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Evaluation of costs and outcomes of physician-owned hospitals across common surgical procedures

Junu Bae [a, b], J. Madison Hyer [b], Anghela Z. Paredes [b], Ayesha Farooq [b], Daniel R. Rice [b], Susan White [c], Diamantis I. Tsilimigras [b], Aslam Ejaz [b], Timothy M. Pawlik [b, *]

[a] Ohio State University College of Medicine, Columbus, OH, USA
[b] Division of Surgical Oncology, The Ohio State University Wexner Medical Center and James Comprehensive Cancer Center, Columbus, OH, USA
[c] Division of Health Information Management and Systems, The Ohio State Wexner Medical Center, The Ohio State University, Columbus, OH, USA

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ABSTRACT

Introduction: The Affordable Care Act introduced restrictions on the creation of new physician-owned hospitals (POH). We sought to define whether POH status was associated with differences in care.
Methods: Patients undergoing one of ten surgical procedures were identified using Medicare Standard Analytic Files. Patient and hospital-level characteristics and outcomes between POH and non-POH were compared.
Results: Among 1,255,442 patients identified, 14,560 (1.2%) were treated at POH. A majority of POHs were in urban areas (n = 30, 90.9%) and none were in low socioeconomic status areas. Patients at POH were slightly younger (POH:72, IQR:68–77 vs. non-POH:73, IQR:69–79) and healthier (CCI; POH:2; IQR: 1–3 vs. non-POH: 3; IQR: 1–4). Patients at non-POH had higher odds of postoperative complications (OR:1.67, 95%CI:1.55–1.80) and slightly higher medical expenditures (POH:$11,347, IQR:$11,139-$11,936 vs. non-POH:$13,389, IQR:$11,381–$19,592).
Conclusions: POH were more likely to be located in socioeconomic advantaged areas, treat healthier patients and have lower associated expenditures.

Introduction

Among the provisions of the Affordable Care Act (ACA) of 2010 were controversial restrictions on the creation of new physician-owned hospitals (POH), as well as restrictions on the expansion of approximately 265 existing POH.[1,2] This provision in the ACA escalated the decades-long debate and seemingly discordant literature regarding POH.[2–15] Critics of POH contend that physician ownership of a hospital is a direct financial conflict of interest. Specifically, POH may potentially aggravate healthcare disparities through deliberate targeting of lower-risk, wealthier patients, while also increasing resource utilization that in turn escalates cost of care.[3–8] Meanwhile, proponents of POH claim that these hospitals are more efficient and provide better care with improved patient outcomes, in part due to the physician owner's ability to risk-share around quality and cost of treatment.[9–14] In addition, several studies have suggested that POH have lower rates of complications and greater patient satisfaction compared with non-POH.[12–14] While most research on POH have been based on only the small subset of specialty-based POH, the ACA ban affects all POH regardless of their specialty status.[15]

The discordance in the healthcare literature, as well as recent legislation, underscores the need for additional data of the prevalence, cost, and effectiveness associated with POH. Therefore, the objective of the current study was to define the impact of POH on a broad array of health care metrics including patient outcomes, quality of care, as well as medical expenses, among Medicare beneficiaries undergoing common surgical procedures. In the current study, we hypothesized that postoperative outcomes would vary based on POH status. Specifically, we sought to define whether POH status was associated with differences in care after controlling for other baseline hospital characteristics among patients who underwent colectomy, cholecystectomy, lung resection, pancreatectomy, liver resection, hernia repair, coronary artery bypass

* Corresponding author. Department of Surgery, The Urban Meyer III and Shelley Meyer Chair for Cancer Research, Professor of Surgery, Oncology, Health Services Management and Policy, The Ohio State University, Wexner Medical Center, 395 W. 12th Ave, Suite 670, USA.
E-mail address: tim.pawlik@osumc.edu (T.M. Pawlik).

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grafting [CABG], abdominal aortic aneurysm [AAA] repair, or total knee/hip arthroplasty (TKA/THA).

Methods

Patient population and data source

Medicare beneficiaries who underwent one of ten procedures (colectomy, cholecystectomy, lung resection, pancreatectomy, liver resection, hernia repair, CABG, AAA repair, TKA, and THA) between 2013 and 2015 were identified from 100% Inpatient Standard Analytic Files (SAF). International Classification of Disease, Ninth Revision (ICD-9) procedure codes were used to categorize patients according to surgical procedure (colectomy [17.31–17.36, 17.39, 45.71–45.76, 45.79, 45.80–45.83], cholecystectomy [51.2, 51.21–51.24], lung resection [32.20, 32.21, 32.22, 32.29, 32.30, 32.41, 32.50, 32.59, 32.9], pancreatectomy [52.51, 52.52, 52.53, 52.59, 52.6, 52.7], liver resection [50.3, 50.22], hernia repair [53.0, 53.00–53.05, 53.1, 53.10–53.17, 53.2, 53.21–53.29, 53.3, 53.31–53.39, 53.4, 53.41–53.49, 53.5, 53.51–53.59, 53.6, 53.61–53.69, 53.7, 53.71–53.75, 53.8, 53.80–53.84, 53.9], CABG [36.10–36.17, 36.19], AAA repair [38.34, 38.44, 38.64, 39.25, 39.71, 39.78], TKA [81.54], and THA [81.51]).

The SAFs contain patient demographic data including information on age, sex, and race; other variables derived from the SAFs were Charlson Comorbidity Index (CCI),[16] Elixhauser Comorbidity Index (ECI),[17] Complexity Score,[18] length-of-stay (LOS), complications, readmission, mortality, as well as health care expenditure/costs. As previously reported, postoperative complications were abstracted and categorized.[19–21] All Medicare payments were price standardized and adjusted by wage index, Disproportionate Share Hospital (DSH), and Indirect Medical Education (IME).[18,22] Hospital-level data were obtained from the December 10, 2015 revision of the Centers for Medicare and Medicaid Services (CMS) Hospital Compare dataset[23] and the American Hospital Association (AHA) survey data. Star rating and hospital ownership information were obtained from the Hospital Compare Dataset; other hospital characteristics such as teaching hospital status, provider network participation, and number of inpatient operations, operating rooms, total licensed beds, and total number of full-time registered nurses were obtained from the AHA survey data.

Hospital ZIP codes were used to determine geographic location within the United States (US) as defined by the 2010 US Census. Using a crosswalk between ZIP codes and ZIP code tabulation areas (ZCTA), the median household income of the ZCTA was extracted. A hospital was considered to be located in an urban area if the ZCTA population, as disclosed by the 2010 US Census, was at least 50,000 people[24] and in a low socioeconomic status area if the ZCTA median household income, as disclosed by the 2015 American Community Survey, was within the lowest quintile for 2015 (<$22,800).[25]

Statistical analysis

Categorical and continuous data were presented as frequency (%) and median (interquartile range [IQR]), respectively. To compare outcomes among patients undergoing surgery at a POH with patients undergoing surgery at a hospital not owned by a physician (non-POH), multivariable analyses were performed. All analyses controlled for sex, race, procedure type, age, and Complexity Score. To characterize the association between POH status and complications, readmission, and mortality, logistic regression was utilized. Similarly, for LOS and expenditure, negative binomial and gamma regression was utilized, both having a log link. Analyses were further stratified by nature of procedure: complex (colectomy, lung resection, pancreatectomy, liver resection, CABG, and AAA) vs. non-complex (cholecystectomy, hernia repair, TKA, and THA). All analyses were performed using SAS v9.4.

Results

Patient characteristics

A total of 1,255,442 patients met all inclusion/exclusion criteria and were included in the analytic cohort (Table 1). Median patient age was 73 years (IQR: 69–79), 45.8% of patients were male (n = 575,604) and the majority of patients were white (n = 1,160,907; 92.5%). Most patients in the cohort were from the Southern (n = 502,993; 40.1%) or Midwestern (n = 327,210; 26.1%) US. Of the ten procedures included in the cohort, TKA (n = 436735; 34.8%) and THA (n = 229950; 18.3%) were the most common procedures, followed by CABG (n = 139,397; 11.1%), colectomy (n = 126,720; 10.1%), cholecystectomy (n = 119,149; 9.5%), and hernia surgery (n = 100,785; 8%); other procedures (i.e. lung resection, AAA, pancreatectomy, and liver resection) comprised less than 5% of the total cohort. The comorbidity burden, as measured by CCI, ECI, and Complexity Score, was relatively low with median values of 0 (IQR: 0–2), 3 (IQR: 1–4), and 7.01 (IQR: 5.26–9.87), respectively.

Among the 1,255,442 patients, 14,560 patients (1.2%) underwent surgery at a POH (Table 1). Compared with patients at non-POH, patients at POH were slightly younger (POH: 72, IQR: 68–77 vs. non-POH: 73, IQR: 69–79) and less likely to be male (POH: n = 6,125; 42.1% vs. non-POH: n = 559,469; 45.9%); patients were overwhelming white at both POH and non-POH (POH: n = 13,563; 93.2% vs. non-POH: n = 1,147,344; 92.5%). Interestingly, the proportion of patients treated at POH in the Southern US (n = 11,761; 80.8%) was more than twice that of patients treated at non-POH (n = 491,232; 39.6%). Of note, the proportion of TKA and THA operations performed at POH was high, comprising 62.6% (n = 9,118) and 20.1% (n = 2,929) of all patients undergoing surgery at a POH, respectively. In contrast, TKA and THA patients made up only 34.5% (n = 427,617) and 18.3% (n = 227,021) of all patients at non-POH, respectively. In addition, comorbidities indices were lower among patients treated at POH, with a lower median ECI (POH: 2; IQR: 1–3 vs. non-POH: 3; IQR: 1–4) and Complexity Score (POH: 6.28; IQR: 4.84–8.49 vs. non-POH: 7.02; IQR: 5.26–9.88).

Hospital characteristics

Among the 2,925 hospitals, the majority was located in an urban area (n = 1,670; 57.1%) with only 2.2% (n = 63) located in a low socioeconomic area; 28.1% (n = 822) were designated teaching hospitals and 43% (n = 1,191) participated in a provider network. Most hospitals were in the Southern (n = 1,088; 37.2%) or Midwestern US (n = 912; 31.2%), with 17% (n = 496) in the Western US and 14.7% (n = 429) in the Northeastern US. Median CMS Star Ratings for most hospital categories were a 3 out of a maximum score of 5, except for nurse communication which had a median grade of 4 (IQR: 3–4).

Overall, 33 (1.1%) hospitals were identified as a POH (Table 2). The overwhelming majority of POH were located in an urban area (n = 30, 90.9%) and none were in a low socioeconomic status area. In contrast to non-POH, just one POH was a designated teaching hospital (POH: n = 1; 3% vs. non-POH: n = 821; 28.4%) and two POH participated in a provider network (POH: n = 2; 6.1% vs. non-POH: n = 1,189; 43.4%). Median CMS Star Ratings for POH were higher than non-POH in all categories (overall star rating for POH: 5, IQR: 4–5 vs. non-POH: 3, IQR: 2–4). POH performed roughly half as many inpatient operations as did non-POH (POH: 642, IQR 278–1,511 vs. non-POH: 1,301, IQR 378–3,387) despite having

Table 1
Patient-level characteristics stratified by treatment at POH/non-POH.

	Total N = 1,255,442	Non-POH N = 1,240,882	POH N = 14,560
Age	73 (69, 79)	73 (69, 79)	72 (68, 77)
Male	575604 (45.8%)	569479 (45.9%)	6125 (42.1%)
Race			
White	1160907 (92.5%)	1147344 (92.5%)	13563 (93.2%)
Black/AA	58803 (4.7%)	58306 (4.7%)	497 (3.4%)
Hispanic	4511 (0.4%)	4464 (0.4%)	47 (0.3%)
Other/Unknown	31221 (2.5%)	30768 (2.5%)	453 (3.1%)
Region			
Northeast	229228 (18.3%)	228915 (18.4%)	313 (2.1%)
Midwest	327210 (26.1%)	324947 (26.2%)	2263 (15.5%)
South	502993 (40.1%)	491232 (39.6%)	11761 (80.8%)
West	196011 (15.6%)	195788 (15.8%)	223 (1.5%)
Procedure			
Colectomy	126720 (10.1%)	126376 (10.2%)	344 (2.4%)
Cholecystectomy	119149 (9.5%)	118931 (9.6%)	218 (1.5%)
Lung Resection	46519 (3.7%)	46359 (3.7%)	160 (1.1%)
Pancreatectomy	6583 (0.5%)	6578 (0.5%)	N/A
Liver Resection	4186 (0.3%)	4184 (0.3%)	N/A
Hernia	100785 (8.0%)	100430 (8.1%)	355 (2.4%)
CABG	139397 (11.1%)	138254 (11.1%)	1143 (7.9%)
AAA	45418 (3.6%)	45132 (3.6%)	286 (2%)
TKA	436735 (34.8%)	427617 (34.5%)	9118 (62.6%)
THA	229950 (18.3%)	227021 (18.3%)	2929 (20.1%)
Charlson Comorbidity Index	0 (0, 2)	0 (0, 2)	0 (0, 1)
Elixhauser Comorbidity Index	3 (1, 4)	3 (1, 4)	2 (1, 3)
Complexity Score	7.01 (5.26, 9.87)	7.02 (5.26, 9.88)	6.28 (4.84, 8.49)

POH, physician-owned hospitals.
N/A: cell value suppressed in agreement with CMS cell size suppression policy.

Table 2
Hospital-level characteristics stratified by treatment at POH/non-POH.

	Total N = 2,925	Non-POH N = 2,892	POH N = 33
Urban Area	1670 (57.1%)	1640 (56.7%)	30 (90.9%)
Low SES	63 (2.2%)	63 (2.2%)	0 (0.0%)
Teaching Hospital	822 (28.1%)	821 (28.4%)	1 (3%)
Participates in Network	1191 (43%)	1189 (43.4%)	2 (6.1%)
Region			
Northeast	429 (14.7%)	428 (14.8%)	1 (3%)
Midwest	912 (31.2%)	906 (31.3%)	6 (18.2%)
South	1088 (37.2%)	1063 (36.8%)	25 (75.8%)
West	496 (17%)	495 (17.1%)	1 (3%)
Star Rating			
Overall Star Rating	3 (2, 4)	3 (2, 4)	5 (4, 5)
Summary Star Rating	3 (3, 4)	3 (3, 4)	4 (4, 5)
Nurse Communication	4 (3, 4)	4 (3, 4)	5 (4, 5)
Doctor Communication	3 (3, 4)	3 (3, 4)	4 (4, 5)
Staff Responsiveness	3 (3, 4)	3 (3, 4)	5 (4, 5)
Cleanliness	3 (2, 4)	3 (2, 4)	4 (3, 5)
Recommend Hospital	3 (3, 4)	3 (3, 4)	5 (4, 5)
Inpatient Operations	1292 (377, 3363)	1301 (378, 3387)	642 (278, 1511)
Number of Operating Rooms	7 (4, 13)	7 (4, 14)	6 (5, 9)
Total Licensed Beds	155 (60, 331)	157.5 (63, 333)	24.5 (13, 51)
Registered Nurses FTE	190 (71, 467)	193 (71, 471)	66 (48, 131)

FTE, Full-time employment; *POH*, physician-owned hospitals.

similar number of operating rooms (POH: 6, IQR 5–9 vs. non-POH: 7, IQR 4–14). POH had fewer total licensed beds (POH: 24.5, IQR 13–51 vs. non-POH: 157.5, IQR 63–333) and less full-time registered nurses than non-POH (POH: 66, IQR 48–131 vs. non-POH: 193, IQR 71–471).

Association between physician ownership and patient outcomes

Overall, patients undergoing treatment at a POH had lower medical expenditures than individuals undergoing a surgical procedure at non-POH (POH: $11,347, IQR $11,139–$11,936 vs. non-POH: $13,389, IQR $11,381–$19,592 Table 3). Moreover, after controlling for comorbidities and other risk factors, patients admitted to non-POH had 67% higher odds of postoperative complications compared with individuals admitted to POH (OR 1.67, 95% CI 1.55–1.80). Additionally, patients operated at non-POH had 10% (OR 1.10, 95% CI 1.09–1.11) and 21% (OR 1.21, 95% CI 1.01–1.45) higher odds of an increased length-of-stay and 30-day mortality, respectively, compared with patients treated at POH. Of note, individuals undergoing treatment at a non-POH had 9% increased odds of being readmitted within 30-days (OR 1.09, 95% CI 1.01–1.17) or 90-days (OR 1.09, 95% CI 1.03–1.15) of the index hospitalization's discharge.

Table 3
Adjusted descriptive statistics stratified by complexity of procedure (complex: colectomy, lung resection, pancreatectomy, liver resection, CABG, & AAA vs. non-complex: cholecystectomy, hernia repair, TKA, & THA).

All Procedures			
	Non-POH N = 1,240,882	POH N = 14,560	Comparison (Ratio/OR)
Expenditure ($)[a]	13389 (11381, 19592)	11347 (11139, 11936)	1.15 (1.14, 1.16)
LOS (days)[a]	3 (3, 6)	3 (2, 3)	1.10 (1.09, 1.11)
Complication at Index	203492 (16.4%)	895 (6.1%)	1.67 (1.55, 1.80)
30-Day Readmission	110810 (8.9%)	845 (5.8%)	1.09 (1.01, 1.17)
90-Day Readmission	188628 (15.2%)	1535 (10.5%)	1.09 (1.03, 1.15)
30-Day Mortality	36164 (2.9%)	130 (0.9%)	1.21 (1.01, 1.45)
90-Day Mortality	50962 (4.1%)	199 (1.4%)	1.15 (0.99, 1.33)
Colectomy, Lung resection, Pancreatectomy, Liver resection, CABG, & AAA			
	Non-POH N = 366,883	**POH N = 1,940**	**Comparison (Ratio/OR)**
Expenditure ($)[a]	24817 (16099, 35,201)	21743 (17432, 30458)	1.29 (1.26, 1.32)
LOS (days)[a]	7 (4, 11)	6 (4, 8)	1.29 (1.25, 1.34)
Complication at Index	124232 (33.9%)	594 (30.6%)	1.40 (1.27, 1.56)
30-Day Readmission	50957 (13.9%)	241 (12.4%)	1.12 (0.98, 1.29)
90-Day Readmission	82429 (22.5%)	433 (22.3%)	0.97 (0.88, 1.09)
30-Day Mortality	24309 (6.6%)	87 (4.5%)	1.21 (0.97, 1.50)
90-Day Mortality	32599 (8.9%)	122 (6.3%)	1.14 (0.95, 1.38)
Cholecystectomy, Hernia repair, TKA, & THA			
	Non-POH N = 837,999	**POH N = 12,620**	**Comparison (Ratio/OR)**
Expenditure ($)[a]	12436 (11016, 14332)	11304 (11079, 11736)	1.14 (1.13, 1.14)
LOS (days)[a]	3 (2, 4)	3 (2, 3)	1.06 (1.05, 1.07)
Complication at Index	79260 (9.1%)	301 (2.4%)	2.02 (1.80, 2.27)
30-Day Readmission	59853 (6.9%)	604 (4.8%)	1.07 (0.99, 1.16)
90-Day Readmission	106199 (12.2%)	1102 (8.7%)	1.13 (1.06, 1.20)
30-Day Mortality	11855 (1.4%)	43 (0.3%)	1.20 (0.89, 1.63)
90-Day Mortality	18363 (2.1%)	77 (0.6%)	1.14 (0.91, 1.43)

[a] Outcome was continuous, and the reported comparison was a ratio of adjusted means.

Stratified analyses were performed comparing patients who underwent non-complex (cholecystectomy, hernia repair, TKA, and THA) versus complex (colectomy, lung resection, pancreatectomy, liver resection, CABG, and AAA) surgical procedures at POHs and non-POHs (Table 3). Among patients who underwent non-complex surgical procedures, individuals treated at non-POH had comparable length-of-stay (POH: 3 days, IQR 2–3 vs. non-POH: 3 days, IQR 2–4), yet were more likely to experience a complication (OR 2.02, 95% CI 1.80–2.27) or be readmitted within 90 days (OR 1.13, 95% CI 1.06–1.20). Additionally, patients at non-POH had higher associated expenditures (POH: $11,304, IQR $11,079–$11,736 vs. non-POH: $12,436, IQR $11,016–$14,332) compared to individuals treated at POH (Fig. 1). Among patients who underwent complex procedures, non-POH patients had a slightly longer length-of-stay (POH: 6 days, IQR 4–8 vs. non-POH: 7 days, IQR 4–11), as well as a greater odds of a complication (OR 1.40, 95% CI 1.27–1.56) with higher median expenditures (POH: $21,743, IQR $17,432–$30,458 vs. non-POH: $24,817, IQR $16,099–$35,201).

Discussion

In the era of transparency, physician ownership of hospitals has raised concerns about competing interests between patient care and hospital profit.[3–8] The ACA limitation on the creation and expansion of POH remains an area of considerable controversy. Data on healthcare outcomes among surgical patients treated at POH and non-POH may therefore be relevant to both physicians and policymakers. The current study was important because it specifically examined the relative outcomes of ten common surgical procedures of varied complexity (colectomy, cholecystectomy, lung resection, pancreatectomy, liver resection, hernia repair, CABG, AAA repair, TKA, and THA) performed at POH and non-POH. Interestingly, case-mix and patient-mix were considerably different at POH versus non-POH. For example, patients treated at POH tended to be healthier at baseline with fewer comorbidities; in addition, the surgical case-mix at POH heavily favored reimbursement-rich, low-morbidity, high-turnover surgical procedures such as TKA and THA. In turn, perhaps not surprisingly, POH had overall lower costs associated with surgical care, as well as better outcomes relative to quality metrics such as complications, readmissions, and mortality versus non-POH. Collectively, the data suggested that better outcomes at POH may be attributable, in part, to POH targeting healthier populations of patients as well as performing more non-complex procedures with low associated morbidity.

Among the 1,255,442 procedures performed at 2,925 US hospitals, only 14,560 procedures (1.2%) were performed at 33 POH (1.1%). While the overall proportion of cases performed at POH was low, there was a geographical variation in POH (Table 2). Specifically, most POH were found in urban areas and the overwhelming majority were located in high socioeconomic areas. In addition, two-thirds of POH were located in either the Southern or Midwestern US. Courtney et al. and Malik et al. had previously noted that 1.7% and 2.2% of orthopedic and spine operations, respectively, were performed at POH.[13,14] In the current study, we noted that roughly 1.8% of orthopedic procedures were performed at POH, while about 0.4% of non-orthopedic procedures were done at POH (Table 1). Interestingly, Horwitz had reported differences in services provided among nonprofit, for-profit and government hospitals.[26] Specifically, among comparable hospitals, for-profits were more likely than nonprofit hospitals, to offer open-heart surgery – a surgical procedure with a high financial margin.[26] In contrast,

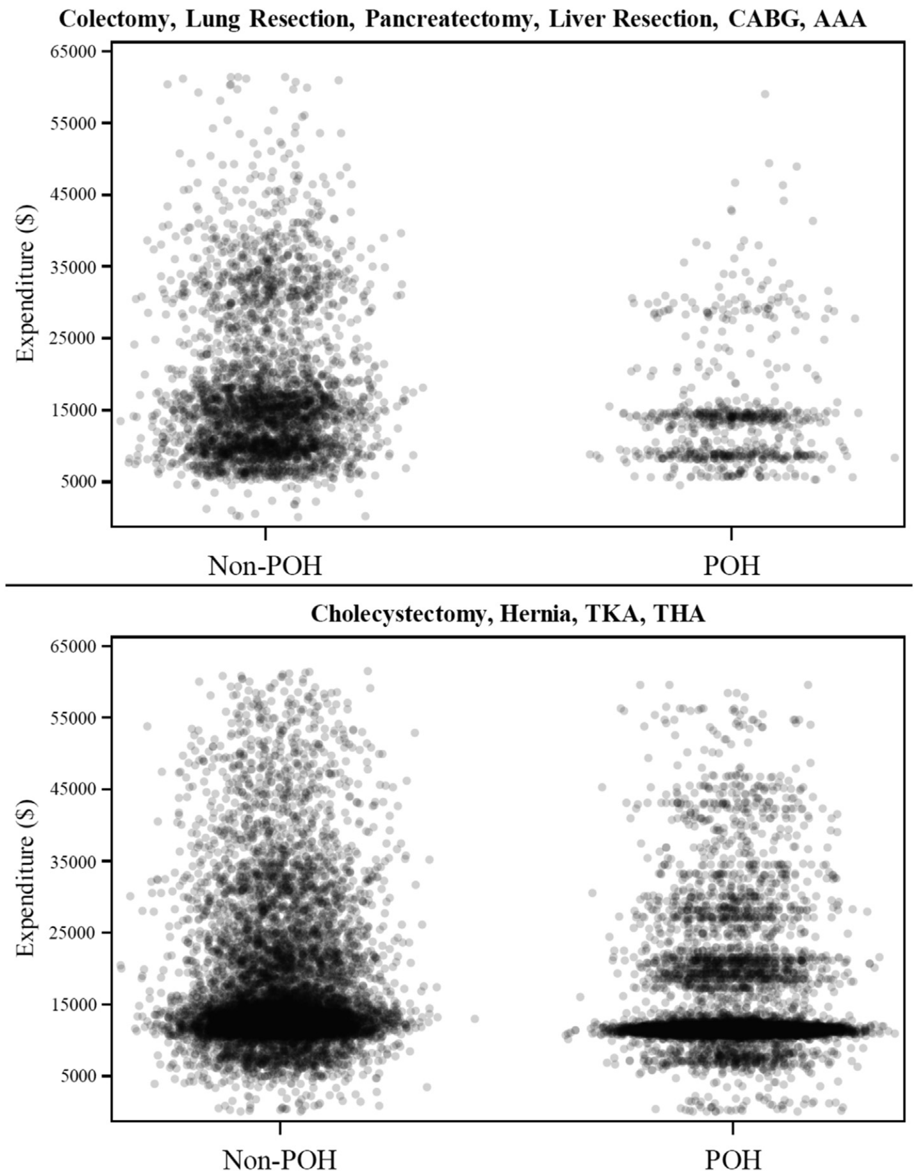

Fig. 1. Cost of treatment at POH/non-POH, stratified by nature of procedure (complex: colectomy, lung resection, pancreatectomy, liver resection, CABG, & AAA vs non-complex: cholecystectomy, hernia repair, TKA, & THA).

unlike open-heart surgery, for-profit hospitals were less likely than nonprofit hospitals to offer low margin services such as psychiatric emergency care.[26] Consistent with these findings, data from the current study demonstrated that POH targeted more advantageous economic areas (e.g. urban, high socioeconomic status) and higher profit margin surgical procedures (e.g. TKA, THA) procedures. Therefore, the data collectively suggests that corporate form/ownership type (POH vs. non-POH) may be an appropriate consideration as a regulatory tool in the ACA to mitigate certain hospital types from over selection of profitable and less disadvantaged patients by reducing the associated financial rewards.

Most previous studies that have examined hospital ownership status have largely focused on differences in patient- and case-mix, while not specifically addressing health outcomes. In the current study, patient outcomes were generally superior at POH versus non-POH after adjusting for patient demographics and Complexity Score. In fact, even after stratifying according to in-patient versus out-patient procedure type, as well as patient and hospital level characteristics, patients treated at POH hospitals had overall better outcomes (Table 3). Specifically, length of stay for the index visit, complication incidence during the index visit, as well as 30- and 90-day readmission were lower at POH for both complex and non-complex procedures. One possibility for these differences may have been related to residual confounding or baseline differences among patient treated at POH versus non-POH. CMS data did not necessarily account for the true severity of underlying comorbidities, and therefore CCI or ECI may not have fully reflected overall patient health status. Thus, despite attempts at controlling for patient and procedure differences, POH likely operated on patients with less severe comorbidities to avoid complications and improve overall patient outcomes. The evasion of higher-risk procedures by POH was evident in that POH performed a disproportionately high number of lower-risk procedures such as TKA/THA and patients treated at POH had a lower the median Complexity Score despite relatively similar CCI and ECI. Interestingly, these results were at odds with data reported by Blumenthal et al. that examined medical patients treated at POH versus non-POH for acute myocardial infarction, congestive heart failure, and pneumonia.[15] In this study, the authors noted that POH treated medical patients who were slightly healthier, yet did not seem to systematically select more profitable or less disadvantaged patients. The reason for these disparate results was undoubtedly multi-factorial and may relate to inherent differences in how medical and surgical patients are referred/selected for care. Specifically, whereas most general hospitals (POH and non-POH) typically offer general medical services to treat common medical conditions such as heart and pulmonary disease, hospitals and surgeons can control the selection of patients for surgical procedures. In fact, one national survey noted that surgeons were more likely to endorse “cherry-picking” than doctors in most other specialties.[27] Specifically, whereas 17% of all physicians said they would “cherry-pick,” 38% of orthopedic surgeons and plastic surgeons felt that way, as did 31% of urologists and 27% of ophthalmologists. As such, differences in patient- and case-mix among POH and non-POH may be particularly pronounced for surgical cases.

One argument for POH has been the potential cost-savings associated with physician ownership and participation in hospital management. Indeed, in the current study, across the 10 operations examined, POH generally had had lower mean costs of care (POH: $11,347, IQR $11,139–$11,936 vs. non-POH: $13,389, IQR $11,381–$19,592; Table 3, Fig. 1). The fact that POH tended to operate on healthier patients and perform less morbid procedures undoubtedly resulted in some cost savings from avoiding complications in higher risk patients. POH may also have been more efficient, in part due to the physician owner's ability to risk-share around quality, as well as a greater focus and specialization around a more limited set of procedures.[9–14] In particular, POH performed almost half as many inpatient operations as did non-POH (POH: 642, IQR 278–1,511 vs. non-POH: 1,301, IQR 378–3,387) yet had almost the same number of operating rooms (POH: 6, IQR 5–9 vs. non-POH: 7, IQR 4–14). Differences in cost may have also been related to differences in baseline hospital characteristics among POH versus non-POH. For example, most POH were in the Southern US, where medical expenses are lower,[28] while the majority of POH were in urban areas, which are associated with higher costs.[29] Additionally, very few POH were located in low SES communities or were designated teaching hospitals, both of which are factors that are considered by the CMS during payment calculation and result in higher reimbursements. Moreover, almost no POH participated in provider networks, which would likely have resulted in additional costs for the patient. Therefore, while POH may have been associated with modest decreased costs of care – several factors that were associated POH status may have favored lower costs.

Several limitations should be considered when interpreting data from the current study. As described above, studies using CMS databases are inherently limited in that these data do not contain details about patient-level characteristics such as the severity of comorbidities or complications and subject to coding error. Additionally, private payers were not considered in our study, thus findings may not be generalizable to patient populations outside of a Medicare cohort. Additionally, information regarding the structures and processes at POH compared to non-POH are not able to be obtained from the current datasets but may be important to consider when examining the influence of hospital ownership status on patient outcomes.

In conclusion, POH were more likely to be located in more advantaged socioeconomic areas and observed healthier patients. In addition, POH performed disproportionately more outpatient lower morbidity procedures associated with a larger financial margin. While operations at a POH hospital were associated with lower health care expenditures, the differences in cost were modest and may have been attributable to factors other than actual improved quality of care. Shifting of more favorable patient- and case-mix based care to POH runs the risk of eroding the healthcare safety net, unfairly leaving other hospitals with higher costs and possibly jeopardizing access to critical services in some communities. As such, relaxation of ACA restrictions on POH need to be carefully considered in light of the possible cherry-picking of healthier patients for more outpatient-based profitable surgical procedures.

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Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amjsurg.2019.10.008.

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