The Effects of Dialysis Firm Consolidation on Patient Health

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Motivation

- An evolving policy question: How should mergers be regulated when firms compete on **quality** and welfare operates through **non-price margins**?

- The **2023 Merger Guidelines** shift the enforcement landscape:
  1. Expanded focus on non-price competition (Athey & Nevo, 2023)
  2. Greater reliance on market structure over the consumer welfare standard (Mercatus Center, 2024)
  3. De-emphasis of efficiencies and pro-competitive effects (Athey & Nevo, 2023)

- This question calls for a **robust evidence base on what mergers actually do** in such settings — this is our goal.
  - Healthcare as the setting; outpatient dialysis as the lab

Theoretical Framework

- Prices are fixed $\Rightarrow$ profits through cost reductions

Costs

- $\downarrow$ Capacity reductions
- $\downarrow$ Economies of scale / standardization

Quality

- $\downarrow$ Reduces access / congestion
- $\uparrow$ Reinvest savings into quality / standardization

Welfare

- $\downarrow$ Switching costs
- $\uparrow$ Better quality at lower cost

- Ex ante, net quality and welfare effects are ambiguous.

Research Question

How does the consolidation of dialysis firms affect patient health?

- Lab: Outpatient dialysis in the United States

The Lab: Dialysis

1. **Life-sustaining treatment for half a million patients** $\Rightarrow$ health effects are *acute*

   - Three times a week, every week
   - 3–4 hours per session

2. Private provision and high degree of consolidation

- Two firms provide **75%** of treatments
- These two firms owned 22% of clinics in 1996 vs. **62% in 2009** (Cutler et al., WP)

The Lab: Dialysis

3. **Prices are vastly regulated by Medicare** $\Rightarrow$ *quality competition* is salient

   - Medicare ESRD covers individuals with kidney disease since 1973
   - A majority (**70%**) of in-center dialysis patients are covered by Medicare FFS (MedPAC, 2021)
   - **$45 billion** in annual Medicare spending (USRDS, 2021)

The Lab: Dialysis

4. **Highly localized markets** $\Rightarrow$ market-wide capacity effects are salient

   - Median travel distance is **5.7 miles** (Prakash et al., 2014)
   - **90%** of patients receive treatment within their county (Wollmann, 2022)

Overview

- Novel evidence consistent with:
  - **Mergers reorganize capacity** (closures & reallocation)
  - **Short run: harm through disruption**
    - Closures $\rightarrow$ treatment disruption $\rightarrow$ mortality
    - Channel distinct from structural quality adjustments
  - **Long run: benefits through reorganization**
    - $\downarrow$ hospitalizations, ICU days, transfusions
    - Organizational efficiencies + reallocation toward better providers
- A framework for evaluating consumer welfare through health effects:
  - **$\sim$\$700M in benefits** (1.5% Medicare savings)
  - **$\sim$\$3.5B in costs**

Data & Empirical Strategy

- **30 years** of U.S. administrative data (1991–2021)
- **800+ merger events**
- Two-step approach:
  - **Step 1:** Stacked event-study — comparing outcomes in counties *with* vs. *without* mergers

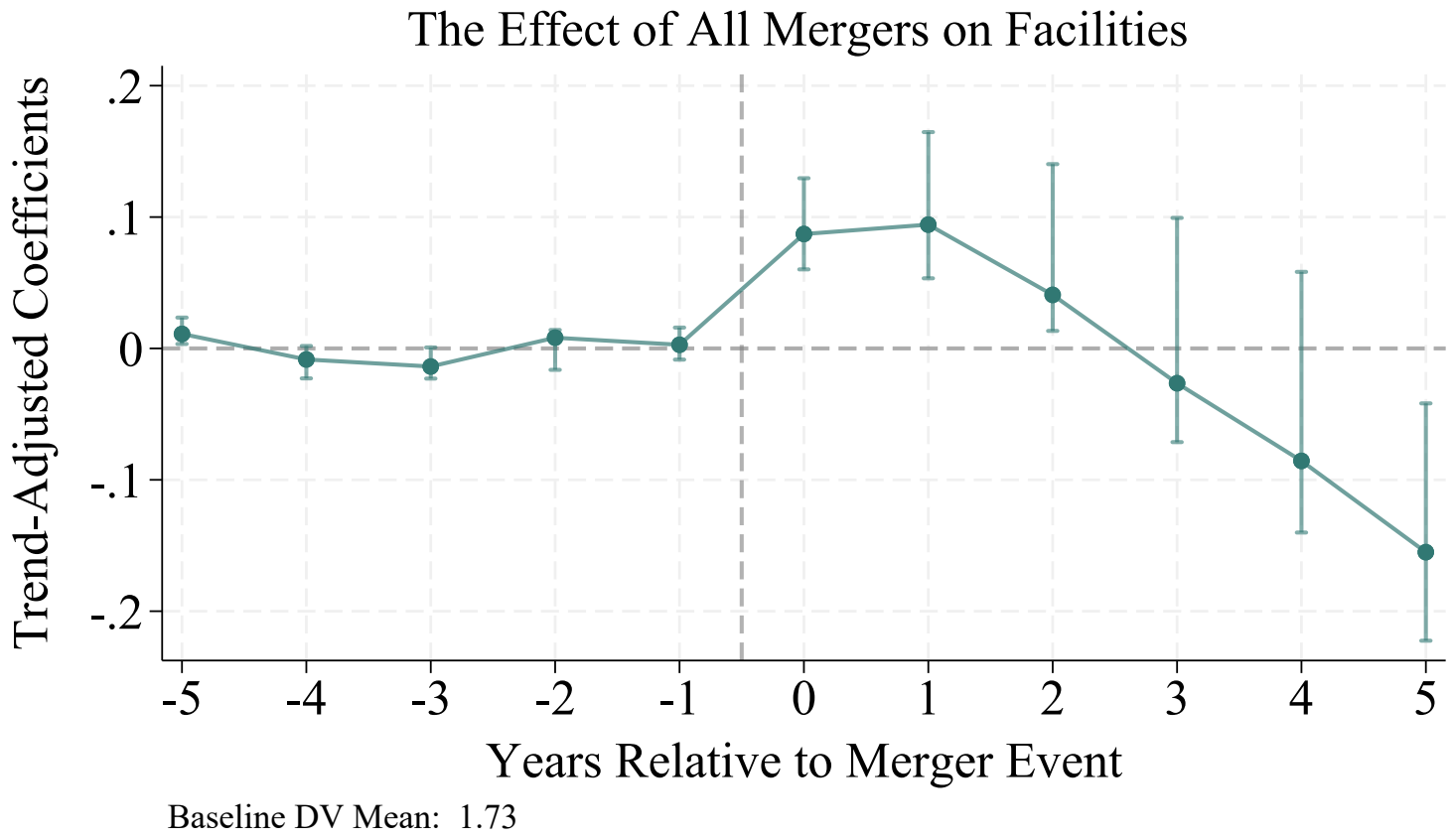
$$y_{i,e,d} = \sum_{\substack{k=-\mathcal{L}' \\ k\neq -1}}^{k=\mathcal{L}} \beta_e^{unadj} \left(\mathrm{D}_{i,d} \times \mathbf{1}\{e=k\}\right) + \underbrace{\mathrm{X}'_{m(i),e}\,\chi}_{\text{county covariates}} + \underbrace{\mathrm{Q}'_{f(i),e}\,\theta}_{\text{facility covariates}} + \lambda_{i,d} + \Omega_{e,d} + \epsilon_{i,e,d} \tag{1}$$

  - **Step 2:** Trend adjustment *à la* Freyaldenhoven, Hansen & Shapiro (2019)

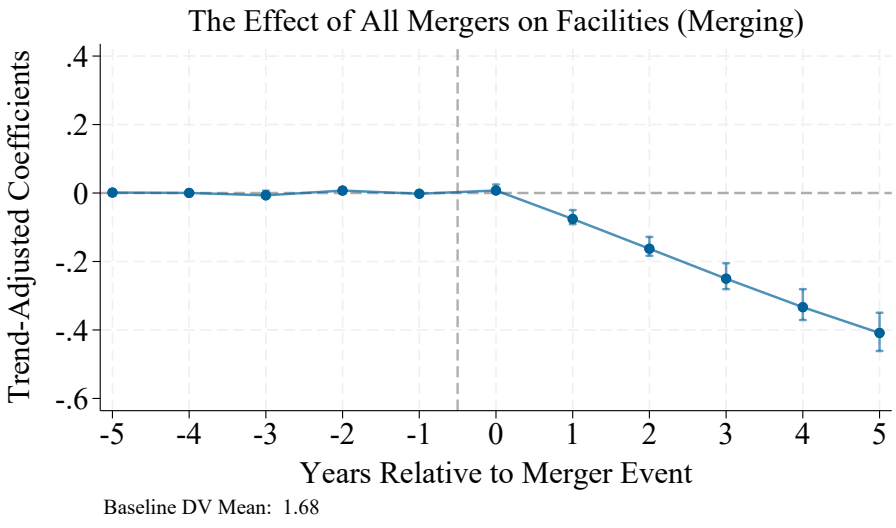
Data Sources Merger Distribution

- Mergers reduce net market capacity by **0.15 facilities (9% decline)** and **3.5 dialysis beds (12.5% decline)**.

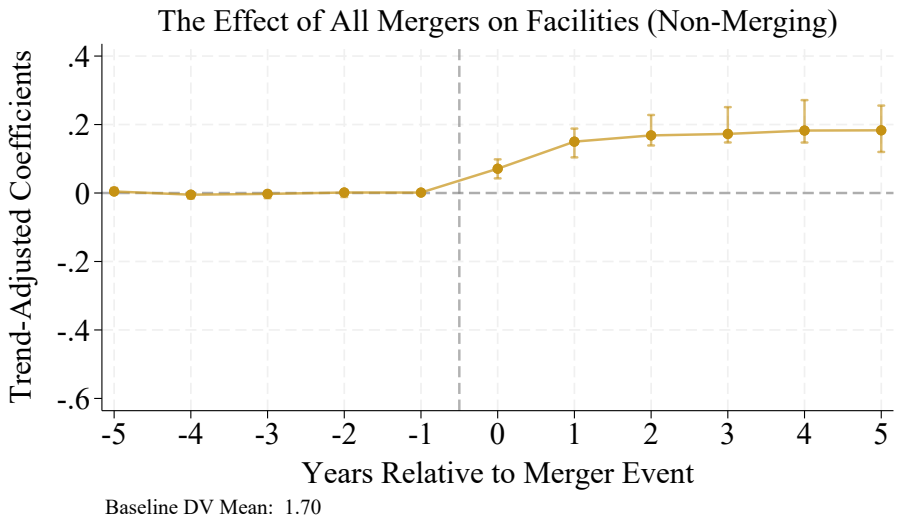
Dialysis Beds



- Closures are driven by **merging targets** shutting down.



(a) Merging Facilities

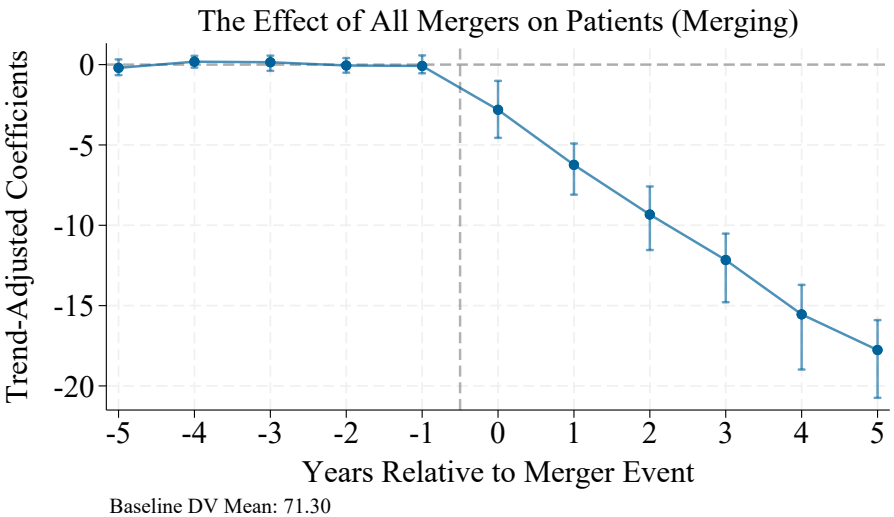


(b) Non-Merging Facilities

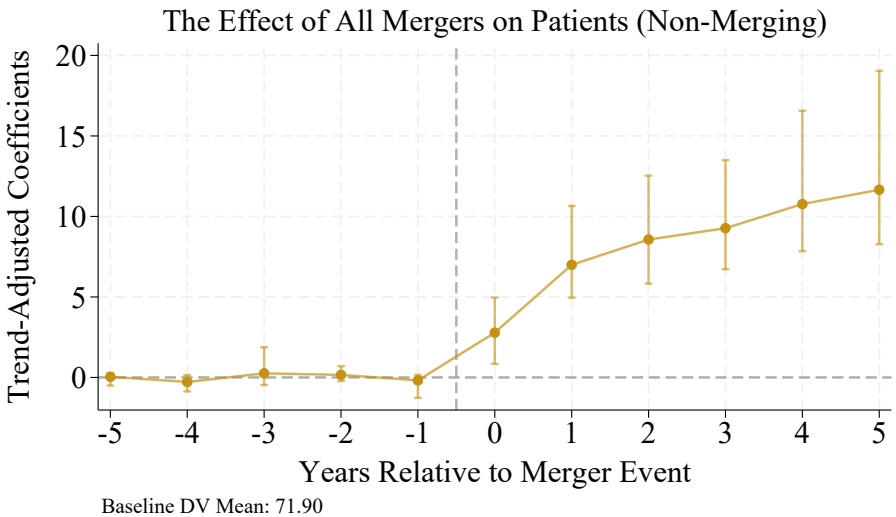
Cannibalization Hypothesis

• Closures → Displacement

- **Patients are displaced** from merging facilities.



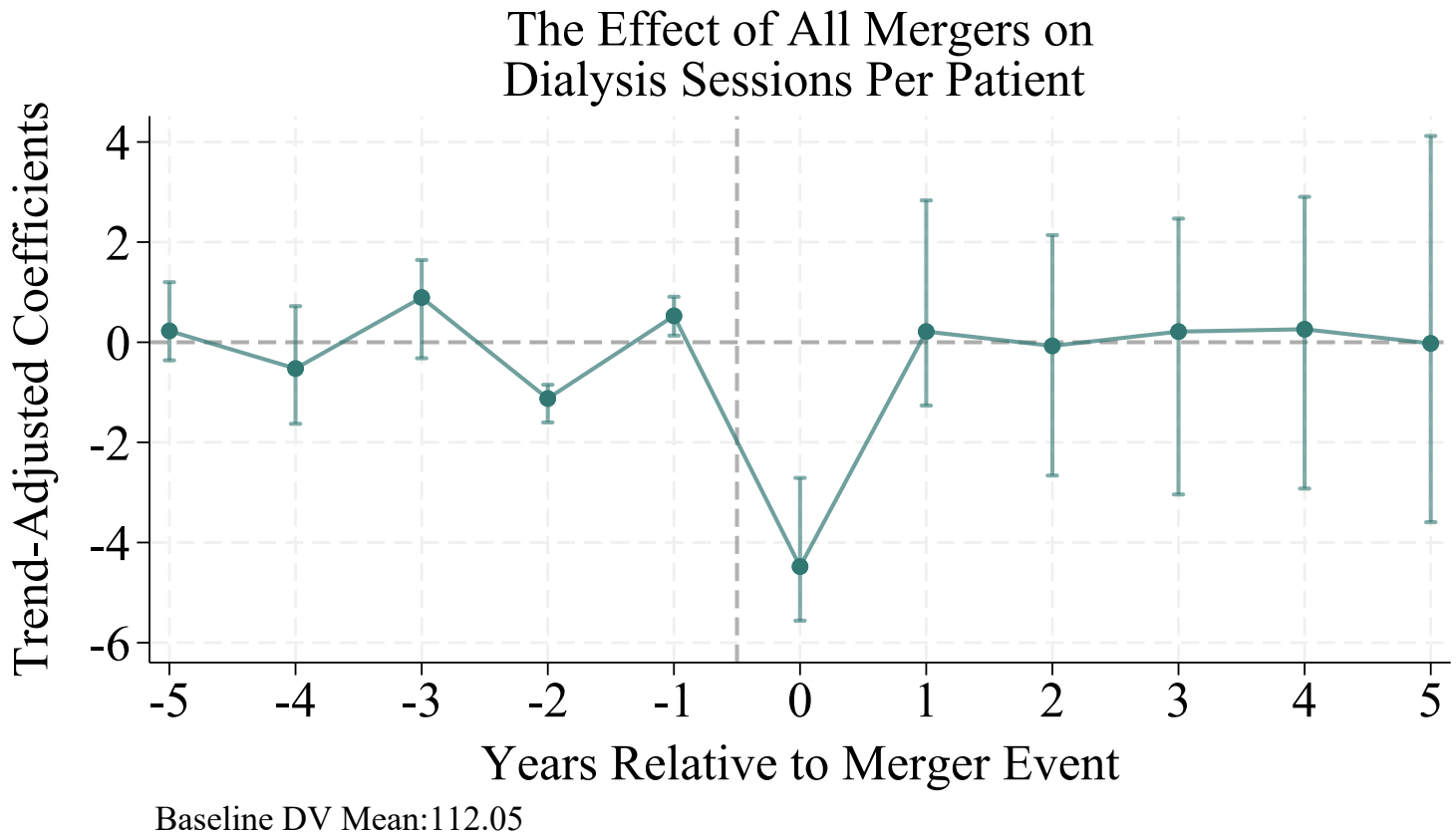
(a) Pat.: Merging Facilities



(b) Pat.: Non-Merging Facilities

• Closures → Displacement → Disruption

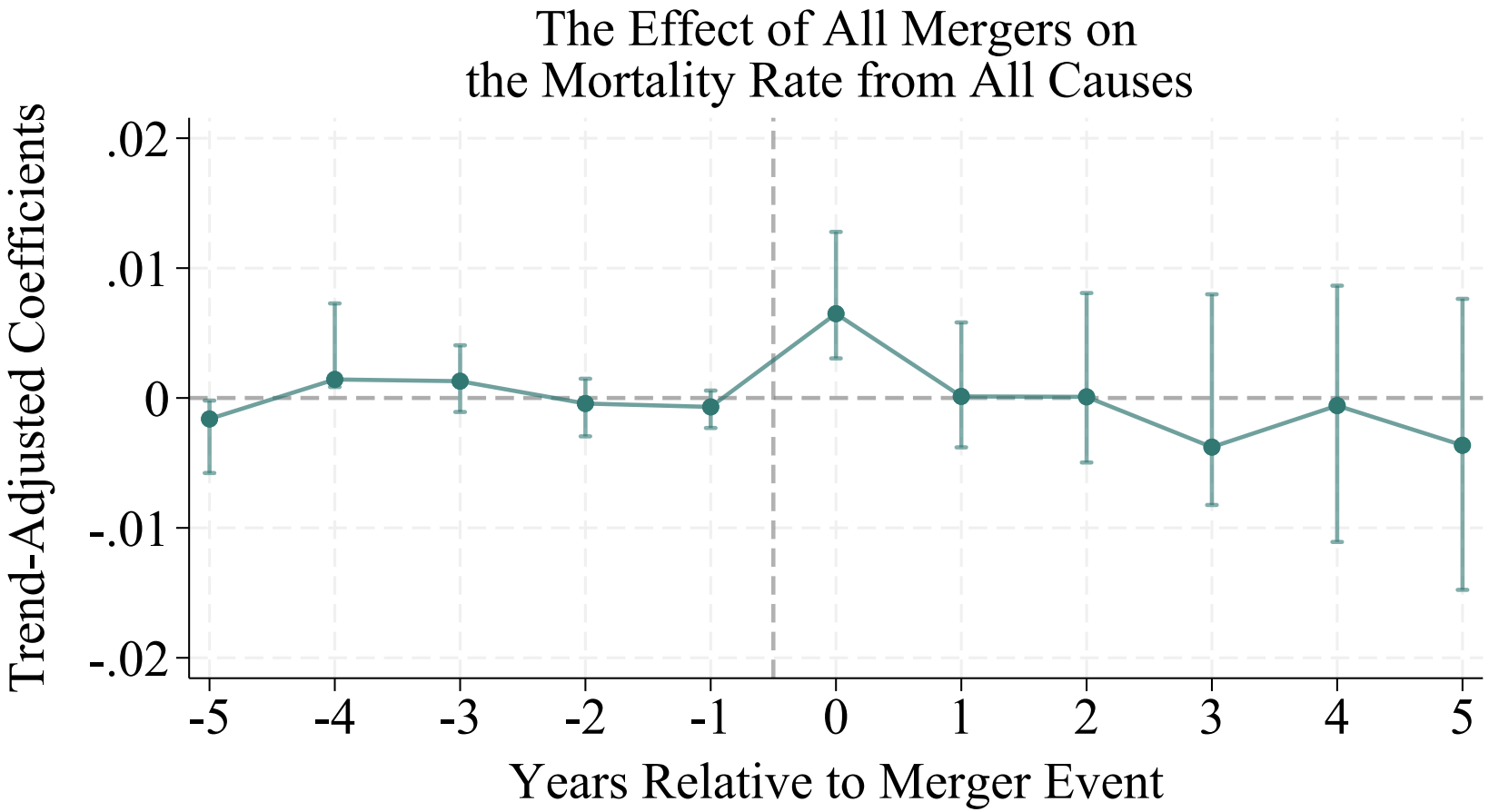
- Treatment is disrupted in the merger year: **5 fewer sessions per patient (5% decline)**.



Travel Distance Staffing

• Closures → Displacement → Disruption → Mortality

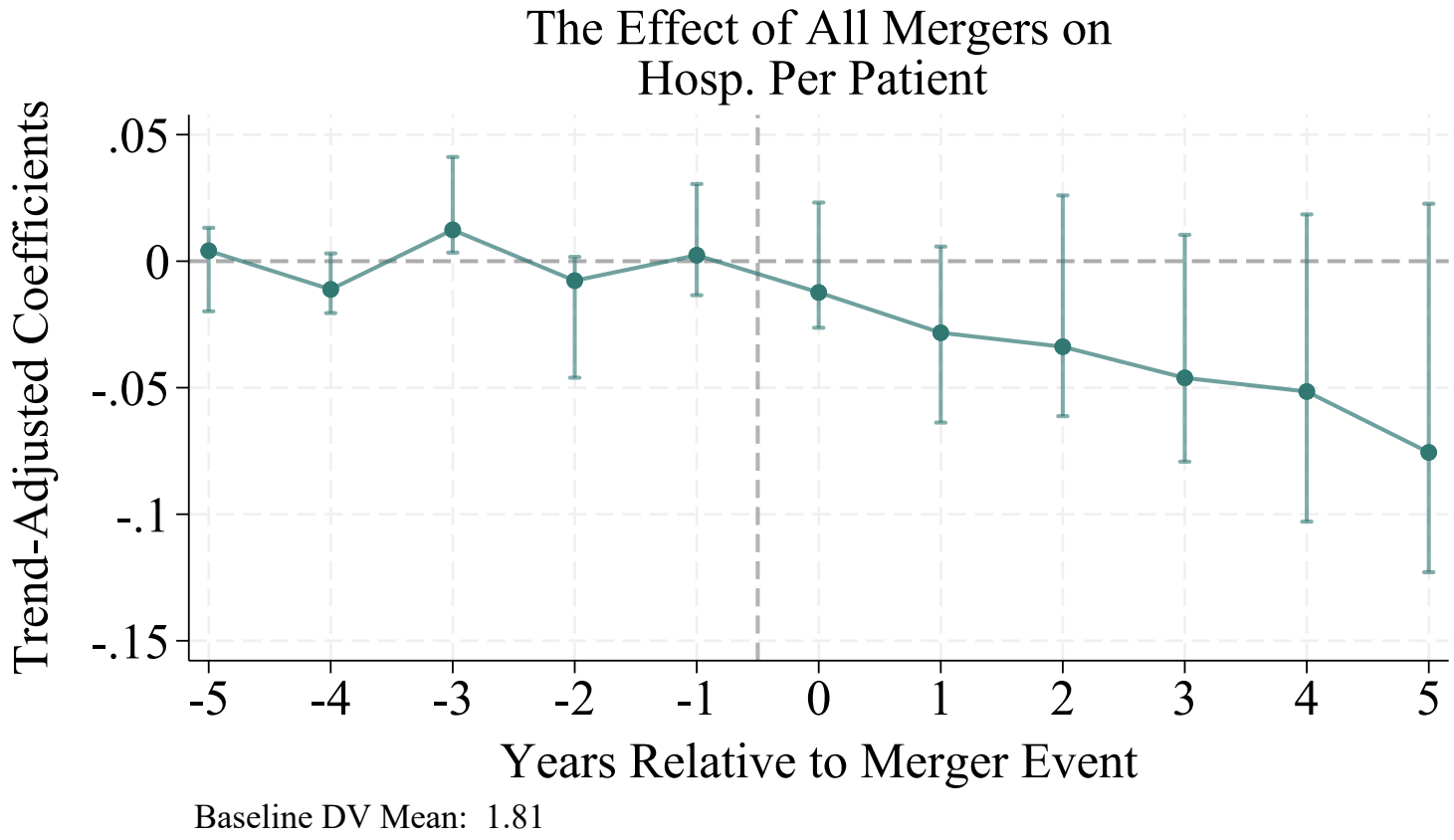
- **Mortality rises in the merger year:** +700 deaths per 100,000 patients **(4% increase)**.



Baseline DV Mean: 0.17

Linking Mortality to Closures Deaths Are Not Harvested

- **Over time, patient health improves** — fewer hospitalizations, ICU days, and blood transfusions.



ICU Days Blood Transfusions

Health Gains Don't Capture Survival of Healthier Patients

	(1) Exogenous Risk Measure	(2) Patient Share Female	(3) Patient Share Black	(4) Patient Share Hispanic
Years After Merger				
0	0.0005	-0.0005	0.0006	0.0004
	(0.0013)	(0.0025)	(0.0020)	(0.0013)
1	0.0020*	0.0001	0.0012	0.0011
	(0.0012)	(0.0023)	(0.0021)	(0.0013)
2	0.0022*	0.0015	0.0016	0.0007
	(0.0012)	(0.0023)	(0.0019)	(0.0013)
3	0.0013	-0.0005	0.0040**	0.0003
	(0.0011)	(0.0020)	(0.0018)	(0.0012)
4	0.0017	-0.0014	0.0051***	0.0008
	(0.0011)	(0.0021)	(0.0018)	(0.0012)
5	0.0024**	-0.0009	0.0038**	-0.0006
	(0.0010)	(0.0020)	(0.0017)	(0.0011)
Years Before Merger				
5	0.0011	-0.0013	-0.0013	-0.0001
	(0.0018)	(0.0028)	(0.0025)	(0.0013)
4	0.0018	0.0019	-0.0036	-0.0004
	(0.0017)	(0.0028)	(0.0024)	(0.0014)
3	0.0019	0.0014	0.0006	-0.0006
	(0.0015)	(0.0026)	(0.0023)	(0.0014)
2	0.0000	-0.0015	0.0026	0.0002
	(0.0014)	(0.0025)	(0.0024)	(0.0013)
Obs.	1,016,777	1,016,777	1,016,777	1,016,777
R-sq	0.768	0.422	0.963	0.935

Table: Change in Patient Risk Composition After A Merger

Market Mechanisms for Quality Improvements

A hypothesis:

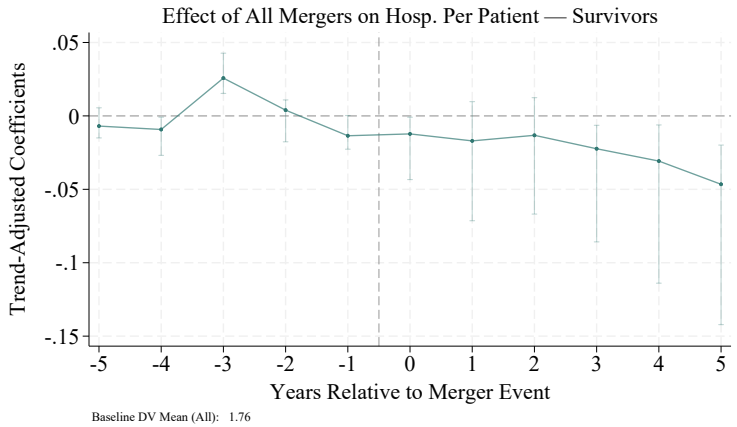
1. **Efficiency gains by surviving merging firms**
   A larger consolidated firm has higher ability to reduce costs and reinvest savings in quality
2. **Exit of lower-quality firms**
3. **Entry of higher-quality firms**

Market Mechanisms for Quality Improvements

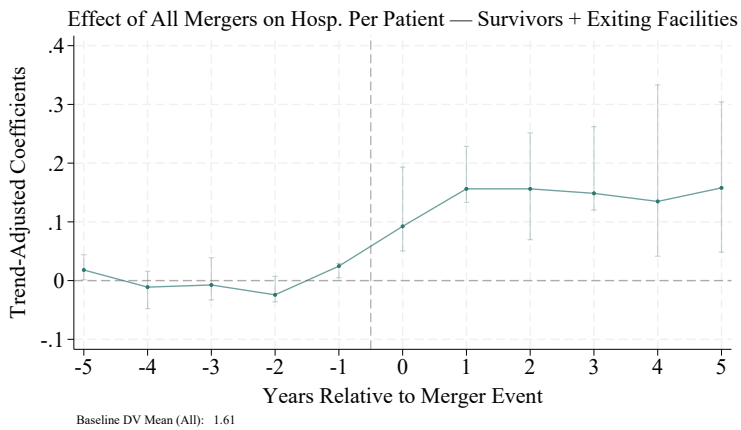
A test:

1. **Efficiency gains by surviving merging firms**
   Health improvements when restricting to *surviving* firms
2. **Exit of lower-quality firms**
   Health declines after adding *exiting* firms to the sample of survivors
3. **Entry of higher-quality firms**
   Health improvements after adding *entrant* firms to the sample of survivors

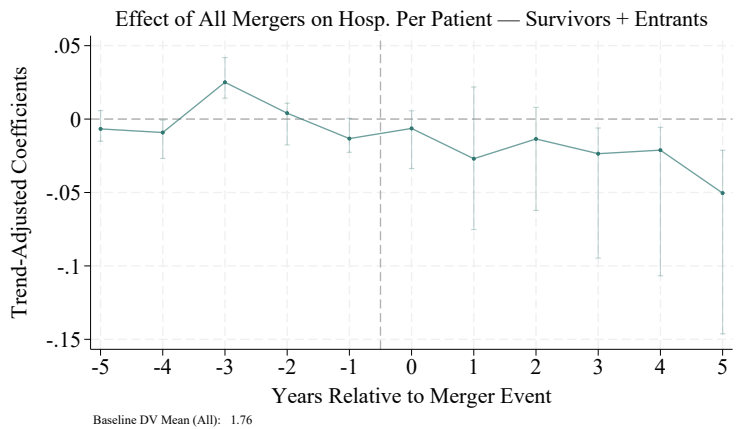
Market Mechanisms for Quality Improvements



(a) Surviving Firms



(b) Surviving + Exiting Firms



(c) Surviving + Entrant Firms

Welfare

Health BENEFITS (5-year horizon)

- -0.248 hospitalizations/patient over 5 years
- $\sim$109,295 merger-exposed patients (23% of U.S. counties)
- \$25,433 Medicare spend per hospitalization (KFF 2021)

Aggregate Benefit: $\sim$\$689M

Health COSTS (merger-year mortality)

- $+0.7$ pp mortality $\rightarrow$ $\sim$765 additional deaths
- YLL: 3,290 (ESKD life expectancy) to 12,471 (U.S. average)
- VSLY: \$130K – \$423K (low, central, high VSL estimates)

Aggregate Cost: \$428M – \$5.3B (central: $\sim$\$3.5B)

Policy Implications

- Protecting against **short-run treatment disruptions** (but not necessarily closures) has the potential to reduce mortality costs while preserving long-run benefits.
  - Pre-merger review of station/facility density in the market
  - Patient transition plans, access reporting, consent decrees

- Market concentration changes are not predictive of health effects.

Market Concentration & Health

Conclusion

How does consolidation of dialysis firms affect patient health?

- **Short run:** mergers → closures → treatment disruption → mortality
- **Long run:** mergers → exit of low-quality providers + efficiency gains among survivors + entry of high-quality providers → health improvements
- **Status quo:** health benefits < health costs
  With reduced disruptions: health benefits > health costs

What Does Dialysis Tell Us About Mergers Where Prices Are Regulated?

1. Expanded focus on non-price competition
   Supported: welfare effects arise through quality, not prices.

2. Greater reliance on market structure
   Caution: concentration is a blunt welfare metric.

3. De-emphasis of efficiencies
   Caution: efficiencies can offset harms; they can be quantified using existing welfare tools and amplified through simple policy levers.

APPENDIX

Data

- **United States Renal Data System**
  - Dialysis sessions, mortality, hospitalization, biomarkers, facility quality, drug dosing
- **CMS Provider of Service Files**
  - Mergers (N = 856) and markets (N = 724 treated, 1,172 control)
- **Other sources** for county-level covariates
  - Income, demographics, CON law status

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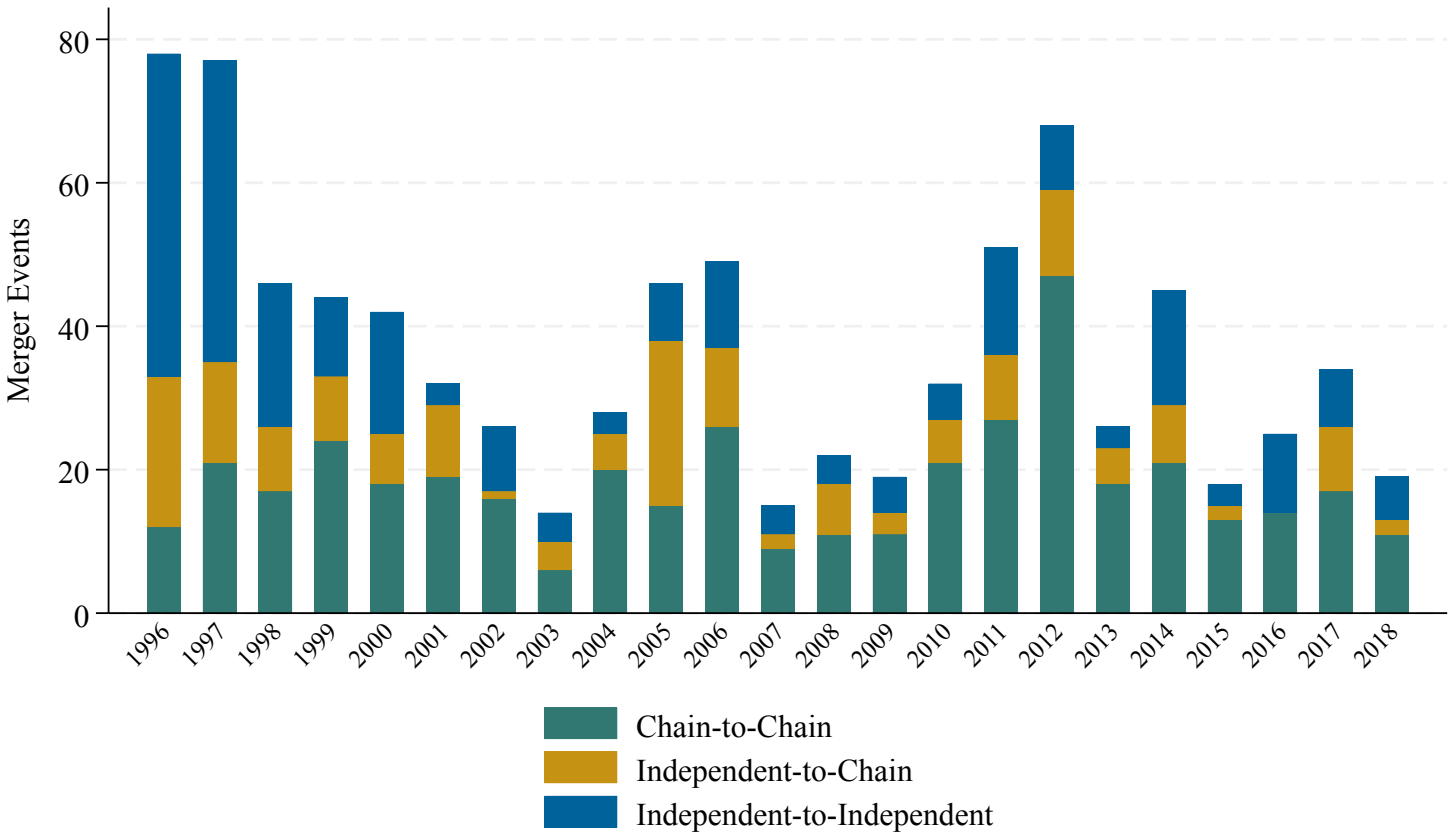
Mergers in the Sample



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Literature on Hospital Consolidation

- **Ho & Hamilton (2000)** — hospital mergers in CA
  - No measurable effect on inpatient mortality
- **Beaulieu et al. (2020)** — hospital mergers & acquisitions 2009–2013
  - No effects on readmission rates or mortality
- **Mariani et al. (2022)** — meta-analysis of 16 hospital merger studies
  - Insufficient and inconsistent evidence on mortality and readmissions
- **Ferrier & Valdmanis (2004)** — efficiency gains of 1997 hospital mergers
  - Unable to conclude that mergers lead to efficiency or productivity improvements

Literature on Consolidation in Dialysis

- **Eliason et al. (2020) — independent-to-chain** mergers **before 2012 reforms**
  - Increased ESA dosing; improved dialysis adequacy
  - Worsened mortality, hospitalization, transplant access
- **Wollmann (2020)** — effects of blocking mergers that fly under the radar
  - Large life-saving effects
- **Cutler et al. (WP)** and **Erickson et al. (2020)** — effects of **market concentration**
  - No effects on dialysis adequacy or staffing (Cutler et al.)
  - Mixed effects on mortality (Erickson et al.)

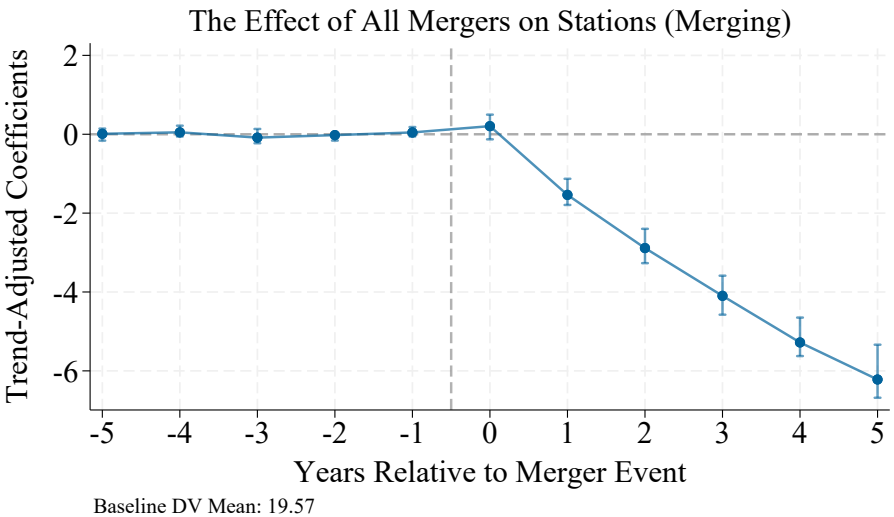
Summary Statistics

- **Sample:**
  - Mergers: 856
  - Markets: 724 treated; 1,172 control
  - Facilities: 3,115 treated; 3,284 control
  - Patients: 66,736 treated; 238,770 control

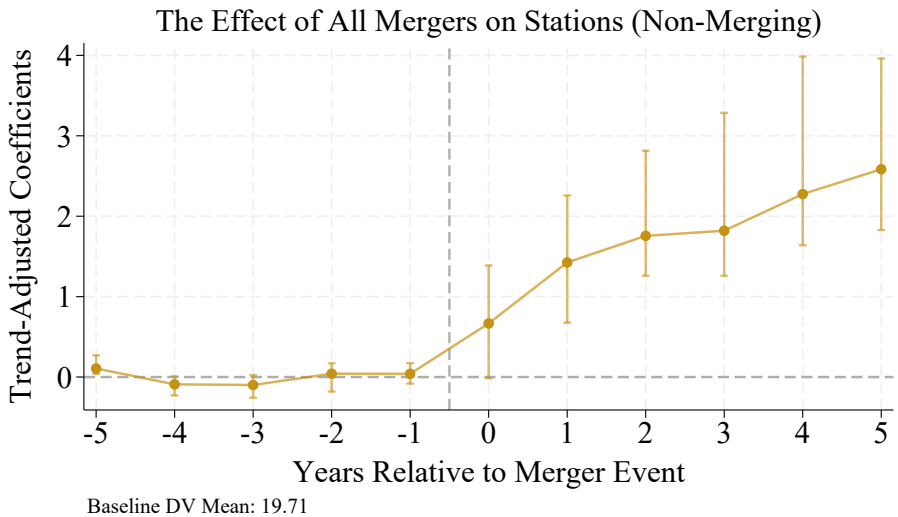
- **Population:**
  - Facilities (1991–2021): 12,704
  - Facilities (2021): 8,448
  - Patients (1991–2021): 3,140,635
  - Patients (2021): 626,914

Stations

- **Net reduction in dialysis stations (≈12.5%)**



(a) Merging Stations



(b) Non-Merging Stations

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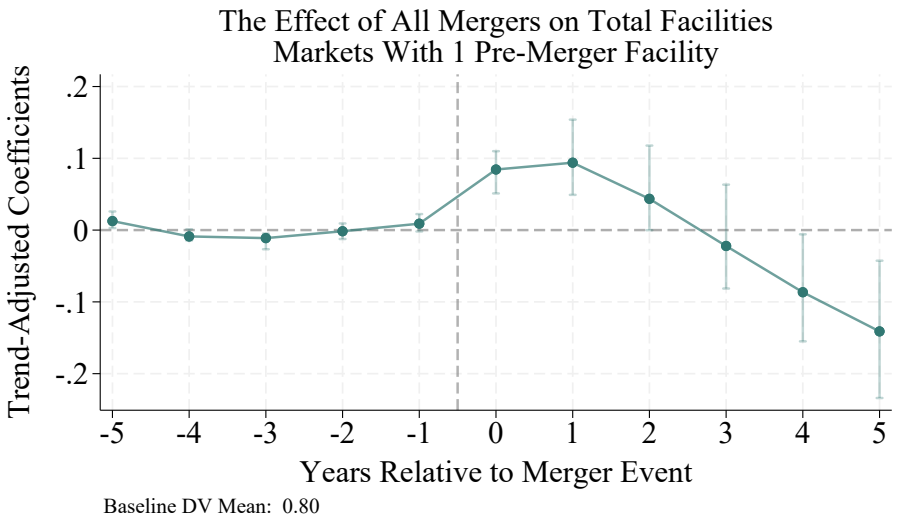
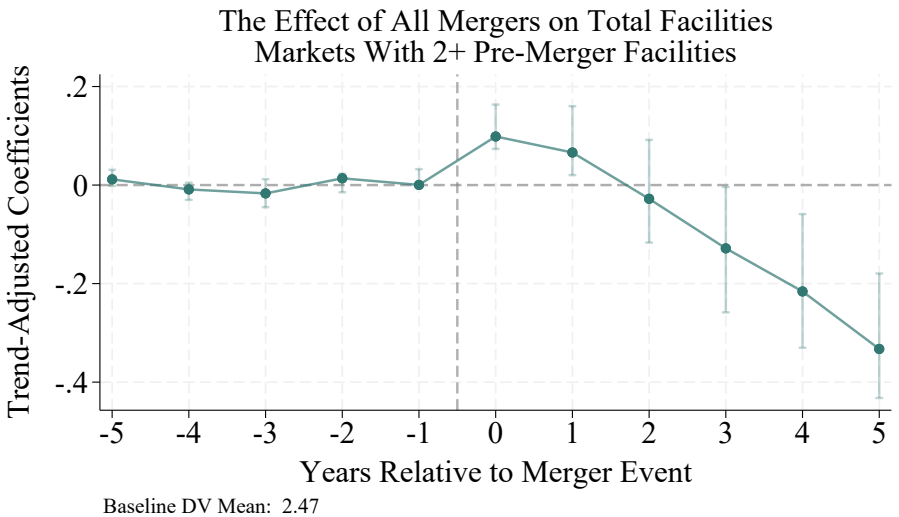
Cannibalization Hypothesis: Closures



(a) Markets with Only 1 Facility



(b) Markets with 2+ Facilities

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Staffing

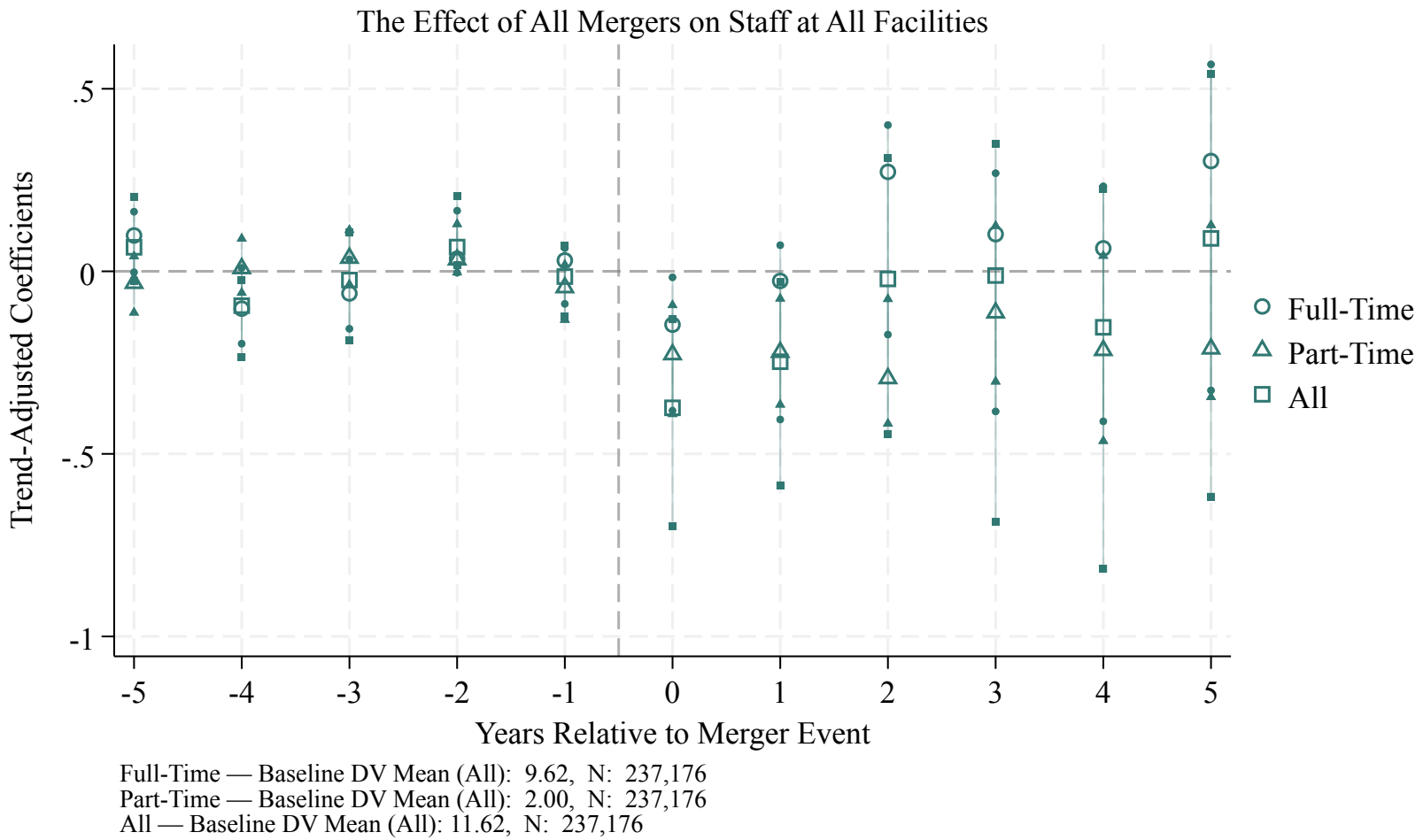

Figure: Staffing Volume

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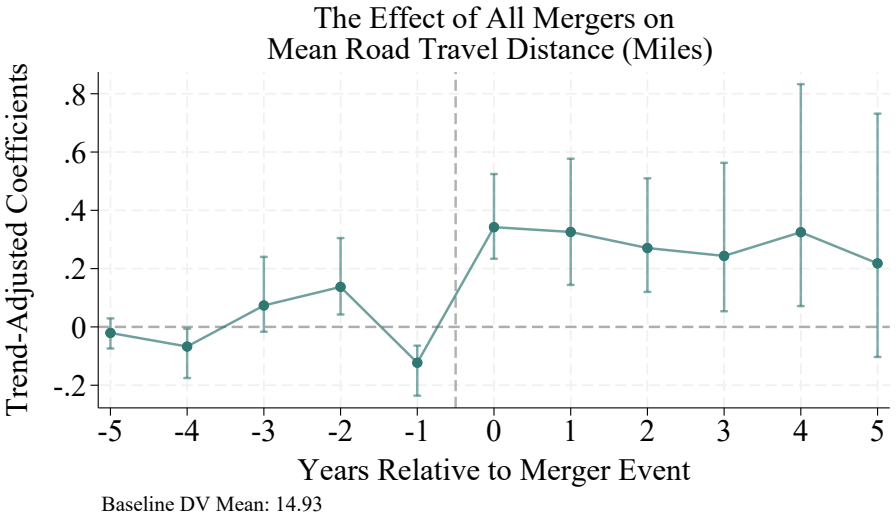
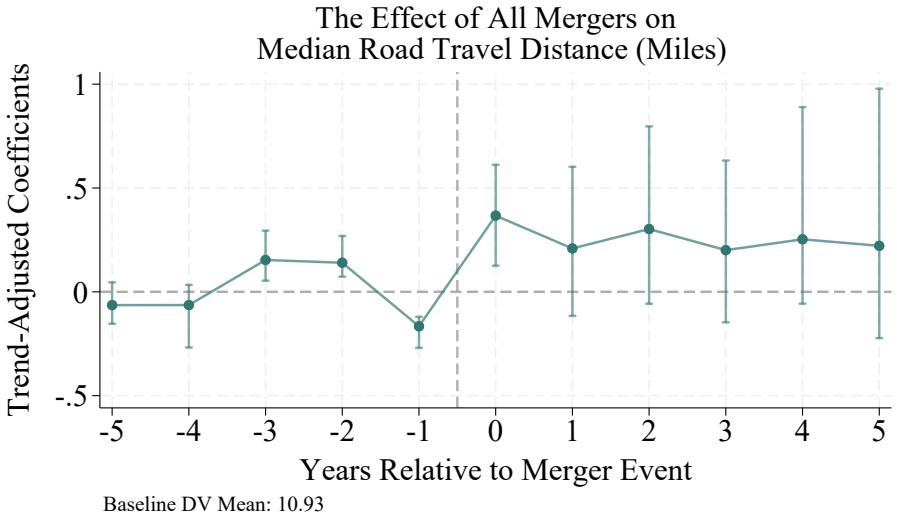
Travel Distance



(a) Mean Road Travel Distance (Miles)



(b) Median Road Travel Distance (Miles)

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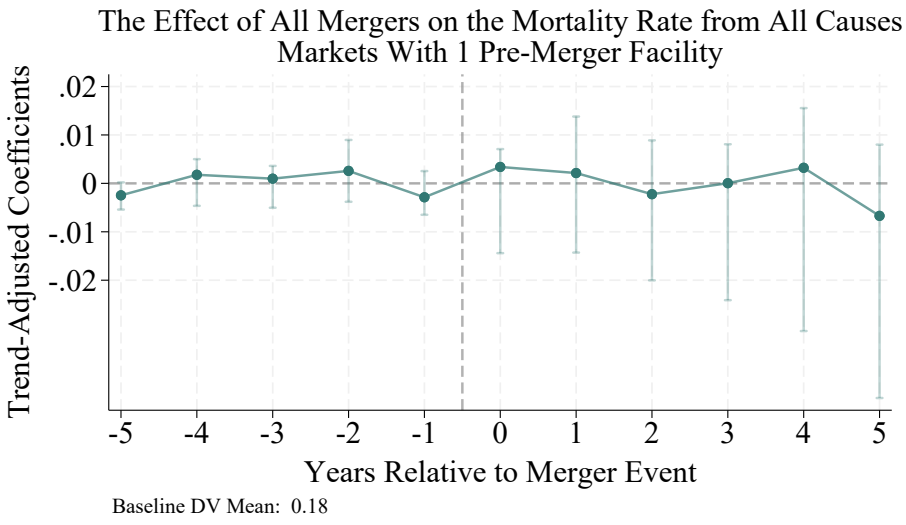
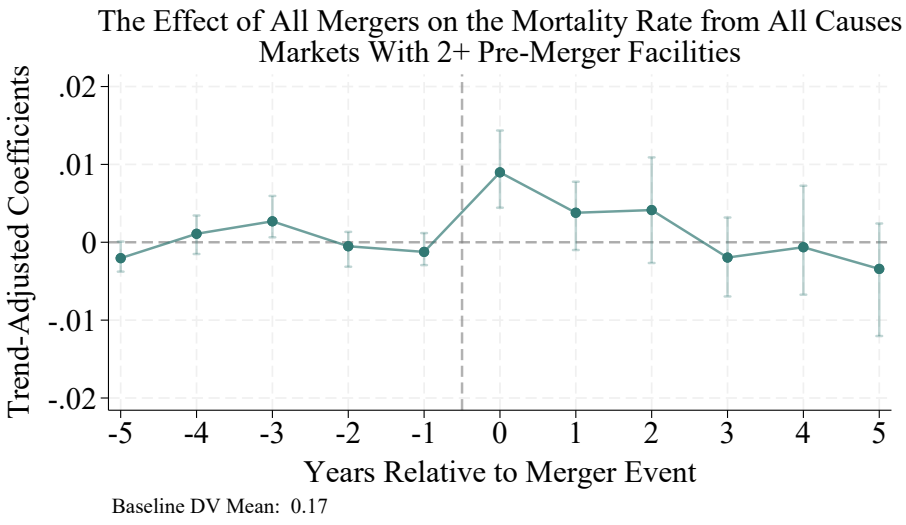
Linking Closures to Mortality



(a) Markets with Only 1 Facility



(b) Markets with 2+ Facilities

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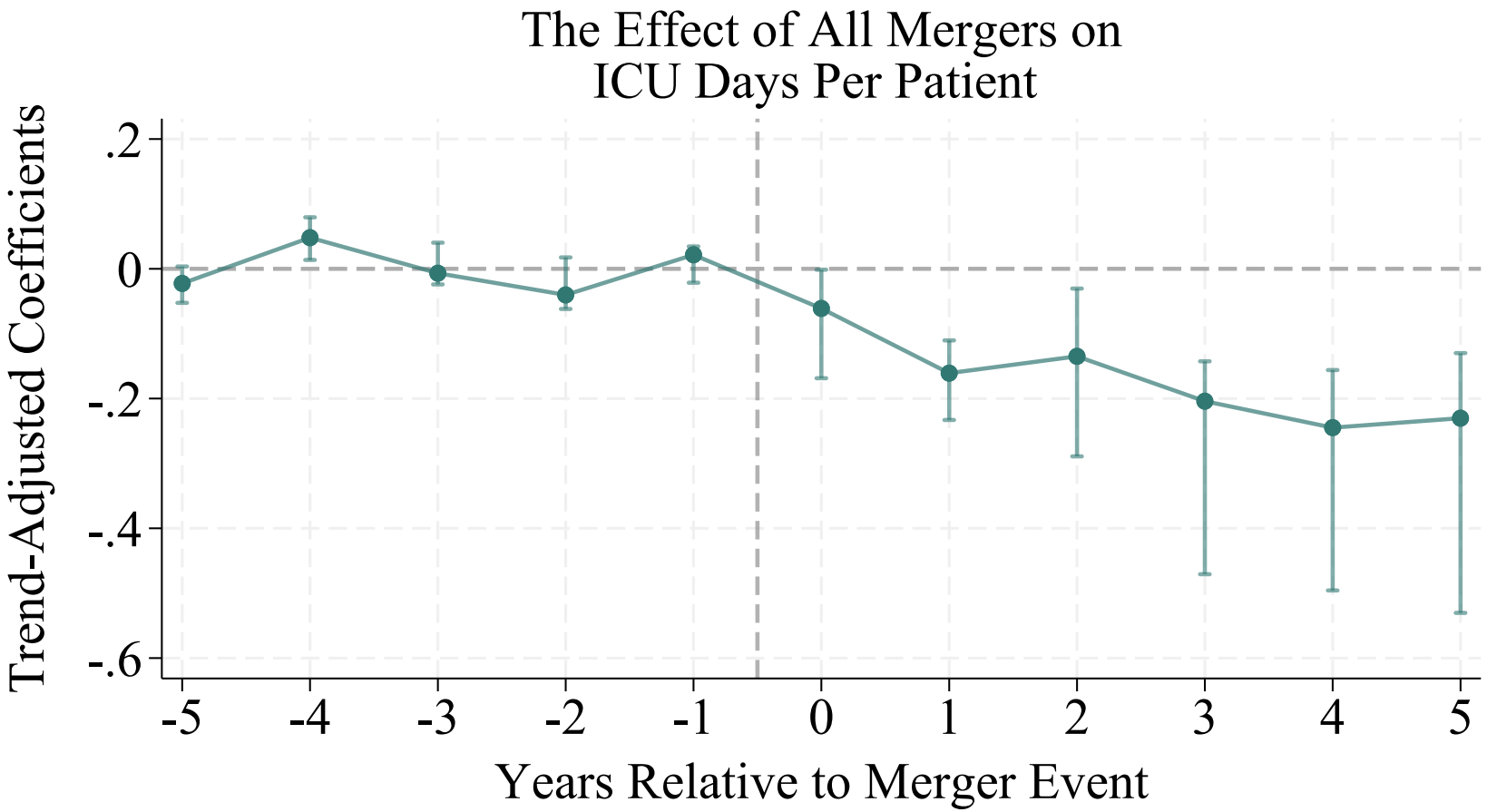
Are Deaths Harvested?

	(1) Patient Share Ages 30–39	(2) Patient Share Ages 40–49	(3) Patient Share Ages 50–59	(4) Patient Share Ages 60–69	(5) Patient Share Ages 70–79	(6) Patient Share Ages 80+
Years After Merger						
0	0.0007	-0.0023	-0.0012	-0.0053***	0.0054**	0.0020
	(0.0012)	(0.0016)	(0.0020)	(0.0021)	(0.0022)	(0.0016)
1	0.0008	-0.0022	0.0010	0.0006	-0.0005	-0.0012
	(0.0010)	(0.0015)	(0.0019)	(0.0021)	(0.0021)	(0.0016)
2	0.0004	-0.0028**	0.0018	0.0002	0.0002	0.0003
	(0.0010)	(0.0014)	(0.0018)	(0.0020)	(0.0020)	(0.0015)
3	0.0009	-0.0015	0.0020	0.0009	-0.0010	-0.0010
	(0.0010)	(0.0013)	(0.0017)	(0.0018)	(0.0019)	(0.0014)
4	0.0018*	-0.0008	0.0004	0.0011	-0.0022	-0.0010
	(0.0011)	(0.0013)	(0.0018)	(0.0017)	(0.0018)	(0.0014)
5	0.0025**	-0.0019	0.0002	0.0009	-0.0002	-0.0026*
	(0.0011)	(0.0012)	(0.0017)	(0.0017)	(0.0017)	(0.0014)
Years Before Merger						
5	0.0002	-0.0012	-0.0003	-0.0004	-0.0010	0.0027
	(0.0014)	(0.0018)	(0.0023)	(0.0025)	(0.0024)	(0.0019)
4	-0.0003	-0.0007	-0.0013	0.0000	0.0009	0.0025
	(0.0013)	(0.0019)	(0.0022)	(0.0023)	(0.0024)	(0.0018)
3	0.0003	-0.0035**	-0.0005	-0.0023	0.0047*	0.0013
	(0.0013)	(0.0016)	(0.0021)	(0.0022)	(0.0025)	(0.0017)
2	-0.0005	-0.0022	0.0015	-0.0008	-0.0000	0.0016
	(0.0012)	(0.0016)	(0.0020)	(0.0022)	(0.0022)	(0.0016)
Obs	1,016,777	1,016,777	1,016,777	1,016,777	1,016,777	1,016,777
R-sq	0.368	0.387	0.368	0.295	0.388	0.508

Table: Change in Patient Age Composition After A Merger

Results: ICU Days

Fewer ICU days per patient



Baseline DV Mean: 2.58

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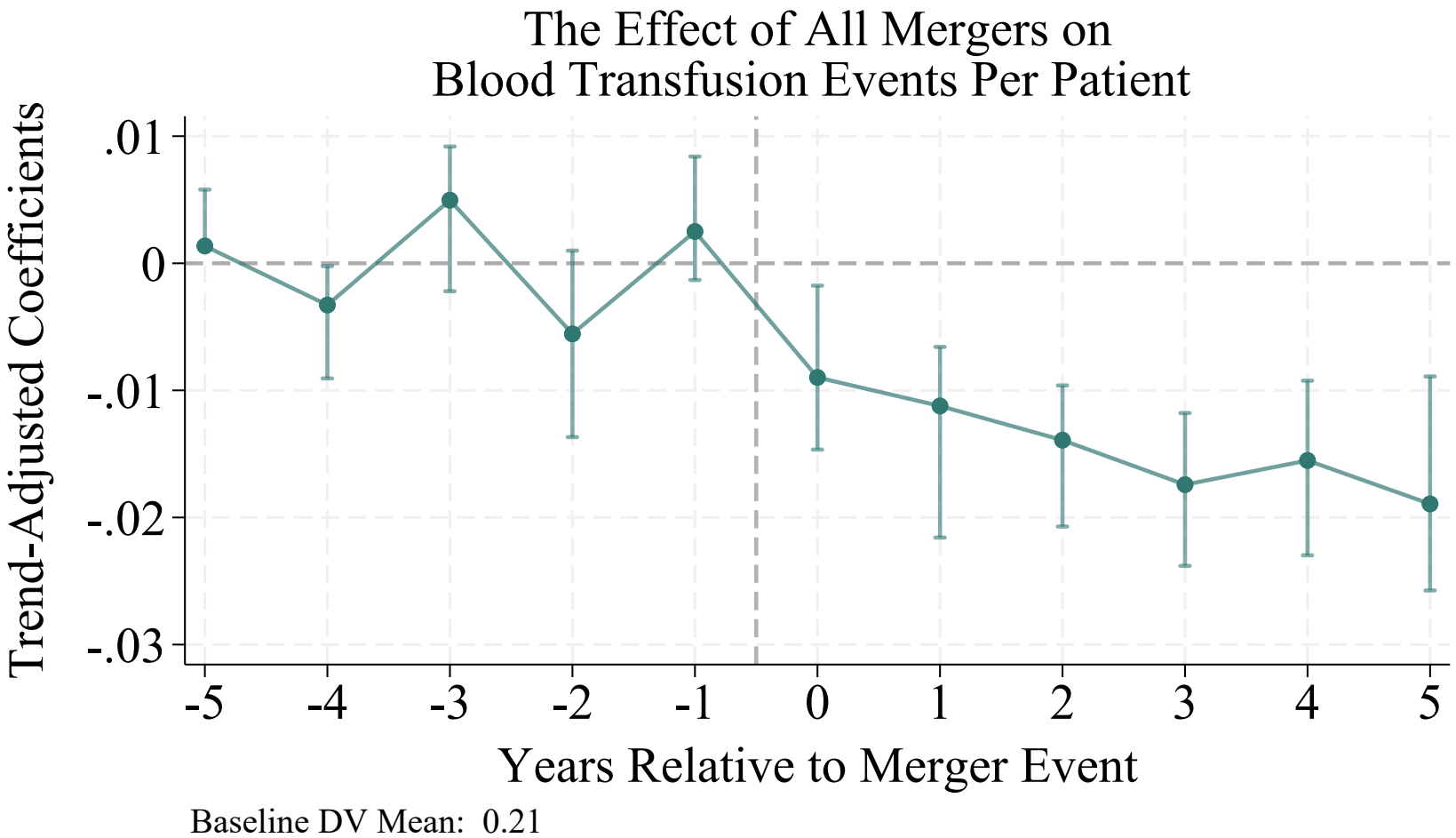
Results: Blood Transfusions

A reduction in inpatient blood transfusion events



Baseline DV Mean: 0.21

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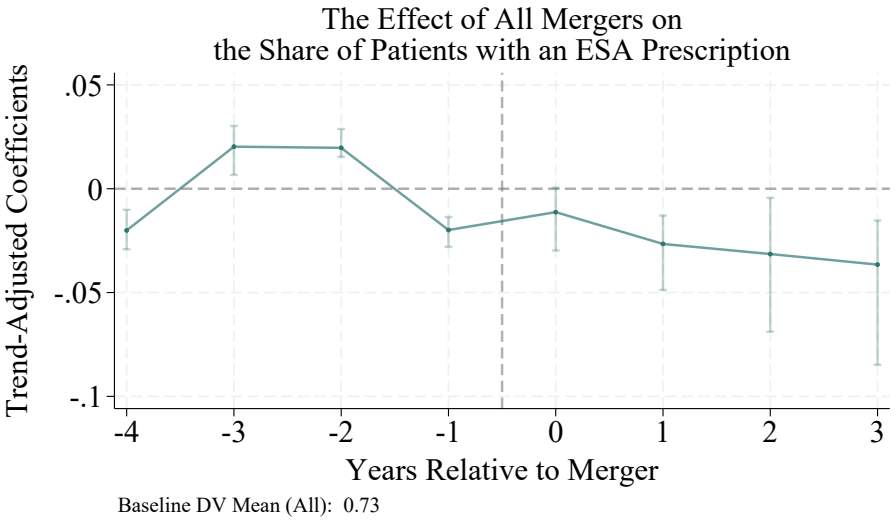
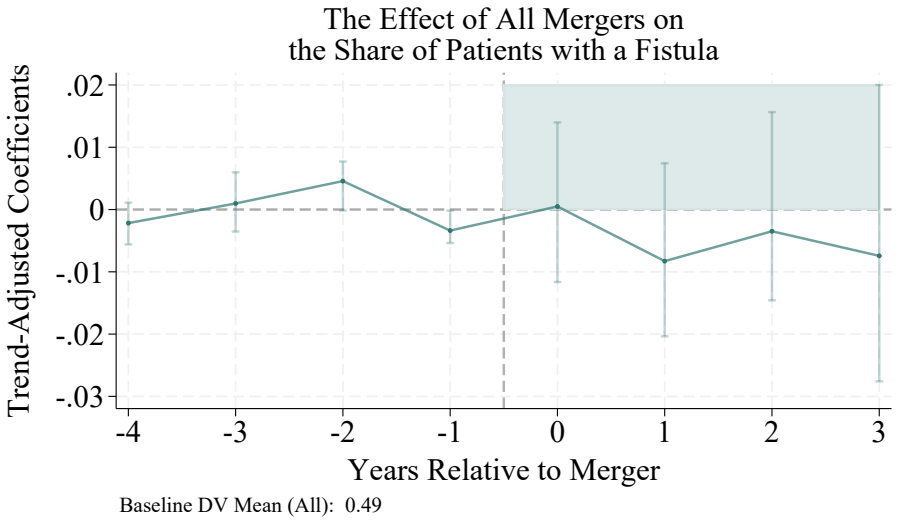
- **Quality does not deteriorate in the long run.**



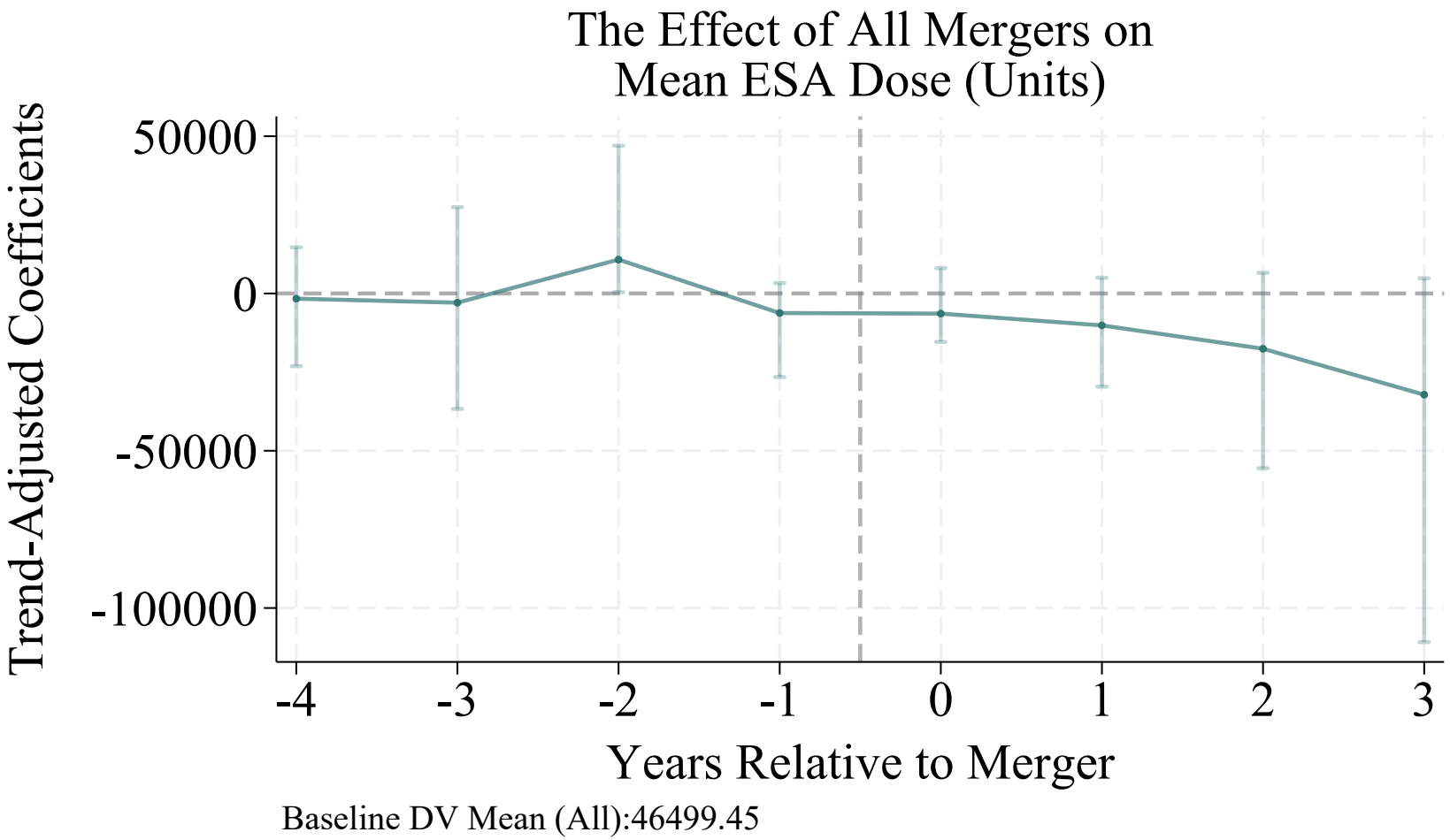
(a) Anemia Drug Usage



(b) Fistula Usage

ESA Dosing Back

Drug Dosing



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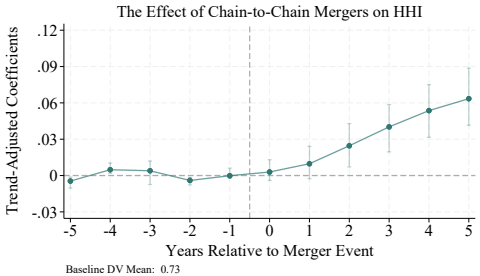
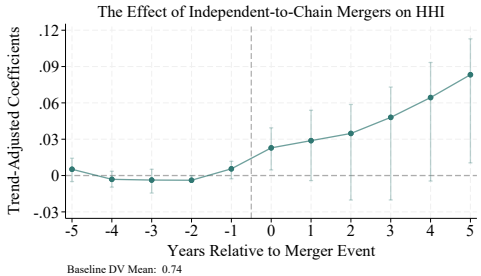
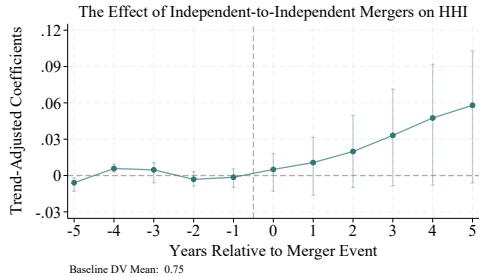
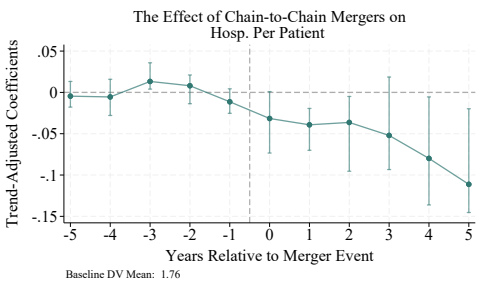
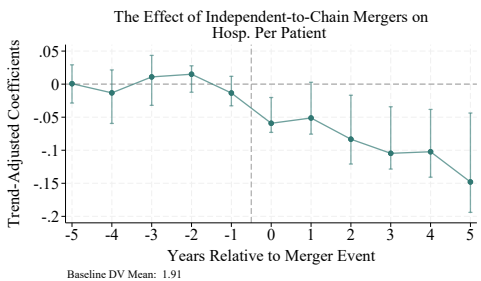
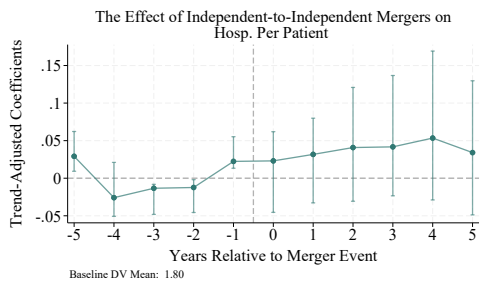
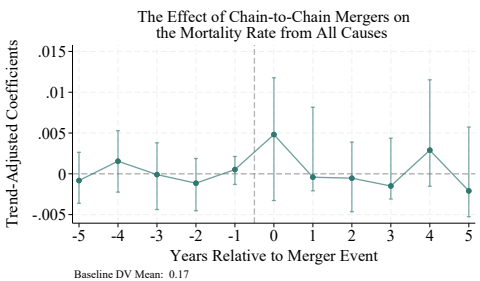
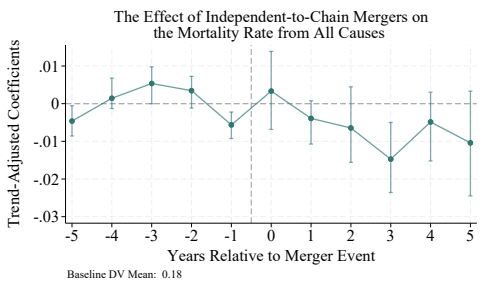
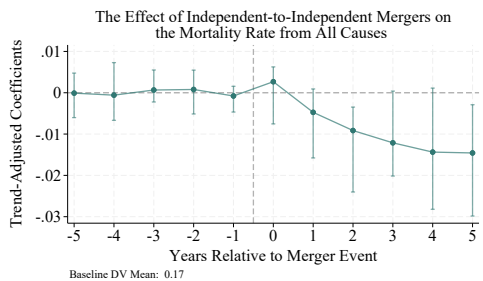
Market Concentration Does Not Predict Health Effects

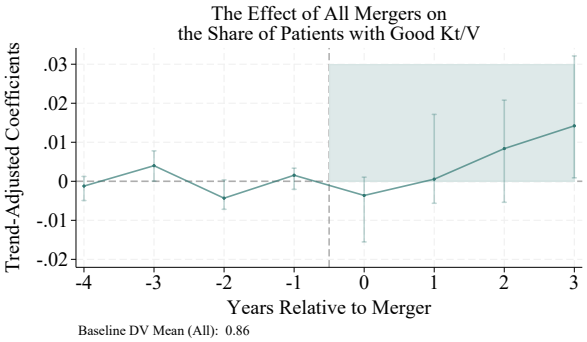
	Chain-to-Chain	Independent-to-Chain	Independent-to-Independent
HHI			
Hosp.			
Mortality			

Back

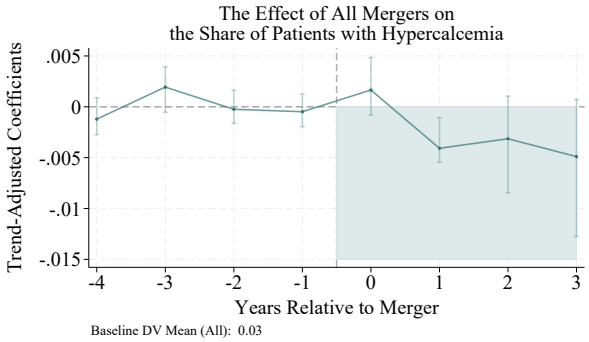
The Quality Incentive Program (QIP)

- In 2011, Medicare ESRD underwent two key changes:
  - Fee-for-service $\rightarrow$ **bundled payment**
  - Introduction of the **Quality Incentive Program (QIP)**
- We ask:
  - How did patient **biomarkers** (collected under QIP compliance) respond to mergers?
  - Did merger effects in the **post-QIP era** differ from the pre-QIP era?

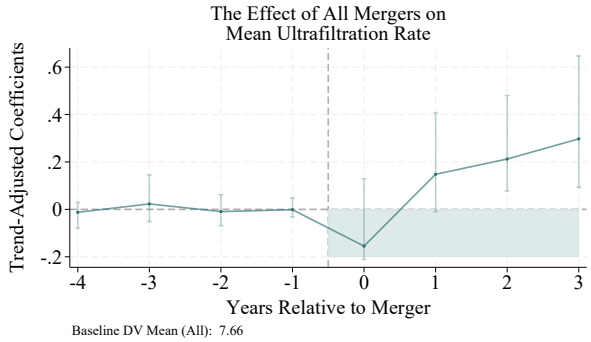
• Long-Run Improvements • Mixed Biomarkers



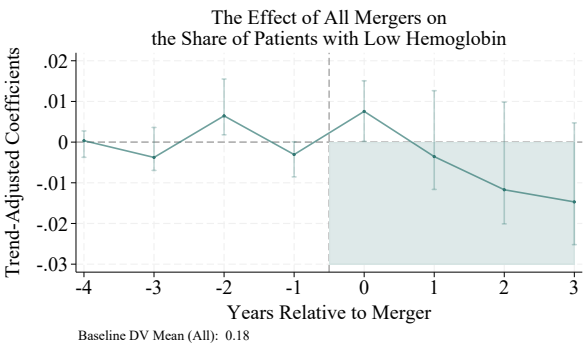
(a) Good Kt/V



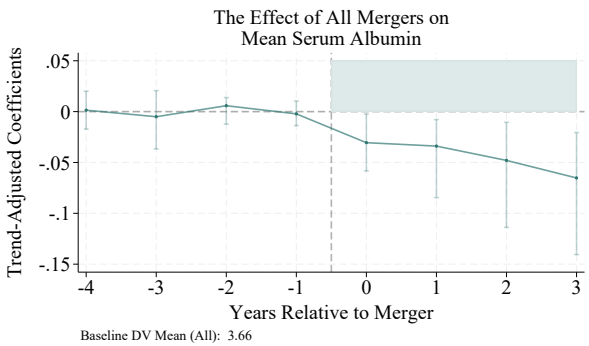
(b) Hypercalcemia



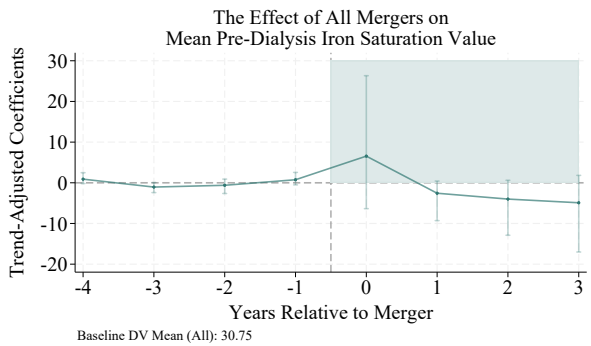
(c) Ultrafiltration Rate



(d) Low Hemoglobin



(e) Albumin



(f) Iron Saturation

No Role of Quality Incentives: Mortality

- **QIP did not mitigate short-run health harms.**

	1991–2011	2012–2021	Difference	p-value
Merger Year	0.0052	0.0078	0.0026	0.7468
	(0.0047)	(0.0067)		
1 Year Post	-0.0045	0.0092**	0.0137	0.0317
	(0.0062)	(0.0054)		
DV Mean	0.1791	0.1636		
N	536,062	216,715		

Table: Effect of Mergers on All-Cause Mortality: Pre- vs. Post-QIP

No Role of Quality Incentives: Hospitalizations

- **QIP did not amplify long-run health gains.**

	Hospitalizations Per Patient			
	1991–2011	2012–2021	Difference	p-value
Merger Year	-0.0052	0.0028	0.0080	0.8266
	(0.0274)	(0.0240)		
1 Year Post	-0.0384	0.0176	0.0560	0.2621
	(0.0382)	(0.0322)		
2 Years Post	-0.0356	-0.0138	0.0218	0.6850
	(0.0387)	(0.0374)		
3 Years Post	-0.0426	-0.0372	0.0054	0.9306
	(0.0439)	(0.0433)		
4 Years Post	-0.0544	0.0101	0.0646	0.3406
	(0.0517)	(0.0438)		
5 Years Post	-0.1043	0.0029	0.1072	0.1836
	(0.0644)	(0.0485)		
DV Mean	1.9639	1.5085		
N	535,271	216,353		

Table: Effect of Mergers on Hospitalizations: Pre- vs. Post-QIP