The Consequences of Hospital Crowding:
Evidence from Texas

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Acknowledgements and Disclaimer

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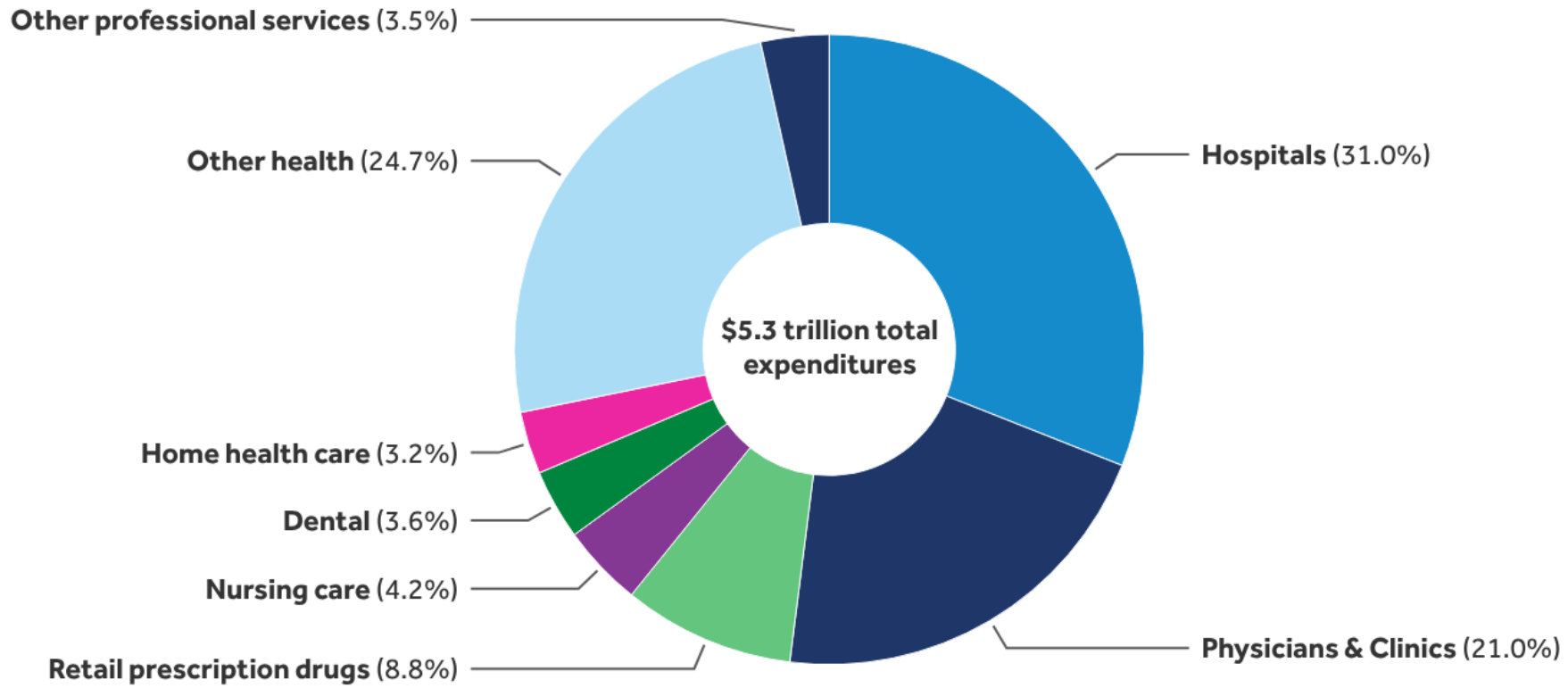
Relative contributions to total national health expenditures, by service type, 2024

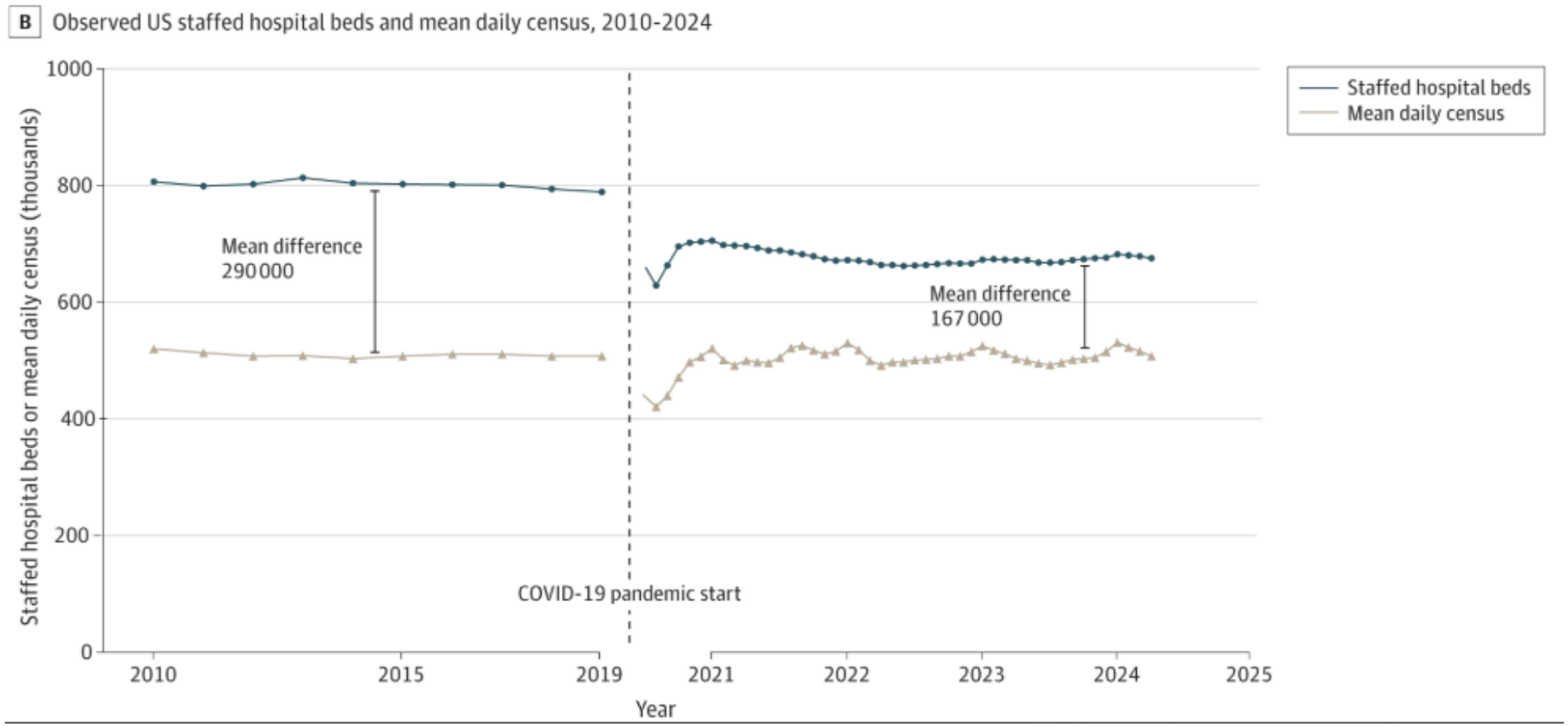


Note: "Other Health" includes spending on durable and non-durable products; residential and personal care; administration; net health insurance; and other state, private, and federal expenditures. "Other professional services" includes spending for services provided by chiropractors, optometrists, physical, occupational, and speech therapists, podiatrists, private-duty nurses, and others. Nursing care represents expenditures for nursing care facilities and continuing care retirement communities. Originally published in How has U.S. spending on healthcare changed over time?

Source: KFF analysis of National Health Expenditure (NHE) data

Peterson-KFF
Health System Tracker

A Crisis in Hospital Capacity?



From Leuchter et al. 2025: Hospital occupancy 11 percentage points higher since 2019; not decreasing

Hospital Capacity Depends on Legal Structure, Staffing, and Demand

- Individual hospitals decide how many of their licensed beds should be staffed and operational
  - Beds aren't a physical concept
    - Licensed beds: maximum number of patients facility is legally authorized to accommodate; authorized by state regulatory agency/certificate of need
    - Staffed bed: operational number of beds ready for immediate occupancy (physically set up and actively supported by clinical staff)
- Emergency Departments (EDs) are the primary gateway for unscheduled admissions

How Will Hospitals Respond to Demand Spikes?

- ED admissions are uncertain and dependent on circumstances the hospital can't control, but needs to try to predict
- If operating at capacity, must make real-time decisions about resource allocation that will affect patients – who gets the bed?
  - Earlier than planned discharge
  - Transfer to other facilities
  - Potential health consequences: readmissions/risk of death
- Maintaining excess capacity will drive up costs, but operating at high occupancy leaves little slack to absorb demand shocks

What Might Drive Decisions?

- Triage/pure health
  - patients most in need stay
- Transferability
  - patients most stable transferred; most uncertain patients stay
- Financial incentives
  - May influence decisions about who to discharge: do for-profits discharge more strategically?
- Location constraints
  - Rural facilities tend to have lower occupancy rates, fewer beds, less flexibility in staffing, and fewer service lines
  - Rural hospitals may have less ability to quickly adjust staffing and may need to discharge or transfer patients when capacity is constrained

What Would Optimal Capacity Mean?

- Balance between maintaining surge capacity for unexpected demand and avoiding costly excess capacity
- Market failures
  - Spillovers if hospitals don't internalize social benefits (e.g. disaster preparedness, pandemic responses)
  - Insurance – individual hospitals may undervalue the risk protection value of capacity
  - Public good aspects of hospital capacity

This Study

Does hospital crowding affect patient health/outcomes?

1) Estimate if emergency care admissions impact outcomes for people discharged the day of the admission shock

2) Stratify by operational constraints and financial incentives

3) Study potential mechanisms for health impacts

Contribution

- Limited empirical evidence on health impacts of hospital capacity constraints
  - Hoe 2022 – Demand shocks lead to quicker/sicker discharges in UK trauma & ortho with increased readmissions
  - Gowrisankaran et al. 2026 – Capacity strain during COVID increases mortality
  - Longer emergency department wait times can affect timely access to care and increase mortality (Hoot and Aronsky 2008; Gruber et al. 2023)
  - Certificate of Need literature (e.g. Courtemanche & Garuccio 2025) inconsistent
- Need to understand how capacity influences health in steady-state/usual conditions, in decentralized health system (U.S.) where hospital ownership and market incentives vary substantially
- Ability to observe high-frequency, individual-level data on patient admissions, discharges
  - We can study effects on those *already* in the hospital during unexpected demand surge
- Large and important state (Texas) with many hospitals and varied market contexts

Person-Level Data on Hospitalizations

- Restricted all payor inpatient discharge claims data provided by the State of Texas
- Dataset provides breadth of information
  - Day and time of admission and discharge
  - Diagnoses, procedure codes, and length of stay
  - Identifies referral from the emergency room and transfers
    - » Can also link ED, outpatient files directly with same identifiers
  - Allows for the calculation of readmission rates
  - In hospital mortality
- Hospital Capacity and characteristics
  - American Hospital Association Survey data

Analysis Sample

- January 2016 to February 2020
  - Focus on non-federal general acute care facilities
  - Dataset covers over 8 million discharges
  - 341 hospitals in sample
    - 132 for profit and 220 non-profit
    - Around 40% rural hospitals but <10% discharge volume

Variables of Interest

Independent Variable

- Daily emergency room inpatient admissions relative to staffed hospital beds

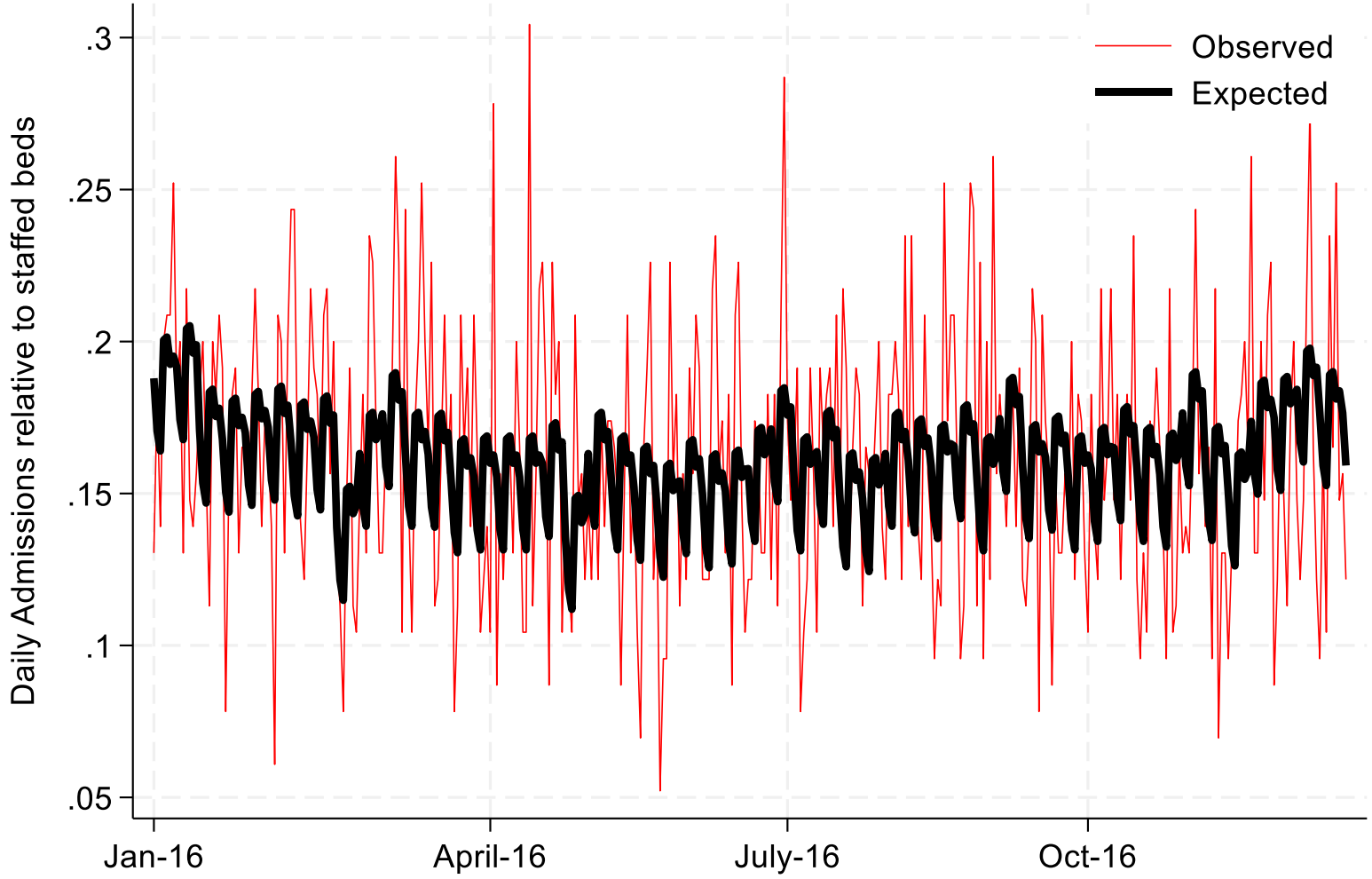
Main Dependent Variables

- Length of stay in days, probability of same day, one-day, and two-day discharge
- Transfers out
- 7- and 30-day hospital readmission probability
- In hospital mortality

Empirical Strategy

- Hospital's best idea of emergency volume is from past experience:
  - Seasonality, holidays, weekends, etc.
  - Local knowledge of this likely to be specific to hospitals
- However, emergency volume fundamentally uncertain and will sometimes be above / below expectations

Example of variation in daily emergency admission rate



Estimation Approach

High dimensional fixed effect regressions to describe difference in outcomes:

$$Y_{iht} = \alpha + \gamma_{ht} + \beta volume_{ht} + X_{it} + \epsilon_{iht}$$

- Y_{iht} : outcome for patient i treated in hospital h, discharged at day t
- $volume_{ht}$: Ratio of emergency admissions to staffed beds at hospital h on day t
- γ_{ht}: hospital-specific year, week-of-the-year, and day-of-the-week fixed effects
- X_{it}: patient level DRG, emergency room admission, insurance type, ethnicity/race, gender, and age

Assumptions

- Regression estimate can be interpreted as the causal impact of hospital specific daily admission shocks on discharged patient outcomes under certain assumptions
- Identification relies on the assumption that day to day variation in emergency admissions is uncorrelated with the error term (other stuff driving patient level outcomes at the hospital-day level)
- Identification occurs through changes in care for people at the end of their hospital stay
  - Importantly, almost all are already admitted when ED admissions spike (~10% of admissions daily are from ED)

Summary Statistics – Independent Variable (Hospital-Day)

	All	For-Profit	Non-Profit	Urban	Rural
Daily Admissions	20.4	20.1	20.5	27.6	4
Daily emergency admissions	13.1	12.9	13.2	17.8	2.3
Daily Admissions relative to staffed beds	18%	20%	17%	22%	11%
Daily Emergency Admissions relative to staffed beds	11%	12%	11%	14%	6%
Observations	402,314	151,510	250,804	279,271	123,043

Inpatient Characteristics (Discharges)

	All	For-Profit	Non-Profit	Urban	Rural
Age	54.6	54.1	54.9	54.3	58.9
Male	41%	40%	41%	41%	38%
White	70%	70%	69%	69%	81%
Black	14%	11%	16%	15%	9%
Asian	2%	2%	2%	2%	2%
Other	14%	17%	12%	14%	8%
Hispanic Origin	28%	35%	24%	28%	23%
Insurance Coverage	89%	90%	88%	89%	92%
Private	31%	30%	31%	31%	29%
Public	57%	60%	56%	57%	63%
Charity / Self-pay	11%	10%	12%	11%	8%
ER Admission	64%	64%	64%	64%	57%

Outcomes of Interest

	All	For-Profit	Non-Profit	Urban	Rural
Length of Stay	4.7	4.5	4.7	4.7	3.8
Same day Discharge	2%	2%	2%	2%	2%
One Day Discharge	14%	15%	13%	14%	16%
Two Days Discharge	24%	24%	23%	23%	27%
Transfer to GAC	1%	1%	2%	1%	6%
Readmission within 7days	12%	12%	13%	12%	11%
Readmission within 30days	23%	22%	24%	23%	19%
In hospital mortality	2%	2%	2%	2%	2%
Observations	8,268,969	3,064,355	5,204,613	7,742,979	526,058

Main Results: Length of Stay

	Length of Stay	Same day Discharge	Transfer to GAC
Operational Outcomes			
Daily Emergency Admissions relative to staffed beds	-0.1470** (0.0725)	0.0891*** (0.0053)	0.0054*** (0.0017)
Implied Effect at 10 pp increase in relative admission rate	-0.31%	42.43%	3.89%

Main Results: Quality of Care

Quality Outcomes	Readmission within 7days	Readmission within 30days	In hospital mortality
Daily Emergency Admissions relative to staffed beds	0.0134 (0.0109)	0.0119 (0.0097)	0.0056*** (0.0012)
Implied Effect at 10pp increase in relative admission rate	1.12%	0.52%	2.66%

Robustness – conditional on current occupancy

	Length of Stay	Same day Discharge	Transfer to GAC	Readmission within 30days	In hospital mortality
All Hospitals (n=8,268,969)					
Daily Emergency Admissions relative to staffed beds	-0.170	0.0681***	0.00552***	0.0123	0.00569***
	(0.671)	(0.00416)	(0.00170)	(0.00959)	(0.00120)
Main results	-0.147**	0.0891***	0.00544***	0.0119	0.00559***
	(0.0725)	(0.00534)	(0.00170)	(0.00966)	(0.00120)

Profit Status Results Similar (more coming)

	Length of Stay	Same day Discharge	Transfer to GAC	Readmission within 7days	Readmission within 30days	In hospital mortality
For-Profit (n=3,064,355)						
Daily Emergency Admissions relative to staffed beds	-0.254***	0.0912***	0.00519**	0.0068	0.0108	0.00513***
	(0.0821)	(0.0078)	(0.0021)	(0.0070)	(0.0071)	(0.0017)
Non-Profit (n=5,204,613)						
Daily Emergency Admissions relative to staffed beds	-0.0645	0.0876***	0.00563**	0.0185	0.0127	0.00603***
	(0.1100)	(0.0072)	(0.0026)	(0.0182)	(0.0159)	(0.0017)

Much Larger Effects for Rural Hospitals

	Length of Stay	Same day Discharge	Transfer to GAC	Readmission within 7days	Readmission within 30days	In hospital mortality
Rural (n=526,020)						
Daily Emergency Admissions relative to staffed beds	-0.293	0.158***	0.0326***	0.0037	0.0040	0.0153***
	(0.2160)	(0.0152)	(0.0069)	(0.0089)	(0.0136)	(0.0038)
Urban (n=7,742,938)						
Daily Emergency Admissions relative to staffed beds	-0.134*	0.0821***	0.0023	0.0144	0.0128	0.00459***
	(0.0768)	(0.0052)	(0.0017)	(0.0119)	(0.0105)	(0.0013)

Evidence of Different Outcomes by Payer

	Length of Stay	Same day Discharge	Transfer to GAC	Readmission within 7days	Readmission within 30days	In hospital mortality
Private (n=2,524,056)						
Daily Emergency Admissions relative to staffed beds	-0.161	0.0750***	0.00637***	0.0145	0.0087	0.0018
	(0.1150)	(0.0065)	(0.0022)	(0.0129)	(0.0114)	(0.0017)
Public (n=4,725,078)						
Daily Emergency Admissions relative to staffed beds	-0.0723	0.0807***	0.00489**	0.0177*	0.0158	0.00689***
	(0.0875)	(0.0042)	(0.0022)	(0.0103)	(0.0096)	(0.0018)
Charity (n=901,754)						
Daily Emergency Admissions relative to staffed beds	-0.351**	0.168***	0.0030	-0.0190	-0.0105	0.00920***
	(0.1680)	(0.0125)	(0.0036)	(0.0156)	(0.0169)	(0.0027)

Mechanisms

Who is most affected?

- Stronger mortality effects among at-risk patients (non-deferrable admissions)

Timing and treatment intensity

- Average discharge hour is later in the day
- Decrease in treatment intensity (fewer surgeries and lower charges)

Patient selection – discharges of low-risk patients

- Increase in emergency admission same day discharges
- Discharge decision not correlated with DRG

Non-Deferrable Admissions

	Length of Stay	Same day Discharge	Transfer to GAC	Readmission within 7days	Readmission within 30days	In hospital mortality
All Hospitals (n=1,006,197)						
Daily Emergency Admissions relative to staffed beds	-0.1670	0.1030***	0.0091*	0.0180	0.0145	0.0125***
	(0.1370)	(0.0066)	(0.0047)	(0.0145)	(0.0129)	(0.0042)

Treatment Intensity

	Total number of Procedures	Primary Surgery	Secondary Surgery	Total number of Revenue Codes	Log Charges
Daily Emergency Admissions relative to staffed beds	-0.5960	-0.0110***	-0.0080**	-0.9190	-0.0420***
	(0.933)	(0.00385)	(0.00357)	(0.757)	(0.0086)
Implied Effect	-3.06%	-0.18%	-0.20%	-0.51%	-0.42%

Patient Selection

ER FLAG SAMPLE Outcomes conditional on same day discharge

	Readmission within 7days	Readmission within 30days	In hospital mortality	Transfer to Any Hosp	Transfer to GAC
All Hospitals (n=116,145)					
Daily Emergency Admissions relative to staffed beds	0.000698	-0.00928	-0.0317*	-0.0547**	-0.0498**
	(0.0243)	(0.0302)	(0.0170)	(0.0223)	(0.0204)

	DRG weight	Observation Stay
All Hospitals (n=8,268,969)		
Daily Emergency Admissions relative to staffed beds	-0.00164	-0.0116
	(0.00100)	(0.00814)

Gut check: we discuss with former TX hospital exec

- What happens when more patients than expected show up?
  - Triage/send home
  - Call in more staff, usually fellows & temp/traveling nurses
  - Shift hospitalists to ED
  - Do less stuff especially time-consuming nursing tasks (turning patients, changing sheets); less frequent checks

Limitations

- Inability (legal restriction on data) to study staffing types (only quantity – more to come)
- Drivers of increased demand may be correlated with things that drive decreased staffing
  - Have looked at number of unique (scrambled) NPIs
- Reliance on fixed effects for predictable vs. nonpredictable changes; any variation not captured treated as unpredictable
  - Lots of robustness around this
- Heterogeneity – types of shocks leading to unexpected admissions may differ (we do control for DRG)

Conclusions

- We show that hospital crowding in Texas affects the delivery of care and increases inpatient mortality
  - Driven by hospitals changing their resource allocations to patients
- Subsample results show that the effect on outcomes are similar for non-profit and for-profit hospitals
- Effects are stronger for rural hospitals and those covered by public insurance

Unplanned hospital crowding substantively increases inpatient mortality.

What capacity level is socially optimal?
How would we achieve it?

Questions, comments, & suggestions are welcome

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