Hospital Choices, Hospital Prices and Financial Incentives to Physicians

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Motivation

- Paper motivated by one aspect of US health reforms: introduction of Accountable Care Organizations (ACOs)
- Represent a potentially major change in structure of the market and in provider incentives
- Begin with a summary: what are ACOs?
- Introduced by the Patient Protection and Affordable Care Act 2010.
The US health reforms do several things:

- Individual Mandate: US citizens and legal residents required to have qualifying health coverage (or pay tax penalty)
- Employer requirements: Employers with \( \geq 50 \) employees required to offer coverage (or pay a fine)
- Health Insurance Exchanges: created so that individuals without access to employer-based insurance can find it elsewhere
- Insurer regulation: require guaranteed issue, restrict rate variation (based only on age, geography, family composition and tobacco use) in individual and small group markets
- Expansion of public programs (Medicaid up to 133% FPL), premium and cost-sharing subsidies to the slightly less poor (up to 400% FPL).
PPACA 2010, cntd:

- Two additional questions:
  - How will these changes be paid for?
  - How will quality of health care be maintained?

- Tax changes to help finance reforms: eg tax uninsured individuals, "Cadillac tax" on highest-cost insurance plans, new annual fees on pharma companies and health insurers

- Accountable Care Organizations: goal is to reduce growth in health care costs while improving quality of care.
The US Medical Care Market

Diagram:
- Insurer
- Physician
- Hospital
- Patient

Patient is connected to Insurer, Physician, and Hospital.
Physician is connected to Hospital.
An ACO is (will be) a group of doctors and hospitals that shares responsibility for providing care to patients

- Initially established for the Medicare program
- Agrees to manage all health care needs of \( \geq 5000 \) Medicare beneficiaries for at least 3 years
- Eligible to share in cost savings made on behalf of Medicare program

Private sector ACOs are forming in parallel to the Medicare initiative

Private ACOs have more flexibility in designing payment arrangements, but many are similar to Medicare ACOs

- Often simultaneously contract with both private payers and Medicare.
ACOs: Cost and Quality Concerns

- Goal is to reduce health care costs (both Medicare and private insurance) while improving quality

- Cost growth:
  - Health care costs rose from 7.2% of GDP in 1970 to 17.9% in 2010
  - $7598 health spending per capita in 2009 ($3311 in UK, $5144 Switzerland, $4072 Germany)
  - Medicare costs also high: social security and defense are only larger federal spending categories.

- And there are quality concerns
  - Example: more than 50% of Medicare beneficiaries have ≥ 5 chronic conditions (diabetes, arthritis, hypertension)
  - Multiple physicians per patient, often don’t communicate well
  - Problems with duplicative care and medical errors

- ACOs are an attempt to address both issues.
How will ACOs work?

- Idea: ACOs give providers incentives to cooperate and save money by avoiding unnecessary tests and procedures.
- From January 2012, groups of providers can apply to become ACOs (for Medicare beneficiaries).
- Current fee-for-service payments continue, but also
- Benchmark (based on past spending) developed for each ACO.
- ACO eligible to share in cost savings relative to benchmark if exceed a minimum level ($\approx 2\%$).
- Keep approximately 50% of savings
  - % linked to performance on quality standards (care coordination; patient safety; preventive care).
- Private ACOs: payment arrangements more flexible but often look very similar.
ACOs: The Policy Debate

- ACOs will change market structure and relative bargaining power.
  - Both horizontal and vertical mergers of providers are likely
  - Potential antitrust issues raised by this provider consolidation

- Less troubling for Medicare, where hospital and physician prices determined centrally

- But prices in private system are determined by insurer-provider bargaining, likely to be affected by provider mergers

- Conflicting views among policy-makers about effects of ACOs:
  - "These organizations will ... improve the quality of care and help lower costs" (Kathleen Sebelius, secretary of health and human services)
  - "[ACOs] could reduce competition and harm consumers through higher prices or lower quality of care" (joint statement by Justice Department and Federal Trade Commission)
Our Question

Our question: What impact do shared savings programs have on the cost and quality of care?

- Similar cost control incentives are applied to different extents by different insurers for their private enrollees in California.
- Opportunity to analyze the cost and quality responses to incentives that are similar to those proposed for ACOs.
  - How much of potential cost savings from ACOs (absent antitrust concerns) are likely to be realized?
  - How is quality of care likely to be affected?
- We will apply these questions to the hospital choice.
Previous papers document lower costs in HMOs (which have restricted networks & give physicians cost-control incentives) compared to other types of insurers but usually not the exact mechanisms or incentives used. Exceptions:

- Cutler, McClellan, Newhouse (2000): HMOs have 30-40% lower expenditures, largely due to lower price per treatment
- Gaynor, Rebitzer and Taylor (2004): medical expenditures per patient increase with the size of physician groups receiving group-based financial incentives in a single HMO
- Evaluations of "ACO" initiatives. Song et al (2011) BCBS of MA "Alternative Quality Contract": physician incentives generated cost savings largely through use of lower-cost outpatient units

This paper: do patients whose physicians have a financial incentive to control hospital costs receive care at lower-priced hospitals? Does this affect quality or convenience of care?
We estimate a utility equation summarizing preferences over hospitals

- Patients in insurers that give referring physicians incentives to control costs (capitation contracts) are admitted to lower-priced hospitals than other same-severity patients
- However the price-quality tradeoff differs very little across insurers
- What differs is the tradeoff made between price and distance
- Patients in high-capitation insurers travel longer distances to access similar-quality hospitals at a lower price.
Focus on privately-insured patients in HMOs (53% of employed population)

Physician contracts: HMOs often have non-exclusive contracts with large physician groups
- Physicians refer patients to affiliated hospitals outside these groups

Capitation payments: fixed payment per patient to cover services
- Often including hospital services
- Or "shared risk arrangements": group shares in inpatient cost savings made relative to pre-agreed target (similar to ACO payment schemes)

Implication: physician groups have incentives to control hospital costs
Alternative is fee-for-service payment: no incentive to control costs.
Implications for Analysis

- We use hospital discharge data for California in 2003
- Dataset does not identify patients’ physician groups or details of compensation schemes
- We observe each patient’s insurer and percent of each insurer’s payments for primary services that are capitated
- Considerable dispersion across insurers
  - Blue Cross: 38% capitated payments
  - Pacificare: 97% capitated payments

Questions: Are hospital choices influenced by price? Does price matter more when the patient is enrolled in a high-capitation insurer?

- If so, physicians likely to be responding to incentives generated by capitation contracts.
We consider privately-insured women in labor

- Obstetrician (OB) often affiliated with 1-3 hospitals
- Patient chooses OB based partly on hospital affiliation

Two possible mechanisms

- Within-physician differential treatment of patients
  - Consistent with previous literature
  - e.g. Melichar (2009), capitated patients have shorter visits than others within-physician

- Physicians with majority capitated patients use the cheaper hospital; others do not
  - More likely if some obstetricians affiliated with a single hospital.
The Price Variable

We observe every patient discharge from every California hospital, 2003

- Detailed information on patient diagnoses and procedures, hospital and insurer characteristics
- But 2 issues with price measure
  - Agent does not know price when decision is made
    - We need an expected price measure
  - Actual price paid to hospital is unobserved
- Instead: list price and average discount at hospital level
- Define expected list price = average list price for ex ante similar patients at the relevant hospital
- "Expected price" = expected list price*(1-average discount)
- We develop a methodology that allows us to account for measurement error in price variable.

Use the discharge data to regress severity-adjusted price on insurer’s percent capitation payments and market fixed effects

- Adjust for severity by dividing this patient’s price by average price for same-severity patients in the sample.

Finding: patients in higher-capitation insurers are admitted to significantly lower-priced hospitals than other same-severity patients in the same market.
But this does not tell the whole story.

- We have not modeled the trade-offs made between price and other hospital characteristics
- Or allowed them to differ between different types of patient
- Or accounted for distance between the patient’s home and the hospital
- Or addressed price measurement error.

A full hospital demand model is needed to account for these issues.
Overview of the Demand Model

Estimate utility of physician making hospital choice (with patient input):

\[ W_{i,\pi,h} = \theta_{p,\pi}(\text{price}_{i,\pi,h}) + g_{\pi}(q_h(s), s_i) + \theta_d d(l_i, l_h) + \varepsilon_{i,\pi,h} \]

- \( \text{price}_{i,\pi,h} = \) price paid by insurer to hospital for patient \( i \)'s services
- \( d(l_i, l_h) = \) distance between hospital and patient’s home
- \( s_i = \) measure of patient severity
- \( q_h(s) = \) vector of perceived qualities for different sickness levels
- \( g_{\pi}(.) = \) flexible function interacting \( q_h(s) \) and \( s_i \)
  - Permits hospitals to have higher quality for some sickness levels
  - And preferences for quality to differ across severities
  - Important to address price endogeneity concerns.
Our Questions

- The price coefficient:
  - Is it negative?
  - More negative when insurer gives physicians incentive to control costs?
- How does perceived quality relate to (i) outcomes? (ii) published quality rankings? (iii) measures of consumer satisfaction?
- Do insurers with a more negative price coefficient send patients to hospitals with lower perceived quality?
Could We Use Standard Methods?

- Previous papers on hospital demand model utility as a function of distance, hospital quality, hospital-patient interactions
- Often multinomial logit models, estimated via Maximum Likelihood; don’t include price paid by insurer
But adding price to this model raises endogeneity concerns

- Very detailed severity - quality interactions $g_\pi(.)$ generate groups that are too sparsely populated to estimate
- Alternative approach is to instrument for price (Gaynor & Vogt 2003) but this is difficult because price varies across patients within a hospital.

- Also the logit method cannot address price measurement error issues.
- We develop a method that addresses both problems.
### Descriptive Statistics: Discharge Data

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Mean</th>
<th>Std Devn.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>88,157</td>
<td></td>
</tr>
<tr>
<td>Number of hospitals</td>
<td>195</td>
<td></td>
</tr>
<tr>
<td>Teaching hospital</td>
<td>0.27</td>
<td></td>
</tr>
<tr>
<td>List price ($)</td>
<td>$13,312</td>
<td>$13,213</td>
</tr>
<tr>
<td>List price*(1-discount)</td>
<td>$4,317</td>
<td>$4,596</td>
</tr>
<tr>
<td>Length of Stay</td>
<td>2.54</td>
<td>2.39</td>
</tr>
<tr>
<td>Readmission within 12 months</td>
<td>2.4%</td>
<td>0.06%</td>
</tr>
<tr>
<td>Discharge &quot;other than home&quot;</td>
<td>1.6%</td>
<td>0.01%</td>
</tr>
</tbody>
</table>
## Prices and Outcomes By Patient Type

<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>Price*(1-disc)</th>
<th>Readmission w/in 12 months</th>
<th>Discharge &quot;not home&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;40</td>
<td>71073</td>
<td>4259 (4329)</td>
<td>2.3% (0.1%)</td>
<td>1.6% (0.1%)</td>
</tr>
<tr>
<td>&gt;40</td>
<td>2044</td>
<td>5420 (5571)</td>
<td>3.5% (0.4%)</td>
<td>2.1% (0.3%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Charlson</th>
<th>N</th>
<th>Price*(1-disc)</th>
<th>Readmission w/in 12 months</th>
<th>Discharge &quot;not home&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>71803</td>
<td>4256 (4265)</td>
<td>2.3% (0.1%)</td>
<td>1.6% (0.1%)</td>
</tr>
<tr>
<td>&gt;0</td>
<td>1314</td>
<td>6277 (8135)</td>
<td>5.8% (0.6%)</td>
<td>3.4% (0.5%)</td>
</tr>
</tbody>
</table>

Notes: Labor diagnosis only. Charlson score (Charlson et al, 1986, *Journal of Chronic Diseases*): clinical index that assigns weights to comorbidities other than principal diagnosis where higher weight indicates higher severity. Values 0-6 observed in data.
Inequalities Analysis

Decision-maker utility from \((i, \pi, h)\) is

\[
W_{i,\pi,h} = \theta_{p,\pi}(\text{price}_{i,\pi,h}) + g_{\pi}(q_h(s), s_i) + \theta_d d(l_i, l_h)
\]

- Define \(s_i\) to be detailed patient severity groups
- \(g_{\pi}(q_h(s), s_i)\) interacts severity dummies with hospital F.E.s
- Approximately 16,000 interaction terms
- Assumption: these terms fully address the endogeneity problem
- Remaining unobservable \(\varepsilon_{i,\pi,h}\) is measurement error
- Also normalize \(\theta_d = -1\):

\[
W_{i,\pi,h} = \theta_{p,\pi}(\text{price}_{i,\pi,h}) + g_{\pi}(q_h(s), s_i) - d(l_i, l_h) + \varepsilon_{i,\pi,h}
\]
Identifying assumption: revealed preference argument. For every patient $i_h$, utility from chosen hospital $h \geq$ that from any alternative $h'$

$$W_{i_h, \pi, h} \geq W_{i_h, \pi, h'}$$

Notation:

$$W(i_h, h, h') = W_{i_h, \pi, h} - W_{i_h, \pi, h'} \geq 0.$$ 

- Intuition: find a pair of same-$\pi$, same-$s$, patients $i_h$, $i_h'$ who can switch hospitals
- Sum their inequalities. Equal and opposite $g_{\pi}(.)$ terms drop out
- This generates one inequality that relates price coefficient to observed variables (price and distance) and error $\varepsilon_{i, \pi, h}$. 
Patient $i_h$ and $i_{h'}$ utility differences (noting that $s_{i_h} = s_{i_{h'}} = s$):

\[
W(i_h, h, h') = \theta_{p,\pi} p^o(i_h, h, h') + g_{\pi}(q_h, s) - g_{\pi}(q_{h'}, s) - d(i_h, h, h') + \epsilon(i_h, h, h') \geq 0
\]

\[
W(i_{h'}, h', h) = \theta_{p,\pi} p^o(i_{h'}, h', h) + g_{\pi}(q_{h'}, s) - g_{\pi}(q_h, s) - d(i_{h'}, h', h) + \epsilon(i_{h'}, h', h') \geq 0
\]

- Sum the 2 expressions to difference out $g_{\pi}(.)$ terms
- Repeat for all such pairs of patients
Average over patient pairs and over alternatives $h' > h$ to address measurement error $\varepsilon_{i,\pi,h}$

$$
\theta_{p,\pi}(\frac{1}{N(h)} \sum_{h' > h} \sum_{i_hi_{h'}} (p^o(i_h, h, h') + p^o(i_{h'}, h', h))) \geq \frac{1}{N(h)} \sum_{h' > h} \sum_{i_hi_{h'}} (d(i_h, h, h') + d(i_{h'}, h', h)).
$$

- This generates one inequality per hospital
- Add moments by interacting inequalities with instruments
- Straightforward to use resulting system of inequalities to generate bounds on the price coefficient of each insurer.
Key Assumptions

- This is a matching estimator: we match patients based on observables (insurer and severity) and use the match to difference out $g_\pi(.)$.
- The key assumptions are that:
  - Severities are defined in enough detail so that $g_\pi(q_h(s), s_i)$ absorbs all unobservables that would cause endogeneity problems.
  - Differences across patients within-severity group affect price but not choices directly.
- We consult with obstetrical experts at Columbia Presbyterian Hospital to get these definitions right.
### Results: Inequalities Analysis

<table>
<thead>
<tr>
<th>% capitated</th>
<th>$\hat{\theta}_{p,\pi}$</th>
<th>$[Cl_{LB}, Cl_{UB}]$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacificare</td>
<td>0.97</td>
<td>-1.50**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-1.68, -1.13]</td>
</tr>
<tr>
<td>Aetna</td>
<td>0.91</td>
<td>-0.92**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.95, -0.86]</td>
</tr>
<tr>
<td>Health Net</td>
<td>0.80</td>
<td>-0.78**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.80, -0.44]</td>
</tr>
<tr>
<td>Cigna</td>
<td>0.75</td>
<td>-0.35**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.40, -0.33]</td>
</tr>
<tr>
<td>Blue Shield</td>
<td>0.57</td>
<td>-0.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.15, 0.23]</td>
</tr>
<tr>
<td>Blue Cross</td>
<td>0.38</td>
<td>-0.29**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.31, -0.25]</td>
</tr>
</tbody>
</table>
Results: Estimated Confidence Intervals
Interpreting the Results

- Price does affect hospital choice, and it matters more when insurers capitate more physicians.
- $\eta^d,p = \text{percent distance reduction needed to compensate for a 1\% price increase.}$

<table>
<thead>
<tr>
<th>Insurer</th>
<th>% capitated</th>
<th>$\eta^d,p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacificare</td>
<td>0.97</td>
<td>11.08</td>
</tr>
<tr>
<td>Health Net</td>
<td>0.80</td>
<td>6.52</td>
</tr>
<tr>
<td>Cigna</td>
<td>0.75</td>
<td>2.49</td>
</tr>
<tr>
<td>Blue Cross</td>
<td>0.57</td>
<td>3.24</td>
</tr>
</tbody>
</table>
Why is the Inequalities Method Useful?

We think this methodology has several benefits compared to other methods:

- Differencing out the $g_{\pi}(.)$ terms addresses endogeneity concerns by making detailed hospital quality - patient severity interaction terms possible (solves the “incidental parameters" problem)
- We take expectations over patients which addresses price measurement error concerns
- We require no assumption on distribution of unobservables
- We allow for selection of patients into insurers based partly on hospital preferences ($g_{\pi}(.)$ terms differ across insurers).
Next step is to go back to inequalities, use $\theta_{p,\pi}$ estimates to generate bounds on quality $g_{\pi}(q_h(s), s)$ for each $(\pi, h, s)$

Econometric tests indicate we can re-write

$$g_{\pi}(q_h(s), s) = \beta_{\pi} q_{h,s}$$

which generates a ranking of hospital qualities for each severity that is the same for all insurers

The $R^2$ of a regression of the unrestricted $g_{\pi}(q_h(s), s)$ on $\beta_{\pi} q_{h,s}$ is 0.98. So we proceed under this assumption.
Then utility equation becomes

$$W_{i,\pi,h} = \theta_{p,\pi}(price_{i,\pi,h}) + \beta_{\pi}q_{h,s} - d(l_i, l_h) + \epsilon_{i,\pi,h}$$

- Translate estimates to weights on price, distance relative to quality:

<table>
<thead>
<tr>
<th></th>
<th>Pacificare</th>
<th>Aetna</th>
<th>Health Net</th>
<th>Cigna</th>
<th>Blue Cross</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\theta_{p,\pi}$</td>
<td>-1.50</td>
<td>-0.92</td>
<td>-0.78</td>
<td>-0.35</td>
<td>-0.29</td>
</tr>
<tr>
<td>Price ($\frac{\theta_{p,\pi}}{\beta_{\pi}}$)</td>
<td>-0.293</td>
<td>-0.295</td>
<td>-0.297</td>
<td>-0.291</td>
<td>-0.290</td>
</tr>
</tbody>
</table>

- Large cross-plan differences in tradeoff between price and distance
- But tradeoff between price and quality differs much less.
- Higher-capitation insurers seem willing to send patients further for lower-priced hospitals, but not willing/able to sacrifice quality to pay a lower price.
Conclusions of Ho and Pakes (2012)

- **Objectives:**
  - Estimate preferences of the agent that determines hospital choice
  - Identify relation between incentive structure and price; quality

- Inequalities method addresses some problems with logit analysis

- **Results indicate:**
  - Price matters more when insurer capitates more physicians
  - Weight on price relative to distance differs across insurers while weight on price relative to quality does not
  - Higher-capitation insurers willing to send patients further for similar-quality lower-priced hospitals.
Related Findings: Potential Impact of ACOs

- Song et al (2011) on BCBS of MA "Alternative Quality Contract"
  - Physician incentives similar to those being developed for ACOs
  - Findings: reduced growth in spending on outpatient services in the first 2 years, largely from referring patients to lower-cost providers
  - Also observed quality of care improvements (chronic care management, adult preventive care, pediatric care)

- Colla et al (2012) on Physician Group Practice Demonstration
  - Medicare ACO pilot program launched by Centers for Medicare and Medicaid Services (CMS) 2005-9
  - Findings: modest average annual cost savings per beneficiary
  - Savings largest for acute care and for lowest-income populations.
Conclusions

- Overall the evidence suggests that ACOs may have a positive impact
  - reduced cost growth, particularly through shifting procedures to lower-priced providers
  - improved quality, e.g. better coordination of care for chronic diseases
- In the longer term this is likely to generate an incentive for hospitals / outpatient clinics to reduce their prices
- However, research is needed to analyze antitrust issues
  - Will ACO initiatives prompt another hospital merger wave?
  - Will hospitals respond to the changes by purchasing physician groups?
  - Impact on prices, referrals, and quality?
- More difficult to address these dynamic, longer-term questions
- An opportunity for future important research.