How Acquisitions Affect Firm Behavior and Performance: Evidence from the Dialysis Industry

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Motivation

- Concentration through mergers and acquisitions
  - Lower costs and better patient outcomes vs. Higher prices and lower quality
- Literature has focused on how mergers affect prices through change in market power.
- Less work has examined the precise channels through which mergers lead to changes in outcomes.

Research objective: How large chains transfer their corporate strategies to the independent facilities they acquire in U.S. dialysis industry.

- Dialysis is a fairly standardized treatment that allows for a direct comparison.
- The dialysis industry has become increasingly concentrated: Two largest corporations, DaVita and Fresenius, own more than 60% of facilities.

U.S. Dialysis Industry

- Dialysis: a medical procedure that cleans blood of patients suffering from end-stage renal disease (ESRD).
- Although a kidney transplant is considered the best treatment, it is often not possible.
- In addition to dialysis, most ESRD patients receive treatment for anemia.
- Anemia is treated with a cocktail of injectable drugs, EPOGEN (EPO), along with an iron analog, such as Venofer or Ferrlecit.
- A dialysis facility's quality measure: clinical indicator and patient outcomes.
  (1) Urea reduction ratio (URR) and hemoglobin (Hgb) levels.
  (2) Mortality and hospitalization.

U.S. Dialysis Industry

- All ESRD patients become eligible for Medicare coverage, regardless of age.
- Medicare paid a composite rate of $128 per dialysis, up to 3 times a week.
- For injectable drugs, providers were reimbursed separately on a fee-for-service basis depending on the quantity of drug administered.
- Administering EPO proved lucrative for providers, accounting for 25% of DaVita's revenue.
- Venofer and Ferrlecit are substitutable, but facilities could effectively receive higher reimbursements per vial for Venofer.

Preview of the Main Results

- Acquired facilities alter their treatments in ways that increase reimbursement and decrease costs.
  (1) Patients' EPO doses increase 129% at independent facilities acquired by large chains.
  (2) The facilities increase use of Venofer relative to Ferrlecit that offers lower reimbursements.
  (3) Large chains replace high-skill nurses with lower-skill technicians at the facilities.
  (4) Facilities increase the patient load of each employee by 11.7% and increase the number of patients by 4.5%, potentially reducing the quality of care.
- Patients at acquired facilities are 4.2% more likely to be hospitalized in a given month.
- Survival rate for new patients fall by 1.3-2.9%.
- New ESRD patients are 8.5% less likely to receive a kidney transplant.
- Patients are 5.1% less likely to have Hgb levels within the recommended range.
- Patients become 1.8% more likely to have adequate URR.

Data

- Patient- and facility-level data from the United States Renal Data System (USRDS).
- Treatment history for almost all dialysis patients since 1991.
- Detailed data on dialysis facilities come from the Annual Facility Survey.

Summary Statistics

TABLE I
PATIENT AND TREATMENT DESCRIPTIVE STATISTICS BY FACILITY TYPE

	Always Independent	Pre-Acquisition	Post-Acquisition	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 (Mi.)[b]	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 (ft.)	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 IU's)	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[a] (%)	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

Empirical Models

A. *Patient-Level Analysis*

$$Y_{ijt} = \beta^{\text{Pre}} D_{jt}^{\text{Pre}} + \beta^{\text{Post}} D_{jt}^{\text{Post}} + \beta^{\text{Chain}} D_{jt}^{\text{Chain}} + \alpha X_{ijt} + \epsilon_{ijt} \quad (1)$$

Y_{ijt} : outcome of interest for patient i at facility j in month t

X_{ijt} : facility and patient controls & year, month, and facility fixed effects

- Note that when including facility fixed effects, β^{Pre} and β^{Chain} are absorbed.

Result: Drug Doses

TABLE III
ACQUISITION EFFECTS ON DRUG DOSES

	(1) Epogen	(2) Epogen	(3) Ferrlecit	(4) Ferrlecit	(5) Venofer	(6) Venofer
Pre-Acquisition	0.270*		-0.0188		0.0650	
	(0.124)		(0.0558)		(0.0604)	
Post-Acquisition	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 x Month FE	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Facility FE		X		X		X

Result: Drug Doses

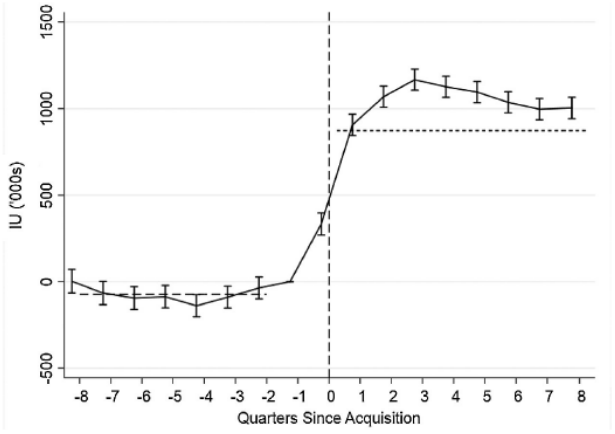

FIGURE II

EPO Dosing Dynamics at Acquired Firms

Empirical Models

B. *Facility-Level Analysis*

$$Y_{jt} = \gamma^{\text{Post}} D_{jt}^{\text{Post}} + \delta X_{jt} + \nu_{jt} \tag{2}$$

Y_{ijt} : outcome of interest for facility j in month t

X_{ijt} : facility controls & year and facility fixed effects

Result: Facility Input Choices

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

Notes. Facility-clustered standard errors in parentheses. An observation is a facility-year. Sample includes facilities involved in an independent-to-chain acquisition and facilities that are independent or owned by the same chain for the entirety of our sample. We drop observations in the year of acquisition. FTE are full-time equivalents. *, **, and *** indicate significance at the 5%, 1%, and 0.1% levels, respectively.

Result: Patient Outcomes

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

Notes. Facility-clustered standard errors in parentheses. An observation is a patient-month. Hemoglobin specifications have different observations because it is not submitted with non-ESA claims for some of our sample. Sample includes hemodialysis patients who have complete covariates and are treated at facilities involved in an independent-to-chain acquisition or that are independent or owned by the same chain for the entirety of our sample. We drop observations within six months of the month of acquisition. Payments are winsorized at the 99th percentile. *, **, and *** indicate significance at the 5%, 1%, and 0.1% levels, respectively.

Result: Patient Outcomes

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

Notes. Estimates from OLS regression. Facility-clustered standard errors in parentheses. An observation is a new dialysis patient. Sample includes new patients starting dialysis at facilities involved in an independent-to-chain acquisition or that are independent or owned by the same chain for the entirety of our sample. For the mortality specifications we drop any patients who start dialysis at facilities acquired within six months of acquisition. We only include those patients who remain at their original facility until death or the end of the observation window. *, **, and *** indicate significance at the 5%, 1%, and 0.1% levels, respectively.

The Effect of Competition on Firm Behavior

- With the price fixed by Medicare, facilities may compete for patients by offering higher-quality treatments.
- Such competition may prevent the acquirer from implementing its strategy to increase profits.
- To investigate the effect, define markets as hospital service areas (HSAs) and use a Herfindahl-Hirschman Index (HHI) to measure concentration.
- Results show that market concentration does not mitigate the transference of firm strategy.
- A key reason is that patients rarely respond to differences in quality.

Result: Acquisition Effect by Concentration

TABLE VII
ACQUISITION EFFECTS BY CONCENTRATION INCREASE: HSA MARKETS

	Drugs			Clinical Outcomes			Hospitalized
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Epogen	Venofer	Ferrlecit	HGB High	HGB Good	URR Good	Any Cause
Post-Acquisition	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)
Post-Acquisition ×	-0.0486	0.0891	-0.0267	0.00747	0.00120	0.00156	-0.00318
Increases HSA HHI	(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)	pp	pp	pp	pp
Pat. & Fac Controls	X	X	X	X	X	X	X
Year x Month FE	X	X	X	X	X	X	X
Facility FE	X	X	X	X	X	X	X

Conclusion

1. Acquisitions lead to clear changes in firm strategy that substantially worsen the quality of care received by patients and increase the cost of care borne by Medicare.
2. Current antitrust statutes may do little to prevent the harmful effects of these acquisitions.
3. Well-designed payment system is important for controlling health care costs and improving patient outcomes.
    - For example, the Quality Incentive Program initiated in 2012 allows Medicare to penalize providers that fail to meet certain quality standards.