Hospital Choices, Hospital Prices and Financial Incentives to Physicians

by

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Questions We Are Trying To Adress.

- How does the incentive structure built into an insurance plan affect the relationship between hospital choice and the price the insurer pays for the hospital's services? (Today's focus.)

- What are the hospital rankings implied by the hospital choice function, and does it differ with the type and/or severity of the patient's condition? (Initial Results.)

- How do the implied rankings compare to; (i) published rankings?, (ii) outcome data (conditional on diagnosis)?

- What does the hospital choice function tell us about the tradeoff between measures of quality, price, and convenience factors? How does the tradeoff differ among plans?

Motivation: Recent US Health Reforms

- Patient Protection and Affordable Care Act (PPACA) 2010 attempts to provide incentives to control costs and improve quality of the Medicare program (about 4% of GDP; third largest federal spending program after defense and social security).

- Accountable Care Organizations (ACOs) play a central role in the PPACA. Expect Medicaid and commercial groups to follow suit (some groups already announced ACO-like plans for private market).

- An ACO will be (starting January 2012) a group of doctors (and possibly hospitals) that shares responsibility for providing care to a large group ($\geq$ 5000) Medicare patients (must agree to manage all the health care needs of their patients).

- Cost Saving in ACOs.
  - Current fee-for-service payments will continue.
  - However, ACO eligible to share in cost savings relative to benchmark if exceed a minimum level ($\approx$ 2%). The benchmark is based on past spending and is developed for each ACO separately.
  - The fraction of the savings they keep will be linked to performance on quality standards (care coordination; patient safety; preventive care), but should average about 50%.

- Centralization is thought to be quality-improving, and the incentives provide a motivation for optimizing their potential. Currently
  - More than 50% of Medicare beneficiaries have $\geq$ 5 chronic conditions (diabetes, arthritis, hypertension).
  - As a result they see multiple physicians per patient, and incentives plus communication failures lead to duplicative care, misallocations, and medical errors.
  - On average 1 in 7 Medicare patients admitted to a hospital is subject to a harmful medical mistake during his / her care (!)

Note 1. The ACO provides incentives for the "group" to save, but no rules on how these incentives will be passed down to individual providers, and this will determine how effective they will be in generating cost savings and quality improvements.

Note 2. The ACO will give providers increased bargaining power vis a vis insurers. We come back to the likely effects of this below.

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

- Similar cost control incentives applied to different extents by different HMOs for their private enrollees in California (see below).
- Yields opportunity to analyze how the cost and quality responses of incentives that are similar to those proposed for ACO's.
- Previous papers document lower costs in HMOs compared to other insurers but not the mechanisms used.

First Question Today. Are patients more likely to visit low cost hospitals when their insurer gives their physician groups incentives to lower costs?

Background on Literature and Issues.

- A substantial previous literature uses hospital discharge records to estimate models of hospital choice. Results are used intensively in merger analysis but the models do not include an analysis of response to hospital prices. $\Rightarrow$ current merger analysis does not account for price increasess to decrease demand, which should mitigate adverse effects of mergers.

- Advent of ACO's will change market structure and relative bargaining power. Implies changes in both;
  - premiums to consumers, and
  - investment decisions.

- FTC is already seeing an increase in hospital merger reviews in anticipation of formation of ACO's.

- Analysis of likely impact are largely absent, and generating controversy across agencies about the ultimate value of ACO's.

E.g.; Conflicting views on 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)

Outline

- Overview of; (i) the market, (ii) the choice and econometric models, and (iii) the limitations imposed by data availability.

- Details on the Dataset

- The Model

  - Multinomial Logit Analysis

  - Inequalities Methodology

- Results on price effects.

- Initial results on quality measures.

The California Medical Care Market 2003

- Focus on HMOs (53% of employed population)

- 7 largest HMOs had 87% of HMO market: we consider all but Kaiser (they do not report prices, and own their own hospitals so transfer pricing would be an issue).

- Physician contracts: California Delegated Model dominates. HMOs have non-exclusive contracts with large physician groups.

- Two payment mechanisms for physician groups

1. Capitation payments (fixed payment per patient to cover services provided): physician groups have incentives to control hospital costs

- Global capitation: payment covers both primary care and hospital stays ($\approx$ 20%).
- The ($\approx$ 80%) non-global typically include "shared risk arrangements" (group shares in inpatient cost savings made relative to pre-agreed target)

2. Fee-for-service contracts.

Capitation arrangements' incentives passed on from physician group to physicians

- Medical groups (contains partners and salaried physicians): by profit sharring and promotion on pay scale contingent on management of costs (for salaried doctors).
- IPA: typically direct capitation.

Our Analysis.

- We utilize hospital discharge data for California in 2003; only women in labor (largest patient group). This is OSHPD data; Census of hospital discharges, private HMO enrollees (some PPO for BS & BC, but we try to limit to in-plan hospitals).
  - Patient characteristics: insurer name, hospital name, diagnoses, procedures, age, gender, zip code, list price
  - Hospital characteristics: average discount, zip code, teaching status, number of beds, services, annual profits.

- 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. There is considerable dispersion in this across insurers
  - Blue Cross: 38% capitated payments
  - Pacificare: 97% capitated payments

Some notes on choice process

- Obstetrician (OB) often affiliated with 1-3 hospitals,
- Patient chooses OB based partly on hospital affiliation,
- Interview evidence indicates physician group practice managers pass on price information to OBs.

Mechanisms for physician response

- 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.

Overview of the Model

Physician and patient jointly make the hospital choice. Our "agent" is the function determining the ordering of hospitals that this generates.

$$W_{i,\pi,h} = \theta_{p,\pi} p_{i,\pi,h} + g_{\pi}(q_h(s), s_i) + \theta_{d,\pi} d(l_i, l_h) + \varepsilon_{i,\pi,h}$$

- $p_{i,\pi,h}$ = 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
- $q_h(s)$ = a hospital-specific vector of perceived qualities for different sickness levels

- $g_\pi(.)$ = plan-specific non-parametric function of $q_h(s)$ and s_i which permits
  - allows hospital quality rankings to differ by severity and plan.

So

- plan tradeoff's between "quality", price and convenience can differ across severities,

- different plans can make these tradeoff's differently.

Our Questions.

- The price coefficient
  - is it negative?
  - more negative when insurer gives physicians incentives to control costs?
- How does perceived quality relate to; (i) outcomes? (ii) published quality rankings?, (iii) measures of consumer satisfaction?
- Do plans with a more negative price coefficient send patients to hospitals with worse outcomes?

Previous Hospital Choice Literature. Utility as a function of distance, hospital quality, hospital-patient interactions.

- Often multinomial logit models with no price term (Gaynor and Vogt construct and use a single price index for each hospital).

- The hospital quality terms and the patient-hospital quality interactions are a particular parameterization of our $g_\pi(q_h(s), s)$ terms.

Our Price Variable

- Agent does not know price when decision is made: need an expected price.

- Assume expected price per entering diagnosis/hospital is the average list price per diagnosis/hospital multiplied by a discount.

- Have data on average list price per entering diagnosis (like hotel "rack rate") and average discount at hospital level.

- Define price = expected list price*(1-average discount)

Major problems with price measure.

- Expectational and/or measurement error; likely more of a problem for severities with a small number of patients.

- Discounts are typically plan specific; we come back to a correction for this below.

Start with multinomial logit analysis (follows previous literature).

- Limited controls for $g_\pi(q_h(s), s)$ (or hospital quality-severity-plan preference interactions). Leads to worry about
  - price endogeneity,
  - expectational and/or measurement error due to small price cells.
- Get positive price coefficient.
- Mitigate both problems by focusing on least sick patients.
- Gives negative price coefficient; more negative for more highly capitated insurers, but magnitudes questionable.

Inequalities analysis

- Choice model generates inequality constraints.

- Use them to construct inequalities that

  – difference out quality-severity terms (our $g_\pi(.)$); to adress endogeneity

  – and then averages over all (not just least sick) patients; to adress expectational and/or measurement error.

- $\theta_{p,\pi}$ significantly negative for all but the one for-profit insurer (Blue Shield, which behaves differently), and both

  – more negative for high-capitation insurers, and

  – more than an order of magnitude larger than for logits.

Descriptive Statistics: Discharge Data

	Mean	Std Devn.
Number of patients	88,157	
Number of hospitals	195	
Teaching hospital	0.27	
List price ($)	$13,312	$13,213
List price*(1-discount)	$4,317	$4,596
Length of Stay	2.54	2.39
Died	0.01%	0.004%
Acute Transfer	0.3%	0.02%
Special Nursing Transfer	1.5%	0.04%

- Average discount is 67.5%.
- Now have data on more detailed outcome measures; readmissions and discharges (other than to home) of mother and baby over the following 12 months.

Prices and Outcomes By Patient Type

	N	Price*(1-disc)	Acute Transfer	Special Nursing
Age				
≤ 40	84130	4269 (4488)	0.3% (0.0%)	1.49% (0.0%)
> 40	4027	5310 (6373)	0.5% (0.1%)	1.54% (0.2%)
Charlson				
0	86326	4276 (4501)	0.3% (0.0%)	1.5% (0.0%)
1	1753	6079 (7060)	0.6% (0.2%)	2.3% (0.4%)
> 1	78	10022 (15186)	5.1% (2.5%)	12.8% (3.8%)

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.

- Price and outcome measures vary in the expected direction with age and Charlson score.

- Most women are under 40, and most women come in with a zero Charlson score (severity, however, also differs by diagnosis).

Multinomial Logit Analysis

$$W_{i,\pi,h} =$$

$$\theta_{p,\pi}(\delta_h lp(c_i, h)) + g_\pi(q_h(s_i), s_i) + \theta_d d(l_i, l_h) + \varepsilon_{i,\pi,h}$$

where
δ_h = 1 - discount, and
$lp(c_i, h)$ = average list price for type c_i at h.

We restrict

$$g_\pi(q_h(s_i), s_i) = q_h + \beta z_h x(s_i)$$

where
q_h= hospital fixed effects,
z_h= hospital characteristics
$x(s_i)$ = P(adverse outcomes $\|$ age, principal diagnosis, Charlson score)

If restriction is **incorrect**, then

$$g_\pi(q_h(s_i), s_i) = q_h + \beta z_h x(s_i) + e_\pi(q_h(s_i), s_i)$$

and

• for fixed s_i, $e_\pi(q_h(s_i), s_i)$ is absorbed in q_h for each π.

• Say s_i varies and treatment for more severely ill patients is higher priced. Then residual will be positively correlated with price if higher quality hospitals are:

(i) proportionately higher priced and

(ii) chosen disproportionately by the more severly ill.

Logit Results: 1

	All	Least sick	Sick
Price	.010**	-0.017*	.012**
	(.002)	(.009)	.002
Distance	-.215**	-.215**	-.217**
	(.001)	(.002)	(.002)
Distance^2	.001**	.001**	0.001**
	(.000)	(.000)	(.000)
$z_h x(s_i)$	Y	Y	Y
(15 coeffts)			
Hosp. F.E.s	Y	Y	Y
(194 coeffts)			
N	88,157	43,742	44,059

Notes:

- Least sick patients are aged 20-39 with zero Charlson scores and all diagnoses "routine".
- Price is average list price by age group (4) × principal diagnosis (21) × Charlson Score (6) × diagnosis Charlson score was in where possible. Often had to aggregate, ≈ 65 price groups per hospital.
- Hospital characteristics include teaching hospital, for profit, offer transplants, nurses per bed, quality of labor services
- Individual characteristics or probabilities of our adverse events conditional on diagnosis, age, Charlson score.

Results: Logit Analysis 2

	% capit	Discharges	Least sick patients Estimates
Spec 1: Price x			
constant			.069**(.014)
% capit			-.127** (.016)
Spec 2: Price x			
Pac-care	0.97	7,633	-0.077** (0.01)
Aetna	0.91	3,173	-0.011 (0.016)
HN	0.80	8,182	-0.038** (0.01)
Cigna	0.75	4,001	-0.021 (0.014)
BS	0.57	7,992	0.018 (0.011)
BC	0.38	12,761	0.008 (0.011)
Distance			-0.215** (0.002)
Distance squared			0.001** (0.000)
$z_h x(s_i)$ controls			Y
Hospital F.E.s			Y
N			43,742

Conclude: Capitation matters for price effect.

Magnitudes?

- *Distance.* Mean (std) of distance travelled for less-sick patients: 6.45 (10.11) miles. Average impact of a 1 mile increase in distance for hospital h, holding all else fixed, on probability P_{ih} that patient i attends hospital h, is a 13.7% reduction in P_{ih}. Comparable to prior estimates.

- *Price.* Mean (std) price for less sick patients: \$3380 (\$1870). A \$1000 price increase for Pacificare enrollees in hospital h a 5.2% reduction in P_{ih}.

Questions of results.

Price effects downward biased?

• Assumes; severity groups ($\approx$ 105) $\times$ hospitals ($\approx$ 195) $= q_h + \beta z_h x(s_i)$. We do this by market. In market with 50 hospitals we get $\approx$ 65 multinomial coefficiets to substitute for what could be 5,250 separate values.

• Small cells for price proxy; average's for small cells too small to averge out measurement error.

Hospital Quality Measures?

• Also did a logit for just sicker patients. Look at correlation between fixed effects for least sick and more sick patients across hospitals. R^2 only $\approx$ .5. There are clear differences, and both are significant.

Perceived hospital quality varies with severity of illness?

Inequalities Analysis

$$W_{i,\pi,h} = \theta_{p,\pi}(\delta_h lp(c_i, h)) + g_\pi(q_h(s), s_i) + \theta_{d,\pi} d(l_i, l_h)$$

- Normalize $\theta_{d,\pi} = 1$. s_i determines severity group and c_i determines price group. Both far more detailed than logit analysis.

- s_i groups: age $\times$ principal diagnosis $\times$ Charlson score $\times$ diagnosis generating Charlson score $\times$ rank of most serious comorbidity.

- Price groups. Severity $\times$ # comorbidities.

- Groupings done at suggestion of Columbia Presbyterian obsetetricians. Logic: rank of most serious comorbidities determines hospital choice, but not the number of co-morbidities (which do determine hospital costs).

- $g_\pi(q_h(s), s_i)$ freely interacts s_i groups ($\approx$ 105) with q_h (hospital F.E.). We assume it absorbs all unobserved quality variation that affects hospital choice.

Temporarily assume

$$p_i^o \equiv \delta_h^o lp^o(c_i^o, h) = \delta_h lp(c_i, h) + \varepsilon_{i,\pi,h},$$

$$E[\varepsilon_{i,\pi,h} | z_{i,\pi,h} \neq p^o(c_i, h)] = 0.$$

Inequalities Analysis: Estimator.

Assumption: If h' was feasible for i_h

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

Prcoedure: Find all pairs of **same** π and s but **different** c patients, say i_h, $i_{h'}$ s.t.:

- $i_{\pi,h}$ visited h and had alternative h'
- $i_{\pi,h'}$ visited h' and had alternative h

sum the two inequalities, and then average over such couples. In resultant inequality:

- Equal and opposite $g_\pi(.)$ terms drop out.
- $\varepsilon_{i,\pi,h}$ terms averaged out.

For any variable $x_{i_h,h}$ Let $x(i_h,h,h') \equiv x_{i_h,h} - x_{i_h,h'}$ (we drop the π index as analysis is done separately for each plan).

If $s^o_{i_h} = s^o_{i_{h'}} = s^o$ and h' feasible for i_h while h feasible for $i_{h'}$

$$0 \leq W(i_h,h,h') = \theta_p p^o(i_h,h,h')$$

$$+ [g(q_h,s^o) - g(q_{h'},s^o)] - d(i_h,h,h') + \varepsilon(i_h,h,h')$$

and

$$0 \leq W(i_{h'},h',h) = \theta_p p^o(i_{h'},h',h)$$

$$+ [g(q_{h'},s^o) - g(q_h,s^o)] - d(i_{h'},h',h) + \varepsilon(i_{h'},h',h).$$

So

$$0 \leq W(i_h,h,h') + W(i_{h'},h',h) =$$

$$\theta_p(p^o(i_h,h,h') + p^o(i_{h'},h',h)) - (d(i_h,h,h') + d(i_{h'},h',h))$$

$$+ \varepsilon(i_h,h,h') + \varepsilon(i_{h'},h',h).$$

Sum over $i_{h'}$ then over $h' > h$ and i_h and let $N(h)$ be the total number of summands, under standard regularity

$$\theta_p[\frac{1}{N(h)}\sum_{h'>h}\sum_{i_h,i_{h'}}(p^o(i_h,h,h')+p^o(i_{h'},h',h))] \geq$$

$$\frac{1}{N(h)}\sum_{h'>h}\sum_{i_h,i_{h'}}(d(i_h,h,h')+d\left(i_{h'},h',h\right))+o_p(1).$$

Using same signed instruments. Add moments by interacting each agent's inequalities with instruments z assuming $E(\varepsilon \mid z) = 0$

- $z =$ positive and negative parts of distance differences. Assumes these are perfectly observed by econometrician, and known to agent when choices made.

Details.

- 106 populated severity groups; 272 populated price groups; 157 hospitals.

- Conduct analysis for each insurer separately. If h has more than 1000 switches with other hospitals for that insurer, it gets separate moments. Sum the switches of hospitals with less than 1000 switches into one moment. 73 - 283 moments per insurer.

- Divide each moment by its estimated standard error

- Find set of $\theta_{p,\pi}$ satisfying implied system of inequalities

  - If none: find $\theta_{p,\pi}$ to minimize amount by which inequalities violated.

- Use PPHI confidence intervals (those that required computing covariance matrix repeatedly at different θ too computationally costly).

Prior "Reduced Form" Analysis.

- Can accept that within severity group across price group variance does not effect our measures of adverse effects (standard χ^2 tests).

- Price variation: Moving from severity to price groupings explains an additional 12% of variance in price (from 50% to 62% of total variance).

Review

Limitation of this methodology

- Assume unobservables causing selection absorbed in $g_\pi(.)$. Working on this.
- Assume price variable has no "systematic" error (i.e. it averages out over hospitals,severity groups, and plans). Come back to this.

Benefits:

- Differencing out the $g_\pi(.)$ terms
  - makes detailed hospital quality/patient severity/plan controls possible,

– allows for selection of patients into insurers based partly on hospital preferences ($g_\pi(.)$ terms depend on π).

- Averaging over patients addresses measurement error problems in price variable, and this with just a mean independence (rather than a full distributional) assumption on the error.

Systematic measurement error? Allow variation in discounts across insurers tor a given hospital ($\delta_{\pi,h} \neq \delta_h$).

- Observe d_h: revenue weighted average of discounts across insurers.

- Regress d_h on h's revenue share from each π interacted with the following observables

- hospital charas (e.g. teaching, FP, share of beds in market, bargain as a system)
- market fixed effects,
- insurer fixed effects.

- Use logistic (log-odds) ratio so that $d_{\pi,h} \in [0,1]$, and estimate by NLLS ($R^2 \approx .45$).

- Use estimates to generate predictions of $d_{\pi,h} \Rightarrow$ price measure
  - Prediction from estimates, $\widehat{d}^1_{\pi,h}$, or
  - d_h minus the impact of other insurers is $\widehat{d}^2_{\pi,h}$.

Preliminary Results: Tests for Inequalities Analysis

- Always point estimates but accept $H_0 : m(\cdot, \theta_0) \geq 0$ (CHT, Andrews-Soares moment shifting).

- Calculate t-statistic for each of our 886 moments at $\theta = \theta_0$. 7.5% negative, $\approx$ 1% with $t \leq -2$.

Summary of t-values.

	Pac/care	Aet.	H/Net	Cigna	BS	BC
# pos.	152	71	166	88	162	247
# neg.	9	2	11	2	7	36
Ave pos.	11.1	19.4	14.5	17.0	17.0	20.1
# $t \leq -2$	0	0	2	0	0	7

Do analysis with and without moments with $t < -2$, not much difference. Present those that exclude moments with $t < -2$.

Results from Inequality Analysis.

- All coefficients but BS significantly negative in all runs. BS is the only *not-for-profit*, and its c.i. indicates little info.

- C.i.'s from $\hat{d}_h^1$ and $\hat{d}_h^2$ fairly close, and somewhat different then from d_h. Use $\hat{d}_h^1$.

- Pacificare (capit=.97), c.i.= $[-1.48, -.76]$
  Aetna (capit=.91), c.i.= $[-2.72, -2.01]$
  Health Net (capit=.80),c.i.= $[-.64, -.12]$
  Cigna (capit=.75),c.i.= $[-.62, -.53]$
  BC (capit=.38), c.i.=$[-.36, -.23]$.

Results from Inequality Analysis.

	% capit.	$\widehat{\theta}_{p,\pi}$	$[CI_{LB},$	$CI_{UB}]$
Using observed discount d_h				
Pac/care	0.97	-1.34	[-1.55,	-1.09]
Aetna	0.91	-4.34	[-5.84,	-4.20]
HNet	0.80	-0.37	[-0.67,	-0.23]
Cigna	0.75	-0.80	[-0.92,	-0.77]
BS	0.57	0.04	[-0.36,	0.47]
BC	0.38	-0.47	[-0.48,	-0.09]
Using $\widehat{d}_h^1$				
Pac/care	.97	-0.98	[-1.48,	-0.76]
Aetna	.91	-2.38	[-2.72,	-2.01]
Hnet	.80	-0.27	[-0.64,	-0.12]
Cigna	0.75	-0.56	[-0.62,	-0.53]
BS	0.57	0.28	[-0.71,	0.94]
BC	0.38	-0.31	[-0.36,	-0.23]
Using $\widehat{d}_h^2$				
Pac/care	0.97	-1.35	[-1.55,	-1.11]
Aetna	0.91	-2.54	[-2.97,	-2.45]
HNet	0.80	-0.43	[-0.57,	-0.13]
Cigna	0.75	-0.61	[-0.67,	-0.58]
BS	0.57	0.30	[-2.24,	0.96]
BC	0.38	-0.50	[-0.51,	-0.16]

Magnitude of Results

- $\eta^{d,p}$ = percent distance reduction needed to compensate for a 1% price increase (using $\widehat{d}$):

HMO	% cap	Logits (less-sick patients) $\eta^{d,p}$	Inequalities (all patients) $\eta^{d,p}$
Pac-care	0.97	0.33	9.8
Cigna	0.75	0.10	2.7
BC	0.38	≤ 0	.4

Conclude. Price effects likely to be

- much higher than from logit analysis,
- vary a great deal with capitation rates.

Preliminary Analysis of Quality Estimates.

1. Transitivity. Given θ_p, for each h we get a partial order which is independent of θ and need not be transitive. If $S_{h,h'}$ are patients who chose h but could have chosen h',$n_{h,h'} = \#S_{h,h'}$, and

$$g(h, h') =$$

$$\frac{1}{n_{h,h'}} \sum_{i \in S_{h,h'}} [\theta_p(p(c_i, h) - p(c_i, h')) + (d(l_i, l_h) - d(l_i, l_{h'}))].$$

So if

$$\frac{1}{n_{h,h'}} \sum_{i \in S_{h,h'}} (p(c_i, h) - p(c_i, h')) > 0,$$

and

$$\frac{1}{n_{h,h'}} \sum_{i \in S_{h,h'}} (d(l_i, l_h) - d(l_i, l_{h'})) > 0$$

then $h \succ h'$.

• Table lists number of non-transitive cycles. Small number and **all** associated with differences in means which were the right sign but not significantly different from zero.

• Though the complete order of hospitals w.r.t. quality depends on θ, there are very few rank reversals as we change θ over its plan-specfic c.i. E.g.: we divided the c.i. into twelve equally sized intervals and consider rank reversals obtained when we evaluate the order at their endpoint θ's. In our biggest diagnosis, over our three largest markets (LA, Bay Area, San Diego); even before we accounted for variance in estimates there was only 1 rank swap for Pacificare, 0 rank swaps for Aetna, and 11 rank swaps for Blue Cross.

Severity	Number ordered	Number cycles $\lvert t\rvert \geq 0$	$\lvert t\rvert \geq 1.95$
Pacificare			
342	2298	0	0
343	1086	246	0
344	4	0	0
366	76	0	0
380	3078	6	0
Cigna			
342	1340	72	0
343	652	0	0
344	0	0	0
366	14	0	0
380	1416	0	0
Aetna			
342	1406	0	0
343	412	0	0
344	0	0	0
366	6	0	0
380	1920	0	0
Healthnet			
342	2162	194	0
343	1154	0	0
344	4	0	0
366	52	0	0
380	2728	6	0
Bluecross			
342	2900	202	0
343	1812	156	0
344	32	0	0
366	266	0	0
380	2918	6	0

2. Consistency of Quality Measures Across Plans.

To get an indication evaluate quality terms at midpoint of c.i. and look at Spearman rank correlation for three largest severity groups across three largest markets. Even without accounting for the variance in the estimate 47% of the correlations across plans were exactly one, and over 80% were above .9.

This is close to allowing us to rewrite

$$g_\pi(\mathbf{q}_h(s), s) = \theta_\pi g(\mathbf{q}_h(s), s)$$

in which case we have a plan independent ranking of hospital qualities for each severity. Modeling assumption required for this is a bit stronger: need affine transformations (in process of building tests for this).

Further results (These still need to be checked before we are sure of them).

- When we compare quality levels across plans they look to be proporitional to the price coefficients. The tradeoff between resulting quality indices and price is almost the same across plans. What differs is the relative weight to distance. Different plans are willing to send patients different distances to obtain a price reduction.

- With new outcomes data; Outcomes conditional on severity do not seem to differ across plans.