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

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Motivation

- Significant consolidation in U.S. healthcare markets
- Long tradition in IO of studying market structure & outcomes
  - Often find that ↑ concentration leads to ↑ prices, ↓ quality
  - Typically look at market power, not the mechanisms underlying these changes
  - But M&A may have effects independent of market power
- Much less work on how M&A directly affects firm behavior
  - Lack of data?
  - What behavior to compare?
Suggestive Results from Our Previous Work

LTCHs Adopt Acquirers’ Discharge Policies (Eliason et al., 2018)

Quality-Quantity Tradeoff in Dialysis (Grieco & McDevitt, 2017)
Our Paper Today

Study how provider behavior and patient outcomes change following \(\approx 1200\) acquisitions of independent dialysis facilities

1. Large chains have a different strategy than independents
   - Use more injectable drugs
   - Replace nurses with techs
   - Treat more patients per employee & station

2. This leads to worse outcomes for patients
   - Survival & transplant rates fall
   - Hospitalizations increase

3. And wastes scarce Medicare resources
   - Payments increase 7.5% for worse outcomes
Previous Work on This Topic

Relates to multiple literatures (too much to cover here)

1. Effects of mergers and acquisitions
   - Health care: Cutler et al. (2015), Dafny et al. (2016), Cooper et al. (2018)
   - Typically don’t consider mechanisms, mostly about how market power affects prices & quality

2. Acquisitions and transference of firm behavior
   - Evidence that new managers implement best practices

3. Payment structure and provider behavior
   - Eliason et al. (2018), as well as countless others
   - Healthcare providers respond to incentives
Institutional Details of the Dialysis Industry
Background on Dialysis

- Kidney functions
  1. Filter toxins from blood
  2. Stimulate production of red blood cells

- ESRD (chronic kidney failure)

- Two treatment options
  1. Dialysis
     - >90% choose in-center hemodialysis
     - 3x/week
  2. Transplant
     - Kidneys scarce, not all patients are suitable
Background on Medicare’s Role in Dialysis

- ~ 500,000 patients, 90% covered by Medicare
- Benefits extended to all patients regardless of age in 1972
- 80/20 split under Medicare Part B
- Private insurance covers first 30 months
- $34.3 billion in spending, 6% of budget
- ESRD costs take up 1% of entire federal budget
- Population growing at 3.4% per year

![ESRD Costs in Billions](chart.png)
Background on Medicare Payments

Medicare initially had a blended payment (our study period)
- Centers paid composite rate of $128 per treatment
- EPO and other drugs separate under FFS

Medicare implemented PPS in 2011 (our next paper)
- $230 for treatment + drugs
Background on EPO

- Treats anemia
- Used by >90% of dialysis patients at any given time
- Largest CMS drug expenditure for many years
  - \( \approx \$1.7\text{bn} \) in CMS expenditures in 2007 just for ESRD
  - \( \approx \$10 \) per 1000 units in reimbursement
- 25% of DaVita revenue and 40% of profits
- Lots of leeway in dosing decisions due to disagreement on optimal hemoglobin target
Background on Dialysis Industry

∼7,000 dialysis centers across U.S.
Dialysis Market Over Time

The graph shows the number of dialysis facilities over time from 1998 to 2010. The facilities are categorized into different chains:

- **Davita** (blue)
- **Fresenius** (red)
- **Other Chains** (green)
- **Independent** (orange)

The number of facilities for each category increases steadily over the years.
DaVita & Fresenius Over Time

Davita Facility Evolution, 1998-2010

Fresenius Facility Evolution, 1998-2010

- Acquired Independent
- Other
Independent Dialysis Facility Acquisitions Over Time

- **Acquisitions**
- **Cumulative Acquisitions**

![Graph showing acquisitions and cumulative acquisitions over time from 1998 to 2010.](image)
Dialysis Facility Acquisitions by Chains Over Time

Cumulative Acquisitions of Independent Dialysis Facilities

- Davita
- Fresenius
- Other Chains
Strategy Matters for Dialysis Chains

“... arguably eccentric ...”
Measuring the Effects of Acquisitions

1. Observable provider choices
   - Injectable drugs
     - Most prominent is EPO (25% revenue, 40% profits)
   - Staffing decisions
     - Nurses vs. technicians
     - Overall staffing level
   - Capacity utilization

2. Clinical measures
   - Urea reduction ratio
   - Hemoglobin

3. Patient outcomes
   - Hospitalization
   - Mortality
   - Transplants
Evidence of Differences in Provider Strategy
Data

- United States Renal Data System (USRDS)
  - Medicare claims for ESRD patients
    - Drug doses
    - Monthly clinical outcomes
  - Medical evidence forms
    - Comorbidities
    - Clinical data at incidence (ESRD severity, anemia severity, BMI)
  - Waitlist and transplant dates
  - Annual facility surveys collected by the CDC and Medicare
    - Employed staff
    - Station counts
    - Supplement with Provider of Service files for acquisition dates
  - Facility cost reports from HCRIS

- Observations for ~14m patient-months
  - Can track same patient over time, even if facility changes
Observable Patient Mix

Table: Patient Covariate Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Always Independent</th>
<th>Pre-Acquisition</th>
<th>Post-Acquisition</th>
<th>Always Chain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>64.25</td>
<td>64.54</td>
<td>63.96</td>
<td>63.38</td>
</tr>
<tr>
<td>Months With ESRD</td>
<td>35.79</td>
<td>31.80</td>
<td>37.61</td>
<td>36.91</td>
</tr>
<tr>
<td>Private Insurance</td>
<td>6.53</td>
<td>7.43</td>
<td>6.66</td>
<td>6.79</td>
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<tr>
<td>Non-Hispanic White (%)</td>
<td>48.55</td>
<td>53.36</td>
<td>44.37</td>
<td>40.38</td>
</tr>
<tr>
<td>Black (%)</td>
<td>32.26</td>
<td>30.63</td>
<td>37.10</td>
<td>40.10</td>
</tr>
<tr>
<td>Hispanic (%)</td>
<td>13.04</td>
<td>10.01</td>
<td>12.78</td>
<td>14.72</td>
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<tr>
<td><strong>Clinical Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>28.16</td>
<td>27.90</td>
<td>28.77</td>
<td>28.38</td>
</tr>
<tr>
<td>GFR</td>
<td>7.91</td>
<td>7.74</td>
<td>8.02</td>
<td>7.71</td>
</tr>
<tr>
<td>Ischemic Heart Disease (%)</td>
<td>17.26</td>
<td>20.48</td>
<td>14.05</td>
<td>13.75</td>
</tr>
<tr>
<td>Diabetic (%)</td>
<td>53.68</td>
<td>54.33</td>
<td>55.16</td>
<td>54.91</td>
</tr>
</tbody>
</table>
Identification of Key Effects

\[ y_{ijt} = \beta Acquired_{jt} + \alpha X_{ijt} + \epsilon_{ijt} \]

- Two primary threats to identification of \( \beta \):
  1. Changing patient mix after acquisition
     - Robust clinical & patient data
  2. Acquisition isn’t random
     - Include facility fixed effects
     - Identification from within-facility changes in ownership
     - No trend prior to acquisition

- Advantages over previous studies:
  1. Large sample of acquisitions
  2. Clear channels through which strategies could change
  3. Limited scope for changing prices (at least for Medicare)
  4. Little evidence market power matters (at least for Medicare)
EPO Doses Increase Substantially After Acquisition

EPO Dosing at Acquired Firms

[Graph showing the increase in EPO dosing over time, with a significant rise after acquisition]
### EPO Regressions

<table>
<thead>
<tr>
<th></th>
<th>(1) Epogen</th>
<th>(2) Epogen</th>
<th>(3) Epogen</th>
<th>(4) Epogen</th>
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</thead>
<tbody>
<tr>
<td>Pre-Acquisition</td>
<td>0.269*</td>
<td>0.271*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.132)</td>
<td>(0.122)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-Acquisition</td>
<td>1.529***</td>
<td>1.413***</td>
<td>0.843***</td>
<td>0.782***</td>
</tr>
<tr>
<td></td>
<td>(0.0872)</td>
<td>(0.0827)</td>
<td>(0.0713)</td>
<td>(0.0779)</td>
</tr>
<tr>
<td>Always Chain</td>
<td>1.511***</td>
<td>1.361***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0834)</td>
<td>(0.0769)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>14,111,310</td>
<td>14,111,310</td>
<td>14,111,310</td>
<td>14,111,310</td>
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<tr>
<td>Dep. Var. Mean</td>
<td>7.536</td>
<td>7.536</td>
<td>7.536</td>
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</tr>
<tr>
<td>Units</td>
<td>log(IU)</td>
<td>log(IU)</td>
<td>log(IU)</td>
<td>log(IU)</td>
</tr>
<tr>
<td>Year x Month FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Pat. &amp; Fac. Controls</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Facility FE</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Patient FE</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Acquired Facilities Switch from Ferrlecit to Venofer

IV Iron Drugs at Acquired Firms

- Ferrlecit (Low $)
- Venofer (High $)
<table>
<thead>
<tr>
<th></th>
<th>$\beta / \bar{y}$</th>
<th>$\bar{y}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurses/Techs</td>
<td>-0.151***</td>
<td>0.974</td>
</tr>
<tr>
<td>Patients/Employee</td>
<td>0.119***</td>
<td>5.122</td>
</tr>
<tr>
<td>Patients/Station</td>
<td>0.046*</td>
<td>3.992</td>
</tr>
</tbody>
</table>
Patients at Acquired Facilities (Mostly) Fare Worse

<table>
<thead>
<tr>
<th></th>
<th>$\beta/\bar{y}$</th>
<th>$\bar{y}$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hospitalizations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Cause</td>
<td>0.061***</td>
<td>0.141</td>
</tr>
<tr>
<td>Septicemia</td>
<td>0.129***</td>
<td>0.007</td>
</tr>
<tr>
<td>Cardiac Event</td>
<td>0.040*</td>
<td>0.030</td>
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<tr>
<td><strong>Clinical Outcomes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good URR</td>
<td>0.025***</td>
<td>0.881</td>
</tr>
<tr>
<td>Low Hemoglobin</td>
<td>-0.0098***</td>
<td>0.095</td>
</tr>
<tr>
<td>High Hemoglobin</td>
<td>0.038***</td>
<td>0.381</td>
</tr>
<tr>
<td>Good Hemoglobin</td>
<td>-0.028***</td>
<td>0.523</td>
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</table>
New Patients Less Likely to Survive/Receive Transplant

<table>
<thead>
<tr>
<th></th>
<th>$\beta$</th>
<th>$\bar{y}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waitlist or Transplant</td>
<td>-0.094**</td>
<td>0.127</td>
</tr>
<tr>
<td>Survive First Year</td>
<td>-0.017**</td>
<td>0.746</td>
</tr>
</tbody>
</table>
Medicare Payments Go Up After Acquisition
Conclusions & Next Steps
Summary & Future Projects

Summary
- Acquisitions lead to changes in providers’ behavior
- Patient outcomes may change irrespective of market power

Future Projects
- Study EPO use after payment reform in 2011 (elevation IV)
- Model “make vs. buy” decision for dialysis chains