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RESEARCH ARTICLE

Predictors of Chain Acquisition among Independent Dialysis Facilities

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Objective. To determine the predictors of chain acquisition among independent dialysis providers.
Data Sources. Retrospective facility-level data combined from CMS Cost Reports, Medical Evidence Forms, Annual Facility Surveys, and claims for 1996–2003.
Study Design. Independent dialysis facilities' probability of acquisition by a dialysis chain (overall and by chain size) was estimated using a discrete time hazard rate model, controlling for financial and clinical performance, practice patterns, market factors, and other facility characteristics.
Data Collection. The sample includes all U.S. freestanding dialysis facilities that report not being chain affiliated for at least 1 year between 1997 and 2003.
Principal Findings. Above-average costs and better quality outcomes are significant determinants of dialysis chain acquisition. Facilities in larger markets were more likely to be acquired by a chain. Furthermore, small dialysis chains have different acquisition strategies than large chains.
Conclusions. Dialysis chains appear to employ a mix of turn-around and cream-skimming strategies. Poor financial health is a predictor of chain acquisition as in other health care sectors, but the increased likelihood of chain acquisition among higher quality facilities is unique to the dialysis industry. Significant differences among predictors of acquisition by small and large chains reinforce the importance of using a richer classification for chain status.

Key Words. Chain acquisition, end-stage renal disease, dialysis, Medicare

The last two decades have seen dramatic growth in the size and number of chain organizations in several health care sectors, including hospitals, nursing homes, and outpatient kidney dialysis facilities (Banaszak-Holl et al. 2002; Cuellar and Gertler 2003; U.S. Renal Data System 2008). In particular, chain-affiliated dialysis centers increased from 14 percent of the market in 1988 to 66 percent in 2006 (U.S. Renal Data System 2005; 2008). The rationale for this growth includes a variety of potential economic benefits of chain membership (e.g., improved resource allocation, standardization of services, increased market power, and presence) that promote higher quality and lead to economies of scale and scope (Pautler 2003). Nonetheless, concerns have been raised regarding reductions in competition and removal of local control.

The financial benefits associated with chain membership may be especially salient in the payment environment faced by dialysis providers. Because almost all dialysis patients become Medicare eligible after their first 90 days of dialysis,[1] Medicare pays for the vast majority of dialysis sessions. Medicare uses a mixed payment methodology for dialysis-related services, the majority of which is a prospective payment covering a specified bundle of services with a cap on the number of weekly sessions. The payment rate has received only minor updates since being introduced in 1983.[2] The remaining payment covers items that dialysis facilities are allowed to bill on a fee-for-service basis separately from the prospective bundle, primarily injectable medications and laboratory tests. The average Medicare payment per dialysis session was U.S.$202 in 2000, U.S.$125 of which was prospectively paid (Hirth et al. 2003).

Acquisition by a chain may yield several direct financial benefits for both the acquired facility and acquiring chain. Facilities gain access to the chain's volume discounts for medications; this is particularly important in the context of Epogen (EPO), a synthetic form of the hormone erythropoietin used to treat anemia (Medicare Payment Advisory Commission 2002), manufactured solely by Amgen (Thamer et al. 2007).[3] Facilities also gain access to the chain's centralized clinical laboratories, presenting another opportunity for financial gain relative to performing low volumes of laboratory work or sending such work to nonaffiliated labs. Meanwhile, by spreading fixed costs (e.g., medical records systems) across more patients, the chain may also benefit from new acquisitions if the average cost faced by chain-affiliated facilities falls. With a larger total patient base, the chain may be able to offer additional services (e.g., one chain-affiliated facility may serve all of the chain's peritoneal dialysis patients in the market).[4] This joint production of different dialysis modalities translates to economies of scope and more treatment options for the patient. Less direct benefits include accessing the chain's skill at improving care through best practice guidelines and advanced information systems.

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Conversely, several factors may counter the potential benefits of acquisitions from the chain's perspective. A facility owner may have local capabilities (e.g., long-standing relationships with patients, staff, and area providers) that cannot readily be transferred to outside owners. Independent ownership also may reduce the difficulty in monitoring staff performance, and owner/managers may have stronger incentives for efficiency. From the independent facility owner's perspective, the loss of autonomy might outweigh the benefits of affiliating with a chain.

From a broader societal perspective, the primary policy concerns regarding chain growth are increases in market concentration and accompanying decreases in patient choice. In 2006, 60 percent of dialysis patients received care from a facility owned by one of the two largest chains (U.S. Renal Data System 2008). Furthermore, mergers during 2004 through 2006 consolidated the six largest chains into just two (U.S. Renal Data System 2008).

Additionally, chains may overcharge if they gain monopoly power. Demand for dialysis-related care is fairly price inelastic because the only alternatives are kidney transplantation or hospice. These monopolies may earn positive economic profits by demanding prices above costs from payers other than Medicare who cannot mandate payment ceilings. In 1999, Gambro, the second largest dialysis provider at the time, was accused of implementing this type of price discrimination after acquiring six dialysis facilities in western Michigan (Taylor 1999). Shortly after the acquisitions, Gambro enacted noncompete clauses and exclusive contracts with area nephrologists, followed by a nearly five-fold increase in prices charged to private insurers. Meanwhile, Gambro facilities in similar geographical areas without monopoly control did not alter their price structures. Even in the Medicare market where prices are fixed, nonprice competition is relevant as dialysis facilities may be able to exploit market power by decreasing services or amenities to increase profits (Held and Pauly 1983), or by reducing choices available to patients regarding both clinical and nonclinical aspects of care.

Despite the continued growth of chains in the dialysis industry and their potential effects on cost, quality, and price, little research has examined factors associated with chain acquisition. Therefore, this article attempts to answer the following questions:

- What characteristics make an independent dialysis facility a more likely target for acquisition by a chain?
- Do small and large chains target different types of independent dialysis facilities for acquisition?

- Are predictors of chain acquisition among dialysis providers similar to predictors of chain acquisition in other health care sectors (i.e., nursing homes and hospitals)?

PREVIOUS RESEARCH

Chain acquisitions have been well studied in other health care sectors. Among the motives for acquisition, many studies support a "turn-around" theory regarding acquisition strategy. Using hospital financial conditions to predict their likelihood of acquisition by a chain, McCue and Furst (1986) and Menke (1997) found that chains purchased hospitals that were financially distressed. Phillips (1999) found similar results for nonprofit hospitals acquired by for-profit chains, and financial uncertainty was also a reason cited in Blumenthal and Weissman's (2000) case study of three teaching hospitals purchased by for-profit chains. More recently, Sloan, Ostermann, and Conover (2003) found that low profit margin was an important antecedent to hospital ownership conversion.

In the nursing home sector, Banaszak-Holl et al. (2002) found that homes with more health deficiencies are more likely to be acquired by chains than those with better quality indicators. Although perhaps less applicable to the dialysis industry than results based on other health care sectors, Danzon, Epstein, and Nicholson (2004) also found financial trouble (i.e., low expected growth rate of earnings) to be a precursor to mergers among pharmaceutical companies.

Research on the dialysis industry has also used chain status to predict such outcomes as cost, practice patterns, and quality, and it can provide some guidance as to the factors that may predict acquisition by a chain. Most studies measure chain status as a binary characteristic, rather than allowing for differences between large and small or national and regional chains, and have reported insignificant chain effects or only cursorily discussed chain effects (Schlesinger, Cleary, and Blumenthal 1989; Griffiths et al. 1994; Hirth, Chernew, and Orzol 2000). Research using richer definitions of chain affiliation (e.g., chain size) has found significant differences between chains and independent dialysis facilities and among chain types in impact on economies of scale, costs, and efficiency. Using seven classes of chain affiliation, Dor, Held, and Pauly (1992) found that all but one of the larger chains had lower costs than chains with fewer units, and Hirth et al. (1999) also reported differences in costs between large and small chains. Similarly, Ozgen and Ozcan (2002) observed significant differences in efficiency across six chain categories compared with independent providers. Finally, Thamer et al. (2007) found marked differences in EPO utilization across the six major chains and in chains relative to independents.

Research on other health care industries also reveals significant differences when chain status is modeled as a multicategory variable. For example, Tennyson and Fottler (2000) found a significant association between chain affiliation and hospital financial performance when differentiating between national and regional hospital systems; the association was insignificant when a binary variable for chain status was used instead. Within the nursing home literature, Banaszak-Holl et al. (2002) found significant differences between three levels of chain size and the number of nursing home residents with pressure ulcers. Together, these findings suggest that using a simple binary variable for chain affiliation is inadequate and may bias results.

Conceptual Framework

Assuming that both the dialysis chain and the independent dialysis facility are profit maximizers, each will decide whether or not to engage in a chain acquisition. The independent facility's owners will set a minimum price (P_{f}) that they are willing to accept from a chain. P_{f} reflects the net present value (NPV) of the facility's expected cash flows, discounted at interest rate r_{f} over time i:

$$\mathrm{NPV}_{\mathrm{f}} = \sum_{i=1}^{\infty} (\mathrm{Revenue}_{i\mathrm{f}} - \mathrm{Cost}_{i\mathrm{f}})/(1 + r_{\mathrm{f}})^{i} = P_{\mathrm{f}} \tag{1}$$

The chain will set a maximum price (P_{c}) that it is willing to offer to the facility. P_{c} reflects the NPV of the facility's profit under the chain's ownership, discounted at interest rate r_{c} over time i:

$$NPV_{\mathrm{c}} = \sum_{i=1}^{\infty} (\mathrm{Revenue}_{i\mathrm{c}} - \mathrm{Cost}_{i\mathrm{c}})/(1 + r_{\mathrm{c}})^{i} = P_{\mathrm{c}} \tag{2}$$

A chain acquisition will occur only when $P_{\mathrm{c}} > P_{\mathrm{f}}$, which is necessary for the existence of an acquisition price that benefits both the buyer and the seller. In other words, an "event" (i.e., acquisition by a chain) will occur only when both firms expect an economic gain, regardless of chain size. However, chain size may affect aspects of the relative value of an acquisition (e.g., joining a larger chain may result in greater volume purchasing discounts).

Under a "turn-around" strategy, the chain perceives the facility to be underperforming (i.e., Cost_{if} in equation (1) is too high); accordingly, the chain will increase the facility's profitability by reducing cost post acquisition. Alternatively, "cream skimming" implies that chains perceive the facility to be well-performing and will focus on increasing revenue streams (i.e., Revenue_{ic} in equation [2]) post acquisition to increase the facility's profitability. That is, although both strategies result in increased profitability post acquisition, turn around focuses on reducing inefficient costs whereas cream skimming focuses on improving revenues.

The decision to sell is relatively straightforward when owners are passive investors motivated by financial gain, but it may become complicated by nonprofit ownership of a minority of facilities and nonfinancial issues for owners actively involved in the operations of the facility who do not want to give up control in the facility's day-to-day operations or want to reduce their work hours (Riley and McGraw-Walsh 2006). Nonpecuniary issues are largely unobservable in our data and may reduce the rate of acquisitions in our data.

Data and Methods

Data Sources

Chain affiliation, financial characteristics, practice patterns, market factors, payer mix, and facility size were collected from Medicare cost reports for freestanding dialysis facilities (Form CMS-265-94) submitted for 1996–2003. The Annual Facility Survey (Form CMS-2744) provided facility age, geographical setting, ownership type, and market factors. Medicare physician/supplier and institutional claims and Medical Evidence Forms (Form CMS-2728) were used to calculate patient characteristics and clinical outcomes at each facility, and data from the National Conference of State Legislatures' (NCSL) website was used to determine which states had certificate of need (CON) laws (NCSL 2009). Kidney Epidemiology and Cost Center (2005) and CMS (2007) describe these data sources in more detail. Predictor variables were lagged 1 year to control for contemporaneous effects, and subsequently, results use only 7 years (1997–2003).

A weighted average, based on the fraction of the reporting period in each year, was used for the few cost reports that spanned two calendar years. Hospital-based facilities, comprising 17 percent of dialysis facilities in 2006 (U.S. Renal Data System 2008), were excluded because their cost reports do not provide information on chain ownership. However, these facilities were included in calculations of dialysis market characteristics.

Measures

Dependent Variable. Two specifications of the dependent variable were used. First, chain acquisition was coded as binary, with "1" indicating an independent facility acquired in that calendar year versus "0" if it remained independent. Second, acquisition was coded separately for acquisitions by "large" (i.e., one of the five largest chains) and "small" (i.e., all other chains) chains. Between 1997 and 2003, the large chains ranged in size from 104 to 1,046, and the small chains ranged in size from 2 to 90.

Independent Variables. The likelihood of an independent dialysis facility's being acquired by a chain is hypothesized to be a function of the following:

- *Facility Financial Performance.* We use a facility's efficiency, as measured by the average composite rate (CR) cost/treatment (adjusted to 2003 dollars), to test for whether poor financial performance affects likelihood of acquisition. Higher costs of delivering these prospectively paid services are expected to make acquisition more likely under a "turn around" hypothesis because of the implied opportunity for cost reduction (i.e., $Cost_{ic}$ in equation [2] will be lower post-acquisition). Facility age (years since Medicare certification) proxies for capital depreciation and may lead to a chain implementing a turnaround strategy using expertise and buying power to upgrade capital stock. Age is not an ideal measure because it can also indicate "survival" as an independent or proxy for other factors that may reduce the incentive to either acquire or sell.
- *Practice Patterns.* Two staffing practice measures were included: staffing intensity (measured as nurse-to-patient ratio) and percent of skilled labor (measured as percent of labor comprised of doctors and nurses). Facilities with a low percentage of skilled staff may be less desirable to patients and payers than those employing more nurses and doctors, but providing higher-skilled labor is more costly. Subsequently, the effect of staffing on acquisition is ambiguous. A binary variable indicating whether a facility offers only hemodialysis (i.e., does not offer peritoneal or home dialysis) was also included. Chains can "turn around" facilities with only hemodialysis by expanding the

service line to include alternative dialysis treatment options. Therefore, offering only hemodialysis is expected to make a facility a more attractive target since the chains' revenues ($Revenue_{ic}$ in equation [2]) is expected to increase post acquisition. We also included the number of dialysis stations per patient. Higher values are a measure of amenity from the patient perspective because of the potential for greater flexibility in scheduling dialysis sessions, but an inefficiency from the facility perspective because higher values imply less intensive use of a fixed input. Given these divergent viewpoints, its effect on the probability of acquisition is an empirical question. Finally, we used a binary variable indicating whether a facility reuses dialyzers. This is a cost-saving practice that also lowers quality (Fan et al. 2005; Robinson and Feldman 2005), making its expected effect on acquisition ambiguous.

- *Clinical Performance.* We used the percent of patients achieving the Kidney Disease Outcomes Quality Initiative's (K/DOQI) recommendations for anemia management (hematocrit [HCT] $\geq$ 33 percent) as a measure of clinical performance. Because diseased kidneys do not produce enough hormones to stimulate red blood cell production, anemia (low HCT) is widespread among dialysis patients. Genetically engineered EPO is an effective treatment. Coupled with the EPO's previously discussed profitability, a "turn-around" hypothesis suggests that fewer patients meeting the K/DOQI guidelines will make acquisition more likely (i.e., the chains' revenues, $Revenue_{ic}$ in equation [2], is expected to increase post acquisition).
- *Market Factors.* We controlled for market size using the number of facilities in the market (defined as the 50-mile radius around each facility's zip code) and market concentration (Herfindahl–Hirschman Index [HHI]).[5] All facilities in the market owned by the same chain were treated as one firm in the HHI calculation.

  As previously mentioned, hospital-based dialysis facilities are included in these market variable calculations. However, chain status for these facilities is unavailable until 2001, so they are treated as independents for the 1997–2000 HHI calculations. To adjust for this potential overestimate of competition, the percent of hospital-based treatments in the market was also included as a control variable.

- *Other Facility Characteristics.* Facility size (total number of dialysis treatments) was used to capture scale economies. The percent of Medicare patients was included because the price charged to private insurers is higher than the Medicare payment rate, so it is likely that chains and facilities consider the payer mix in their P_c and P_f, respectively. If chains are better at negotiating payment rates with private insurers, a higher percentage of privately insured patients will increase the likelihood of acquisition. We also controlled for preacquisition ownership status (nonprofit versus for-profit), geographic setting (rural versus urban), year, presence of CON law, and ESRD network affiliation.[6]
- *Patient Characteristics.* Covariates that control for patient population differences across facilities included average patient age, percent African American, percent in first year of dialysis, patient size (measured by the mean body surface area of patients), percent of underweight patients (measured as patients with a body mass index $< 18.5\,kg/m^2$), and the percentages of patients who are HIV positive, drug dependent, or with histories of myocardial infarction (MI), pericarditis, or peripheral vascular disease (PVD). These comorbidities and weight measures were significant predictors of facility costs in previous dialysis-related research (Kidney Epidemiology and Cost Center 2005).

Missing covariate values for single years were imputed using the facility's mean value on a measure.[7] If chain status was missing, the preceding and following years' values on the variable were compared. If they matched, the missing year was assigned that value. When the values differed, the missing year was assigned "No" for chain affiliation so that it would not be the event year. If more than two consecutive years of data were missing for a facility, values were not imputed and subsequent facility-year observations also were omitted from the sample. Results were not sensitive to the missing year imputations and methodology.

Methods

A discrete time hazard model was employed to predict the probability that a chain acquired a dialysis facility in any year between 1997 and 2003 (Allison 1982; 1995). The unit of observation was facility-year. A facility was included in the sample until it was acquired or lost to follow-up.

Predictors of acquisition by a dialysis chain were estimated using a logistic model:

$$\log\left(\frac{P_{it}}{1-P_{it}}\right) = \alpha_{it} + X_{it}\beta \tag{3}$$

in which each facility i is acquired by a chain at time t, given that it has not already been acquired. X_{it} represents the independent variables listed above. A multinomial logistic model was used to predict factors affecting acquisition by either a small or large chain. The effect of the covariates (β) was interpreted as the change in the log odds of being acquired associated with a one-unit change in the covariate. All continuous variables are standardized, so that a one-unit change in a covariate corresponds to its respective standard deviation (SD) with other covariates held at their mean.

RESULTS

Of the 3,978 unique freestanding dialysis facilities submitting cost reports during 1997–2003, 920 (23 percent) were independent at some time during that period, which would place them at risk of being acquired by a chain and eligible for inclusion in the analysis. Forty-five percent of these facilities (N= 411/920) was acquired by a chain during the study period: 166 by small chains and the remaining 245 by large chains.[8] Together, these 920 unique dialysis facilities correspond to 3,351 facility-years over the 7-year span (this does not include years post acquisition).

Table 1 provides descriptive statistics, overall and by acquisition status. Tables 2 and 3 show the multivariate results. For the two categorical covariates (network and year), odds ratios are not of particular interest because the comparison is only relative to the omitted category. Therefore, only results from the likelihood ratio tests of joint significance are reported for these two variables.

Significant Predictors of Dialysis Chain Acquisition

The results in Table 2 indicate that poor financial performance predicted acquisition. Holding other covariates constant, a U.S.$75.86 (1 SD) increase in CR cost/treatment was associated with a 25 percent increase in the odds of being acquired. Older facilities, which may have relatively out-of-date capital stock or unmeasured factors correlated with an owner's lack of desire to sell or undesirability as a target, had lower odds of acquisition. Only one of the

Table 1: Descriptive Statistics, Overall and by Acquisition

	All Independent Facilities N = 3,351		*Acquired by Chain?*	
Dialysis Facility Characteristics	*Mean or %*	*SD*	*No N = 2,940 Mean or %*	*Yes N = 411 Mean or %*
Facility financial performance				
CR cost/treatment (2003 dollar)	169.80	75.86	168.72	177.49
Facility age (years)	6.14	6.26	6.27	5.18
Practice patterns				
Staffing intensity (RN-to-pt ratio)	0.1	0.22	0.1	0.1
% Skilled labor	32	14	32	31
Stations per pt	0.3	0.22	0.3	0.29
Offer hemodialysis only (% of facilities)	53	—	53	49
Reuse dialyzers (% of facilities)	75	—	74	76
Clinical performance				
% of pts with HCT $\geq$ 33%	61	26	62	59
Market factors (market = 50-mile radius)				
HHI	2,380	1,836	2,403	2,220
Market size (treatments in 1,000s)	596	793	599	573
% HB facilities in market	15	18	15	15
Other facility characteristics				
Facility size (treatments in 1,000s)*	10.16	8.55	10.13	10.35
% Medicare treatments	74	16	74	75
For-profit (% of facilities)	89	—	89	93
Rural (% of facilities)	23	—	23	22
CON (% of facilities)	21	—	22	16
Pt characteristics				
% of pts with HIV+ diagnosis	1	5	1	2
% of pts with PVD diagnosis	40	13	40	41
% of pts with pericarditis diagnosis	2	3	2	2
% of pts with drug dependence diagnosis	2	3	2	2
% of pts with MI diagnosis	15	9	15	13
% of pts < 18 years old	0	1	0	0
% of pts 18–44 years	16	9	16	17
% of pts 45–59 years	26	9	26	25
% of pts 60–69 years	24	8	24	25
% of pts 70–79 years	24	10	24	24
% of pts 80+ years	10	7	10	9
% African American pts	29	27	29	33
% female pts	48	10	47	48
% pts underweight (BMI < 18.5 kg/m^2)	6	5	6	6
BSA	1.82	0.06	1.82	1.82
% pts in first year of dialysis	32	18	32	34

Notes. 3,351 facility-year observations correspond to 920 unique independent facilities, which can appear up to seven times (1997–2003) in the model.

*Assuming three treatments per week per patient, average facility size corresponds to approximately 67 patient-years per facility-year observation.

BMI, body mass index; BSA, body surface area; CR, composite rate; CON, certificate of need; HB, hospital-based; HCT, hematocrit; HHI, Herfindahl–Hirschman Index; MI, myocardial infarction; PVD, peripheral vascular disease; pt, patient.

Table 2: Odds Ratios and 95% Confidence Intervals (CI) with Binary Chain Outcome

		95% CI	
Variable	*Odds Ratio*	*Lower*	*Upper*
Intercept	0.09	0.04	0.18***
Facility financial performance			
CR cost/treatment (2003 dollar)	1.25	1.05	1.48**
Facility age (years)	0.85	0.73	0.98*
Practice patterns			
Staffing intensity	1.05	0.93	1.19
% skilled labor	0.96	0.83	1.11
Stations per pt	0.83	0.70	0.99*
Offer hemodialysis only (reference = *N*)	0.79	0.61	1.04
Reuse dialyzers (reference = *N*)	1.10	0.81	1.49
Clinical performance			
% of pts with HCT $\geq$ 33%	1.30	1.10	1.54**
Market factors (market = 50-mile radius)			
HHI	0.88	0.73	1.07
Market size (treatments in 1,000s)	1.43	1.09	1.88**
% HB facilities in market	1.03	0.86	1.25
Other facility characteristics			
Facility size (treatments in 1,000s)	1.15	0.98	1.35
% Medicare treatments	0.93	0.80	1.08
For-profit (reference = *N*)	1.42	0.91	2.24
Rural (reference = *N*)	1.15	0.81	1.62
CON (reference = *N*)	1.56	0.96	2.52
Pt characteristics			
% of pts with HIV+ diagnosis	1.10	1.00	1.22*
% of pts with PVD diagnosis	1.22	1.04	1.42*
% of pts with pericarditis diagnosis	1.03	0.91	1.15
% of pts with drug dependence diagnosis	0.92	0.79	1.06
% of pts with MI diagnosis	0.88	0.76	1.03
% of pts $<$18 years old	0.93	0.79	1.10
% of pts 18–44 years	0.84	0.69	1.02
% of pts 45–59 years	0.80	0.66	0.97*
% of pts 60–69 years (reference)			
% of pts 70–79 years	0.90	0.74	1.09
% of pts 80+ years	0.97	0.81	1.15
% African American pts	1.14	0.97	1.34
% female pts	1.04	0.89	1.21
% pts underweight (BMI $<$ 18.5 kg/m^2)	1.05	0.91	1.21
BSA	1.08	0.90	1.28
% pts in first year of dialysis	1.03	0.88	1.21
Likelihood ratio test of categorical variables			
Year			***
Network			***

Notes. Significantly different from zero at: *0.05 level; **0.01 level; ***0.001 level.

All continuous variables are standardized, so a one-unit change in the covariate corresponds to its respective SD, with other covariates held at their mean.

BMI, body mass index; BSA, body surface area; CR, composite rate; CON, certificate of need; HB, hospital-based; HCT, hematocrit; HHI, Herfindahl–Hirschman Index; MI, myocardial infarction; PVD, peripheral vascular disease; pt, patient.

Table 3: Odds Ratios and 95% Confidence Intervals (CI) with Multinomial Chain Outcome

	Acquisition by a Small Chain†			*Acquisition by a Large Chain*†		
		95% CI			*95% CI*	
Variable	*Odds Ratio*	*Lower*	*Upper*	*Odds Ratio*	*Lower*	*Upper*
Facility financial performance						
CR cost/treatment (2003 dollar)	1.27	0.98	1.64	1.23	0.99	1.53
Facility age (years)	0.87	0.69	1.09	0.83	0.69	1.00*
Practice patterns						
Staffing intensity	1.18	1.01	1.39*	0.97	0.80	1.17
% Skilled labor	0.97	0.78	1.20	0.96	0.80	1.16
Stations per pt	0.71	0.53	0.94**	0.92	0.74	1.13
Offer hemodialysis only (reference = *N*)	1.02	0.67	1.53	0.68	0.49	0.95*
Reuse dialyzers (reference = *N*)	1.49	0.90	2.47	0.96	0.66	1.39
Clinical performance						
% of pts with HCT $\geq$ 33%	1.23	0.95	1.60	1.30	1.06	1.61**
Market factors (market = 50-mile radius)						
HHI	0.79	0.59	1.07	0.98	0.76	1.25
Market size (treatments in 1,000s)	1.59	1.01	2.51*	1.36	0.98	1.90
% HB facilities in market	1.06	0.81	1.40	1.02	0.80	1.31
Other facility characteristics						
Facility size (treatments in 1,000s)	1.37	1.08	1.73**	1.04	0.85	1.28
% Medicare treatments	0.81	0.66	1.00*	1.06	0.86	1.30
For-profit (reference = *N*)	1.67	0.82	3.38	1.37	0.78	2.42
Rural (reference = *N*)	1.90	1.16	3.11**	0.76	0.47	1.21
CON (reference = *N*)	1.33	0.68	2.61*	1.88	0.99	3.60
Pt characteristics						
% of pts with HIV+ diagnosis	1.17	1.04	1.33**	1.04	0.89	1.21
% of pts with PVD diagnosis	1.16	0.92	1.47	1.23	1.01	1.49*
% of pts with pericarditis diagnosis	1.14	0.98	1.34	0.95	0.81	1.11
% of pts with drug dependence diagnosis	0.84	0.65	1.08	0.96	0.81	1.14
% of pts with MI diagnosis	0.91	0.73	1.14	0.86	0.70	1.06
% of pts $<$18 years old	0.96	0.75	1.21	0.93	0.75	1.15
% of pts 18–44 years	0.82	0.61	1.09	0.83	0.66	1.06
% of pts 45–59 years	0.83	0.62	1.09	0.76	0.59	0.98*
% of pts 60–69 years (reference)						
% of pts 70–79 years	0.96	0.72	1.27	0.85	0.66	1.09
% of pts 80+ years	1.02	0.79	1.31	0.91	0.73	1.14
% African American pts	1.05	0.81	1.35	1.19	0.97	1.47
% female pts	1.11	0.89	1.39	0.97	0.80	1.18
% pts underweight (BMI $<$ 18.5 kg/m^2)	0.97	0.77	1.22	1.11	0.94	1.32
BSA	1.10	0.84	1.44	1.05	0.84	1.30
% pts in first year of dialysis	1.11	0.88	1.40	1.00	0.81	1.22
Likelihood ratio test of categorical variables						
Year			***			
Network			***			

Notes. Significantly different from zero at: *0.05 level; **0.01 level; ***0.001 level.

†Reference category for dependent variable is "not acquired." 166 and 245 facilities were acquired by small and large chains, respectively.

All continuous variables are standardized, so a one-unit change in the covariate corresponds to its respective SD, with other covariates held at their mean.

BMI, body mass index; BSA, body surface area; CR, composite rate; CON, certificate of need; HB, hospital-based; HCT, hematocrit; HHI, Herfindahl–Hirschman Index; MI, myocardial infarction; PVD, peripheral vascular disease; pt, patient.

practice pattern variables—stations per patient—significantly predicted chain acquisition. Facilities with more stations per patient were less likely to be acquired by a chain. Facilities with better clinical performance were significantly more likely to be acquired by a chain than facilities with poor outcomes. Specifically, a 26 percent (1 SD) increase in patients with HCT $\geq$ 33 percent increased odds of chain acquisition by 30 percent.

Facilities in larger markets were significantly more likely to be acquired than those in smaller markets, but the level of competition (as measured by HHI) did not predict acquisition. The network and year dummy variables were significant as a group, reflecting geographic concentration of acquisitions (e.g., over a third of acquisitions occurred in just three of the 18 ESRD networks) and a steady yearly decline in number of acquisitions, respectively. No other facility characteristics (i.e., facility size, payer mix, ownership status, rural versus urban status and presence of CON) were significant predictors of acquisition at the $p < .05$ level.

Differences in Predictors of Acquisition Based on Dialysis Chain Size

Table 3 presents the predictors of acquisition by a small versus large chain; the reference category is "not acquired." Having fewer stations per patient and higher staffing intensity made acquisition by a small chain more likely. Larger markets and facilities, fewer Medicare patients, and a rural setting also increased the likelihood of acquisition by a small chain.

A facility's clinical performance was not a significant predictor of small chain acquisition despite being highly significant in the binomial model. However, the odds ratios in the two models presented in Table 3 are similar, and the percent of patients with HCT $\geq$ 33 percent remained a significant determinant for large chain acquisition. Like the binomial model results, older facilities also had significantly lower odds of acquisition by a large chain. The only other facility characteristic significantly associated with acquisition by a large chain was whether the facility offers multiple modalities: facilities that only offered hemodialysis were significantly less likely to be acquired by a large chain than facilities that offered multiple modalities. The effect of market size was similar in magnitude to results from the binomial model (odds ratios were 1.43 for all acquisitions versus 1.36 for acquisition by a large chain, respectively); however, the market size effect was not quite significant in the multinomial model ($p = .06$). This may be due in part to the smaller number of events observed in this model and to the corresponding larger standard errors in each of the two acquisition categories.

DISCUSSION

Similar to previous research from the nursing home and hospital industries, poor financial health predicts acquisition by a dialysis chain. However, unlike findings in other health care sectors that examine the effect of quality indicators on the likelihood of acquisition, dialysis chains were more likely to acquire facilities that had *better* quality outcomes (higher percent of patients achieving HCT targets). Taken together, the results suggest a mixed logic motivating dialysis chain acquisitions that differs slightly from the "turn-around" hypothesis supported in the nursing home and hospital literatures. Opportunities to reduce costs and improve revenues by enhancing clinical performance through additional use of EPO may motivate both the corporate chains and the facilities themselves to engage in acquisition: higher HCT levels result from using more EPO; in turn, using more EPO may yield a lower price from Amgen. Chains may be more able than independent providers to obtain volume discounts and hence, to engage in strategic use of EPO to improve clinical performance. Relative to our conceptual model, the acquisition of low-performing facilities is likely to imply that their value under independent ownership was low relative to their potential value as part of a chain.

This discrepancy also might arise from different industry characteristics. Most of the studies that support a "turn-around" strategy for hospitals use data from 1980 to 2000, a period when the industry was declining. Meanwhile, the dialysis industry has been steadily growing to accommodate the increasing patient base. Given the increasing supply of facilities, chains operating in expanding industries may focus less on the potential to reduce cost (i.e., turn around) than chains in nongrowth industries while also directing their efforts toward increasing revenue streams that can be realized from already well-performing facilities (i.e., cream skimming). In the case of acquisitions of high-performing facilities, the net value from an acquisition is likely driven less by underperformance (resulting in depressed value under independent ownership) than by the chain placing high value on the revenue stream as part of its overall growth strategy. Additionally, there are no direct substitutes for dialysis centers as there are for both hospitals and nursing homes (e.g., outpatient surgical centers, assisted living facilities, home health agencies).

As in previous studies examining acquisitions by small versus large chains, we found significant differences in acquisition strategy between differently sized chains. It may be that larger chains pursue broader national or geographically differentiated strategies when acquiring units, whereas smaller chains stay focused on the local facility's advantages and location (i.e., facilities near their existing locations). Our finding—that more factors predict acquisition by a smaller chain than by a larger chain—suggests that smaller dialysis chains target specific facilities while larger chains pursue firm growth per se. However, the main difference between acquisitions by a small versus a large chain is one of degree. For example, both sizes of chains may offer bulk purchasing discounts, but the savings may be greater with larger chains, which (all other things being equal) would increase the achieved gain in value relative to acquisition by a smaller chain.

Future analyses could compare the effects of growth strategies on acquisition of units already chain owned as compared with acquisition of independent facilities as well as geographical differences in large versus small chain growth. Additionally, measuring the distance from the target to the nearest facility that is already owned by the acquiring chain could help explain the different acquisition strategy between chains (e.g., if the distance is greater for large chains than small chains, it would support our theory that the latter are more interested in proximity).

Our future research agenda also includes incorporating more information about the acquirers; in particular, how a chain's presence affects its market power after an acquisition (e.g., a chain that already owns a facility in the market will gain more market power through an acquisition than would another chain that has no presence). However, this complicates the analysis because any independent facility would be at risk of being acquired by the 91 unique chains in operation during the study period, and each of the chains acquiring the independent facility would need to be treated as a distinct type of event being predicted (i.e., 91 chains for each of the 3,351 observations). This analysis may detect interesting and important acquisition strategies among the different chains, but it is beyond the scope of our current research.

There are several limitations to our findings. First, chain data were not available for hospital-based dialysis facilities and they were excluded from the analysis. However, hospital-based facilities make up a relatively small proportion of the entire industry, and to the extent that their financial characteristics and practice patterns are similar to freestanding facilities, providers may still be able to glean information from these findings. Second, we only examined acquisition of independent facilities from 1997 to 2003 when the dialysis industry was growing, so results may not be applicable to other time periods or to other markets that are stagnant or declining. Third, we assumed that all chains and independent dialysis facility owners are profit maximizers. Given that 75 percent of all dialysis units are for-profit (U.S. Renal Data System 2008) and 86 percent of independent facilities in our dataset are for-profit, this assumption is not problematic for the majority of our sample. However, some buyers (e.g., the fifth largest chain in 2004 was nonprofit) and sellers may focus on different consequences of chain acquisition. For instance, some independent dialysis owners may be nearing retirement and looking to cut back on their workload, while others may be new to the industry and interested in gaining the managerial help and efficiency offered by chains. As one author observes, "the decision to sell one's business is very personal . . ." (Riley and McGraw-Walsh 2006, p. 65). Unfortunately, the seller's age, experience, and other demographic information are not available. Additionally, although using the number of dialysis treatments may appear more like a measure of output than a measurement of facility size, this is the standard approach taken in dialysis research literature and is significantly and strongly correlated with other measures of size (i.e., staffing and dialysis stations). Therefore, we feel confident that the number of treatments performed at the facility is a valid proxy for facility size. Finally, our research limited analysis to the antecedents of chain acquisition because it was previously unexplored within the dialysis industry, leaving the consequences of chain acquisition on dialysis facility performance unanswered. However, preliminary analyses suggest important benefits associated with chain acquisition over independent ownership during the first 5 years after chain acquisition (Pozniak 2006).

Despite these caveats, our research suggests some important policy implications. To the extent that dialysis chains are acquiring high-cost facilities that might have otherwise had their clinical practices constrained by a poor financial situation or even gone out of business, chain acquisition of independent facilities could result in more efficient management, improved practice patterns, and better clinical outcomes. Cost savings are especially salient for the dialysis population due to the high cost of treating dialysis patients.[9] However, by acquiring a facility in a less concentrated market, the dialysis chain can make inroads into the market and gain market power by acquiring or building additional facilities. Private insurers will feel the brunt of any chain monopolistic pricing behavior, and chains with significant market power may also be detrimental for patients by restricting their choice of providers.[10] Furthermore, any policy intended to affect dialysis chain growth needs to take into account different growth strategies employed by differently sized or geographically located chains.

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NOTES

1. However, Medicare is the secondary payer up to 33 months after the onset of ESRD for those patients who begin treatment with private health insurance.
2. Differences in payment occur based on facility setting (hospital-based facilities receive slightly more than freestanding facilities), geographical area (over 50 percent of the prospective payment is adjusted for differences in local labor costs), and, starting in 2005, a limited set of patient characteristics (Office of the Federal Register 2004).
3. Amgen was recently able to extend its patent for Epogen to 2016.
4. Although the vast majority of patients receive in-center hemodialysis, there are other treatment modalities—including home hemodialysis, continuous ambulatory peritoneal dialysis, and continuous cycler-assisted peritoneal dialysis—which can be performed at home.
5. The HHI uses the sum of the square of each firm's market share (i.e., the dialysis treatments performed at each facility) to determine market concentration. The measure ranges from nearly zero, reflecting nearly perfect competition, to 10,000, indicating a pure monopoly.
6. The 18 ESRD networks receive funds from local dialysis facilities to improve the quality of care and are used instead of state or Census region because they are a more meaningful geographic categorization for the dialysis industry.
7. However, because HCT values became increasingly higher per facility over time, these missing values were computed using the mean of the previous and the following year.
8. Fifty-three chain-affiliated facilities became unaffiliated with a chain during the study period. These facilities are considered chains for all periods subsequent to the first period in which they report a chain affiliation (i.e., they do not re-enter the model once they become independent).
9. Although only 1.1 percent of Medicare patients suffer from ESRD, they account for 7.4 percent of the Medicare budget, translating to over U.S.$22 billion in 2006 (U.S. Renal Data System 2008).
10. Although patients are free to change facilities, most stay at the facility to which they were initially referred by their nephrologist due to the severity of their illness and ties with their doctor.

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Supporting Information

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.

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