HOW ACQUISITIONS AFFECT FIRM BEHAVIOR AND PERFORMANCE: EVIDENCE FROM THE DIALYSIS INDUSTRY
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Outline

Introduction

- Research Question:
  How do mergers and acquisitions in the healthcare industry, particularly in outpatient dialysis facilities, impact treatment strategies, patient outcomes, and healthcare expenditures?
- Motivation:
  - Healthcare markets are increasingly concentrated due to M&A
  - While previous studies have explored associations between market structure and outcomes, there's a lack of understanding regarding the specific mechanisms driving changes in outcomes post-acquisition.
  - This research aims to fill this gap by examining large chains implement their strategies in acquired facilities and leverage economies of scale to influence care quality and costs.

Literature

- Contribution to Mergers and Acquisitions Literature:
  - Adds to the understanding of mergers and acquisitions effects, particularly in healthcare.
  - Contrasts with existing literature by focusing not only on price effects but also on quality outcomes post-acquisition.
- Contribution to "Roll-up" Strategies Literature
- Contribution to Dialysis Industry Economics Literature (e.g., Dai 2014; Dai and Tang 2015; Wilson 2016a, 2016b; Cutler, Dafny, and Ody 2017; Grieco and McDevitt 2017; Gaynor, Mehta, and Richards-Shubik 2018; Eliason 2019)

Medical Background

End-Stage Renal Disease (ESRD):

- Diagnosed when kidneys fail to perform these functions adequately.
- Survival options: kidney transplant or dialysis.

Dialysis:

- Hemodialysis or peritoneal dialysis.
- Over 90% of patients choose in-center hemodialysis.

Anemia Treatment:

- Most ESRD patients receive treatment due to erythropoietin deficiency, using EPO and intravenous iron analogs, such as Venofer or Ferrlecit.

Medical Background

A dialysis facility's quality of care may be assessed through **clinical indicators** and **patient outcomes**.
Clinical Indicators for Dialysis Facility Quality:

- Urea Reduction Ratio (URR): Measures waste filtration during dialysis.
- Hemoglobin (Hgb) Levels: Indicates anemia severity.

Patient Outcomes:

- Mortality and hospitalization rates.
- especially septicemia (which can be reduced by properly cleaning machines) and cardiovascular (events exacerbated by excessive EPO use)

the Role of Medicare in Dialysis

Medicare Coverage for ESRD Patients:

- After 90 days of ESRD diagnosis, all patients become eligible for Medicare coverage, regardless of age.
- Over 80% of ESRD patients receiving dialysis in the US are enrolled in Medicare.

Medicare Reimbursement Policy:

- Medicare pays a composite rate of around $128 per dialysis treatment, up to three times a week per patient.
- Injectable drugs are reimbursed separately based on the quantity administered.

the Market for Dialysis

Market dominated by for-profit chains like DaVita and Fresenius, controlling over 60% of facilities and earning 90% of revenue.
Advantages of Dialysis Chains:

- Potential lower costs due to volume discounts and centralized services.
- Stronger bargaining position with commercial insurance companies.

Standardization and Operation Manuals:

- Chains implement firm-wide standards and operation manuals.

Quality Concerns:

- filthy or unsafe conditions, excessive use of injectable drugs, and potential discouragement of kidney transplants.
- Lawsuits against providers and scrutiny by regulatory bodies.

Data

Patient- and facility-level data from the United States Renal Data System (USRDS). Patient Data:

- includes demographic information, cause of ESRD, comorbidities, residential ZIP Code, facility of treatment, mortality data, transplant status, and waitlist status.

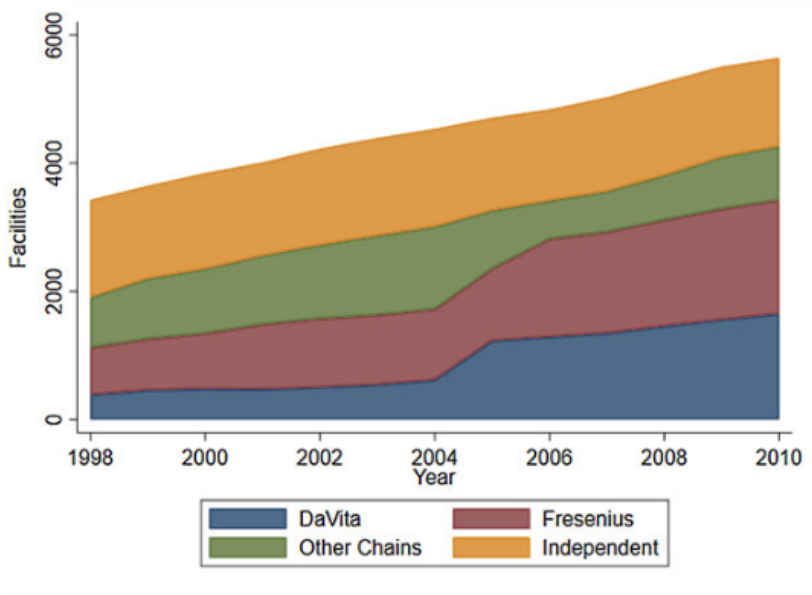
Facility Data:

- Includes facility ID, address, chain affiliation, labor inputs, number of dialysis stations, for-profit status, and types of treatment offered.

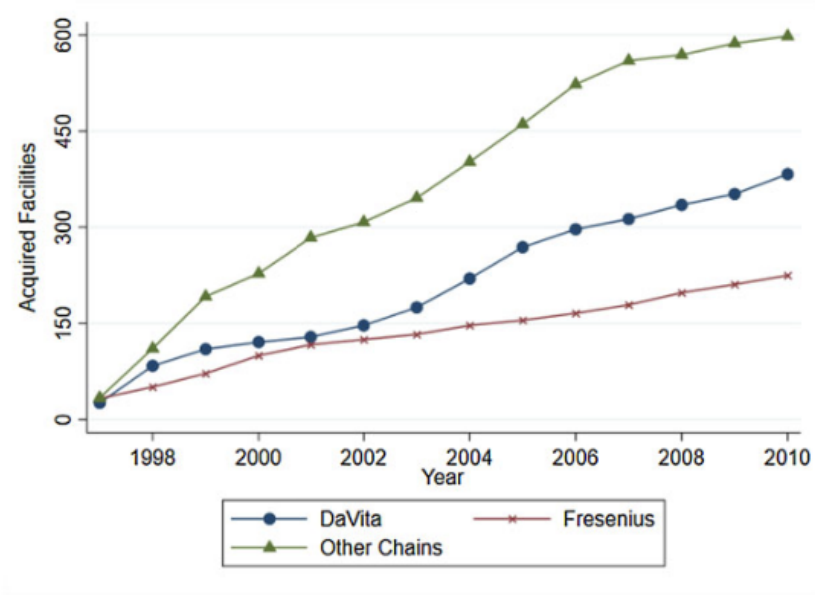
Acquisition Data:

- Precise acquisition dates obtained from Provider of Service files and annual cost reports submitted to CMS.

Descriptive Statistics



(A) Market Evolution, 1998–2010



(B) Acquisitions by Major Chains, 1998–2010

FIGURE I

Dialysis Market Evolution and Facility Acquisitions by Major Chains over Time

Descriptive Statistics

TABLE I

PATIENT AND TREATMENT DESCRIPTIVE STATISTICS BY FACILITY TYPE

	Always independent	Preacquisition	Postacquisition	Always chain
Clinical characteristics				
GFR	7.92	7.74	7.99	7.71
Hemoglobin	7.68	7.67	7.73	7.56
Atherosclerotic heart disease (%)	5.74	7.18	4.76	4.77
Peripheral vascular disease (%)	13.44	14.33	12.53	11.47
Ischemic heart disease (%)	17.25	20.58	14.84	13.75
Congestive heart failure (%)	31.07	32.04	30.29	28.56
Demographics				
Male (%)	53.87	53.18	52.93	52.15
Non-Hispanic white (%)	48.56	53.42	44.41	40.44
Black (%)	32.30	30.65	36.23	39.98
Hispanic (%)	13.06	10.03	13.79	14.77
Asian (%)	3.33	2.57	2.62	2.41
Other race (%)	5.61	5.33	4.91	4.52
Age (years)	64.31	64.53	64.02	63.38
Months with ESRD	35.83	31.75	37.06	36.88
Distance (miles)[a]	4.93	5.36	5.11	5.00
Area Demographics				
% 18–24 with only high school	31.79	33.24	33.19	32.90
% 18–24 with only bachelors	9.10	7.81	7.46	7.76
Median income ($)	50,404.87	48,202.46	47,441.34	47,637.76
Facility characteristics				
Facility age (years)	14.08	12.02	10.10	13.86
Facility elevation (feet)	195.54	198.65	211.42	192.58
For-profit (%)	40.99	64.09	96.40	88.70
Patient health				
Predicted mortality (%)	1.03	1.07	1.06	1.17
Treatment				
EPO per session ('000 IUs)	4,495.66	4,728.87	6,223.04	6,259.82
Venofer per session (mg)	7.95	7.60	15.93	14.86
Ferrlecit per session (mg)	6.49	7.22	4.65	4.86
Payments per session	179.22	171.79	184.58	183.15
Waitlist or transplant[b] (%)	10.92	9.63	9.76	9.52
Patient-months	2,880,503	1,483,917	1,960,286	7,836,538
Incident patients	235,144	142,815	126,582	400,161

Descriptive Statistics

No systematic differences across facility types for many attributes.
Treatment Disparities:

- Patients at chain-owned facilities receive more EPO per session and are more likely to receive Venofer than Ferrlecit.
- Payments per session increase by about 7% at facilities acquired by a chain.

Descriptive Statistics

TABLE II

FACILITY SUMMARY STATISTICS

	Always independent	Preacquisition	Postacquisition	Always chain
Stations	14.30	16.63	18.39	17.92
	(8.63)	(7.82)	(8.13)	(7.39)
Hemodialysis (%)	89.90	91.69	92.36	94.22
	(19.25)	(15.92)	(14.76)	(13.06)
Privately insured (%)	6.52	7.43	6.66	6.79
	(6.17)	(5.85)	(4.12)	(5.38)
Nurses	5.61	5.14	4.23	3.70
	(4.06)	(3.76)	(2.63)	(2.26)
Technicians	4.95	6.20	6.65	6.22
	(5.09)	(4.77)	(4.53)	(4.12)
Nurses/techs	1.62	1.08	0.77	0.72
	(2.21)	(1.17)	(0.70)	(0.59)
Patients/employee	4.14	4.75	5.84	5.52
	(2.76)	(2.14)	(2.09)	(2.34)
Has night shift (%)	24.85	23.85	23.88	18.47
	(43.22)	(42.62)	(42.64)	(38.81)
For-profit (%)	35.15	66.48	94.12	88.10
	(47.75)	(47.21)	(23.53)	(32.37)
Facility elevation (feet)	251.24	205.88	209.83	229.52
	(359.41)	(242.46)	(282.05)	(342.04)
Facility age (years)	12.93	9.11	9.74	10.98
	(9.71)	(8.61)	(7.11)	(8.50)
Facility-years	7,824	4,063	4,137	16,459

Notes. An observation is a facility-year. Standard deviations are in parentheses.

chain-owned facilities:

- substitute toward lower-cost technicians and away from higher-cost nurses
- treating more patients per employee.

THE IMPACT OF ACQUISITIONS

difference-in-differences research design that compares independent facilities acquired by chains to those that are never acquired:

$$Y_{ijt} = \beta_{pre} D_{jt}^{Pre} + \beta_{post} D_{jt}^{post} + \beta_{chain} D_{jt}^{chain} + \alpha X_{ijt} + \epsilon_{ijt}$$

- Y_{ijt} is the outcome of interest for patient i at facility j in month t;
- D_{pre} and D_{Post} are indicators for whether facility j in month t will be acquired in the future or has already been acquired;
- D_{Chain} is an indicator for whether facility j is always owned by a chain.

To avoid measurement error in the date of acquisition and to allow enough time for a firm's strategy to be fully implemented, exclude all observations within a six-month window on either side of the acquisition date.

Identification Threats and Remedies

Primary Threat to Identification:

- Chains may acquire independent facilities with patients having characteristics affecting outcomes through channels unrelated to ownership change.

Overcoming Identification Challenges:

- Patients treated at acquired independent facilities are not systematically different along observable characteristics.
- Richness of data allows control for clinically relevant covariates

the Effect of Drug Doses

TABLE III

ACQUISITION EFFECTS ON DRUG DOSES

	Epogen (1)	Epogen (2)	Ferrlecit (3)	Ferrlecit (4)	Venofer (5)	Venofer (6)
Preacquisition	0.270*		−0.0188		0.0650	
	(0.124)		(0.0558)		(0.0604)	
Postacquisition	1.350***	0.829***	−0.351***	−0.303***	0.784***	0.612***
	(0.0822)	(0.0725)	(0.0466)	(0.0627)	(0.0555)	(0.0751)
Always chain	1.343***		−0.335***		0.722***	
	(0.0775)		(0.0391)		(0.0454)	
Observations	14,161,244		12,473,162		11,595,400	
Dep. var. mean	7.538		0.589		1.337	
Units	log(IU)		log(mg)		log(mg)	
Year × month FE	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Facility FE		X		X		X

- substantial increase in EPO usage
- switch from Ferrlecit to Venofer for more profit

the Effect of Drug Doses

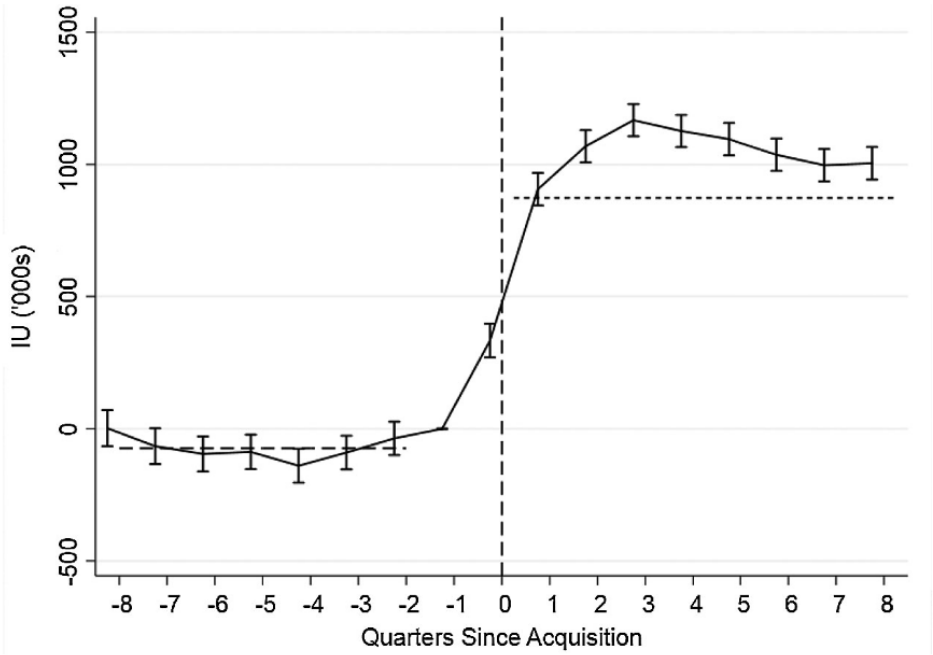


FIGURE II

EPO Dosing Dynamics at Acquired Firms

$$Y_{ijt} = \sum_s \delta^s D^s_{jt} + \alpha X_{ijt} + \epsilon_{ijt}$$

where D^s_{jt} is a dummy for facility j being acquired at time $t + s$

the Effect on Facility Input

facility-year level: $Y_{ijt} = \gamma^{Post} D_{jt}^{Post} + \delta X_{jt} + \nu_{jt}$

TABLE IV

ACQUISITION EFFECTS ON FACILITY INPUT CHOICES

	Nurses (1)	Technicians (2)	HD patients (3)	Total stations (4)	Nurses per tech (5)	Patients per employee (6)	Patients per station (7)	Employees per station (8)
Postacquisition	−0.0204	0.0456*	0.134***	0.0210	−0.146***	0.599***	0.179*	−0.0289
	(0.0194)	(0.0230)	(0.0187)	(0.0410)	(0.0410)	(0.107)	(0.0825)	(0.0185)
Observations	24,868	24,868	42,944	43,046	23,217	24,868	43,046	24,868
Dep. var. mean	1.548	1.703	61.554	18.574	0.969	5.129	3.992	0.814
Units	log(FTE)	log(FTE)	log(Patients)	log(Stations)	—	—	—	—
Year FE	X	X	X	X	X	X	X	X
Facility FE	X	X	X	X	X	X	X	X

upon acquisition, to reduce cost:

- switch from nurses to technicians
- higher patients per employee, patients per station

the Effect on Patient Outcome

TABLE V

ACQUISITION EFFECTS ON OUTCOMES

	URR Good (1)	Hgb Good (2)	Hgb High (3)	Hospitalized any cause (4)	Payments per session (5)
Postacquisition	0.0183***	−0.0266**	0.0382***	0.00599***	0.0665***
	(0.00496)	(0.00825)	(0.00899)	(0.00170)	(0.00617)
Observations	14,161,244	13,271,104	13,271,104	14,161,244	14,161,243
Dep. var. mean	0.881	0.523	0.382	0.141	5.150
Units	percentage points	percentage points	percentage points	percentage points	log($)
Year × month FE	X	X	X	X	X
Pat. & fac. controls	X	X	X	X	X
Facility FE	X	X	X	X	X

- Higher Hgb due to larger EPO usage
- increased hospitalization, especially for septicemia and cardiac events
- increased Medicare expenditure

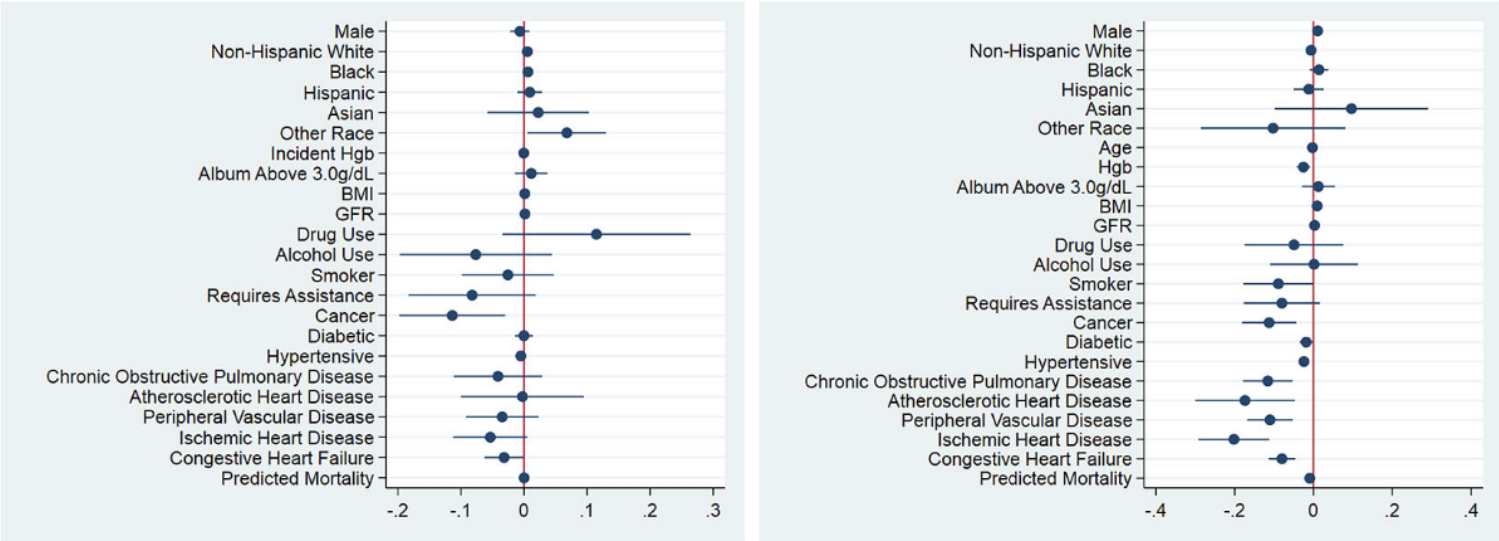
the Effect on Patient Outcome

TABLE VI

ACQUISITION EFFECTS ON TRANSPLANTS AND MORTALITY

	Waitlisted or transplanted within:		Survives for:	
	365 days (1)	730 days (2)	365 days (3)	730 days (4)
Postacquisition	−0.0108*	−0.0188*	−0.0127**	−0.0174**
	(0.00468)	(0.00738)	(0.00476)	(0.00654)
Observations	610,955	498,056	539,487	457,184
Dep. var. mean	0.127	0.208	0.746	0.597
Units	percentage points	percentage points	percentage points	percentage points
Year FE	X	X	X	X
Pat. & fac. controls	X	X	X	X
Facility FE	X	X	X	X

the Effect on Patient Selection



(A) Monthly Patients (B) New Patients

FIGURE III

Changes in Patient Mix after Acquisition

$$X_{ijt} = \beta^{Post} D_{jt}^{Post} + \gamma_j + \delta_t + \epsilon_{ijt}$$

facilities treating healthier patients: new patients at acquired facilities are less likely to have a variety of comorbid conditions

THE EFFECT OF COMPETITION ON FIRM BEHAVIOR

- investigate whether competition from other dialysis firms can discipline the behavior of newly acquired facilities
- defines markets as HSAs (hospital service areas)
- uses a Herfindahl-Hirschman Index (HHI) to measure concentration
- define *post-acquisition HHI* as what the HSA's HHI would have been in the month before acquisition had the facility already been acquired, to avoid confounding the effect of acquisition with the entry of new dialysis facilities.

Change on Market Concentration

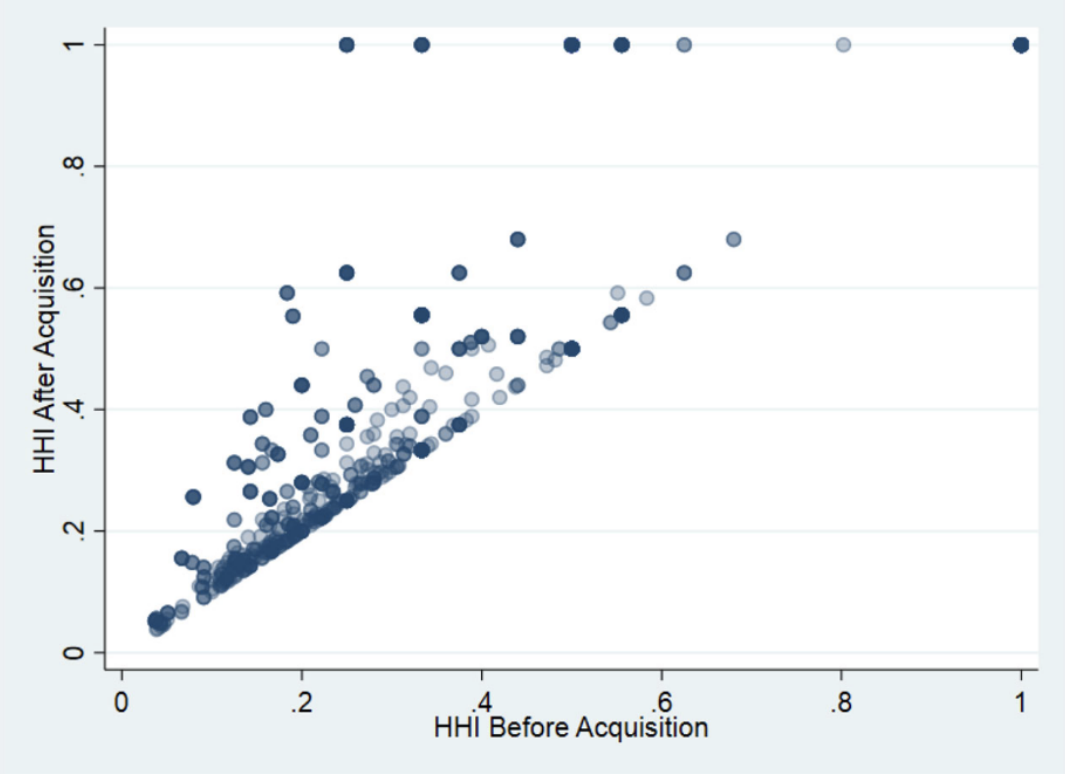


FIGURE IV

Changes in Concentration across Markets

- HHI increases in only 34.4% of HSA-months following an acquisition
- changes in facility behavior and patient outcomes are not driven by changes in market concentration

Acquisitions That Increase HHI Have Similar Effects

TABLE VII

ACQUISITION EFFECTS BY CONCENTRATION INCREASE: HSA MARKETS

	Drugs			Clinical outcomes			Hospitalized
	Epogen	Venofer	Ferrlecit	Hgb high	Hgb good	URR good	Any cause
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Postacquisition	0.808***	0.553***	−0.286**	−0.0313**	−0.0123*	0.0174*	0.00800**
	(0.0752)	(0.123)	(0.100)	(0.0112)	(0.00533)	(0.00708)	(0.00250)
Postacquisition × increases HSA HHI	−0.0486	0.0891	−0.0267	0.00747	0.00120	0.00156	−0.00318
	(0.0823)	(0.151)	(0.124)	(0.0153)	(0.00614)	(0.00893)	(0.00324)
Patient-months	14,161,244	11,595,400	12,473,162	13,271,104	13,271,104	14,161,244	14,161,244
Units	log(UI)	log(mg)	log(mg)	percentage points	percentage points	percentage points	percentage points
Pat. & fac controls	X	X	X	X	X	X	X
Year × month FE	X	X	X	X	X	X	X
Facility FE	X	X	X	X	X	X	X

$$Y_{ijt} = \beta_{Post} D_{jt}^{Post} + \gamma_{Post} D_{jt}^{Post} \times IncreasesHHI_j + \alpha X_{ijt} + \epsilon_{ijt}$$

- the outcomes in markets where an acquisition increased concentration do not differ from those where an acquisition did not
- therefore, the decrease in quality of care occurs through the transference of firm strategy, not an increase in market power.

Why Competition Does Not Discipline Provider Behavior

TABLE VIII

EFFECT OF ACQUISITION ON FACILITY SWITCHING

	All		First year	
	Any (1)	Never return (2)	Any (3)	Never return (4)
Postacquisition	−0.000707	−0.000467	−0.000384	−0.000300
	(0.000507)	(0.000454)	(0.000847)	(0.000772)
Observations	13,898,240	13,898,240	3,416,860	3,416,860
Dep. var. mean	0.016	0.013	0.024	0.020

- standard models of competition with endogenous provider quality predict that quality will increase with competition, assuming that demand increases with product quality
- In practice, patient demand in the U.S. dialysis market does not respond to the decline in quality following an acquisition
- may be due to a lack of options and travel cost

PREACQUISITION DIFFERENCES ACROSS CHAIN AND INDEPENDENT FACILITIES

why independent facilities do not imitate the behavior of the more profitable chain facilities before acquisition?
estimate the impact of an acquisition on total variable profits per dialysis session and several variables related to EPO

$$Y_{jt} = \beta_{pre} D_{jt}^{Pre} + \beta_{post} D_{jt}^{post} + \beta_{chain} D_{jt}^{chain} + \alpha X_{jt} + \epsilon_{jt}$$

PREACQUISITION DIFFERENCES ACROSS CHAIN AND INDEPENDENT FACILITIES

TABLE IX

EFFECT OF CHAIN ACQUISITION ON PROFIT MEASURES

	Variable profits per session (1)	EPO margin (2)	EPO cost per 1,000 IUs (3)	EPO units per session (4)	Total EPO costs (5)
Preacq	1.360	−0.581	−0.371**	222.5	−0.451
	(2.497)	(1.652)	(0.141)	(204.1)	(1.723)
Postacq	18.17***	7.851***	−1.237***	778.8***	0.965
	(2.205)	(1.334)	(0.145)	(171.9)	(1.464)
Always chain	22.16***	7.975***	−1.340***	812.2***	0.745
	(2.344)	(1.626)	(0.156)	(193.4)	(1.724)
Constant	30.60***	1.113	9.190***	3,835.8***	35.36***
	(3.704)	(3.399)	(0.205)	(265.7)	(2.833)
Year FE	X	X	X	X	X
State FE	X	X	X	X	X
Observations	25,934	25,934	25,934	25,934	25,934
Post – pre	16.81	8.432	−0.866	556.3	1.416
p-value	[.000]	[.000]	[.000]	[.000]	[.0720]
Always chain – post	3.993	0.123	−0.103	33.42	−0.220
p-value	[.002]	[.880]	[.000]	[.732]	[.806]

PREACQUISITION DIFFERENCES ACROSS CHAIN AND INDEPENDENT FACILITIES

Profit Composition at Acquired Facilities:

- Majority of per-session profit increase at acquired facilities attributed to EPO.
- Chains pay lower prices for EPO due to negotiated volume discounts with drug suppliers– scale economies from buyer power not available to smaller independent facilities.

Objectives and Incentives:

- Chains may prioritize financial performance over patient outcomes.

Risks and Financial Reserves:

- Chains may accept risks on patient care due to financial reserves to cover litigation costs, highlighted by instances of large settlements by chains like DaVita.

Conclusion

Changes in Behavior at Acquired Facilities:

- Increase per-session reimbursements from Medicare by elevating drug doses and shifting to more lucrative drugs.
- Optimize resource utilization by treating more patients with the same staff and stations.
- Cut costs by replacing high-skill nurses with lower-skill technicians.

Effect on Patient Outcomes:

- Quality of care declines at acquired facilities
- Medicare spending increases

Conclusion

Policy Implications:

- Current antitrust laws may not address the harmful effects of acquisitions that impact care quality rather than market concentration.
- Policies like certificate of need laws and reimbursement structures could inadvertently drive consolidation.

Broader Applications and Future Research:

- Lessons from dialysis industry acquisitions applicable to other healthcare and education sectors.