

FACTORS UNDERLYING VARIATION IN INPATIENT HOSPITAL PRICES

AMY L. KATZEN, JD, MPP,¹ TASNEEM CHIPTY, PhD,² MEGAN WULFF, JD, MPH,¹ KATHERINE SCARBOROUGH MILLS, JD, MPH¹

¹Massachusetts Health Policy Commission, Boston, MA, ²Matrix Economics, Boston, MA



INTRODUCTION

Variation in prices paid to health care providers for the same services is a well-documented national phenomenon.¹ In Massachusetts, state agencies, including the Office of the Attorney General, the Massachusetts Center for Health Information and Analysis (CHIA), and the Health

Policy Commission (HPC), have reported on extensive variation in hospital prices. Evidence also suggests that higher-priced hospitals tend to receive higher volume, which contributes to rising healthcare spending.

RESEARCH OBJECTIVE

Market participants and policymakers have generally agreed that some variation in hospital prices may be tied to desirable hospital characteristics that generate value for patients or for society as a whole, but that some may also be due to market power, which allows some pro-

viders to extract supracompetitive rates from payers. The HPC sought to identify the hospital characteristics associated with higher and lower commercial prices for general acute care inpatient hospital services in Massachusetts.

STUDY DESIGN

We designed a multivariate regression analysis to examine price variation at 60 Massachusetts acute care hospitals among 14 commercial payers.

Our dependent variable is a measure of price, based on CHIA's 2013 hospital relative price index that compares each hospital's acuity-adjusted net revenue per discharge to the average acuity-adjusted net revenue per discharge across a commercial payer's network.² Due to differences in acuity adjustment tools, hospital relative price is not comparable across payers. To include all hospital-payer combinations, we used hospitals' relative price percentile for each commercial payer. This measure is bounded between 0 and 100 percent and provides an ordinal ranking of hospitals by price.

The explanatory variables in our base specification include hospital characteristics, demographics of the population served, measures of market structure, and hospital system characteristics. The data were gathered from sources including CHIA, the Center for Medicare and Medicaid Services, the Massachusetts Health Data Consortium, and the Internal Revenue Service. The variables are:

- Hospital quality as measured by safety score (2013 Patient Safety Indicators (PSI)-90);³
- Hospital type (academic medical center (AMC), specialty, teaching but not AMC, community hospital);
- Share of discharges that were higher-acuity, or "tertiary;"
- Share of the hospital's discharges paid by Medicaid and other state programs;
- Share of the hospital's discharges paid by Medicare;
- Mean household income in hospital primary service areas (PSAs);
- Number of hospitals with PSAs overlapping with the focal hospital's PSA (and this variable squared);

- Indicator variable for the existence of an AMC or specialty hospital with a PSA overlapping with the focal hospital's PSA; and
- Number of system-wide staffed beds, for the system to which the hospital belongs (and this variable squared).

Thus, the base model can be written as:

$$\text{Percentile_Rank}_{hp} = \beta_0 + \beta_1 \text{PSI-90_Score}_h + \beta_2 \text{Mean_PSA_Income}_h + \beta_3 \text{Teaching}_h + \beta_4 \text{AMC}_h + \beta_5 \text{Specialty}_h + \beta_6 \text{Tertiary_Share}_h + \beta_7 \text{Safety_Net_Share}_h + \beta_8 \text{Medicare_Share}_h + \beta_9 \text{CompetingCommTeachHosp}_h + \beta_{10} \text{CompetingCommTeachHosp}_s^2 + \beta_{11} \text{AMC_Nearby}_h + \beta_{12} \text{SystemBeds}_s + \beta_{13} \text{SystemBeds}_s^2 + \varepsilon_{hp}$$

We estimated the parameters of this model using ordinary least squares (OLS).

We also ran several sensitivity analyses:

- We used CMS's Total Performance Score as a measure of hospital quality in place of the PSI-90.⁴ This variable incorporates more quality metrics than the PSI-90, but was only available for 53 general acute care hospitals, while the PSI-90 was available for all 60 hospitals.
- Out of concern that the variable for having an AMC or specialty hospital with an overlapping PSA would be highly correlated with the number of hospitals overlapping with the focal hospital's PSA, we excluded the AMC variable.
- We ran a version of each specification that controlled for system characteristics with hospital system fixed effects, instead of system-wide staffed beds.
- We estimated the regression model using a general linear model with a logit error distribution, to account for the fact that the dependent variable is bounded between 0 and 100 percent.

RESULTS

We find that a substantial portion of hospital price variation is associated with market structure, as measured by the presence of local competitors and the hospital's system size:

- Number of hospitals with overlapping service areas:** Having competitor hospitals in a hospital's service area was generally associated with lower price percentiles. As seen by the positive sign on the "squared" term, this price effect decreased as the number of competitors increased.
- Existence of an AMC or specialty hospital with an overlapping service area:** Sharing a service area with an AMC or specialty hospital was strongly associated with lower price percentiles.
- Number of system-wide staffed beds:** The number of system-wide staffed beds, accounting for nonlinear effects, was strongly associated with a hospital's price percentile. A small increase in system-wide staffed beds for all hospital systems except for Partners Healthcare was associated with a lower price percentile. For Partners Healthcare, it was associated with a higher price percentile.
- System fixed effects:** Most of the system fixed effects were significant as compared with the reference group of hospitals without a system affiliation. Some systems were associated with higher price percentiles, while others were associated with lower price percentiles.

We also find that a portion of hospital price variation is associated with the type of care provided, even after accounting for case mix:

- Hospital type and provision of tertiary services:** Teaching status was associated with higher price percentiles, while status as an academic medical center was insignificant. Provision of more tertiary services was associated with higher price percentiles.
 - Share of discharges paid by Medicaid/state programs and Medicare:** Both of these variables were associated with lower price percentiles.
- Finally, we find little association between a hospital's price variation and its measured quality or local demographics.
- Quality:** Generally, neither the PSI-90 nor the Total Performance Score were statistically significant. In the GLM specifications, better PSI-90 scores were associated with higher price percentiles for the three specifications that included hospital system fixed effects and/or excluded the variable on whether there is an AMC or specialty hospital with an overlapping PSA.
 - Household income:** Mean household income in the hospital's PSA was not statistically significant.

Results for the base specification and the sensitivity with system fixed effects are shown below. For all variables, our results are generally robust across all sensitivities explored.

TABLE: OLS Estimation Results

INDEPENDENT VARIABLE	SPECIFICATION (1)	SPECIFICATION (2)
PSI-90	-9.854 (-1.04)	-12.07 (-1.33)
Mean income in PSA zip	0.065 (0.79)	-0.043 (-0.75)
Teaching hospital	10.34** (2.31)	11.19** (3.31)
AMC hospital	-3.367 (-0.30)	-2.052 (-0.22)
Specialty hospital	-0.981 (-0.09)	-3.362 (-0.38)
Share of discharges tertiary	1.794*** (3.16)	1.446*** (3.60)
Share of discharges paid by Safety Net	-0.345* (-1.83)	-0.463*** (-4.10)
Share of discharges paid by Medicare	-0.385** (-2.69)	-0.517*** (-3.98)
Number of community, teaching hospitals with overlapping PSAs	-1.201 (-1.67)	-1.437*** (-4.50)
Number of community, teaching hospitals with overlapping PSAs, squared	0.035 (1.34)	0.044** (2.54)
AMC/specialty with overlapping PSA	-11.08** (-2.97)	-9.159*** (-8.31)
Number of staffed beds in system	-0.0140* (-1.99)	
Number of staffed beds in system, squared	.000006** (2.80)	
Baystate Health		-14.65*** (-12.17)
Berkshire Health System		-0.118 (-0.05)
Beth Israel Deaconess		-7.886** (-2.46)
Cape Cod Healthcare		5.671** (2.70)
Catholic Health East		-30.36*** (-11.00)
Circle Health		-13.28*** (-4.07)
Heywood Healthcare		-20.20*** (-13.86)
Lahey Health System		-2.656 (-0.92)
Partners HealthCare System		10.15** (2.93)
Partners Negotiated		-6.112*** (-8.48)
Southcoast Health System		18.39*** (13.39)
Steward Health Care System		-10.52*** (-9.13)
Tenet Healthcare Corp.		1.526 (0.73)
UMass Memorial Health Care		-0.159 (-0.12)
Adjusted R2	0.327	0.374

Note: T-statistics are shown in parentheses to the right of the estimated coefficient. Asterisks denote statistical significance, with * P<0.10, ** P<0.05, *** P<0.01.

CONCLUSIONS

Our analysis suggests that community and teaching hospitals compete with one another on price, but that this competitive effect has a diminishing effect after a certain amount of competition is achieved. That the presence of an AMC in a hospital's PSA so significantly reduces relative price percentile indicates that community and teaching hospitals in competition with an AMC are disadvantaged in their negotiations with payers, who may value the community and teaching hospitals less if their members can easily visit an AMC.

The findings indicate that the system to which a hospital belongs may play an important role in hospital price; the size of the system with which a hospital is affiliated is one measure for the potential market power that system brings to bear. That the squared version of this variable is positive while the linear term is negative suggests that at smaller system sizes, adding more beds may yield efficiencies that allow for lower prices, while after a certain size, adding more beds increases the system's market power and yields higher prices.

The price variation across inpatient hospitals in Massachusetts cannot be explained by differences in hospital quality as measured in this analysis.⁵ This result may be sensitive to the quality measures used, and ongoing development of quality metrics can aid future analysis of this point. Analyses using larger data sets may be able to study several quality metrics in the same specification, which could further aid the analysis.

Finally, our finding that caring for more public payer patients is associated with lower commercial relative price percentile illustrates the double challenges that hospitals serving more public payer patients face, as they receive lower commercial rates while relying more on generally lower-paying public payers.

POLICY IMPLICATIONS

While some of the higher commercial prices paid to certain Massachusetts hospitals for inpatient services may be tied to value (e.g., provision of more tertiary services that might require cross-subsidization by higher rates for non-tertiary services), our analysis suggests that market power, driven by a lack of competition, is a significant factor in price disparities.

These findings emphasize the importance of ongoing efforts to ensure hospital market competition, and may also suggest value in active efforts to mitigate the effects of existing market dysfunction.

CONTACT

Amy L. Katzen, *Project Manager*
Market Performance
Health Policy Commission
Amy.Katzen@state.ma.us

Dr. Tasneem Chipty, *Managing Principal*
Matrix Economics
tchipty@matriceconomics.com

Megan Wulff, *Deputy Policy Director*
Market Performance
Massachusetts Health Policy Commission
Megan.Wulff@state.ma.us

Katherine Scarborough Mills, *Policy Director*
Market Performance
Massachusetts Health Policy Commission
Katherine.Mills@state.ma.us

www.mass.gov/HPC

- See, e.g., Zack Cooper et al., The Price Ain't Right? Hospital Prices and Health Spending on the Privately Insured, Working Paper: Nat'l Bureau of Econ. Research (Dec. 2015), available at http://www.healthcarepricingproject.org/sites/default/files/pricing_variation_manuscript_0.pdf.
- See Center for Health Information & Analysis, Relative Price Methodology Paper (2016), available at <http://www.chiamass.gov/assets/docs/r/pubs/16/RP-Methodology-Paper-9-15-16.pdf>.
- See Agency for Healthcare Research & Quality, Patient Safety For Selected Indicators: Technical Specifications, Patient Safety Indicators 90 (PSI-90) (2013) available at <https://www.qualityindicators.ahrq.gov/Downloads/Modules/PSI/V45/TechSpecs/PSI%2090%20Patient%20Safety%20for%20Selected%20Indicators.pdf>. Higher PSI-90 scores indicate a higher rate of complications and therefore worse quality performance.
- See Ctrs. for Medicare & Medicaid Servs., The Total Performance Score Information, available at <https://www.medicare.gov/hospitalcompare/data/total-performance-scores.html>.
- Other studies have also found no relationship between price and quality. See Office of Att'y Gen. Martha Coakley, Examination of Health Care Cost Trends and Cost Drivers Pursuant To G.L. c. 118g, § 6 ½(B): Report For Annual Public Hearing (Mar. 2010), available at <http://www.mass.gov/ago/docs/healthcare/2010-hcctd-full.pdf>; Office of Att'y Gen. Maura Healey, Examination of Health Care Cost Trends and Cost Drivers Pursuant To G.L. c. 12, § 11n: Report For Annual Public Hearing Under G.L. c. 6D, § 8 (Sept. 2015), available at <http://www.mass.gov/ago/docs/healthcare/cctcd5.pdf>.