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Organization and Performance of US Health Systems

Nancy D. Beaulieu, PhD; Michael E. Chernew, PhD; J. Michael McWilliams, MD, PhD; Mary Beth Landrum, PhD; Maurice Dalton, MA; Angela Yutong Gu, MA; Michael Briskin, BA; Rachel Wu, BA; Zakaria El Amrani El Idrissi, BA; Helene Machado, BS; Andrew L. Hicks, MA; David M. Cutler, PhD

Viewpoint page 287 and Editorial page 293

Supplemental content

IMPORTANCE Health systems play a central role in the delivery of health care, but relatively little is known about these organizations and their performance.

OBJECTIVE To (1) identify and describe health systems in the United States; (2) assess differences between physicians and hospitals in and outside of health systems; and (3) compare quality and cost of care delivered by physicians and hospitals in and outside of health systems.

EVIDENCE REVIEW Health systems were defined as groups of commonly owned or managed entities that included at least 1 general acute care hospital, 10 primary care physicians, and 50 total physicians located within a single hospital referral region. They were identified using Centers for Medicare & Medicaid Services administrative data, Internal Revenue Service filings, Medicare and commercial claims, and other data. Health systems were categorized as academic, public, large for-profit, large nonprofit, or other private systems. Quality of preventive care, chronic disease management, patient experience, low-value care, mortality, hospital readmissions, and spending were assessed for Medicare beneficiaries attributed to system and nonsystem physicians. Prices for physician and hospital services and total spending were assessed in 2018 commercial claims data. Outcomes were adjusted for patient characteristics and geographic area.

FINDINGS A total of 580 health systems were identified and varied greatly in size. Systems accounted for 40% of physicians and 84% of general acute care hospital beds and delivered primary care to 41% of traditional Medicare beneficiaries. Academic and large nonprofit systems accounted for a majority of system physicians (80%) and system hospital beds (64%). System hospitals were larger than nonsystem hospitals (67% vs 23% with >100 beds), as were system physician practices (74% vs 12% with >100 physicians). Performance on measures of preventive care, clinical quality, and patient experience was modestly higher for health system physicians and hospitals than for nonsystem physicians and hospitals. Prices paid to health system physicians and hospitals were significantly higher than prices paid to nonsystem physicians and hospitals (12%-26% higher for physician services, 31% for hospital services). Adjusting for practice size attenuated health systems differences on quality measures, but price differences for small and medium practices remained large.

CONCLUSIONS AND RELEVANCE In 2018, health system physicians and hospitals delivered a large portion of medical services. Performance on clinical quality and patient experience measures was marginally better in systems but spending and prices were substantially higher. This was especially true for small practices. Small quality differentials combined with large price differentials suggests that health systems have not, on average, realized their potential for better care at equal or lower cost.

Author Affiliations: Department of Health Care Policy, Harvard Medical School, Boston, Massachusetts (Beaulieu, Chernew, McWilliams, Landrum, Hicks); National Bureau of Economic Research, Cambridge, Massachusetts (Chernew, Dalton, Gu, Briskin, Wu, El Amrani El Idrissi, Machado, Cutler); Division of General Internal Medicine, Department of Medicine, Brigham and Women's Hospital, Boston, Massachusetts (McWilliams); Department of Economics, Harvard University, Cambridge, Massachusetts (Cutler).

Corresponding Author: Nancy Beaulieu, PhD, Department of Health Care Policy, Harvard Medical School, 180 Longwood Ave, Boston, MA 02115 (beaulieu@hcp.med.harvard.edu).

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Health care delivery organizations in the United States have undergone continuous consolidation over multiple decades.[1-4] One result of this consolidation has been the creation of health systems: organizations of physicians, hospitals, and other facilities capable of providing a full range of medical services for most patients. During the COVID-19 pandemic, physician receptivity to joining health systems increased.[5] Integrated systems of care have the potential to improve quality and efficiency through care coordination and use of information technology,[6-8] but also have greater market power to negotiate higher prices.[4,7-9]

Previous research has quantified changes in spending and quality associated with horizontal integration (eg, mergers between and among hospitals) and vertical integration (eg, hospital acquisition of physician practices). Consolidation has generally been associated with higher spending.[10-19] However, most of these studies have been done in Medicare samples, where prices are administered. Further, none of the studies have had the sample size to examine differences by type of parent organization. Several studies have examined the relationship between horizontal and vertical integration and quality of care.[9-13,20-24] The findings of these studies are mixed, owing to differences in study design, samples, performance measures, and control variables. Few studies have compared commercially negotiated prices paid to vertically integrated and nonintegrated physicians, with variable ranges.[16,18,19] None of the studies had the sample size to examine differences by type of parent organization.

Research on health systems has been stymied by the absence of comprehensive data on health system organization linkable to claims and other data. Previous studies of health system performance have typically focused on a limited number of measures, a subset of physician practices or hospitals, specific patient subpopulations, or geographic areas.[25-34] The data for this study are national and comprehensive, based on a wide range of vetted data sources, and thereby facilitate performance analyses that include a rich set of covariates and that cover a broad range of measures for quality, spending, and price outcomes. We leveraged a novel and comprehensive database to broaden our understanding of health systems and the quality and cost of care delivered by them in 3 ways: (1) providing a comprehensive look at the prevalence of health systems; (2) examining how hospitals and physicians that are part of health systems differ from those that are not; and (3) comparing the quality of care delivered and the prices paid to physicians and hospitals in health systems with those not in health systems and across different types of systems.

Methods

Health System Definition and Description

A health system was defined as a group of health care organizations (eg, physician practices, hospitals, skilled nursing facilities) that are jointly owned or managed. Health systems were required to include at least 1 general acute care hospital, 10 primary care physicians, and a total of 50 physicians all located within a single hospital referral region (HRR).[35] These criteria were a consensus decision by investigators in the Agency for Healthcare Research and Quality's Comparative Health Systems Performance Initiative.[36] Health systems must qualify in at least 1 HRR in which system physicians and hospitals are located.

Twenty-five different data sources were combined to identify and describe health systems and their hospitals and physicians in 2018. eAppendices A and B in the Supplement describe the data and the process for identifying and categorizing health systems. Health systems were assigned to 1 of 5 mutually exclusive categories according to ownership and size: academic, public, large for-profit, large nonprofit, and other private.

Characteristics of health systems analyzed included size (number of general acute care hospitals and beds, total physicians), composition (eg, ratio of general acute care hospital beds to primary care physicians, percentage of system physicians with a primary care specialty, and integration with postacute facilities), and geographic scope (count of HRRs in which health system physicians and hospitals were located). eAppendix C in the Supplement describes data and measures used to characterize health systems, physicians, hospitals, and other health care facilities.

Performance Measures

Health system performance was measured in 7 dimensions: preventive care quality, chronic care quality, mortality and hospital readmissions, patient experience, utilization of low-value care, spending, and price. Performance on preventive care quality and patient experience was assessed based on responses to surveys administered in 2017-2018. Performance in all other dimensions was assessed based on analyses of 2018 claims data. eAppendix D in the Supplement describes data and computation of performance measures.

Medicare patients were included if they had continuous enrollment in Medicare Parts A and B and were aged 65 years or older. Patients were attributed to systems based on the system affiliation of the primary care physician who provided the plurality of their primary care visits, as is done in studies of the Medicare accountable care organization (ACO) program.[13] For spending analyses, adult commercially insured patients were similarly attributed (eAppendix E in the Supplement).

Quality and Utilization

Quality of care was measured by the experiences, timeliness, and appropriateness of care received by patients. Preventive care measures (% of beneficiaries reporting flu shot, pneumonia vaccination) were computed from Medicare Consumer Assessment of Healthcare Providers and Systems (CAHPS) survey data. Measures of chronic care quality for patients with diabetes and cardiovascular disease included hemoglobin A_{1c} and low-density lipoprotein testing rate; prescription drug adherence (metformin, statin, β-blocker, angiotensin-converting enzyme inhibitors, antiplatelet therapy); and rate of cardiac rehabilitation following hospitalization for an acute myocardial infarction. Patients were considered to be adherent to medication if their prescription drug fills covered at least 80% of the days in the measurement period. Mortality and readmissions occurring within 30 days of admission (mortality) or discharge (readmissions) from an acute care hospital were computed for hospitalized Medicare patients. Annual mortality was measured for all attributed Medicare patients.

Patients' experiences with care were measured using CAHPS survey data on overall ratings (care, personal physician, specialists), physician communication (4-item composite), timely access to care (3-item composite), and 11 items related to care coordination and

management. Low-value care was measured by binary variables indicating whether patients received services previously identified as providing minimal average clinical benefit.[37] Six composite measures were constructed based on the type of service (eg, cancer screening, diagnostic testing) and measured whether patients received any low-value services in the category.

Average annual spending per beneficiary on hospital inpatient, hospital outpatient, and physician services were computed from Medicare and commercial claims data. Spending on all services excluding prescription drugs was aggregated to an annual total.

Commercial Prices

Price comparisons between hospitals and physicians in systems vs those not in systems are based on commercial prices gathered from claims of a large national insurer with 20 million health insurance plan members in all 50 states. Commercial prices were tabulated for a selected set of services delivered to adult patients aged 18 to 64 years. Average prices for physician services were computed in 2018 commercial claims data as allowable charges (eTable D4 in the Supplement lists included *Current Procedural Terminology* codes). Average prices for 40 of the most common inpatient hospital services were computed as diagnosis related group payments (eTables D5 in the Supplement).

Patient Characteristics

Medicare patients were characterized by age, sex, Medicaid enrollment, disability as original reason for Medicare enrollment, chronic conditions, race and ethnicity, and income and education in the patient's zip code. Health status was assessed by the number of chronic conditions (up to 27), the presence of end-stage kidney disease, and the Centers for Medicare & Medicaid Services Hierarchical Condition Category score. Additional characteristics for the subset of beneficiaries responding to the CAHPS Survey included highest level of educational attainment, smoking status, functional limitations, and general and mental health ratings.

Percentage of Care Delivered in Systems

Using Medicare claims data, the percentage of hospital admissions and specialty physician office visits provided by system and nonsystem hospitals and physicians were tabulated separately for patients attributed to health system physicians and patients attributed to nonsystem physicians.

Statistical Analysis

To analyze the characteristics of physicians and hospitals in health systems compared with those not in health systems, mean values of the selected characteristics were compared. The Spearman correlation coefficient was computed to assess the relationship between 2 measures of system size: count of physicians and count of hospital beds. Linear regression analysis was used to compare characteristics of patients attributed to health system physicians with patients from the same HRR attributed to nonsystem physicians.

To analyze performance differences between system and nonsystem physicians and hospitals, and between types of systems, linear regression analysis was used to assess quality, experiences, utilization, and spending among patients attributed to health systems relative to patients attributed to nonsystem physicians. Controls included patient characteristics (eg, age, number of chronic conditions) and indicator variables for the HRR in which the patient resided.

In analyses of commercial prices, professional fees (for physician services) and facility fees (for hospital inpatient services) paid to system physicians and hospitals were compared with payments for the same services to nonsystem physicians and hospitals. We adjusted for differences in site of care (eg, hospital outpatient department vs office) by including an indicator variable for services provided in an office and for region with HRR dummy variables. Given that prices generally do not vary with patient characteristics, these analyses did not include controls for patient characteristics.

Our primary analyses of performance were designed to answer the question "Is the quality and cost of health care delivered in systems better, worse, or the same as the quality and cost of health care delivered outside systems?" This is a descriptive analysis, the results from which may be relevant for clinicians and patients. In secondary analyses, we investigated the separate influence of system membership and physician practice size on performance. Practices were classified into 4 categories based on the number of physicians billing to the practice tax identification number: 1 to 10, 11 to 50, 51 to 200, and more than 200 and dummy variables for these practice sizes were added to the main regression specification. In addition, differences in performance by practice size were assessed separately for system and nonsystem practices by including system-practice size interaction effects. See eAppendix F in the Supplement for details.

Analyses were performed using STATA (StataCorp) and SAS (SAS Institute) software. A P value less than or equal to .05 was used to assess statistical significance.

Results

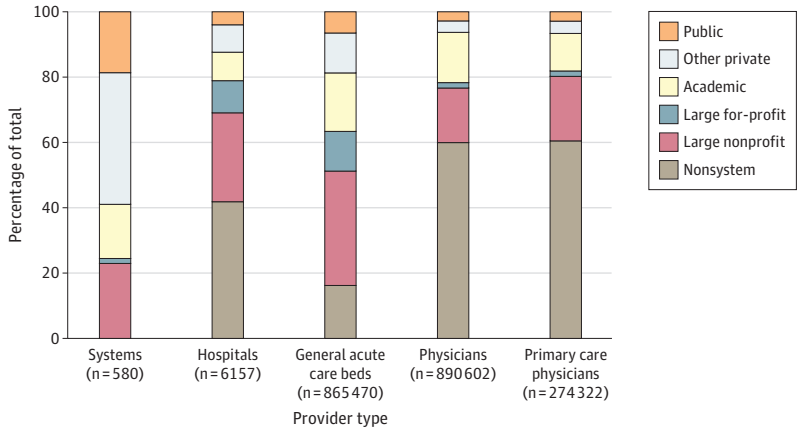
Five hundred eighty health systems were identified (**Figure 1**). Other private systems were the most common type of health system (n = 233), followed by large nonprofit systems (n = 132), public health systems (n = 106), academic systems (n = 100), and large for-profit systems (n = 9). Sixty-four percent of acute care hospitals and 84% of general acute care hospital beds were in health systems. Overall system membership of postacute care facilities/agencies was low (range, 6%-10%) and higher for specialty hospitals (range, 25%-59%) (eFigure G1 in the Supplement). Forty percent of active physicians and 40% of primary care physicians were part of health systems in 2018. Academic and large nonprofit health systems accounted for most system physicians (80%) and general acute care beds in system hospitals (64%).

Description of Health Systems

Health systems varied greatly in size, as measured by counts of physicians and general acute care hospital beds (**Figure 2**). There was a positive rank correlation between number of physicians in a system and number of hospital beds ($\rho = 0.55$; $P < .001$), but also wide variation in the ratio of general acute care hospital beds to primary care physicians (median, 6.6; IQR, 4-17), suggesting that health systems varied in their degree of primary care orientation (eFigure G2 in the Supplement).

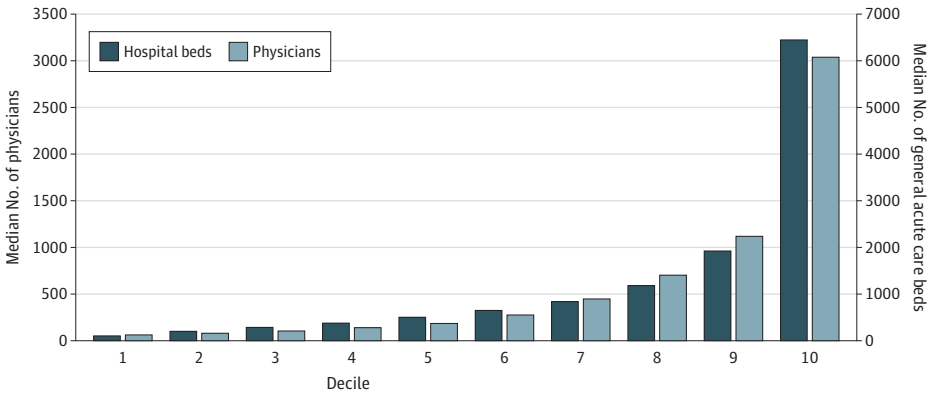
Eighty percent of health systems were located within a single HRR, while 23 systems (4%) were located in 6 or more HRRs

Figure 1. Health Systems by Type



The leftmost column shows the percentage of all health systems (n = 580) of health system type (academic, large nonprofit, large for-profit, public, and other private; see eAppendix B in the Supplement for definitions of the system types). The other 4 columns show the percentage of hospitals, general acute care hospital beds, physicians, and primary care physicians not in any system and in each type of health system.

Figure 2. Health Systems Size



Each health system was assigned to a decile of the distribution of number of affiliated physicians and separately to a decile of the distribution of number of beds in affiliated hospitals. The height of each light blue bar represents the median number of physicians among systems in the decile listed on the horizontal axis; units are on the left vertical axis. The height of each dark blue bar represents the median number of hospital beds among systems in the decile listed on the horizontal axis; units are on the right vertical axis.

(eFigure G3 in the Supplement). There was wide variation across states in the percentage of physicians who were part of health systems (eFigure G4 in the Supplement).

Comparison of Hospitals and Physicians In and Out of Health Systems

Compared with hospitals not in systems, system hospitals were larger (67% had >100 beds vs 23% of nonsystem hospitals, $P < .001$, eFigure G5 in the Supplement), less likely to be critical access (15% vs 48%, $P < .001$) and located in a rural area (5% vs 22%, $P < .001$), and more likely to be teaching (15% vs 4%, $P < .001$) and for-profit (15% vs 12%, $P = .002$). System hospitals were more likely than nonsystem hospitals to participate in a Medicare ACO (38.0% vs 21.4%, $P < .001$) and the Bundled Payments for Care Improvement Initiative (8.4% vs 3.9%, $P < .001$), and less likely to participate in the 340B drug pricing program (46.0% vs 50.5%, $P = .002$) (**Table 1**). System and nonsystem hospitals were similar in the percentage designated as safety-net hospitals (13.1% vs 15.0%, $P = .08$).

Physicians and Practices in and out of Health Systems

Compared with nonsystem physicians, a larger percentage of physicians in health systems were located in a metropolitan area (93.5% vs 77.4%, $P < .001$), in zip codes with a higher social deprivation index (34.4% vs 19.3%, $P < .001$), in practices billing as hospital-based outpatient departments (45.4% vs 2.9%, $P < .001$), and participating in Medicare ACOs (39.6% vs 13.2%, $P < .001$) (Table 1). Academic health systems had the largest percentage of physicians practicing in areas with the highest social deprivation index (44.1%) and in hospital-based outpatient departments (58.8%), and the highest participation in Medicare ACOs (43.4%). Large nonprofit systems had the highest percentage of physicians with a primary care specialty (36.5%), and academic systems had the lowest percentage (23.2%).

The percentage of physicians who were part of a health system varied substantially across specialties (eFigure G6 in the Supplement). Relatively similar percentages of system and nonsystem physicians had primary care specialties (30.4% vs 30.6%, $P < .001$). Rates of health system membership were highest among hospice and palliative care specialists, cardiologists, oncologists, neurologists, endocrinologists, and some hospital-based specialties (eg, radiology and pulmonology/critical care medicine). Ophthalmologists, dermatologists, and physicians specializing in allergy and immunology were less likely to practice in systems.

The practice size distributions for system and nonsystem physicians were very different (eTable G1 and eFigure G7 in the

Table 1. Characteristics of Physicians and Hospitals In and Out of Health Systems

				Health system type				
	Nonsystem	System	*P* value[a]	Academic	Other private	Large for-profit	Large nonprofit	Public
Physicians, %[b]								
High social deprivation index	19.3	34.4	<.001	44.1	20.2	31.3	28.4	34.6
Hospital-based outpatient department	2.9	45.4	<.001	58.8	50.3	35.5	31.3	54.6
Medicare Shared Savings Program ACO	13.2	39.6	<.001	43.4	37.4	16.7	40.3	29.1
Metropolitan area	77.4	93.5	<.001	97.1	77.3	89.9	93.8	93.5
Primary care	30.6	30.4	<.001	23.2	33.6	30.5	36.5	31.1
General acute care hospital characteristics, %[c]								
340B	50.5	46.0	.002	50.1	54.5	2.7	52.6	68.2
Bundled Payments for Care Improvement	3.9	8.4	<.001	12.4	6.9	9.1	8.0	4.7
Critical access	47.7	14.9	<.001	7.3	19.2	3.7	20.1	9.0
For-profit	11.8	14.9	.002	2.2	4.4	76.9	3.8	4.3
Medicare Shared Savings Program ACO	21.4	38.0	<.001	40.8	37.6	25.6	42.1	32.7
Rural	22.2	5.0	<.001	2.0	6.7	0.8	7.1	2.4
Safety net	15.0	13.1	.08	16.3	11.7	17.6	9.7	24.2
Teaching	4.2	14.5	<.001	39.3	9.3	8.3	10.4	17.5

Abbreviation: ACO, accountable care organization.

[a] The *P* value denotes the significance level of a test of differences in system and nonsystem means. See eAppendix C in the Supplement for definitions of each of these characteristics and data used in their computation.

[b] Physicians in systems and physicians not in systems were characterized by the percentage: with a primary care specialty, practicing in a hospital outpatient department, participating in a MSSP ACO, located in a zip code with a high social deprivation index, and located in a metropolitan area. These characteristics were separately tabulated for physicians in each type of system.

[c] General acute care hospitals in systems and not in systems were characterized by the percentage: with for-profit ownership, teaching, critical access designation, participating in the federal 340B drug pricing program, participating in Centers for Medicare & Medicaid Services' BPCI Initiative, participating in a MSSP ACO, with a safety-net designation, and located in a rural area. These characteristics were separately tabulated for general acute care hospitals in each type of system.

Supplement). Seventy-four percent of large practices (>100 physicians) and 81% of Medicare patients attributed to large practices were in systems. In contrast, 97% of small practices (<11 physicians) and 98% of Medicare patients attributed to small practices were not in systems. Academic systems and large nonprofit systems had the highest percentage of physicians in large practices (85% and 76%, respectively). Sixty-one percent of nonsystem physicians were concentrated in smaller practices composed of 10 or fewer physicians.

Proportion of Care Delivered by Health System Physicians and Hospitals

The vast majority of hospital admissions for Medicare beneficiaries attributed to system physicians occurred in system hospitals (94%). A large but somewhat smaller share of hospitalizations for beneficiaries attributed to nonsystem physicians (84%) also occurred in health system hospitals (eTable G2 in the Supplement). In comparison, health system physicians accounted for a much larger percentage of specialty office visits for system-attributed patients (44%) than nonsystem-attributed patients (20%) (*P* < .001).

Comparative Performance of Health Systems

Characteristics of Medicare Beneficiaries

Among Medicare beneficiaries in 2018, 40% were attributed to nonsystem physicians and 29% were attributed to a health system. Thirty-one percent of beneficiaries were omitted because they did not have a visit with a primary care physician. Patients attributed to health system physicians were similar on a wide range of characteristics to patients attributed to nonsystem physicians (eTables E1-E3 in the Supplement). Many differences were statistically significant but small in magnitude. Compared with beneficiaries not in health systems, health system beneficiaries were more likely to be Black (7.5% vs 6.6%, *P* < .001), less likely to be enrolled in Medicaid (8.7% vs 10.3%, *P* = .001), and less likely to live in a rural area (2.1% vs 3.1%, *P* < .001). System and nonsystem patients were similar on multiple measures of health status (chronic condition count, Hierarchical Condition Category score, and patient's general and mental health self-ratings) in both samples.

Clinical Quality

On most measures, quality of care and patient experiences were similar for system and nonsystem patients (**Table 2**). For preventive care, health system patients were somewhat more likely to receive flu shots and pneumonia vaccinations (78.8% vs 76.1%, *P* < .001 and 81.9% vs 77.1%, *P* < .001, respectively). Rates were highest in academic health systems (flu shot, 80.4%; pneumonia vaccination, 83.8%). For cardiovascular and diabetes care, health system patients had better guideline care on most measures, except lipid testing, but these differences were small in magnitude. Thirty-day hospital mortality and readmissions were similar between system and nonsystem patients; hospitalized health system patients were somewhat more likely to be readmitted (16.3% vs 15.7%, *P* < .001) but less

Table 2. Comparative Performance of Health Systems on Quality and Patient Experience

Measure[d,e]	Nonsystem unadjusted mean[f]	System adjusted mean[g]	System[a]		Mean differences by system type[b,c]					
			Mean difference[c]	*P* value	Academic	Other private	Large for-profit	Large nonprofit	Public	*P* value
Preventive care, %										
Receipt of flu shot	76.1	78.8	2.7	<.001	4.3	1.3	1.5	2.6	2.2	<.001
Pneumonia vaccine	77.1	81.9	4.8	<.001	6.7	3.6	2.3	4.8	3.2	<.001
Cardiovascular, %										
Lipids test	78.7	75.9	−2.8	<.001	−5.0	−2.0	−1.1	−2.0	−3.2	<.001
AMI cardiac rehabilitation	23.5	24.6	1.1	<.001	0.7	0.8	−1.2	1.5	3.0	.004
Antiplatelet therapy adherence[d]	87.5	88.1	0.6	.02	0.2	0.1	−0.3	1.0	0.8	.41
ACE inhibitor adherence after HF[d]	51.4	51.1	−0.3	.13	−0.6	−0.6	−0.4	0	−0.4	.28
β-Blocker adherence after HF[d]	65.1	65.8	0.7	<.001	1.0	0.2	−0.2	0.8	0.3	.04
β-Blocker adherence after AMI[d]	73.8	73.7	−0.1	.78	−0.6	−0.5	−1.1	0.4	0.2	.52
Any statin	73.8	75.8	2.0	<.001	2.5	1.4	0.7	2.0	1.6	<.001
Statin adherence[d]	65.6	66.3	0.7	<.001	0.5	0.5	0.3	1.0	0.2	<.001
Diabetes, %										
HbA_{1C} test rate	84.5	85.9	1.4	<.001	1.5	0.7	0.6	1.9	0.2	<.001
LDL test rate	85.0	82.9	−2.1	<.001	−3.6	−1.3	−1.0	−1.3	−3.6	<.001
Any statin	72.3	75.2	2.9	<.001	3.8	1.9	1.9	2.7	3.0	<.001
Statin adherence[d]	74.2	75.0	0.8	<.001	0.8	0.4	0.6	1.1	0.4	.02
Any metformin	59.4	63.3	3.9	<.001	4.4	3.2	3.2	3.9	3.9	.002
Metformin adherence[d]	72.0	72.6	0.6	<.001	0.3	0.4	0.5	1.0	0.2	.002
Hospital mortality and readmissions, %										
Mortality in 2018 irrespective of hospital admission	3.0	3.0	0	.03	0.1	0	0	0	0.1	.04
Mortality 30-d post discharge from index hospital admission	5.7	5.5	−0.2	<.001	−0.4	−0.3	−0.2	−0.2	−0.2	.04
Readmissions 30-d post discharge from index hospital admission	15.7	16.3	0.6	<.001	1.1	0.5	0.6	0.3	0.3	<.001
Low-value care composites, %										
Cancer screening	16.4	13.9	−2.5	<.001	−3.2	−2.2	−1.2	−2.4	−2.5	<.001
Diagnostic testing	10.5	9.2	−1.3	<.001	−1.3	−1.1	−1.6	−1.3	−1.2	.57
Preoperative testing	8.3	8.1	−0.2	<.001	−0.3	−0.2	0.1	−0.2	−0.3	.04
Imaging	21.9	21.3	−0.6	<.001	−1.1	−0.3	−0.3	−0.4	−0.3	.002
Cardiovascular testing and procedures	10.9	10.3	−0.6	<.001	−0.9	−0.4	−0.2	−0.6	−0.5	<.001
Invasive procedures	4.9	4.8	−0.1	.03	−0.3	0	0.2	0	0.1	<.001
Patient experience										
Overall rating, %										
Rate care = 9 or 10	61	61.5	1.5	<.001	2.9	0.3	0.3	1.3	1.9	.006
Rate personal physician = 9 or 10	76	77.3	1.3	<.001	2.3	1.3	−1.9	1.2	1.1	.04
Rate specialist = 9 or 10	73	74.5	1.5	<.001	1.8	1.7	0.4	1.8	−0.3	.27
Composite[h]										
Physician communication composite	9.1	9.1	0.04	.002	0.05	0.04	−0.04	0.04	0.04	.41
Timely access composite	8.4	8.3	−0.06	<.001	−0.06	−0.07	−0.01	−0.05	−0.15	.28

(continued)

Table 2. Comparative Performance of Health Systems on Quality and Patient Experience (continued)

Measure[d,e]	Nonsystem unadjusted mean[f]	System adjusted mean[g]	System[a]		Mean differences by system type[b,c]					
			Mean difference[c]	*P* value	Academic	Other private	Large for-profit	Large nonprofit	Public	*P* value
Coordination and management[h]										
How often physician seemed informed about care from specialist	3.3	3.4	0.06	<.001	0.10	0.05	−0.02	0.05	0.07	<.001
How often personal physician has medical records and other information	3.9	3.9	0.01	.006	0.01	0.00	−0.02	0.01	0.02	.057
How often physician office followed up with test results	3.6	3.6	0.02	<.001	0.04	0.02	−0.04	0.03	0.01	.006
How often got test results as soon as needed	3.7	3.7	0.01	.007	0.02	0.00	−0.03	0.01	0.01	.04
How often personal physician talks about all medicines	3.4	3.5	0.05	<.001	0.06	0.05	0.01	0.06	0.05	.31
Physician had visit notes, %	44	58	14	<.001	18	10	6	16	9	<.001
Last 6 mo, got help from personal physician to manage care	1.2	1.2	0.00	.85	0.00	0.00	−0.02	0.00	0.00	.87
Last 6 mo, plan/physician office followed up about hospital stay	1.4	1.4	0.00	.76	−0.03	−0.01	−0.01	0.00	0.05	.55
Reminders from plan/physician office in last 6 mo[h]										
Make appointment for tests/treatment	1.5	1.5	−0.02	<.001	−0.02	−0.01	−0.01	−0.03	−0.01	.68
Get flu shot or immunization	1.6	1.6	−0.03	<.001	−0.06	−0.02	0.01	−0.04	−0.01	.004
Screening tests	1.7	1.7	−0.03	<.001	−0.03	−0.01	−0.02	−0.03	−0.01	.52

Abbreviations: ACE, angiotensin-converting enzyme; AMI, acute myocardial infarction; HbA_{1C}, hemoglobin A_{1c}; HF, heart failure; LDL, low-density lipoprotein.

[a] The system mean difference is the average difference in performance between patients attributed to system primary care physicians and patients attributed to nonsystem primary care physicians adjusted for patient characteristics and geographic area; it is equal to the health system coefficient in the performance regression. The *P* value refers to a test in which the null hypothesis is the mean system difference equals zero.

[b] The mean difference by system type is the average difference in performance between patients attributed to primary care physicians in each type of system and patients attributed to nonsystem primary care physicians adjusted for patient characteristics and geographic area; it is equal to the health system type coefficient in the performance regression. The *P* value refers to a test in which the null hypothesis is equality of mean differences across system types.

[c] 95% CIs are provided in eTable G12 in the Supplement.

[d] Separate regressions were estimated for each performance measure listed in left column of the table. (See eAppendices D and F in the Supplement for details on performance measure and regression specifications.)

[e] Adherence is measured as having a prescription or therapy covering at least 80% of days in the calendar year (eAppendix E in the Supplement).

[f] The unadjusted nonsystem mean for each performance measure equals the unadjusted average for patients attributed to primary care physicians not in a health system. It is provided here for comparison with the system mean difference to illustrate the magnitude of the difference between system and nonsystem performance.

[g] The adjusted system mean equals the sum of the unadjusted nonsystem mean and the adjusted system mean difference.

[h] The data sources and rating scales for the patient experience measures vary and are described in eAppendix D in the Supplement.

likely to die (5.5% vs 5.7%, $P < .001$). On clinical quality measures, there was little variation by type of health system; no health system type consistently performed better or worse than other types.

Low-Value Care Utilization

Compared with nonsystem patients, system-attributed patients were less likely to receive low-value services in each of the 6 categories (Table 2; eTable G3 in the Supplement). The receipt of low-value care was similar across types of health systems.

Patient Experiences

For nearly all measures, patient experiences were very similar for patients attributed to health system physicians and nonsystem physicians (Table 2). This includes overall ratings of physicians and composite measures of physician communication and timely access to care. In the area of care coordination and management, health system patients rated their care marginally higher on some measures but reported slightly lower rates for reminders about scheduling appointments and preventive care. The range of performance by health system type was small; where performance differed significantly by system type, academic health systems were more likely to be rated higher and large for-profit health systems were more likely to be rated lower.

Commercial Prices

On average, commercial prices were higher in systems for a variety of physician services: 26% higher for outpatient physician visits

Table 3. Comparison of Spending and Prices for Physician and Hospital Services

Service/spending category[c,d]	System		Mean difference by system type[a,b]					
	Difference[b,e]	*P* value	Academic	Other private	Large for-profit	Large nonprofit	Public	*P* value
Physician service prices, %								
Inpatient visits	13.1	<.001	19.8	−3.2	6.3	13.1	3.9	<.001
Outpatient visits	26.0	<.001	35.0	8.3	14.5	24.8	15.2	<.001
Selected procedures								
Cardiologists	16.3	<.001	29.1	−1.1	−0.5	15.1	16.8	<.001
Gastroenterologists	16.3	<.001	24.5	−9.8	14.0	14.8	16.4	<.001
Orthopedic surgeons	18.9	<.001	18.1	0.8	25.1	23.3	13.8	.006
Other surgeons	12.0	<.001	20.5	−14.1	9.4	11.0	12.4	<.001
Hospital service prices, %								
Inpatient visits for various DRGs	30.6	<.001	37.6	18.0	31.8	31.0	11.0	<.001
Commercial spending/capita, $								
Hospital facility								
Inpatient (mean = 1564)	−55	<.001	−115	−160	68	−15	−127	<.001
Outpatient (mean = 1559)	495	<.001	1068	756	−38	227	697	<.001
Physician services (mean = 3336)	−95	<.001	−15	−374	−95	−86	−303	<.001
Total spending (mean = 7139)	333	<.001	912	234	−54	110	314	<.001
Medicare spending/capita, $								
Hospital facility								
Inpatient (mean = 3518)	311	<.001	518	304	290	197	321	<.001
Outpatient (mean = 2015)	455	<.001	779	461	97	306	537	<.001
Physician services (mean = 3833)	−206	<.001	−308	−233	23	−158	−289	<.001
Total spending (mean = 11 286)	591	<.001	1063	572	459	347	604	<.001

Abbreviation: DRG, diagnosis related group.

[a] In spending analyses, mean difference by system type is the average difference in spending between patients attributed to primary care physicians in each type of system and patients attributed to nonsystem primary care physicians adjusted for patient characteristics and geographic area; it is equal to the health system type coefficient in the spending regression. In price analyses, the mean difference by system type is the average percentage difference in price paid to physicians and hospitals in each type of system and compared with prices paid to nonsystem physicians and hospitals adjusted for care setting and geographic area; it is equal to the health system type coefficient in the price regression. The *P* value refers to a test in which the null hypothesis is the mean difference is equal across system types.

[b] 95% CIs are provided in eTable G13 in the Supplement.

[c] Separate regressions were estimated for each category of physician services, hospital services, and spending listed in the left column of the table (in the Supplement, see eAppendix D for details on price and spending measures and eAppendix F for details on regression specifications).

[d] Average unadjusted per-capita spending by beneficiaries attributed to nonsystem primary care physicians is shown in the left column next to spending category description.

[e] In price analyses, the system mean difference is the average percentage difference in price paid to system physicians and hospitals compared with nonsystem physicians and hospitals adjusted for care setting and geographic area; it is equal to the health system coefficient in the price regression. In spending analyses, the system mean difference is the average difference in spending between patients attributed to system primary care physicians and patients attributed to nonsystem primary care physicians adjusted for patient characteristics and geographic area; it is equal to the health system coefficient in the spending regression. The *P* value refers to a test in which the null hypothesis is the mean system difference equals zero.

(excluding facility fees and adjusted for site of care), 13% higher for visits delivered during an inpatient hospital stay, and 12% to 19% higher for selected procedures performed by cardiologists, gastroenterologists, and surgeons (**Table 3**). System price differentials for physician services varied substantially across system types. Prices were highest in academic systems and lowest in other private health systems. Commercial hospital prices for admissions in 40 of the most common diagnosis related groups were on average 31% higher ($P < .001$) in system hospitals compared with nonsystem hospitals and varied substantially across system types (range: 38% higher for academic systems, $P < .001$, no significant difference for public health systems, $P = .45$; Table 3).

Spending

Average spending among commercial and Medicare beneficiaries attributed to system physicians was 4.7% and 5.2% higher, respectively, than spending among nonsystem patients (both $P < .001$, Table 3). These modest differences in spending are a result of both system and nonsystem patients receiving a large proportion of their care from system physicians and hospitals (eTable G2 in the Supplement). For both commercial and Medicare populations, lower spending on physician services for system patients was more than offset by higher spending on hospital outpatient facilities. Among both Medicare and commercial beneficiaries, academic health systems had the highest total spending. Large nonprofit systems had the lowest Medicare spending, and large for-profit systems had the lowest commercial spending.

Performance and Price Differences Associated With Physician Practice Size

Results of the main analyses were not adjusted for practice size. Because most large practices with attributed beneficiaries were in

systems and most small practices were not in systems (eTable G1 in the Supplement), it is difficult to isolate the contribution to performance differences of belonging to a health system separately from the contribution of practice size.

Secondary analyses were conducted to examine the association between performance and the size of the primary care practice to which patients were attributed. For most clinical and patient experience measures, there is a small positive relationship between practice size and performance. Adjusting for practice size reduces the small performance differences associated with health system affiliation in the main analysis (eTables G4-G6 in the Supplement). For example, the gap between system and nonsystem practices in receipt of pneumonia vaccination falls from 4.8% to 0.2% with practice size adjustment. Total spending in systems remained significantly higher than nonsystem spending after practice size adjustments, but the magnitudes of system differences were reduced (eTable G7 in the Supplement).

For physician prices, there was a strong positive relationship between practice size and price (eTable G8 in the Supplement). Practices with greater than 50 physicians received price premiums of 20% to 36% for physician visits and 10% to 46% for selected procedures performed by specialists relative to practices with fewer than 11 physicians. The gap between system and nonsystem prices was largest in small- and medium-sized practices (eTable G9 in the Supplement). System physicians in small- and medium-sized practices were paid approximately the same amount as physicians in larger practices, while nonsystem physicians in small- and medium-sized practices were reimbursed much less.

Summary

Compared with patients attributed to nonsystem physicians, health system patients received slightly better care on preventive and clinical performance measures and reported experiencing better care in some dimensions. Health system patients received lesser amounts of low-value care but incurred 5 percent higher spending. Prices for services delivered by health system physicians and hospitals were significantly higher than prices paid to nonsystem physicians and hospitals. Adjusting for practice size reduced the magnitude and significance of most health system performance differences on quality and spending measures and greatly reduced price differences for physician services among large practices. Still, small- and medium-sized system practices received much higher prices than nonsystem practices of comparable size.

Discussion

The health care delivery system has undergone major structural change because of horizontal and vertical consolidation. While this change has been ongoing, there are no systematic analyses of its implications for the cost and quality of medical care. We created a national database of health systems and examined the impact of system affiliation on the cost and quality of care received. There are 4 major findings of this analysis.

First, most hospitals and 40% of physicians were members of health systems in 2018. Health system hospitals and physicians accounted for 89% of hospital admissions and 29% of physician visits by traditional Medicare beneficiaries. The enormous share of medical care delivered in health systems suggests that the health system is currently the dominant form of organization in US health care.

Second, health systems varied greatly in size and composition. Most systems are small, but some are enormous. Many of the largest systems are private nonprofit and academic, but there are large for-profit systems as well. These descriptive findings on health systems are broadly consistent with and modestly extend what is known from recent studies.[2,38-40]

Third, quality and experiences of care received by health system patients were only modestly better than for nonsystem patients. Most of the differences in quality of care and patient experiences associated with health systems appear due to lower performance in nonsystem small practices. Large practices have roughly similar quality both within and outside of systems. Because practice size and system affiliation are so tightly correlated, however, evidence that system membership by itself is associated with better performance is lacking.

Fourth, commercial prices paid to system physicians and hospitals were much higher than prices paid to nonsystem physicians and hospitals. This is particularly true for small- and medium-sized practices, which received a significant price premium when part of systems. Across systems, hospitals in a large or academic system received the highest prices. These findings are consistent with previous research showing positive correlation between commercial prices and vertical integration of hospitals and physician practices[16,18,19] and with studies finding higher prices in concentrated hospital and physician markets.[14,41-43] The findings also suggest that large independent practices may wield market power comparable with health systems. The large amount of care delivered by health system hospitals and physicians to nonsystem patients, combined with relatively high prices paid to large nonsystem practices, helps to explain the modest differences in spending between system and nonsystem patients. Because these findings are cross-sectional and not based on exogenous variation in belonging to a system or not, the results cannot establish causal inferences. However, the findings are relevant for understanding where price and quality are currently the highest.

Limitations

This study has several limitations. First, inconsistency in data inputs would affect system assignment of physicians and facilities. While there is no universal definition of a health system, the Agency for Healthcare Research and Quality's Compendium of US Health Systems lists a similar number of health systems (n = 637) with a high degree of overlap (80%) among the largest ones (eTable G10 in the Supplement).[44] Second, the study's definition of a health system was based on ownership and joint management; other relationships among physicians and hospitals (eg, affiliations, membership in ACOs) have the potential to influence performance as well.[45-48] Third, the number of physicians billing under the same tax identification number is an imperfect measure of practice size. Fourth, patients attributed to health system physicians may have differed from patients attributed to nonsystem physicians in ways that could not be observed and were not correlated with observable characteristics. However, characteristics of Medicare patients attributed to system and nonsystem practices were very similar, and sensitivity analyses indicate study findings are insensitive to adjustment for patient characteristics

(eTable G11 in the Supplement). Fifth, study results may not generalize to other populations (eg, Medicaid, Medicare Advantage, or based on alternative attribution algorithms). Sixth, the uneven geographic distribution of health systems limits the generalizability of study findings to possible health system formation in areas currently without many systems. Seventh, delays in the availability of study data generate an unavoidable lag between the study period and publication date. Still, most of the health systems in this study are delivering care today, in similar organizational form or as part of other larger health systems.

Conclusions

In 2018, health system physicians and hospitals delivered a large portion of medical services. Performance on clinical quality and patient experience measures was marginally better in systems but spending and prices were substantially higher. This was especially true for small practices. Small quality differentials combined with large price differentials suggests that health systems have not, on average, realized their potential for better care at equal or lower cost.

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Acquisition, analysis, or interpretation of data: Beaulieu, McWilliams, Landrum, Cutler, Hicks, Dalton, Briskin, Gu, Wu, El Amrani El Idrissi, Machado.
Drafting of the manuscript: Beaulieu, Cutler, Dalton, Gu.
Critical revision of the manuscript for important intellectual content: Beaulieu, McWilliams, Chernew, Landrum, Cutler, Hicks, Briskin, Wu, El Amrani El Idrissi, Machado.
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