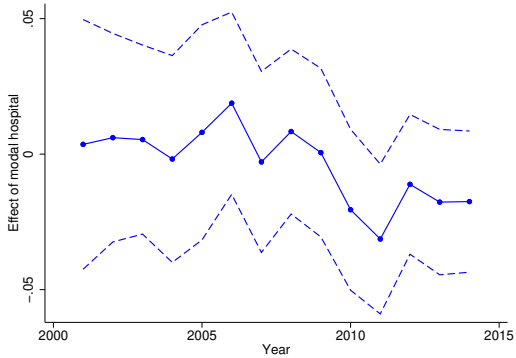
- Qualitative literature on VA vs. private sector focuses on health IT and integrated care
  - Legislation to improve health IT and integration (Accountable Care Organizations) in private sector around 2010 (HITECH Act and ACA)

- Difficult to directly study joint mechanism in the VA
  - VA data $\sim$ 6 years after transformation in mid 1990s
  - Veterans with no VA attachment rarely sent to VA EDs

- Approach: study effect of care at (non-VA) modal hospital for veterans with only non-VA prior care
  - Exploit timing of IT and ACO adoption in private sector

IT Adoption in Sample (healthit.gov)

- Modal hospital effect small (20% of VA effect) ▸ Modal Effect

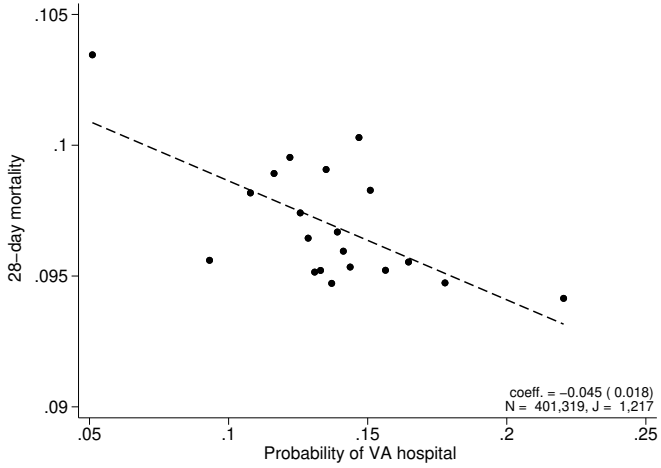


- Effects by year positive only after 2010; confirmed by regressions exploiting IT and ACO timing at hospital level

Conclusion

- VA is higher productivity: among dually eligible veterans in emergencies, it reduces mortality by 46% at lower cost
- Mechanisms
  - Orientation towards population health rather than fee-for-service
  - Specialization in a known patient population
  - Suggestive impact of IT adoption and integrated care in non-VA hospitals
- Relevant for VA and more broadly for understanding the productivity of health care systems

Visual IV



Note: controls for zip code + ALS/BLS + ambulance source + time categories + prior utilization

Robustness

- Baseline controls:
  1. zip code (1,678 indicators)
  2. ambulance source (e.g., residential, clinic) (3 indicators)
  3. ambulance ALS/BLS type (3 indicators)
  4. time categories (year $\times$ month, day of week) (176 + 6 indicators)
  5. prior utilization (primary care, ED, inpatient in VA and non-VA) (6 indicators)

Robustness

- Additional patient controls:
  6. demographics (age, race, gender) (31 indicators)
  7. socioeconomic status, combat history, and eligibility (21 indicators)
  8. extended prior utilization (8 variables)
  9. Elixhauser indices $\times$ source for prior diagnoses (3×31 indicators)
  10. 3-digit ambulance ICD9 code (778 indicators)
- Additional co-rider controls (Altonji & Mansfield 2018):
  11. co-rider baseline controls (pickup source, ambulance service, prior utilization) (12 variables)
  12. co-rider hold-out controls (demographics, 1-digit ICD9 codes, predicted mortality) (21 variables)

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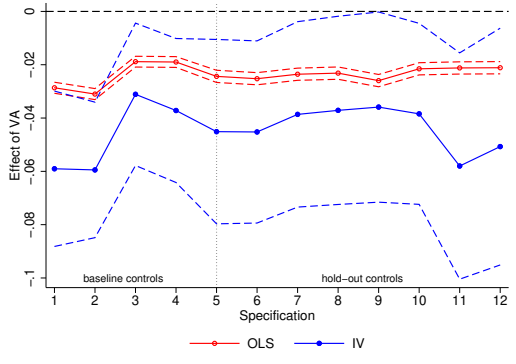
Robustness

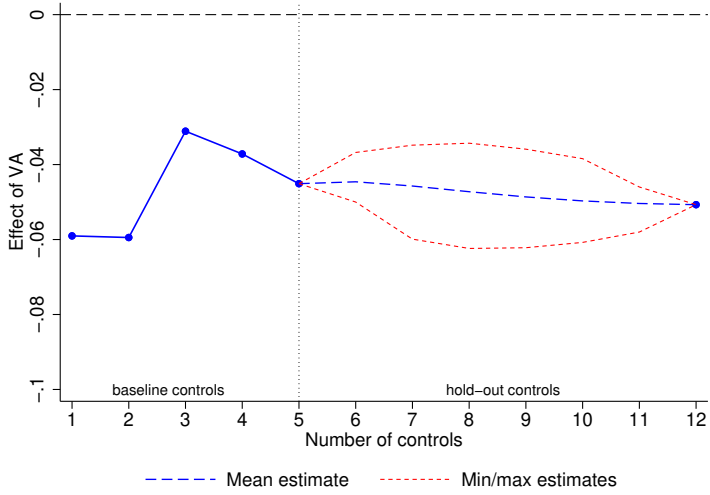
- Both IV and OLS estimates highly robust regardless of controls



Baseline controls: (1) zip code, (2) ambulance source, (3) ALS/BLS, (4) time categories, (5) prior utilization;

Hold-out controls: (6) demographics, (7) socioeconomic/combat/eligibility, (8) extended prior utilization, (9) prior diagnoses, (10) ambulance diagnoses, (11) co-rider baseline controls, (12) co-rider hold-out controls

Robustness


0
−.02
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Effect of VA
baseline controls
hold−out controls
1
2
3
4
5
6
7
8
9
10
11
12
Number of controls
Mean estimate
Min/max estimates

Exclusion Restriction

Table A.4: Robustness of Exclusion Restriction

	(1)	(2)	(3)	(4)	(5)	(6)
	A: Dependent variable: 28-day mortality					
VA hospital	-0.053	-0.045	-0.039	-0.045	-0.045	-0.045
	(0.019)	(0.018)	(0.018)	(0.018)	(0.018)	(0.021)
Outcome mean	0.097	0.097	0.097	0.097	0.097	0.097
Observations	401,319	401,319	401,319	401,319	401,319	401,319
	B: Dependent variable: 28-day spending					
VA hospital	-4,671	-5,138	-4,561	-4,963	-4,976	-4,461
	(1,027)	(973)	(972)	(937)	(938)	(1,142)
Outcome mean	12,280	12,280	12,280	12,280	12,280	12,280
Observations	401,319	401,319	401,319	401,319	401,319	401,319
Ambulance charges splines	Yes	No	No	No	No	Yes
Mileage splines	No	Yes	No	No	No	Yes
Out-of-sample mortality	No	No	Yes	No	No	Yes
Chosen non-VA hospitals						
Out-of-sample mortality	No	No	No	Yes	No	Yes
Out-of-sample spending	No	No	No	No	Yes	Yes

Note: This table presents IV estimates of the effect of the VA on 28-day mortality (Panel A) and on 28-day spending (Panel B). In each panel, each column involves a set of controls for ambulance actions on the specific ride (flexible functions of the charges incurred by the ambulance company, flexible functions of the mileage driven by the ambulance company), for "out-of-sample" outcomes by the ambulance company, and for non-VA hospitals chosen by the ambulance company ("out-of-sample" averages of mortality and spending for these non-VA hospitals). "Out-of-sample" refers to patients outside of the main analytical sample (Appendix Table A.1) because they have no VA utilization in the prior year; specifically, they are computed using patients with only non-VA utilization in the prior year (Panel B of Appendix Table A.13). Regressions are run on the main analytical sample. Further details are given in Appendix A.1.1.

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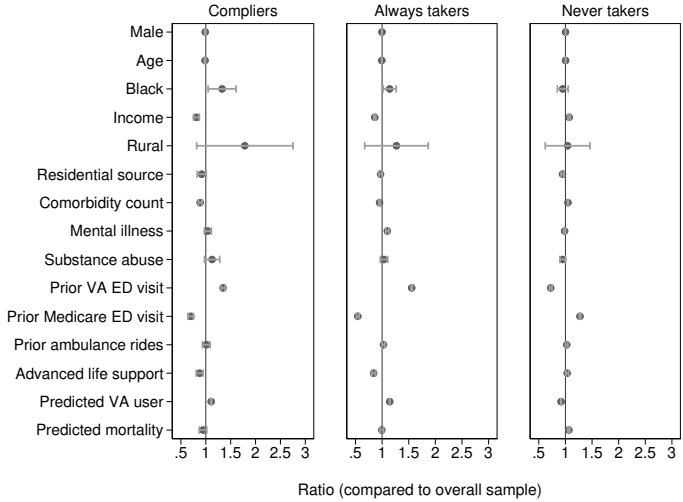
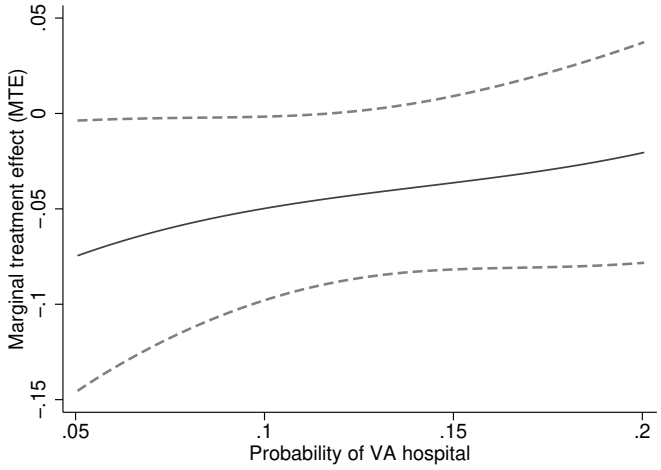
Complier and Non-Complier Characteristics



MTE Curve



Notes: (1) controls for zip code + ambulance source + ALS/BLS + time categories + prior utilization

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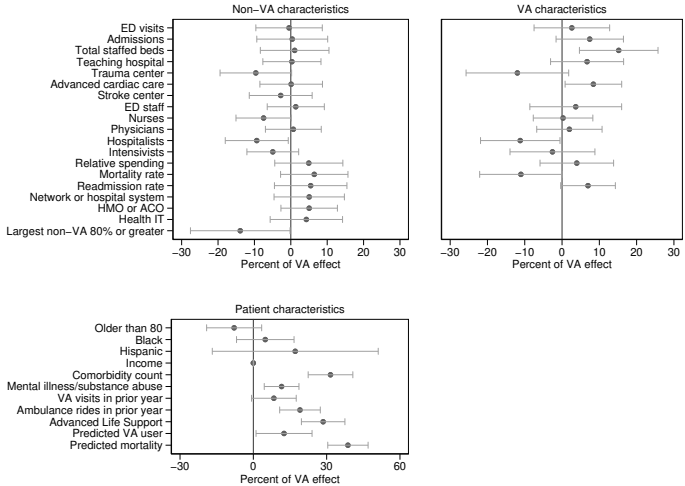
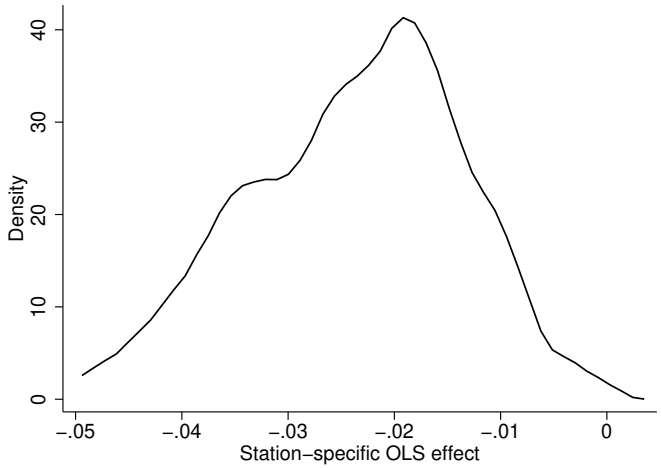
Heterogeneity by Hospitals and Patients



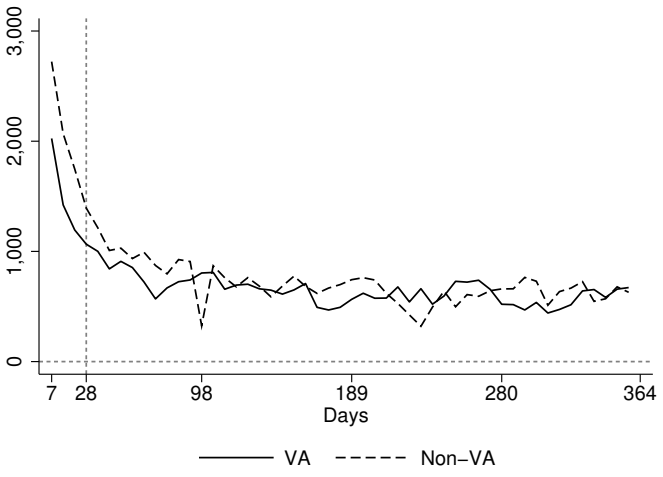
Station-Level OLS Heterogeneity

- Empirical Bayes posterior effects by station:

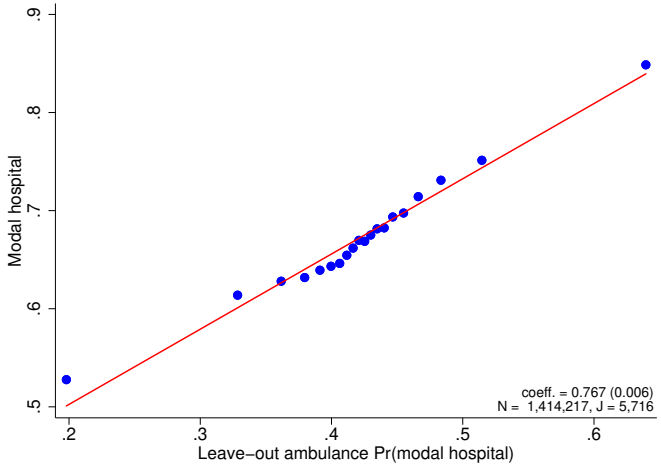


Spending Flow

- Complier spending flow conditional on survival:

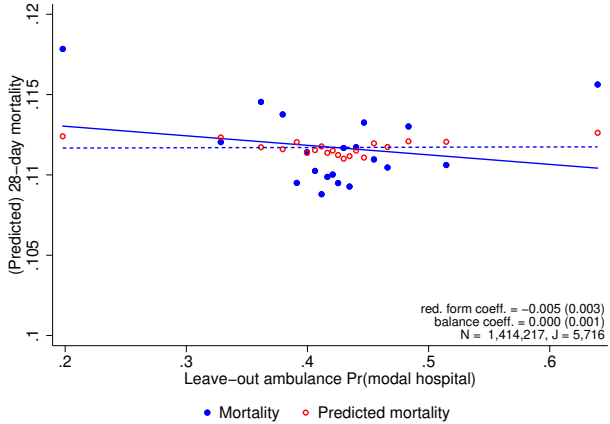


First Stage for Modal Hospital



Note: controls for zip code + ALS/BLS + ambulance source + time categories + prior utilization

Effect of Modal (Non-VA) Hospital



2SLS Coeff = -0.006 (0.004)

Note: controls for zip code + ambulance source + ALS/BLS + time categories + prior utilization

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