Is Physician Organization Related to Efficiency and Patient Outcomes?

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HSR&D HEALTH SERVICES RESEARCH & DEVELOPMENT

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Premise

- The key to improving the effectiveness of healthcare lies with clinicians.
- Although they often lack information and resources to provide optimal care,[1] and often face perverse incentives to overtreat, they are responsible for the production and distribution of care.[2]
- Major gains in effectiveness requires understanding and changing clinicians' behavior.

1. Committee on Quality Health Care in America IoM. *Crossing the quality chasm: a new health system for the 21st century*. Washington, DC: National Academics Press; 2001.
2. Fuchs VR. *Who shall live? Health, economics, and social choice*. New York,: Basic Books; 1974.

Clinician Behavior

- A large literature has focused on using incentives to change clinician behavior.[1]
- Less work has focused on culture.
- Culture matters because it shapes clinicians' judgment, communication, and teamwork.

1. Rosenthal MB, Dudley RA. Pay-for-performance: will the latest payment trend improve care? *JAMA.* Feb 21 2007;297(7):740-744.

Contribution of this Study

- We follow a natural experiment in which patients are randomly assigned to one of two residency teams in the same VA hospital
- We explore differences in practice patterns and patient outcomes.

Doyle JJ, Jr., Ewer SM, Wagner TH. Returns to physician human capital: Evidence from patients randomized to physician teams. *J Health Econ. Aug 24 2010;29(6):866–882.*

Outline

- Background
- Description of the natural experiment
- Methods
- Results
- Discussion

Background

- People in the US receive substantially different amounts and types of medical care depending on where they live
  - Wennberg, J. and A. Gittelsohn (1973)

- This work launched new fields of research including health disparities and quality of care

Causes of Small Area Variation

- Observed
  - Patient outcomes
  - Facility resources
  - Patient characteristics
- Partially observed or unobserved
  - Physician characteristics
  - Organization of clinical teams
  - Patient preferences
  - Patient risk
  - Patient’s selection of provider

Physician Training

- A considerable share of variation in practice patterns and patient outcomes can be attributed to physician practice styles
- Practice styles are influenced by training and organization
- If we can understand the role of training and organization, we can improve system performance and patient health

Natural Experiment

- A large, urban VA hospital is affiliated with two residency programs and patients are assigned to a residency team based on the last digit of their SSN (odd or even)
- Random assignment only happens at the main hospital– not at substations
- Random assignment happens for most specialties, but not all (e.g., neurology)

Residency Program

- Anecdotally: program A and B do not get along
- Rounds are conducted at different times so there is minimal overlap
- Different attending physicians
- Ancillary staff (e.g., nurses) are the same

Methods

- Linked real SSN to all discharges at VAMC
- Random assignment:
  - Odd ending SSN = program A
  - Even ending SSN = program B
- At this time, we don’t have information about residents

Data

- Utilization data from Patient Treatment Files (1993-2009)
- Cost data from HERC Average Cost Data and Decision Support System (1998-1999)
- Mortality data from VA Vital Status File

Outcomes

- Length of stay (logged)
- Cost (logged 2006$): total and DSS subtotals
- 28 day and 1 year hospital readmission
- 30 day and 1 year mortality
- Timing of procedures

Subsamples

- Chronic heart failure (CHF)
- Acute myocardial infarction
- Chronic obstructive pulmonary disease (COPD)
- Gastro-intestinal bleed (Volpp, 2007)

- Stroke patients
- Patients at substations

Control Variables

- Age
- Gender
- Race (white, nonwhite)
- Marital status (married, divorced, other)
- Disease severity (Deyo-modified Charlson Index)
- Time, day, month, and year of admission
- Zip code characteristics (education, age, race, density)

Analytical Questions

- Was randomization applied consistently?
- Do outcomes differ by residency programs? And if so, why?
- Is the quality of care different?

Analytical Models

- Continuous and count data
  - Semi-log models
  - General linear models (log link and gamma distributions)
- Logistic models for dichotomous outcomes
- Model choice has no effect on results

Random Assignment: Demographics

	Program A (Odd SSN)	Program B (Even SSN)	p-value
age	63.0	62.8	0.35
18-34	0.019	0.022	0.15
35-44	0.074	0.075	0.80
45-54	0.186	0.186	0.94
55-64	0.229	0.229	0.92
65-69	0.134	0.131	0.50
70-74	0.149	0.146	0.57
75-84	0.179	0.184	0.39
84+	0.030	0.027	0.24
male	0.976	0.978	0.19
white	0.466	0.472	0.42
married	0.443	0.446	0.65
divorced	0.271	0.269	0.80
Observations (discharges)	35932	36434	

Random Assignment: Admission info

	Program A (Odd SSN)	Program B (Even SSN)	p-value
Charlson index = 0	0.294	0.290	0.52
Charlson index = 1	0.274	0.278	0.37
Charlson index = 2	0.433	0.432	0.91
Midnight-6am	0.096	0.098	0.56
6am-12 noon	0.237	0.233	0.29
12 noon-6pm	0.420	0.425	0.28
6pm - Midnight	0.247	0.245	0.59
weekend	0.163	0.162	0.72
Observations (discharges)	35932	36434	

Random Assignment: Zip Code Info

	Program A (Odd SSN)	Program B (Even SSN)	p-value
median HH Income	33714	33945	0.24
fraction HS dropout	0.249	0.247	0.18
fraction HS only	0.317	0.318	0.34
fraction Some College	0.271	0.272	0.024*
fraction white	0.628	0.633	0.48
fraction black	0.331	0.327	0.52
fraction aged 19-34	0.214	0.213	0.21
fraction aged 35-64	0.368	0.369	0.38
fraction aged 65+	0.141	0.141	0.22
population per 1000 sq meters	1.102	1.072	0.09
Observations (discharges)	35932	36434	

Summary of Randomization

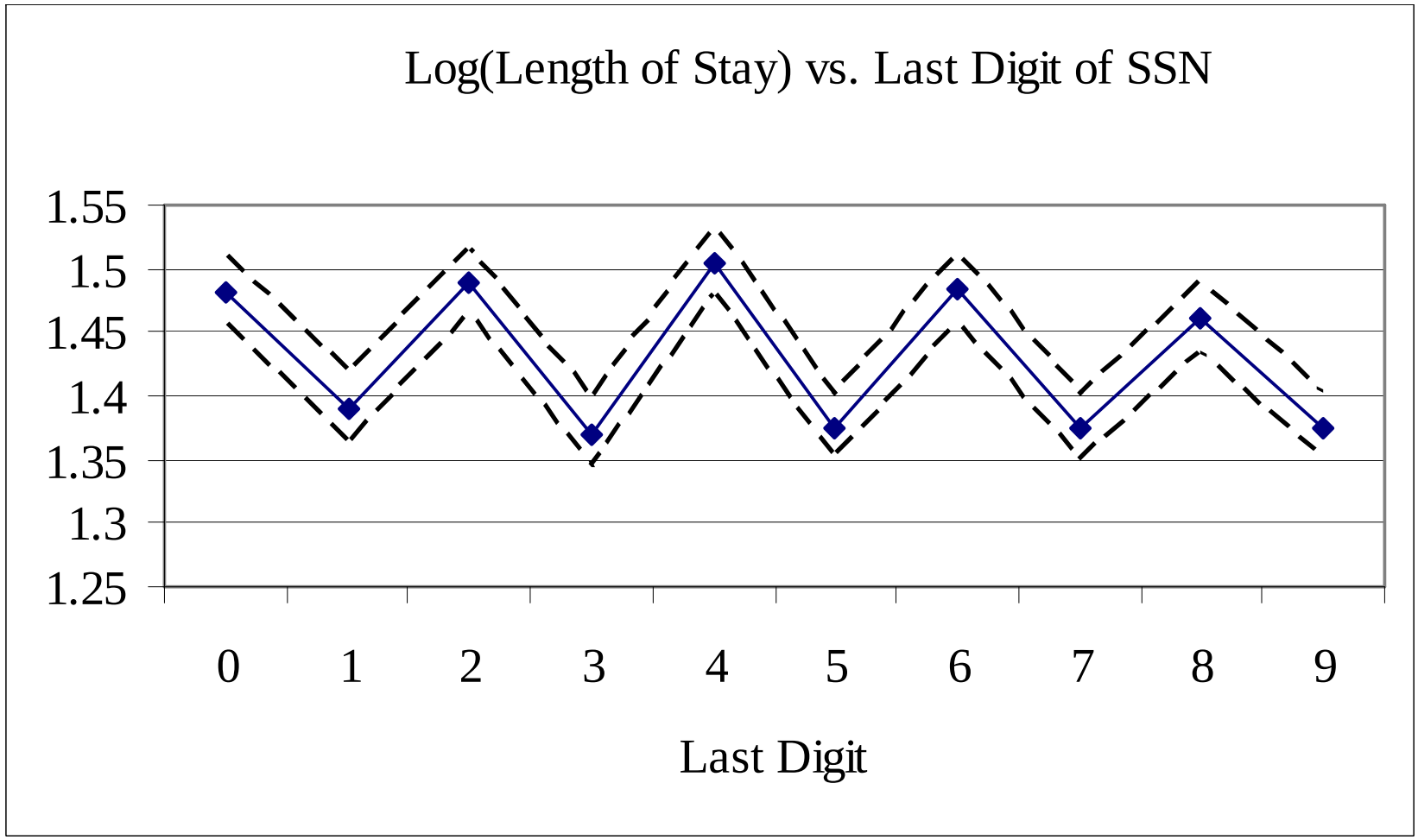
- Patients treated by the two residency programs are not statistically different.
- “Successful” randomization

Results: Length of Stay

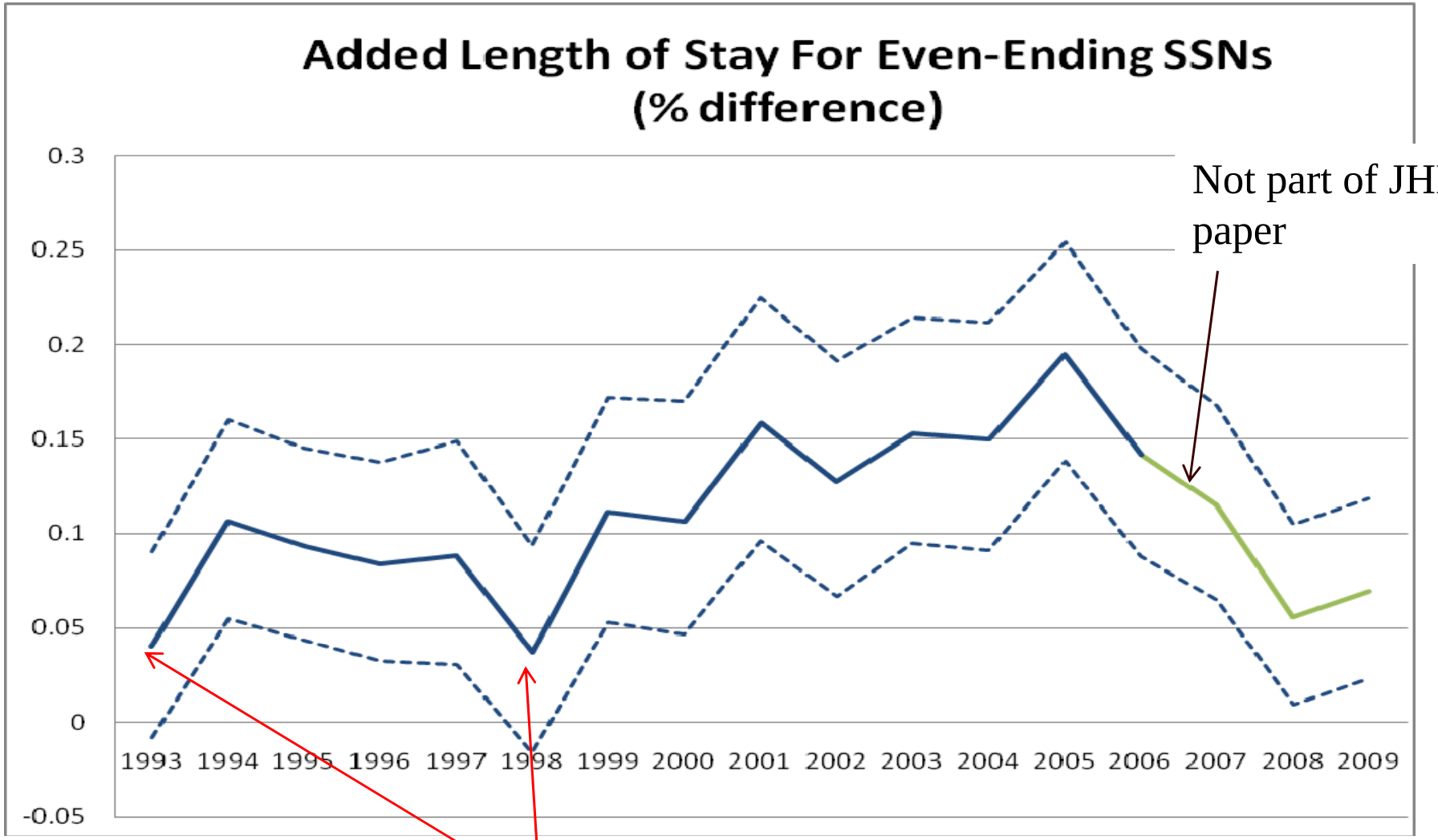
Dependent Variable:	log(length of stay)		
	(1)	(2)	(3)
Assigned to Program B	0.108 [0.0086]**	0.114 [0.0075]**	0.113 [0.0072]**
Diagnosis Fixed Effects	No	Yes	Yes
Full Controls	No	No	Yes
Observations	72366		
Mean of Dep Var	1.4309		

Models estimated using OLS. Robust standard errors in brackets, clustered by patient. Full controls include variables listed in Table 1, as well as month, year, and day-of-the-week indicators. * significant at 5%; ** significant at 1%

Length of Stay



Effect over Time



Results: Cost

Dependent Variable:	log(accounting cost)		
	(4)	(5)	(6)
Assigned to Program B	0.113 [0.0136]**	0.123 [0.0116]**	0.125 [0.0114]**
Diagnosis Fixed Effects	No	Yes	Yes
Full Controls	No	No	Yes
Observations	34098		
Mean of Dep Var	8.6297		

Models estimated using OLS. Robust standard errors in brackets, clustered by patient. Full controls include variables listed in Table 1, as well as month, year, and day-of-the-week indicators.
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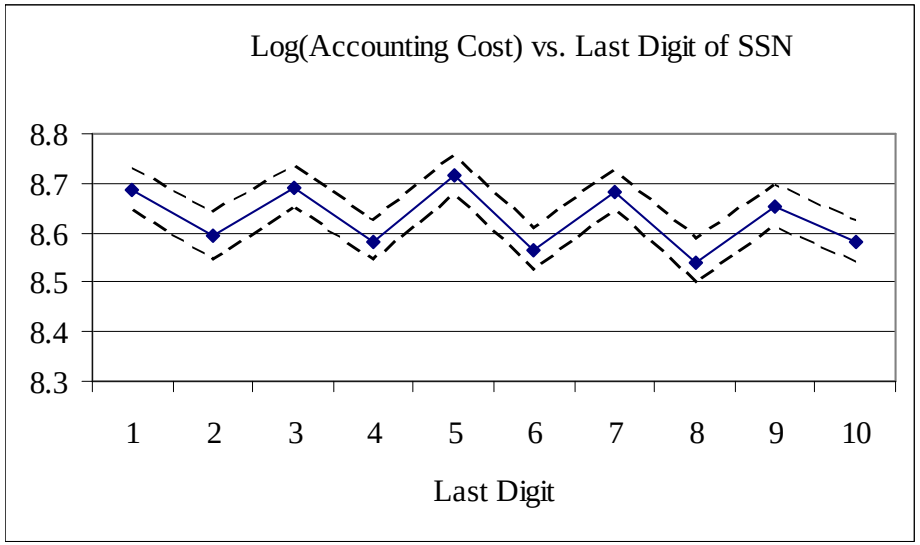
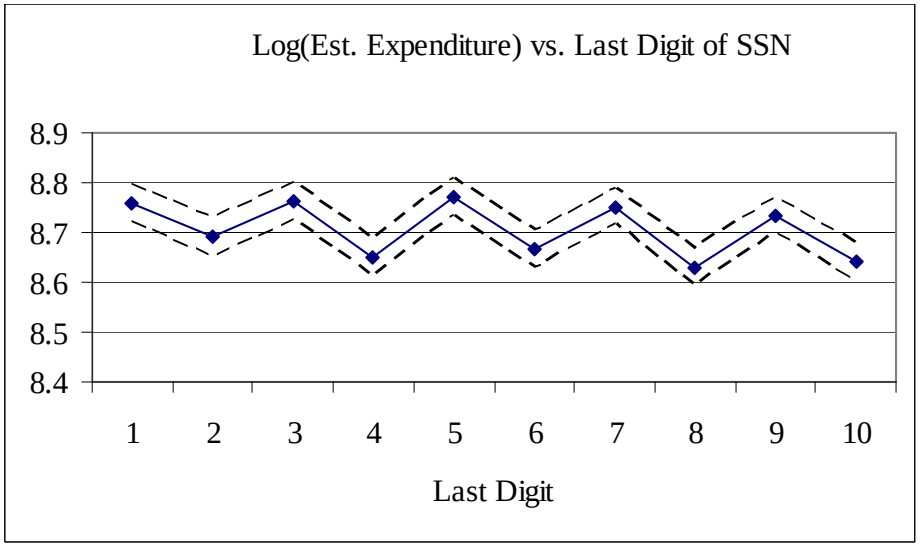
Costs

DSS



HERC



Cost Subtotals

DSS Cost subtotal	Assigned to Program B		Observations	Mean of Dep Var
Nursing	292	[88.2776]**	34098	4145
Surgery	-123	[30.5502]**	34098	1354
Radiology	40	[12.1013]**	34098	483
Lab	53	[8.8733]**	34098	415
Pharmacy	112	[48.6039]*	34098	982
All Other	253	[46.0791]**	34098	2431

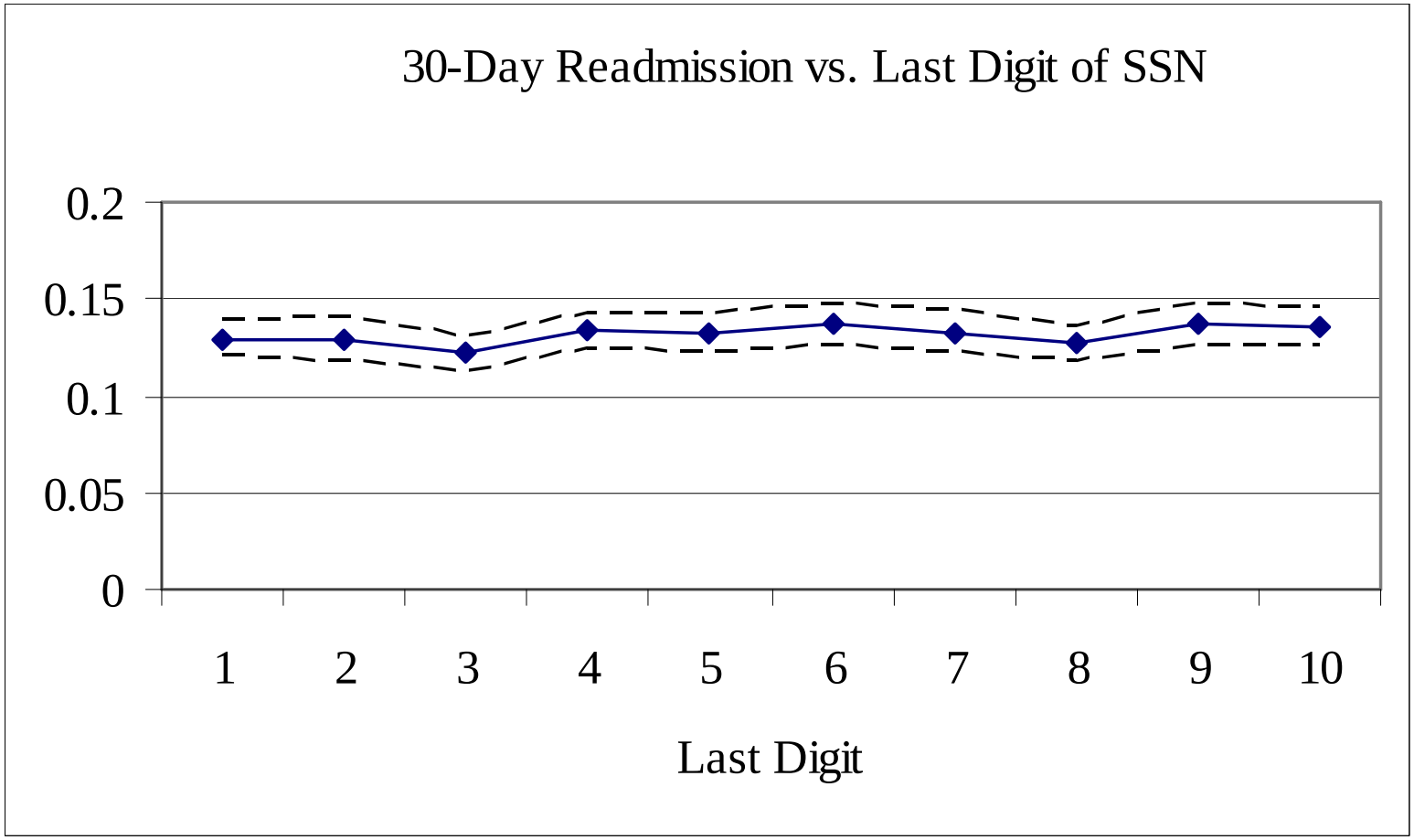
Models estimated using OLS. Robust standard errors in brackets, clustered by patient. Full controls include variables listed in Table 1, as well as month, year, and day-of-the-week indicators.
* significant at 5%; ** significant at 1%

Readmission

Dependent Variable:	30-day Readmission			1-year Readmission		
	(1)	(2)	(3)	(4)	(5)	(6)
Program B	-0.002	-0.002	-0.002	0.006	0.006	0.006
Lower Ranking Program	[0.0032]	[0.0031]	[0.0030]	[0.0058]	[0.0053]	[0.0051]
Diagnosis Fixed Effects	No	Yes	Yes	No	Yes	Yes
Full Controls	No	No	Yes	No	No	Yes
Observations	71954			66938		
Mean of Dep Var	0.1315			0.4287		

Models estimated using OLS. Robust standard errors in brackets, clustered by patient. Full controls include variables listed in Table 1, as well as month, year, and day-of-the-week indicators.
* significant at 5%; ** significant at 1%

Readmission



Mortality

Dependent Variable:	30-day Mortality			1-year Mortality		
	(1)	(2)	(3)	(4)	(5)	(6)
Assigned to	-0.001	-0.001	-0.001	-0.007	-0.006	-0.007
Program B	[0.0020]	[0.0019]	[0.0019]	[0.0051]	[0.0045]	[0.0044]
Diagnosis Fixed Effects	No	Yes	Yes	No	Yes	Yes
Full Controls	No	No	Yes	No	No	Yes
Observations	71954			66938		
Mean of Dep Var	0.0642			0.2418		

Models estimated using OLS. Robust standard errors in brackets, clustered by patient. Full controls include variables listed in Table 1, as well as month, year, and day-of-the-week indicators.
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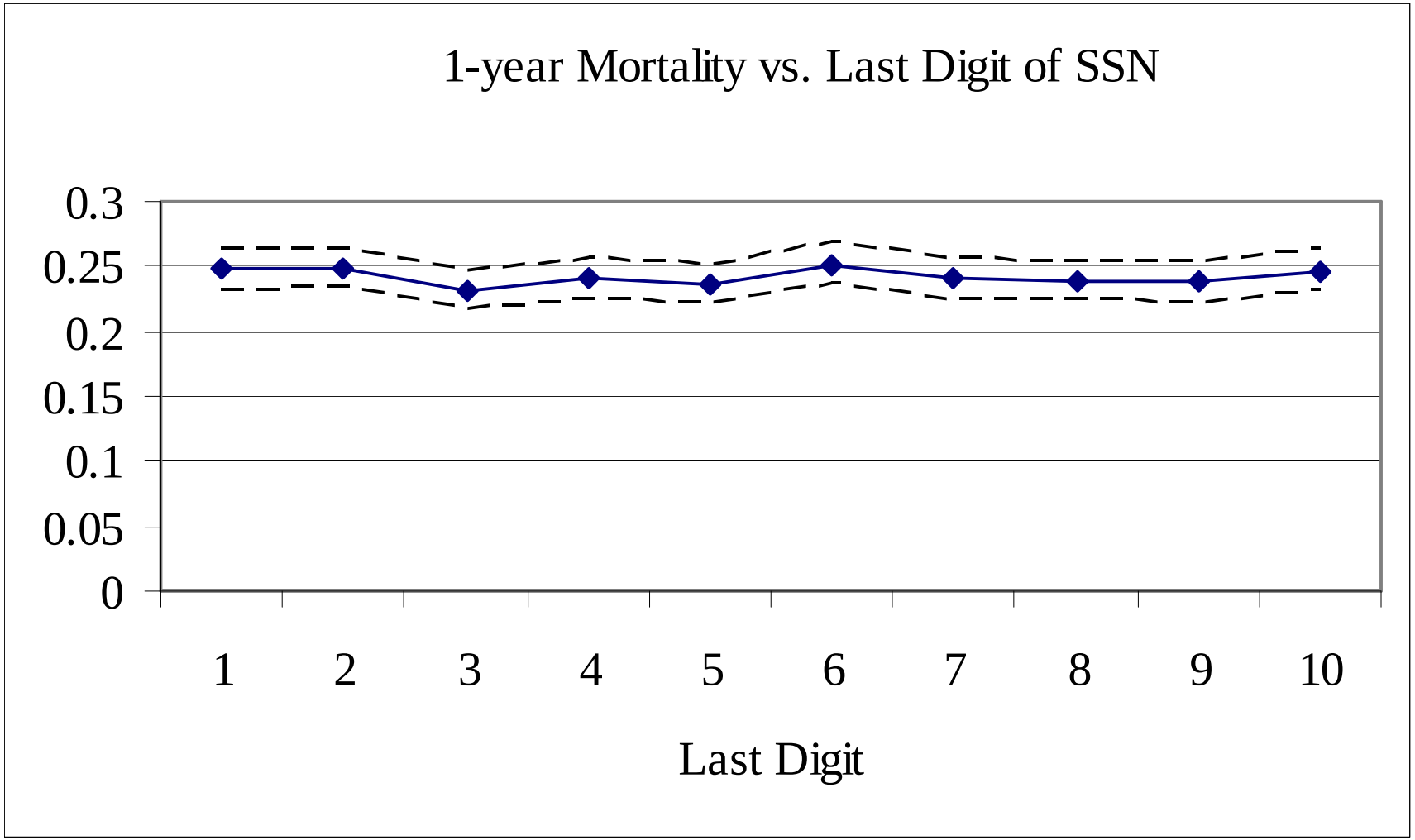
Mortality


1-year Mortality vs. Last Digit of SSN
0.3
0.25
0.2
0.15
0.1
0.05
0
1
2
3
4
5
6
7
8
9
10
Last Digit

By Diagnosis

	Dependent Variable	Coeff. On Program B	S.E.	Mean of Dep. Var.	Obs.
Heart failure	log(length of stay)	0.252	[0.0272]**	1.531	3598
	1-year mortality	0.005	[0.0210]	0.349	3249
Acute myocardial infarction	log(length of stay)	0.089	[0.0372]*	1.6126	2187
	1-year mortality	-0.030	[0.0201]	0.2477	2071
Chronic Obstructive Pulmonary Disease	log(length of stay)	0.191	[0.0343]**	1.3557	2137
	1-year mortality	0.001	[0.0256]	0.2936	1965
GI Bleed	log(length of stay)	0.163	[0.0370]**	1.4029	1974
	1-year mortality	-0.015	[0.0221]	0.2182	1856

Models estimated using OLS. Robust standard errors in brackets, clustered by patient. Full controls include variables listed in Table 1, as well as month, year, and day-of-the-week indicators.
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Robustness Checks

	Dependent Variable	Coeff. On Program B	S.E.	Mean of Dep. Var.	Obs.
Sample: nervous system patients	log(length of stay)	0.047	0.048	1.34	1353
	30-day readmission	-0.011	0.022	0.191	1345
	1-year mortality	-0.040	0.021	0.153	1284
Sample: Outside main facility	log(length of stay)	-0.012	0.014	1.89	70775
	1-year mortality	0.005	0.004	0.141	63299
Sample: Drop transferred patients.	log(length of stay)	0.114	0.007**	1.42	69451
	30-day readmission	-0.003	0.003	0.129	69047
	1-year mortality	-0.007	0.004	0.241	64177

Models estimated using OLS. Robust standard errors in brackets, clustered by patient. Full controls include variables listed in Table 1, as well as month, year, and day-of-the-week indicators.
* significant at 5%; ** significant at 1%

Summary of Results

- Patients treated by program A have 8-20% lower LOS than patients treated in program B
- Cost differences also exist and remain after controlling for LOS
- No differences in readmission and mortality

What's Causing This Effect?

- We ranked diagnosis by mortality rate and broke the diagnoses into quartiles
- Analyzed LOS by quartiles

log(length of stay)	Coeff. On Program B	S.E.	Mean of Dep. Var.	Obs.
1st quartile (least likely to die)	0.023	[0.0167]	1.131	8767
2nd quartile	0.112	[0.0131]**	1.1794	17153
3rd quartile	0.119	[0.0116]**	1.4759	26420
4th quartile (most likely to die)	0.142	[0.0141]**	1.7182	20026

- Effect gets bigger as patients get sicker

Procedures and Surgeries

Dependent Variable:	Number of Procedures	Number of Surgeries
	(1)	(2)
Assigned to Program B	0.250	-0.002
	[0.0143]**	[0.0036]
Observations	72366	72366
Mean of Dep Var	1.681	0.290

Models estimated using OLS. Robust standard errors in brackets, clustered by patient. Full controls include variables listed in Table 1, as well as month, year, and day-of-the-week indicators.
* significant at 5%; ** significant at 1%

Use and Timing of Procedures

	Pr (test)			# | any			days to first test		
	A	**B**		**A**	**B**		**A**	**B**	
All cases									
observations	35932	36434							
any diagnostic	68.4%	73.1%	**	2.99	3.25	**	1.41	1.55	**
xray	22.4%	25.1%	**	1.77	1.77		3.04	3.17	
chest xray	6.3%	7.5%	**	1.11	1.13	*	4.39	4.69	*
endoscopy	5.2%	5.7%	**	1.26	1.30	**	4.90	4.89	
angiography	8.1%	8.3%		2.70	2.67		3.16	3.53	**
cardiac stress test	6.4%	7.8%	**	1.02	1.02		3.96	4.39	**
Other cardiac test, including echo	12.7%	15.0%	**	1.12	1.11		1.39	2.21	**

- Story within AMI, COPD, CHF and GI bleed patients is consistent.

Residency Programs

- **Program A** (treats odd-ending SSNs)
  - MCAT ranking 1/126 (mean 12.2) in 2006
  - NIH funding ranking 4/126 in 2006
  - Supposedly greater use of specialists as attendings
- **Program B** (treats even-ending SSNs)
  - MCAT ranking 48/126 (mean 10.4) in 2006
  - NIH funding ranking 79/126 in 2006
  - Supposedly more international medical graduate residents
- UCSF (for comparison's sake)
  - MCAT ranking 17/126 (mean 11.1)
  - NIH ranking 3/126

Cause?

- At this point, we don't know the cause
- Three hypotheses
  1. Differences are attributable to selection of human capital: program A attracts smarter people than program B
  2. Differences are attributable to training of human capital: program A does a better job of training than B
  3. Differences in the attending / resident teams is driving the effect

Proposed Research

- How extensive is the effect?
  - OQP quality data
  - Surgery– randomization also happens in surgery
- Can we identify the cause?
  - Training and resident supervision
  - Qualitative interviews to assess communication and teamwork

Limitations & Criticisms

- We have heard two criticisms
  1. Results may not generalize to non-VA
  2. These data come from a single VA hospital and may not generalize to other VA's

- VA is a critical component of provider training.[1]
  - 17,000 medical students are trained in VA facilities every year (16,139 med school graduates in 2007)
  - 30% of all US residents receive training in VA facilities each year

- This is a "mouse model"– a very unique opportunity to gain insights on clinician behavior and teamwork

1. AAMC; Winship D, Ullian E. Advisory Committee on Veterans Health Administration (VHA) Resident Evaluation, *Report to the Secretary of Veterans Affairs*

Summary

- Cost and length of stay differ, and the differences are biggest with sickest patients
- No differences with regard to readmission or mortality
- Notable differences in the use and timing of procedures
- Would love your feedback on extending this research