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RESEARCH ARTICLE

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Hospital resource allocation decisions when market prices exceed Medicare prices

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Abstract

Objective: To examine nonprofit hospitals' financial and spending allocations when the private sector payment rate is higher than the Medicare's payment rate.

Data Sources: Hospital financial data for 2014–2018 from Center for Medicare and Medicaid Services Hospital Cost Reports, hospital characteristics from the American Hospital Association (AHA) Annual Survey.

Study Design: Hospital and year level fixed effects regressions modeling each hospital's (1) operating net income per discharge equivalent (DE); (2) administrative cost per DE; (3) patient care cost per DE; (4) registered nurse per bed; charity care cost per DE; and (5) provision of unprofitable services as a function of the private sector to Medicare payment ratio (PMR).

Data Collection/Extraction Methods: Hospital/year-level data from hospital cost reports merged with AHA data. Samples included general short-term hospitals with nonprofit ownership, excluding critical access hospitals.

Principal Findings: The final sample included a total of 8862 hospital-year observations, with a mean PMR of 1.62. Nonprofit hospitals having a 0.1 higher PMR were associated with $257 (95% CI: $181–$334) increase in operating net income per DE; $66 (95% CI: $32–$99) increase in administrative cost per DE; $170 (95% CI: $120–$220) increase in patient care cost per DE; and $18 (95% CI: $10–$25) increase in charity care cost per DE. We found hospitals hired 0.86 (95% CI: −0.08 to 1.81) more registered nurses per 100 beds, but no evidence on providing more beds for unprofitable services, such as obstetric care, burn care, alcohol/drug abuse treatment, or psychiatric care.

Conclusions: Higher private sector prices led primarily to greater surplus and administrative cost for nonprofit hospitals and smaller increases in spending on services that will directly benefit patients.

KEYWORDS
costs, health care, health insurance, hospitals, spending

What is known on this topic

- Hospital prices paid by private insurance and self-insured employers are considerably higher than Medicare's payment rates, especially in areas with highly concentrated hospital markets.
- Hospitals respond to changes in patient revenue by adjusting their operating expense and net income.

What this study adds

- Nonprofit hospitals, with higher private sector to Medicare payment ratios, used the additional funds to increase their operating net income and administrative costs more than their increases on patient care spending, charity care spending, or the provision of unprofitable services.
- For nonprofit hospitals, higher private sector payment rates were associated with better financial performance but very small increases in community benefit provision.

1 | INTRODUCTION

High prices are the main reason that the United States spends more on the healthcare sector than other industrialized countries.[1] The average prices paid by private insurance and self-insured employers for hospital services have increased much faster than public sector prices since 1997.[2] By 2018, the private sector payment rates were often double Medicare's prices for many procedures, with price differentials even higher in more concentrated hospital markets.[3–5] Recently, there has been a growing policy interest in lowering private sector hospital prices.[6–10] However, there is concern that cost containment policies could reduce access to and quality of hospital care.[4,5]

Therefore, it is important to investigate how hospitals with the higher private sector to Medicare payment differentials spend these additional dollars. If these additional dollars are primarily allocated to direct patient care and community benefits, then lowering private sector prices could potentially hinder access to care and reduce the quality of care. However, if these revenues add to a hospital's profit and administrative spending, then the increase in patient welfare would be lower. This would be especially relevant for nonprofit hospitals, as they should prioritize their spending in patient-care operations and community benefit provisions to justify their tax-exempt status.[11,12]

1.1 | Review of literature

Hospital prices paid by private insurers vary widely within and across markets.[3] On average, they are substantially higher than Medicare's payment rates, and the payment differential had increased over time. According to the American Hospital Association's (AHA) annual survey, the average private sector hospital payment rate increased from 13% above Medicare's rate in 1997 to nearly 70% above Medicare's rate in 2018.[2] Other researchers have calculated the differential using different data sources and methods of comparison: Duffy and coauthors calculated a 70% price differential using 2017 Medicare hospital cost reports compiled by RAND.[13,14] Using a sample of mostly self-insured employer claim data and simulated Medicare payments, Whaley and coauthors estimated private plans paid hospitals 147% more than the Medicare price.[15] Chernew and coauthors found inpatient services were 106% higher for self-insured employers in 2017.[4] Studies using claim data enable researchers to estimate payment differentials for specific procedures, but usually include services from a sample of geographic areas, hospitals, payers, and patients that could pay disproportionally higher prices. For example, the fully insured plans, exchange plans, uninsured self-pay patients, worker's compensation payments generally paid different prices from the self-insured employer plans.[14,16] Maryland claims, which were excluded from the previous two studies, had lower commercial to Medicare price differential due to the all-payer system.[4] In contrast, studies using aggregated national hospital level data typically show a lower differential, perhaps because all hospital markets, services, and transactions were included. Moreover, the price differential was calculated using the actual patient revenue and utilization instead of simulated Medicare payment rates. In this study, we use aggregate hospital financial data since it comprises all services and includes all actual patient revenues and utilizations.

Little is known on how hospitals with higher PMRs actually spent this additional revenue. Hospital representatives have argued that higher private sector price is needed to cross-subsidize the payment shortfalls from public insurance and uncompensated care loss (including community benefit provision), an argument commonly known as "cost-shifting."[17] One concern about the cost-shifting hypothesis is that nonprofit hospitals will spend or retain all the revenue they receive, and so the higher the PMR, the higher the revenue, and therefore, the higher the cost.[18,19] Therefore, hospitals with higher PMRs will have higher costs, and the differential between costs and Medicare payment rates will be greater. In many empirical studies, no evidence for cost shifting is found, while in others it is minor and rare.[20] Some studies have shown that hospitals cut their operating expenses in response to public program payment rate reductions, which is in line with the hypothesis that hospital spending is responsive to their revenues.[18,19]

Private hospitals in the United States incurred a high level of administrative cost, accounting for 21% of operating expense 2018.[21] Other studies have shown that CEO compensation at major hospitals had doubled from $1.6 million in 2005 to $3.1 million in 2015, while the wage gap between CEOs and registered nurses had increased from 23:1 to 44:1.[22] Whether higher PMR could enable hospitals to spend disproportionately more on administrative cost or senior executive compensations than patient care cost has important implications for patient welfare. However, few studies have explored this topic.

Recent hospital finance literature found that nonprofit hospitals, on a national average, spent less on charity care than for-profit hospitals.[23] Another study found no evidence that nonprofit hospitals provided more charity care or provided more unprofitable services than for-profit hospitals in response to an increase in market power.[24]

Since community benefit provision is required to justify tax exemption status for nonprofit hospitals, an analysis of whether higher PMRs could lead to increased community benefit provision has important policy implications.[25] Yet, the topic of how nonprofit hospitals spend the additional money has received little attention.

1.2 | Research contribution

In this study, we address how nonprofit hospitals, which accounted for 57% of the total number of community hospitals in the United States, spent their additional revenue income obtained from higher private sector markup compared to the Medicare payment.[26] We compare how much was spent to fulfill the hospital's self-interest (surplus and administrative cost) and how much was allocated to improve patient welfare and community benefit (patient care, nurse staffing, charity care, and unprofitable services). Using hospital financial data during 2014–2018 and a hospital and year level fixed effects model, we evaluate the association between nonprofit hospital's private sector to Medicare payment ratio (PMR) and their operating net income; administrative cost, patient care spending, registered nurse per bed, charity care spending, and unprofitable service provision.

This paper documents the nonprofit hospitals' financial and spending behaviors, as well as community benefit provision associated with private sector markup from the Medicare's price. The study results will inform private health plans, self-insured employers, and patients if hospitals are allocating more of their healthcare spending to fulfill their self-interest or patient benefit. Moreover, our results will help policymakers to evaluate policy options to lower private sector prices and could encourage more community benefit provisions, especially in areas with highly concentrated hospital markets.

2 | METHODS

2.1 | Data and sample

We used the Center for Medicare and Medicaid Services (CMS) Hospital Cost Report (form 2552-10) for the calendar year 2014–2018, which was compiled and processed by RAND (RAND hospital data, May 2021 version).[13] This dataset contained information on hospital characteristics, utilization, cost, and financial outcomes for all Medicare-certified general acute-care hospitals. We merged this data with American Hospital Association (AHA)'s annual survey database to obtain information on hospital staffing levels and unprofitable service provision.[27] To adjust for covariates, we used hospital-level Medicare wage and case-mix index, county-level poverty and uninsured information from Small Area Income and Poverty Estimates (SAIPE) program and Small Area Health Insurance Estimates (SAHIE) program developed by the US Census Bureau.[28–30]

The merged dataset included a total of 12,697 hospital-year observations from 2721 unique general short-term hospitals with nonprofit ownership. We excluded critical access hospitals since Medicare reimbursed them under a cost-based reimbursement system (3305 observations). We excluded hospitals with missing values for outcomes, covariates, or where we were unable to construct valid PMR measure due to missing or negative patient revenue or utilization (328 observations). We excluded hospitals with an average length of stay exceeded 30 days; whose operating expense per patient exceeded $100,000 (dollars of the year 2018); whose charge-cost ratio was lower than 0.2 or higher than 15.0; whose expense-to-revenue ratio was lower than 0.5 or higher than 3.0; and hospitals with the highest and lowest 1% PMR values (202 observations).[31] A total of 8862 hospital-year level observations (1951 unique hospitals) were included in the final sample (Appendix S1). They accounted for 67% hospital-year level observations, 91% hospital beds, and 91% patient volume (measured by the number of discharge equivalents) among all Medicare-certified general short-term nonprofit hospitals located in the 50 states and District of Columbia during 2014–2018.

2.2 | Independent variables

The primary explanatory variable was the hospital-year level private sector market price to Medicare payment ratio (PMR). This ratio enabled us to benchmark private sector prices against Medicare payment rates, which are set to approximate the cost of efficient healthcare delivery.[32]

Following Duffy and coauthors' methodology, PMR was calculated as the ratio of private insurance revenue per discharge equivalent over the Medicare revenue per discharge equivalent.[14] Medicare revenue was obtained directly from the RAND hospital data, while revenue from private payers was computed as the total patient revenue after subtracting revenues from Medicare, Medicaid and CHIP, charity care, and state and local indigent programs. Discharge equivalent (DE) measured the combined hospital inpatient and outpatient utilization, standardized into inpatient discharge unit.[33] The RAND data identified the number of Medicare DEs. The number of private insurance DE was calculated using the total number of DEs multiplied by the share of private insurance utilization over the total utilization from all payers. This private insurance share was estimated by the ratio of private insurance charges (total charges subtracting charges from nonprivate payers) over total charges from all payers. In addition, Medicare Advantage (MA) plans were included in the Medicare price calculation because RAND hospital data did not identify MA revenue, cost, or discharges separately. In fact, the MA plan payment rates closely followed the traditional fee-for-service Medicare plans.[34] In the statistical analysis section, we incorporated the hospital-year specific MA plan inpatient days as a percentage of total Medicare inpatient days in our regression model to adjust for any possible variation in MA plan prices, revenue, and utilization.

2.3 | Outcome variables

In this study, we focused on two sets of outcomes: The variables more associated with the hospital's self-interest were operating net income per DE and administrative cost per DE. The services more associated

with patient benefits were patient care cost per DE, registered nurse to bed ratio, charity care spending per DE, and unprofitable service provision.

Using the RAND hospital data, we identified the hospital's operating net income (variable *net income from patient care services*), operating cost (variable *operating expenses*), and administrative cost (variable *administrative and general expenses*). We further subtracted administrative cost from operating cost and used this nonadministrative operating expense as a proxy measure for patient care-related cost. All outcomes were divided by the number of DEs to generate the per capita measure and adjusted to dollars of the year 2018 using the consumer price index (CPI).

Using data from the AHA, we calculated the number of registered nurses (RN) per bed. We were interested in RN staffing because a higher level of RN staffing has been associated with improved quality of hospital care.[35–37] In addition, we measured the hospital's charity care spending and unprofitable service provision, which were the two commonly used measures of community benefits for tax-exempt hospitals.[38] We calculated charity care spending per DE from the RAND hospital data. The AHA survey records the number of hospital beds for obstetrics care, burn care, alcohol and drug abuse treatment, and psychiatric care, which were often cited as examples of unprofitable services.[39] Therefore, we used the number of beds for these services as a proxy measure of the hospital's unprofitable service provision.

2.4 | Statistical analysis

We summarized descriptive statistics for PMR, stratified by calendar year and hospital characteristics. We also calculated summary statistics for outcome variables. Following the literature on hospital finance, we used ordinary least square (OLS) regression with hospital and year fixed effects to estimate hospital behavior as a function of PMR.[33,39,40] Our model was identified within the hospital over time and estimated hospital behaviors associated with 0.1 increase in current year PMR, weighted by hospital bed size.

To address potential confounders, we adjusted for six sets of covariates: We controlled hospital-level payer-mix measured by the percentage of private insurance, Medicare, and Medicaid utilization, as well as MA plan inpatient days as a percentage of total Medicare inpatient days as a proxy measure for MA plan market share. We adjusted for hospital characteristics, including bed size, the number of employed physicians per bed as a proxy measure for the hospital's acquisition of physicians, as well as Medicare case-mix index, wage index, and resident-bed ratio. We adjusted for the average length of stay and inpatient to outpatient utilization share (inpatient discharge as a percentage of DE) as proxies for patients' overall case mix. We controlled for market factors, including system affiliation and county-level hospital market concentration, aggregated on system level and measured using the Herfindahl–Hirschman index.[31,41] The hospital market share was calculated using the number of inpatient days.[42] We controlled state-level policy factors, including ACA Medicaid expansion status and Medicaid to Medicare payment ratio.[43] We adjusted county-level poverty rate and the unemployment rate as local socioeconomic factors. The fixed-effects model addressed the time-invariant unobservable factors that were correlated with PMR.

We conducted multiple sensitivity analyses: We calculated each hospital's 5-year average operating net income, PMR, and private patient volume. We ranked hospitals by these three criteria, stratified them into four quartiles, and ran the same fixed effects model in each quartile. We ran our models without weighting by bed size. As alternative modeling, we performed log transformation on both PMR and outcome variables to evaluate the percentage change. We ran the five-year pooled cross-sectional regressions to capture the variations between hospitals. To explore the effect heterogeneity across different hospital ownership, we also ran the same models on public and for-profit hospitals.

3 | RESULTS

3.1 | Descriptive results

Our study included a total of 8862 hospital-year observations during 2014–2018, with an overall mean PMR of 1.62. The mean PMR had increased from 1.60 in 2014 to 1.64 in 2016 and then declined to 1.61 in 2018 (Table 1). PMRs also varied across different hospitals, geographic, and market characteristics. Hospitals located in the western United States or located in more concentrated hospital markets had higher PMRs, while hospitals in northeastern United States, training medical residents, or receiving disproportionate share subsidies experienced lower PMRs (Table 1). We conducted pair-wise *t*-tests on every subcategory. All of these results were significant at a level of 0.001.

Table 2 presents the summary statistics for outcome variables. On average, hospitals experienced a $59 loss in operating net income per DE. While not a focus of this study, it should be noted that once nonoperating services were included, the average net income increased to $865 per DE, and 75% of hospitals were able to earn a profit. Hospitals incurred an average administrative cost of $2972 per DE and a patient care-related cost of $12,663. The hospital spent $364 on charity care and employed 212 registered nurses per 100 beds. Hospitals had an average of 21.2, 0.3, 1.5, and 14.9 beds for obstetric care, burn care, alcohol and drug abuse treatment, and psychiatric care, respectively. All financial outcomes were adjusted to 2018 dollars using the consumer price index (CPI).

3.2 | Regression results

Table 3 presents the fixed effects model evaluating the association of higher PMRs with outcome variables: Nonprofit hospitals with 0.1 higher PMR were associated with $257 higher operating net income and $66 higher administrative cost, holding all else at their mean. Hospitals spent $170 more on patient care, $18 more on charity care, and hired 0.86 (0.4%) more registered nurses per 100 beds. There was

no evidence of an increased number of hospitals beds for obstetric care, burn care, alcohol and drug abuse treatment, or psychiatric care associated with higher PMR.

Table 4 and Figure 1 present the regression results stratified by operating margin quartile (panel A), PMR quartile (panel B), and private payer utilization share quartile (panel C). The results are presented in ascending order. Across all 12 stratifications, the increase in patient care cost was always lower than the increase in operating net income, although hospitals in Q4 were typically associated with a larger increase in patient care cost and nurse bed ratio. Regarding the

TABLE 1 Summary statistics for the private sector to Medicare payment ratio (PMR)

		Private sector to Medicare payment ratio		
Hospital characteristic	**Percent of hospitals**	**Mean**	**Median**	**Interquartile range**
Number of hospitals	8862	1.62	1.57	1.30–1.88
Census region				
Northeast	21%	1.45	1.39	1.19–1.67
Midwest	31%	1.72	1.67	1.39–2.01
South	31%	1.54	1.53	1.24–1.78
West	17%	1.81	1.74	1.47–2.11
Number of beds				
Small (<100)	29%	1.78	1.73	1.44–2.11
Medium (100–299)	46%	1.58	1.53	1.27–1.83
Large (300+)	25%	1.50	1.47	1.24–1.73
Geographic classification				
Rural	6%	1.73	1.67	1.40–2.02
Micropolitan area	16%	1.75	1.69	1.40–2.04
Metropolitan area	78%	1.59	1.54	1.27–1.84
Teaching status				
Nonteaching	58%	1.69	1.64	1.36–1.97
Minor teaching	31%	1.58	1.54	1.29–1.82
Major teaching	11%	1.35	1.30	1.09–1.55
Disproportionate share				
Yes	89%	1.61	1.56	1.29–1.87
No	11%	1.70	1.67	1.38–1.98
System affiliation				
Yes	77%	1.62	1.58	1.31–1.87
No	23%	1.61	1.55	1.26–1.90
Hospital market concentration (at county level)				
Unconcentrated[a]	5%	1.46	1.44	1.17–1.71
Moderately concentrated[b]	10%	1.54	1.48	1.22–1.76
Highly concentrated[c]	57%	1.61	1.56	1.29–1.86
Monopoly[d]	28%	1.70	1.65	1.37–1.97
Calendar year				
2014	20%	1.60	1.54	1.27–1.85
2015	20%	1.62	1.57	1.30–1.88
2016	20%	1.64	1.6	1.31–1.90
2017	20%	1.63	1.59	1.31–1.88
2018	20%	1.61	1.56	1.29–1.87

Abbreviation: HHI, Herfindahl–Hirschman index.
[a]Herfindahl–Hirschman index (HHI) lower than 1500.
[b]HHI between 1500 and 2500.
[c]HHI between 2500 and 10,000.
[d]HHI at 10,000.
Source: Center for Medicare & Medicaid Hospital Cost Reports compiled by RAND Corporation, 2014–2018.

TABLE 2 Summary statistics for outcome variables

Category	Outcome measures	# of hospitals	Mean	Median and IQR
Nonpatient care	Operating net income per DE	8862	−$59	−$5 (−$890, $941)
	Administrative cost per DE	8862	$2972	$2680 ($1904, $3743)
Patient care	Patient care cost per DE	8862	$12,663	$11,525 ($9335, $14,538)
	Registered nurse per bed	8862	2.12	2.01 (1.58, 2.51)
Community benefit	Charity care per DE	8862	$364	$252 ($126, $471)
	Obstetric care beds	7973	21.16	16 (8, 28)
	Burn care beds	7973	0.33	0 (0, 0)
	Alcohol/drug abuse care beds	7973	1.46	0 (0, 0)
	Psychiatric care beds	7973	14.90	0 (0, 23)

Note: For unprofitable service beds, there were 889 out of 8862 missing values.
Abbreviation: DE, discharge equivalents.
Source: Center for Medicare & Medicaid Hospital Cost Reports compiled by RAND Corporation, 2014–2018; American Hospital Association Annual Survey database, 2014–2018.

nonpatient care outcomes, hospitals with a higher operating margin in panel A or higher PMR in panel B were associated with a smaller increase in operating net income. However, the smaller increase was largely offset by a sharp increase in administrative costs.

Sensitivity analysis results are presented in Appendix S4. Results from the unweighted model, log-linear model, and five-year pooled OLS model were similar to the main model. We also explored effect heterogeneity across different hospital ownership: Compared to nonprofit hospitals, PMRs were higher among for-profit hospitals but lower for public hospitals (Appendix S3). Under 0.1 higher PMR, for-profit hospitals experienced a smaller profit increase. However, the increase in administrative cost was about three times of the nonprofit hospitals, while the magnitude in patient care spending was only a quarter of nonprofit hospitals. In contrast, public hospitals did not spend more on administrative costs under higher PMR. Instead, they spent 50% higher on patient care costs compared to nonprofit hospitals. In fact, public hospitals were the only ownership category where an increase in patient care cost exceeded the total increase in operating net income and administrative costs.

4 | DISCUSSION

As shown in earlier studies, higher private sector price led to higher operating surplus and greater hospital spending.[18,19] This study focused on where the additional dollars were spent and found that the majority of the additional income was allocated primarily to services and programs that promoted hospital's self-interest instead of patient benefit. The total increase in the operating net income and administrative cost was approximately twice the increase in patient care spending. This empirical finding contradicted the expectation that nonprofit hospitals would reinvest their surplus in patient care operations, especially in providing more community benefits to justify their tax-exempt status.[11,12]

Prior research also found mixed evidence on whether high-priced hospitals were associated with a higher quality of care.[44] Hospital consolidation has been shown to be a key factor associated with higher private sector prices.[45–47] Yet, prior research did not find an improved quality of care associated with hospital mergers.[45] Higher prices could result in a better quality of care when additional revenues are spent on areas that are positively associated with patient benefits, such as patient care cost, nurse staffing, charity care, and unprofitable services provision. Therefore, because the additional resources were largely allocated to nonpatient care-related activities, it is less surprising that quality did not improve.

According to the cost-shifting argument, higher PMR should improve the hospital's financial viability and enable them to spend more on patient care and community benefit. We did find relatively small increases in patient care and charity care spending associated with higher PMR. However, the increased amounts were always lower than the increase in operating net income, regardless of how we stratified the study sample (Table 3 and Figure 1). It was true that hospitals with higher operating margins or PMR were associated with a smaller increase in operating net income. However, this smaller increase was largely offset by the sharp rise in administrative costs. This suggests that many nonprofit hospitals may have their objectives influenced more by their own interest than patient benefits. This suggests that private insurance plans, self-insured employers, and patients paying higher market prices are not necessarily receiving a higher marginal value with regard to patient care services.

4.1 | Limitations

Our study has a number of limitations: First, both RAND hospital data and AHA survey are based on administrative records provided by individual hospitals. They might be subject to data reporting errors. Second, we have used hospital-level data in this analysis that has shown lower ratios than calculations using claim-level

TABLE 3 Regression result, impact of the private sector to Medicare payment ratio (PMR) on outcome variables

	Operating net income per DE ($)	Administrative cost per DE ($)	Patient care cost per DE ($)	Charity care per DE ($)	RN per 100 beds	OBGYN beds	Burn care beds	Alcohol/drug abuse beds	Psychiatric care beds
PMR (0.1)	257.35*** (39.12)	65.53*** (17.00)	170.18*** (25.46)	17.71*** (3.77)	0.86* (0.48)	−0.05 (0.17)	−0.01 (0.01)	−0.02 (0.05)	−0.20 (0.13)
Beds	1.07 (1.03)	−0.28 (0.39)	−0.99 (0.67)	0.09 (0.13)	−0.25*** (0.07)	0.06*** (0.01)	0.00 (0.00)	0.00 (0.00)	0.02* (0.01)
Inpatient-DE ratio	6.76 (12.61)	8.11 (9.31)	48.74*** (13.74)	4.19** (1.89)	−0.13 (0.35)	−0.06 (0.14)	0.00 (0.01)	0.04 (0.03)	0.13 (0.11)
Private patient (%)	89.55*** (25.69)	13.62 (12.22)	122.70*** (21.13)	−45.94*** (7.01)	0.07 (0.37)	0.09 (0.18)	−0.01 (0.00)	−0.01 (0.03)	0.03 (0.09)
Medicare patient (%)	18.83 (25.51)	23.47* (12.81)	152.11*** (23.26)	−33.97*** (5.26)	0.08 (0.52)	−0.16 (0.18)	0.00 (0.01)	−0.08 (0.06)	0.12 (0.13)
Medicaid patient (%)	43.33* (24.39)	15.80 (16.04)	102.30*** (21.60)	−54.48*** (7.75)	−0.22 (0.43)	0.07 (0.17)	−0.00 (0.00)	−0.00 (0.04)	0.09 (0.13)
Medicare to Medicaid price ratio	253.43*** (97.73)	176.74*** (50.14)	415.85*** (88.58)	23.32 (18.23)	3.41 (2.17)	0.26 (0.40)	−0.02 (0.02)	−0.10 (0.11)	−0.10 (0.31)
Case-mix index (0.1)	119.82** (59.92)	156.88*** (44.36)	495.81*** (54.85)	−9.63 (7.53)	2.14 (1.45)	−0.51 (0.31)	0.02 (0.04)	−0.15 (0.11)	−0.26 (0.45)
Wage index (0.1)	266.26*** (74.39)	119.28** (58.54)	186.51** (87.41)	−0.39 (11.39)	1.01 (1.97)	−0.01 (0.45)	−0.08 (0.06)	0.11 (0.26)	−0.73 (0.80)
Length of stay	−593.27*** (121.24)	374.84*** (66.51)	1541.53*** (120.38)	91.78*** (16.92)	−2.49 (2.69)	0.43 (0.91)	0.07 (0.06)	0.25 (0.26)	−1.06* (0.63)
Residents per bed	34.89 (22.10)	−5.26 (6.61)	−14.22 (14.72)	0.86 (2.06)	1.75** (0.79)	0.19 (0.12)	0.00 (0.00)	0.01 (0.03)	−0.11 (0.13)
Employed physicians per bed	−6.07 (4.05)	0.05 (1.56)	12.44** (5.85)	1.06 (0.97)	0.20*** (0.06)	0.01 (0.01)	−0.00 (0.00)	−0.01 (0.01)	0.01 (0.02)
System affiliation	81.40 (94.25)	−17.26 (66.02)	−161.70 (130.01)	−72.06* (38.81)	−2.72 (3.96)	−1.17 (1.21)	−0.00 (0.03)	0.30 (0.24)	0.35 (0.65)
Medicare Advantage plan share	−0.96 (2.01)	0.40 (1.38)	−2.72 (2.22)	0.71* (0.40)	−0.04 (0.07)	0.04* (0.03)	0.00 (0.00)	−0.00 (0.01)	0.03 (0.02)
Hospital HHI (1000s)	−25.04 (44.48)	−17.06 (22.86)	10.39 (37.91)	−3.94 (6.20)	2.65 (1.62)	−0.40 (0.59)	−0.03 (0.03)	0.06 (0.10)	0.55 (0.56)
Poverty rate	−15.43 (30.04)	15.20 (15.05)	−6.29 (20.64)	2.65 (2.87)	0.21 (0.53)	0.19 (0.19)	−0.00 (0.01)	−0.02 (0.05)	−0.21 (0.14)
Unemployment rate	−16.20 (53.67)	−19.01 (29.82)	−79.59* (48.16)	7.08 (8.96)	0.62 (1.25)	0.70 (0.48)	−0.04* (0.02)	0.12 (0.11)	−0.42 (0.32)
Medicaid expansion	117.13 (238.14)	−29.41 (81.93)	−68.88 (273.93)	−40.05 (32.37)	−7.23** (3.28)	1.35* (0.74)	−0.12 (0.09)	0.01 (0.23)	−0.51 (0.70)
Constant	−12,803.37*** (2795.93)	−5689.70*** (1491.27)	−21,525.56*** (2592.68)	3783.84*** (596.96)	226.65*** (51.20)	10.24 (18.45)	1.74* (1.02)	0.31 (6.19)	26.85* (13.80)
Observations	8862	8862	8862	8862	8862	7973	7973	7973	7973
Adjusted R^2	0.82	0.90	0.97	0.80	0.86	0.95	0.97	0.91	0.97

Note: For unprofitable service beds, observations with missing values (889 out of the 8862) were dropped for regression models. Coefficients for constant included hospital fixed effects. Individual year fixed effects were not shown in this table (but included in the regression model). Medicare Advantage (MA) plan share was measured by hospital-year specific MA plan inpatient days as a percentage of total Medicare inpatient days.

Abbreviations: admin., administrative; DE, discharge equivalents; OBGYN, obstetrics and gynecology; PMR, private sector to Medicare payment ratio; RN, registered nurse.

*Statistical significance: $p < 0.10$; **Statistical significance: $p < 0.05$; ***Statistical significance: $p < 0.01$.

Source: Center for Medicare & Medicaid Hospital Cost Reports compiled by RAND Corporation, 2014–2018; American Hospital Association Annual Survey database, 2014–2018.

TABLE 4 Stratified regression results

Outcome measures	Panel A: Profit margin quartile				Panel B: PMR quartile				Panel C: Private patient share			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Operating net income per DE	$310***	$207***	$274***	$208***	$378***	$264**	$212***	$242***	$220***	$205***	$357***	$364***
Administrative cost per DE	$37	$47*	$74**	$116***	$28	$39	$117***	$67**	$77**	$64**	$68***	$66
Patient care cost per DE	$181***	$103**	$187***	$203***	$129***	$121**	$223***	$186***	$155***	$158***	$143***	$268***
Registered nurse per 100 bed	1.18	−0.42	1.02	1.88*	1.17	1.75	0.59	0.38	0.96	−0.10	0.83	3.39**
Charity care per DE	$16**	$12*	$23***	$21***	$30***	$6	$28***	$16***	$20***	$17**	$12	$25***
Obstetric care beds	−0.34	0.20	0.03	−0.22	0.14	−0.14	−0.12	−0.03	0.02	−0.15	−0.52*	0.48*
Burn care beds	0.01	0	−0.04	0	0	0	0.01	−0.04	−0.02	0.01	−0.02	−0.02
Alcohol/drug abuse beds	−0.08	0.02	−0.05	0.10	−0.01	−0.05	−0.01	0.02	0.07	−0.01	−0.01	−0.18
Psychiatric care beds	−0.13	−0.16	−0.20	−0.11	−0.12	−0.41	−0.34**	0.01	0.09	−0.51	−0.51**	0.02

Abbreviations: DE, discharge equivalent; PMR, private sector to Medicare payment ratio.
*Statistical significance: $p < 0.10$; **Statistical significance: $p < 0.05$; ***Statistical significance: $p < 0.01$.
Source: Center for Medicare & Medicaid Hospital Cost Reports compiled by RAND Corporation, 2014–2018; American Hospital Association Annual Survey database, 2014–2018.

data. Due to limitations in Medicare cost report data, a more detailed breakdown of cost structure, such as nurse staffing costs, senior executive compensation, technology acquisition, and contracted labor, was not available. Moreover, the hospital-level data did not include utilization information for individual procedures, which could be different in Medicare and privately insured patients. To address this issue, we have adjusted for patient case mix and payer mix in our model. Since PMR was calculated using the revenue and utilization from all hospital services, this measure captured the hospital's overall pricing power aggregated across all services.[14,48] Third, we did not explicitly assess the relationship between PMR and patient's clinical outcomes. However, we did examine patient care cost, nurse staffing level, charity care, and the number of hospital beds allocated to four types of unprofitable services. These measures are all important proxies for quality of care. Fourth, we were not able to directly measure private sector prices and utilization. Instead, we estimated them using formulas and might be subject to inaccuracies. Fifth, we were not able to control the unobserved, time-varying factors that could be correlated with PMR.

4.2 | Policy implications

This study informs private insurers, patients, and self-insured employers that the majority of the revenue that nonprofit hospitals collected from higher private sector prices was allocated to net income and administrative expense. Private payers and governments may use this finding to negotiate or design policy options to lower hospital payment rates. Recently, a growing number of states are exploring strategies to lower private sector hospital prices: Washington, Nevada, and Colorado have passed public option legislation to offer more affordable private insurance plans by reducing private insurance payment rates (e.g., capping the rate at 160% of Medicare rates for Washington).[8,49] State employee organizations in Montana and Oregon have tied their payment rates for hospital services to Medicare's payment rates.[9,10] Rhode Island, Massachusetts, Colorado have set spending targets that expressively limit hospitals rate increase.[50] These limits place a focus on the private sector payment rates since the increases are typically higher than Medicare's payment amounts. Some states, such as Vermont all-payer ACO model, are exploring some version of the Maryland all-payer rate-setting model, which limits the amount that the hospitals can charge the private insurers.[51]

Tax-exempt hospitals are required to provide community benefits and document the spending under Internal Revenue Service (IRS) Form 990 Schedule H. In a recent report, the Government Accountability Office (GAO) recommended that Congress should improve the oversight of a hospital's tax-exempt status, including a clearer definition and better documentation of the hospital's community benefit provision.[52] If policymakers want to increase the level of spending on services that benefit patients and the community, one option is to

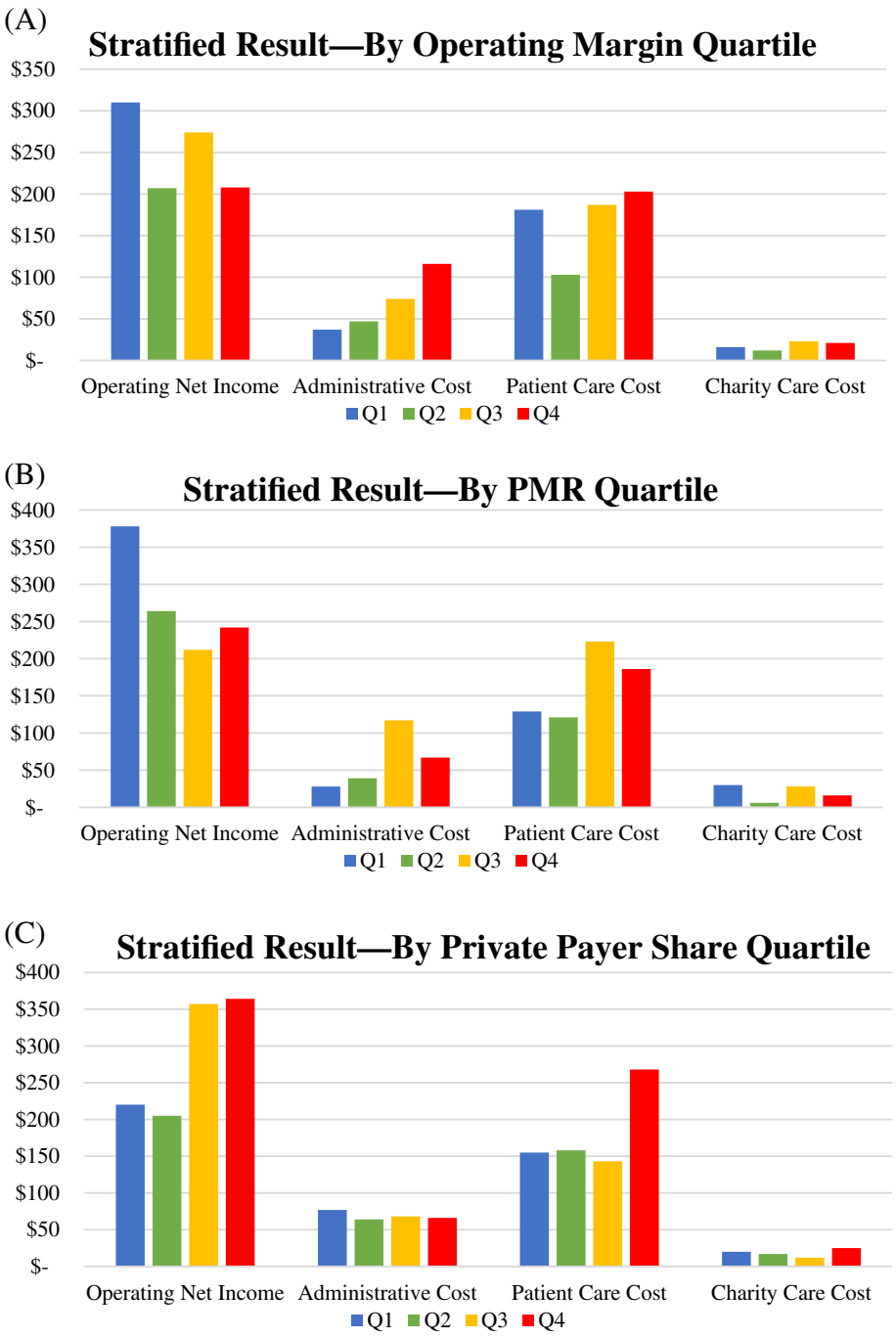

FIGURE 1 Regression results for operating net income, administrative cost, patient care cost, and charity care per DE, stratified by (A) profit margin quartile, (B) PMR quartile, and (C) private payer utilization quartile. DE, discharge equivalents; PMR, private sector to Medicare payment ratio *Source*: Center for Medicare & Medicaid Hospital Cost Reports compiled by RAND Corporation, 2014–2018; American Hospital Association Annual Survey database, 2014–2018 [Color figure can be viewed at wileyonlinelibrary.com]

rank hospitals based on the percentage of revenues that the hospital spends on charity care, patient care services, surplus, and administrative expense. It could be included in the hospital compare measure maintained by CMS. The government could establish a maximum percentage the hospital can earn on profit or spend on overhead as a share of patient revenue. This is similar to the limitation that health insurers can spend on administrative services. They can also re-evaluate the tax exemption treatment. However, given the perverse behaviors by health plans under the medical loss ratio regulation, it is possible that hospitals could respond to the spending cap by reclassifying their costs or other unintended behaviors.[53]

5 | CONCLUSION

When the market price is substantially above the Medicare payment rate, hospitals allocate much of the additional revenue to increase their surplus and administrative expense but not direct patient care, unprofitable services, or charity care. Commercial insurers, self-insured companies, and policymakers can use this information to negotiate lower prices or redesign their benefit and cost-sharing packages to encourage greater use of the less expensive hospitals. State and federal governments can rank hospitals based on charity care provision and other factors that are

associated with patient benefit. The government can also re-evaluate the tax exemption treatment for nonprofit hospitals that spend most of the additional money on services that benefit the hospital but not patients or the community.

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CONFLICT OF INTEREST

All authors declare no potential conflicts of interest with respect to the research, authorship, or publication of this article.

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