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Abstract

The use of measures of patient-centered care to evaluate hospital care is mandated by The Patient Protection and Affordable Care Act of 2010. Using three years of data from 315 California acute-care hospitals and data collected from patients via the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey, we seek to evaluate patients' hospital-care experience by (1) analyzing patients' experience-of-care scores in light of these hospitals' patient profiles, structural characteristics, and outcomes in 2011, and (2) determining and analyzing the extent of changes in patients' experience of care over the three-year period 2009–2011. For 2011, we find significant variation in patients' experience-of-care scores associated with hospitals' different patient profiles and structural characteristics. In spite of these single-year differences, virtually all aspects of patients' experience of care showed improvement over the 2009–2011 period.

Keywords

Patient-centered care, patient hospital experience, value-based purchasing, HCAHPS, hospital quality of care, affordable care act, hospital outcomes

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Background

Delivering patient-centered care (PCC) has become a major objective of the US healthcare system.^{1, 2} PCC has been defined as care that is “respectful of and responsive to individual patient preferences, needs, and values and [that ensures] that patient values guide all clinical decisions.”³ Value for patients has in turn been defined as a measure of positive health outcomes gained per dollar spent. The reasoning behind adopting patient value as a guiding criterion is that it cuts through the divergent goals of the multitude of stakeholders in health care.^{4–7}

In the hospital setting, the importance of PCC for evaluating patient care and for judging exceptional quality and excellent care delivery has been prioritized with the passage of The Patient Protection and Affordable Care Act of 2010 (PPACA) colloquially known as ‘Obamacare.’

⁸ The culmination of years of legislative efforts to address

quality problems in health care, PPACA mandates high value for patients as a key goal. Some observers have noted that valuing the patient's perspective is an important aspect of service quality.^{9,10} Here, service quality signifies how well the health-care experience aligns with patients' expectations.^{11–13} Good service quality in hospital care consists of positive patient-care experiences from the patient's point of view, from helpful communications with physicians, nurses, and staff to providing clean and comfortable facilities, managing pain, and supplying and explaining discharge information.^{9,14}

One essential feature of the PPACA legislation designed to improve the patient's quality of care and their satisfaction with their hospital stay is the Medicare payment methodology known as value-based purchasing (VBP). The underlying rationale of the VBP approach is to incentivize hospitals to prioritize patient-centered care by shifting the payment paradigm away from the current

supply-side-driven system based on established provider arrangements to paying for patient-centered services on the basis of patients' needs and the services' value to the patient. Proponents assert that PCC enhances patients' input and patient choice on matters related to their care; others note that PCC is also designed to improve coordination of care and to enhance employee outcomes.^{15,16} Fundamentally, PCC aims to craft a care-delivery system that addresses patient needs and preferences and that structures care that enhances performance outcomes.^{16,17}

Given the new importance of the patient's hospital experience, it is paramount to measure and report data pertinent to patient values accurately and reliably. Such data will enable hospitals, policymakers, and stakeholders to understand how variations in different hospitals' patient populations and structural characteristics impact patients' experience of care.^{1,17} But measuring patients' hospital experience at a level that is valid and that permits broad transparency, comparison, evaluation, and system action has been a challenge and the ability to do so is evolving slowly at the national level.^{18,19} For over a decade the Centers for Medicare & Medicaid Services (CMS) have been laying the groundwork to measure patients' hospital experience.^{20,21} This effort, initiated in 2002, began as voluntary collection of hospital-level treatment and outcome data and data on the patient's hospital experience. In 2004 Medicare mandated that hospitals provide such data and imposed penalties on hospitals that failed to comply. These data were made publicly available in 2005. In 2012, as specified in the PPACA, a hospital's actual performance on value-based quality measures from their patient's experience on value-based measures of the quality of its patients' experiences began to be used to reward or penalize. In effect, with the passage of the PPACA legislation, most of the nation's acute-care hospitals that accept Medicare payments are competing with each other based in part on the value that patients attribute to their services.^{22, 23}

This initiative began to "bite" in October 2012 when Medicare payments to hospitals were reduced by 1 percent to create a pool of approximately \$1 billion for incentive payments to hospitals. The magnitude of individual payments was based on hospitals' performance on measures of their clinical processes and patient experience. In December 2012, Medicare announced that, using the value-based purchasing methodology, 1,557 hospitals with outstanding quality ratings would receive higher Medicare payments for quality ratings, and that payments would be reduced for 1,427 hospitals. The maximum rate adjustment up or down is 1 percent of a hospital's regular Medicare payments.²⁴

In this quality-focused competitive environment, it is essential for hospitals to understand the factors that

influence patients' experience of care and other measures of quality. Recognition is growing of the importance of patient-centered care, and of the evidence of its effectiveness in contributing to other system goals. To date, however, little research has examined the hospital setting, or hospitals' patient profiles and structural characteristics and their links to patients' care experiences.²⁵ Such research is critical to understanding what hospital characteristics impact patients' experience of care and how the health-care system can improve patient outcomes. This imperative is made ever more urgent by the VBP incentives in the PPACA. The lack of empirical evidence to help policymakers, hospitals, and stakeholders identify the key drivers of patients' experience of care is a concern.^{2,15,17,26}

Our investigation has two primary objectives. First, we analyze variation in patients' 2011 experience-of-care scores in light of hospitals' patient profiles, structural characteristics, and outcomes. To do so, we use data from 315 California general acute-care hospitals and ten corresponding measures of patients' experience of care from Hospital Consumer Assessment of Healthcare Providers and Systems, also known as the CAHPS Hospital Survey (HCAHPS). Second, for the same hospitals, we seek to determine the extent of change in patients' experience of care over the three-year period 2009–2011.

Data And Methodology

The variables we use are widely employed in organizational and hospital research and in policy analysis²⁷ to capture definitive features of a hospital's market area, patient population, and structural and outcome characteristics. These variables highlight a causal pathway, partially modeled in Donabedian's early research on health-care quality, whose focus is the structures and processes that influence hospital performance.²⁷⁻²⁹ Shaller has summarized the major aspects of these relationships most pertinent to patient-centered care, and also noted the importance of the market areas in which hospitals compete.¹⁷ We thus broadened our framework to include market characteristics.^{28,30,31}

Our database on California hospitals consists of linked data from five databases. We began with the HCAHPS survey for the years 2009–2011, which captures patients' experience of care in the hospital.³¹ To capture patient characteristics that might impact hospitals' experience-of-care scores, we aggregated 2009–2011 patient-level discharge data from the U.S. Agency for Healthcare Research and Quality's (AHRQ) Healthcare Cost and Utilization Project–State Inpatient Database (HCUP–SIDs) for each hospital by year and linked it to the experience-of-care data.³² The HCUP-SID data enabled us to create aggregate annual data for each hospital on such key clinical and nonclinical variables as patient

demographics (average age, percent female, racial composition), the percent of patients covered by various payers (Medicare, Medicaid, private including HMO, self-pay, no charge, and other); racial composition (white, black, Hispanic, Asian, other); average number of diagnoses and procedures for each patient treatment, hospital charges, average length of stay, and percent who died during their inpatient stay.^{32,33}

To capture organizational and process information about the hospitals not present in the HCUP-SIDs, we linked the American Hospital Association's (AHA) Annual Survey Database for California hospitals to the HCAHPS and HCUP-SID data. This data encompasses organizational structure, facilities and services, utilization, community-orientation indicators, physician arrangements, managed-care relationships, expenses and staffing.³⁴ We also used data from the California Office of Statewide Planning and Development (OSHPD), which annually collects detailed financial and utilization data including 30-day mortality rates and readmission rates for acute myocardial infarction (AMI), congestive heart failure (CHF), and pneumonia (PN).³⁵ Finally, for each hospital we linked Area Resource File (ARF) data from the Health Resources and Services Administration to capture variations in different levels of a hospitals' market concentration.³⁶

Construction of Variables

Patients' experience of care. Our focus variables are patients' experience-of-care scores. The HCAHPS survey is administered between 48 hours and six weeks after discharge, by mail, telephone, mail with telephone follow-up, or interactive voice response on the telephone via an approved vendor. It is administered to a random sample of patients at least eighteen years old after an inpatient stay of at least one night for medical, surgical, or maternity care. The patients themselves must complete the survey. Patients with a foreign address, those discharged to a hospice or to law enforcement, or those who requested privacy when admitted are excluded. Estimates indicate that 85 percent of inpatients at participating hospitals are eligible.³⁷ Participating hospitals (those whose data qualified them for public reporting of their survey scores) accounted for 97 percent of eligible inpatient stays in March 2009.³⁷ Core HCAHPS was available for 315 of the 325 California hospitals (97 percent) over the three-year period.

The experience-of-care survey consists of 27 questions and takes 7–10 minutes to complete. Of the first 22 questions, 18 are substantive; responses to them are publicly reported on the HCAHPS website. Four questions are used to screen for eligibility to answer subsequent questions. The survey also includes 5 questions about respondents' sociodemographic characteristics.

Of the 18 substantive questions, 14 produce data subsequently used to construct 6 composite measures: communication with nurses and with doctors, responsiveness of staff, pain management, communication about medicines, and discharge information. Two questions pertain to the cleanliness and quietness of the hospital environment, and there are two overall measures: a 0–10 rating of the hospital and a measure of willingness to recommend the hospital. With a few exceptions, the response options are *never*, *sometimes*, *usually*, and *always*. For the question about willingness to recommend the hospital, the response options are *definitely no*, *probably no*, *probably yes*, and *definitely yes*. Further details on the methodology and survey-instrument construction can be found on the HCAHPS website and in survey documentation.^{31,38} We used the ten resulting composite measures as our dependent variables. The percent of patients at each hospital who responded to each question positively constituted the hospital's score.

Patient profiles and hospital characteristics. An extensive empirical literature examines the effects of hospital competition on the cost and quality of hospital services, on access, and on patients' experience. These studies typically find statistically significant effects.³⁹ As our market-competition measure, we used the Herfindahl-Hirschman Index (HHI), calculated as the sum of the squared market shares of all hospitals in a given local market. The hospital's referral region (HRR), or the area from which the hospital draws the vast majority of its patients, is used to identify each hospital's market.⁴⁰ This measure—Hospital HHI in HRR—signifies the hospital's level of competition. We define competition in keeping with the Federal Trade Commission's definition: unconcentrated (high level of concentration), HHI less than 1500; moderately concentrated, 1501–2499; and highly concentrated: greater than 2500, where greater concentration means less competition.

Typically, organizational studies differentiate between hospitals on the basis of their ownership type and variation in their missions and goals.^{41,42} Consistent with AHA definitions for short-term community hospitals³⁴, we specify four groups of hospitals: (1) for-profit; (2) private, not-for-profit; (3) private, not-for-profit, religious; and (4) government-controlled. Teaching status, determined from AHA data, is specified by three binary variables: (1) no teaching; (2) affiliation with a medical school but not with the Council of Teaching Hospitals; and (3) membership in the Council of Teaching Hospitals. This categorization treats teaching in terms of level of teaching commitment.⁴³ Bedsize is differentiated by four categories: <100, 100–199, 200–299, and >300. We use bedside categories to capture differences in scale and complexity.⁴³ We use three measures to capture service intensity: mean number of chronic conditions per patient,

mean diagnoses per patient, and medical procedures per patient.

Patient-care quality can vary by hospital payer, racial/ethnic composition, age, and/or gender, and consequently influence patients' experience of care.⁴⁴⁻⁴⁷ Each hospital's payer mix is represented by the percent of patients insured by Medicare, Medicaid, private insurance, and other insurance (self-pay, no insurance, other insurers). We specified five racial/ethnicity categories: (1) white, (2) black, (3) Hispanic, (4) Asian or Pacific Islander, and (5) other. We also collected data on the age and gender composition of a hospital's population.

Several variables capture hospitals' outcomes and quality of care. The mean cost per patient is aggregated from patient charges in the HCUP dataset; the cost/charge ratio is used to convert charges to costs.^{48,49} To capture resource use, we include a hospital's average length of stay. To capture possible differences in hospital quality, we include 30-day mortality rates and 30-day readmission rates for AMI, CHF, and PN.

Analytical Methodology

To compare different hospitals' patient profiles, structures and processes, and outcomes, we use quartile analysis.^{50,51} Quartiles and interquartile ranges subdivide the array of data on a specific variable into four even parts— 25 percent in each quartile—and thus are helpful for comparing performance ranges across a variable of interest. The interquartile range is the spread of data between the 25th and 75th quartiles; these middle values represent 50 percent of the data. The appeal of quartiles for our study is that they subdivide data on each patient and hospital variable into comparable segments; thus, for each variable, the highest quartile can be compared to the lowest quartile, and the differences can be assessed. In practice, we are comparing the range of patient profiles and hospital characteristics with the range of patients' experience-of-care scores. Such comparisons capture the current levels of achievement of hospitals with similar goals and missions, and not necessarily aspirational standards or goals yet to be achieved.

To accomplish this type of comparison, for most of the continuous variables, we created three groups of experience-of-care scores for each patient characteristic and hospital feature (see Table 1). For each variable, hospitals were sorted into a high group (the 25 percent with the highest experience-of-care scores), a low group (the 25 percent with the lowest experience-of-care scores), and a middle group composed of the remaining 50 percent of hospitals.

For each variable to which we apply quartile analysis, such as those in the category Payer Source, we report the mean and standard deviation and the interquartile ranges used to

create the high, middle, and low groupings. The number of cases is also reported; where values are missing, we employed the quartile strategy on the remaining cases.

For several structural variables where quartile analysis would be less informative and meaningful - hospital ownership, bedsize, teaching status, and health-system status - we used categorical analysis. For all comparisons, we tested the statistical significance among groups and reported p-values.

It is important to note that, though we have considered strategically important patient and hospital variables and employed them in a comparative research framework, our research is primarily descriptive. Some of the variables we have aggregated by quartiles have correlations in the .4 to .5 range. Thus, for example, the quartile variable for hospitals with a high share of Medicaid patients is correlated with the quartile variable for hospitals with a low share of private/HMO patients at a .48 significance level ($p < 0.01$). This is one of the higher correlations in our data, reminding us that hospitals in these categories can overlap. We use this knowledge to temper the generalizability of our results.

Results

Hospital Population

Overall, in 2009–2011, California hospitals' 11.4 million discharges represented 9.8 percent of total U.S. hospital discharges and accounted for 15.8 percent of the nation's total hospital costs.³² The 315 hospitals in the sample account for 95.1 percent of all California hospital discharges. For the three major diagnoses - AMI, CHF, and PN - California accounted for 8.2 percent of total U.S. discharges and 11.2 percent of aggregate U.S. costs. For these three diagnoses, the 213,330 patients discharged from the hospitals in our study represent 95.7 percent of all California discharges in 2011. Specifically, the hospitals in our study represent 98.5 percent, 97.5 percent, and 92.6 percent respectively of all AMI, CHF, and pneumonia patients discharged in California in 2011.³²

Table 1 reports the means and standard deviations of California hospitals' experience-of-care scores, and of their patient profiles and institutional characteristics. The high and low interquartile ranges for the scale variables are also shown. Overall, patients at nearly two-thirds (65.8 percent) of California hospitals gave high ratings to their overall hospital-stay experience. The highest patient-experience score, 81.1 percent, was for the measure "patients being given discharge information about what to do during their recovery." In contrast, fewer than half of the hospitals were rated by their patients as always quiet at night. Doctors earned slightly higher scores than nurses, 76.8 percent vs. 72.1 percent, for communicating well with patients.

These California hospitals represent a diverse range of patient and hospital characteristics. As Table 1 shows, average age at the time of visit was 49.6 years; 59 percent were female. Medicare was the primary source of payment for over one-third of patients (37.4 percent); Medicaid (25.4 percent) and private/HMO payers (28.2 percent) paid for nearly equal percentages of patients. The racial/ethnic breakdown of patients at the average California hospital was 57 percent white, 27.7 percent Hispanic, 6.7 percent black, and 6.6 percent Asian patients. By way of comparison, according to 2012 US Census Bureau estimates, for California's overall population, it was 39.4% white, 38.2 percent Hispanic, 6.6% black, and 13.9% Asian. Over the three-year period, the mean number of chronic conditions, diagnoses, and procedures per patient at the average hospital averaged 3.7, 8.0, and 1.5 respectively.

The typical hospital was non-governmental and not-for-profit (46.9 percent), though over 20 percent were for-profit. About one-third of the hospitals (32.4 percent) had 100–199 beds; 23.2 percent had fewer than 100 beds, and 27 percent had over 300 beds. Nearly three-quarters (74.6 percent) had no medical school or COTH affiliation, and approximately one-third (34 percent) were not affiliated with a comprehensive health system. The mean patient cost per hospital stay averaged \$11,697, and the average length of stay was 4.5 days. The mortality rate was highest for AMI patients (15.6 percent); patients with CHF and pneumonia experienced mortality rates of 11.1 percent and 11.9 percent respectively. CHF patients experienced the highest 30-day readmission rate, 24.7 percent.

Patients' Experience-of-Care Scores

Table 2 (found at end of article) reports hospitals' experience-of-care scores by patient and hospital characteristics; for most characteristics, three scores are reported, corresponding to the groups of hospitals in the low, middle, and high quartiles for the characteristic in question

Experience-of-care scores by patient and hospital characteristics in 2011. Of the 29 patient and hospital characteristics listed in Table 2, we found significant differences on the experience-of-care scores for 19 patient and hospitals characteristics on the "Overall hospital ratings" (66 percent); 23 (79 percent) on "Would recommend to family and friends"; 19 (66 percent) on "Doctors always communicated well"; 19 (66 percent) on "Nurses always communicated well"; 17 (59 percent) on "Always communicated about medications"; 20 (69 percent) on "Always communicated about discharge information"; 12 (41 percent) on "Hospital staff was responsive"; 17 (59 percent) on "Pain was always well controlled"; 13 (45 percent) on "Rooms were always quiet"; and 14 (48 percent) on "Rooms were always clean."

Six of the 29 patient and hospital measures—Medicaid insurance, private/HMO insurance, proportion of white patients, proportion of black patients, bedsize, and market-concentration level—were significant across all 10 experience-of-care measures. In contrast, there was only one statistically significant Medicare difference ("Always communicated about medications") across the 10 experience-of-care measures.

Of the hospital characteristics, all hospital characteristics were significant with the two general characteristics of the patient's experience-of care—measures "Overall hospital rating high" and "Always recommend to family and friends." But only the hospital ownership and bedsize were significant across all 10 dimensions of the patient's experience-of-care measures.

The hospitals that earned higher scores in the categories "Overall ratings of the hospital care experience high" and "Always recommend to family and friends" were non-governmental, non-profit, and affiliated with a medical school or the Council of Teaching Hospitals; belonged to a centralized or moderately centralized system, and operated in moderately competitive or more competitive markets. Hospitals with <100 beds and >300 beds received higher experience-of-care scores than those with an intermediate number of beds.

Hospitals with higher nurse-to-bed staffing ratios received scores higher than or equal to those of hospitals with lower ratios on all measures except "Always quiet at night." By contrast, hospitals with lower physician-to-bed ratios typically had higher experience-of-care scores.

As Table 2 shows, high-cost California hospitals earned significantly better experience-of-care scores than lower-cost hospitals. Similarly, the hospitals with lower lengths of stay consistently had higher experience-of-care scores than hospitals with longer lengths of stay; all 10 measures are statistically significant. For the hospital-cost measures, only the two measures associated with overall experience of care, the four communication measures, and "Pain was always controlled" were statistically significant.

The patterns related to 30-day mortality rates are mixed. For AMI patients, 8 of the 10 experience-of-care scores are higher at hospitals with low 30-day mortality rates than at hospitals with high mortality rates, but the differences average only 1 or 2 percent. In contrast, heart-failure patients' experience-of-care scores are 3 or 4 percentage points higher at hospitals with low mortality rates; 6 of the 10 differences in the heart-failure patients' experience-of-care scores are significant. For pneumonia patients, experience-of-care scores are evenly split: four are higher at low-mortality hospitals than at high-mortality hospitals, four are lower, and two are identical.

Table 1. Hospital Means and SDs and Inter-Quartile Ranges for High and Low Designations

	Mean	Std. Dev.	Interquartile Range Definitions		# of Hospitals
			Low <25	High >75	
Patients' Experience-of-Care Scores					
Patient would rate their overall hospital care experience high	65.8%	9.4%	-	-	315
Patient would definitely recommend hospital to family and friends	68.3%	10.6%	-	-	315
Doctors always communicated well	76.8%	4.9%	-	-	315
Nurses always communicated well	72.1%	6.1%	-	-	315
Staff always explained medication before giving them to patients	58.3%	6.1%	-	-	315
Patients were given information about what to do during recovery	81.1%	4.3%	-	-	315
Patients always received help as soon as they wanted (staff responsive)	59.2%	8.4%	-	-	315
Pain was always well controlled	67.1%	5.9%	-	-	315
Always quiet at night	49.0%	9.2%	-	-	315
Room was always clean	69.1%	6.9%	-	-	315
Patient Characteristics					
Patient age	49.6	10.3	43.1	55.3	315
Female	59.0%	6.4%	56.0%	62.4%	315
Payer Source					
% Medicare	37.4%	14.1%	28.0%	44.7%	315
% Medicaid	25.4%	17.6%	10.5%	35.2%	315
% Private/HMO	28.2%	16.9%	15.4%	39.6%	315
% Other (none, no pay, other)	9.0%	8.0%	4.7%	10.6%	315
Race/Ethnicity					
% White	57.0%	27.3%	37.4%	79.7%	315
% Black	6.7%	9.8%	0.60%	9.3%	315
% Hispanic	27.7%	23.3%	9.93%	38.3%	315
% Asian	6.6%	10.3%	0.42%	8.4%	315
% Other	2.0%	3.0%	0.25%	2.6%	315
Patient Conditions					
Mean number of chronic conditions	3.7	1.1	2.9	4.4	315
Mean number of diagnoses	8.0	2.0	6.6	9.1	315
Number of procedures	1.5	0.7	1.1	1.8	315
Hospital Ownership					
Government	20.0%	-	-	-	63
For-Profit	20.9%	-	-	-	66
Not for Profit, Non-Government	46.9%	-	-	-	148
Religious	12.1%	-	-	-	38
Bedsize					
<100	23.2%	-	-	-	73
100-199	32.4%	-	-	-	102
200-299	17.5%	-	-	-	55
>300	27.0%	-	-	-	85
FTE nurse/bed	1.7	0.7	1.2	2.1	315

continued

Table 1 continued. Hospital Means and SDs and Inter-Quartile Ranges for High and Low Designations

	Mean	Std. Dev.	Interquartile Range Definitions		# of Hospitals
			Low <25	High >75	
Hospital Staffing					
FTE MD/bed	0.13	0.19	0.04	0.15	315
FTE nurse/bed	1.7	0.7	1.2	2.1	315
Teaching Status					
No major teaching	74.6%	-	-	-	235
Medical school	19.7%	-	-	-	62
Council of Teaching Hospitals	5.7%	-	-	-	18
Health-System Status					
Not part of a health system	34.0%	-	-	-	107
Comprehensive health system	4.8%	-	-	-	15
Moderately comprehensive health system	22.9%	-	-	-	72
Decentralized	23.2%	-	-	-	73
Independent	12.4%	-	-	-	39
Competition in Region					
Unconcentrated	67.3%	-	-	-	212
Moderately concentrated	19.7%	-	-	-	62
Highly concentrated	13.0%	-	-	-	41
Hospital Outcomes					
Mean costs	\$11,697	\$5,052	\$8,453	\$13,513	290
Mean length of stay	4.5	2.6	3.6	4.8	315
Acute myocardial infarction (AMI) mortality rate	15.6	1.6	14.5	16.7	268
Acute myocardial infarction (AMI) readmission rate	19.6	1.3	18.7	20.5	252
Heart failure (HF) mortality rate	11.1	1.6	10.1	12.1	301
Heart failure (HF) readmission rate	24.7	1.7	23.5	25.8	302
Pneumonia (PN) mortality rate	11.9	2.1	10.4	13.1	302
Pneumonia (PN) readmission rate	18.2	1.3	17.3	19.0	301

The experience-of-care patterns associated with 30-day readmission rates for AMI, CHF, and PN patients are clearer. In general, Table 2 shows that hospitals with lower readmission rates for all three diagnoses have higher experience-of-care scores in 2011; 20 of the 30 comparisons are statistically significant.

2009–2011 changes in patients' experience-of-care scores. Table 2 also reports changes in patients' experience of care over the three-year 2009–2011 period for each patient and hospital characteristic. In striking contrast to the high number of significant differences between groups of hospitals evident in these measures in 2011, few of these changes achieve statistical significance.

When we examine percentage changes over the 2009–2011 period, we find far fewer significant differences in the

experience-of-care scores associated with each patient and hospital characteristic. Of the 29 patient and hospital characteristics, we found significant differences in 5 (17 percent) for "High overall hospital rating"; 6 (21 percent) for "Would recommend to family and friends"; 8 (28 percent) for "Doctors always communicated well"; 12 (41 percent) for "Nurses always communicated well"; 4 (14 percent) for "Always communicated about medications"; 2 (7 percent) for "Always communicated about discharge information"; 6 (21 percent) for "Hospital staff was responsive"; 7 (24 percent) for "Pain was always well controlled"; 7 (24 percent) for "Rooms were always quiet"; and 7 (24 percent) for "Rooms always were clean."

On the whole, Table 2 shows substantial improvement over the three-year period 2009–2011, as embodied in percentage changes in experience-of-care scores for most

patient and process measures. Most California hospitals, regardless of differences in their patient populations and organizational features, showed experience-of-care improvements over the three-year period. Among the 890 measures of change over the three-year period shown in Table 2, only 31 (3.5 percent) had negative coefficients. It is noteworthy that, of these 31 negative results, over half were associated with 3 variables: 7 with government-owned hospitals and 5 each with the insurance variables Medicaid and private/HMO.

Discussion

Passage of the PPACA in 2010 brought to fruition years of legislative efforts to address quality problems in health care. A key goal of this effort is a focus on patient-centered care to achieve high value for patients.⁵² Fundamentally, patient-centered care endeavors to craft a care-delivery system that can address patient needs and preferences and structure care that enhances the patient's experience.^{16,17} Patient-centered care has been shown to increase patients' adherence to treatment recommendations^{15,53,54} and to lead to better health outcomes^{37,55-57}, higher staff satisfaction^{57,58}, and better financial performance^{59,60}. Even so, evidence is thin about the factors that influence the patient experience. With the advent of value-based purchasing reimbursement incentives in the PPACA legislation, hospitals are under greater pressure to scrutinize and improve patients' hospital experience.

We sought to answer two basic questions about the relationship between patients' experience of care and various patient and hospital characteristics. In addressing the first question—"What effects do hospitals' different patient profiles, structural characteristics, and outcomes have on patients' experience of care in 2011?"—we find that, even after several years of exposure to the HCAHPS legislation's mandated requirements, which began in earnest in 2004²³, California hospitals' experience-of-care scores vary significantly in 2011. This variation is not isolated: it spans most major aspects of hospitals' patient profiles, structures, and outcomes. Specifically, over half of the patient and hospital variables we analyzed showed significant differences on seven experience-of-care measures: "High overall hospital rating"; "Would recommend to family and friends"; "Doctors always communicated well"; "Nurses always communicated well"; "Always communicated about medications"; "Always communicated about discharge information"; and "Pain was always well controlled."

However, in addressing the second question—"To what extent, if any, have hospitals improved their patients' experience-of-care scores?"—we find that virtually all experience-of-care scores associated with each of the patient and hospital characteristics improved over the

2009–2011 period. That is, despite the high number of significant differences among hospitals on numerous experience-of-care measures in 2011, patients' experience of care at most of these same hospitals improved over the three-year period. Moreover, reviewing the significance levels of percentage changes in experience-of-care scores over three years for various patient and hospital characteristics, we note that most of the differences between high and low groups of patient care experience scores between the experience-of-care scores of the highest and lowest quartiles are not statistically significant at the $p < 0.05$ level.

Several findings about specific aspects of these differences are notable and warrant further investigation. For one thing, Medicaid and private/HMO insurance were consistently significant but in understandably different directions: hospitals with fewer Medicaid patients exhibited experience-of-care scores very similar to those of hospitals with high shares of private/HMO populations. Conversely, experience-of-care scores for hospitals with more Medicaid patients had experience-of-care scores like those of hospitals with smaller private/HMO populations. These findings are probably due to correlations among some of these characteristics: a hospital with a higher share of private/HMO patients is likely to have a lower share of Medicaid patients and vice-versa. But studies have shown that patients with Medicaid coverage tend to receive lower-quality care than those with Medicare or private insurance^{61,62}, and differences in health insurance have been shown to affect patient outcomes.^{44,63-65} Prior research has not addressed the impact of a hospital's proportion of Medicaid patients on patients' experience of care. Ekman analyzed the effects of health insurance on treatment-seeking behavior and found that different types of health-insurance programs influence the probability of utilizing care, the intensity of utilization, and individual spending on care.⁶⁶ Other research has demonstrated that enrollment in health insurance does not have any effect on treatment-seeking in general, or on utilization of facility-based professional care, both of which tend to be influenced by patients' low levels of satisfaction with health-care providers, poor perceived quality of care, and enrollees' uncertainty about the nature and extent of their insurance benefits.⁶⁷

We found only one statistically significant difference in the experience-of-care scores of hospitals with high, middle, and low proportions of Medicare patients ("Always communicated about medications"). This finding was unexpected in light of prior research. Two points merit consideration. First, there were no significant differences on most measures of patients' experience of care between hospitals with high and low shares of Medicare patients. Second, none of the percentage changes in experience-of-care measures over three years were significant affected by Medicare. Taken together, these two points indicate a

positive experience of care among all Medicare patients in 2011 that is not apparent in Medicaid or private/HMO patients. Of related interest is a lack of significant differences among the quartiles measuring changes in Medicare patients' experience-of-care scores between 2009 and 2011. This finding implies that Medicare patients' positive experience of care held steady over the 2009–2011 period.

These findings about insurance may be reinforced by the racial/ethnic differences evident in the measures. A growing body of evidence links racial/ethnic differences and insurance coverage to hospital quality.^{44,45,68-71} At California hospitals with higher shares of white patients, every 2011 experience-of-care score is several percentage points higher on average than at hospitals with higher black, Hispanic, and Asian patients. Furthermore, the differences among hospitals with high, middle and low populations of all four major racial/ethnic groups are statistically significant for all measures except Hispanics' scoring of "Rooms were always quiet."

Thus, though there are still significant differences in patients' experience of care across different patient populations and hospital characteristics, and improvements that need to be made, the vast majority of patients experienced improvement in their experience of hospital care over the 2009–2011 period. Yet the experiences of low-income Medicaid-insured patients and minority groups warrant further research.

Limitations

The average rate of response to the HCAHPS post-discharge survey is 34 percent, raising the possibility of nonresponse bias. Studies have found that nonresponse bias is less a matter of participants' response rates than of the use of protocols that are not rigorous and consistently standardized⁷²⁻⁷⁴ like those of the HCAHPS surveys.³⁸ A related issue is whether HCAHPS surveys capture unique aspects of selected patient characteristics. Our patient data aggregates patient characteristics at the hospital level. We included 100 percent of hospitals' discharges, but HCAHPS's survey methodology finds that approximately 300 patient surveys a year are sufficient to achieve the desired level of statistical reliability for a hospital.³⁸ Thus small hospitals may not generate enough patient surveys, and the survey mode can vary from mail to telephone to interactive voice methods.^{70,75,76} Thus, though HCAHPS surveys reliably capture and report hospitals' experience-of-care scores, they may not capture the broad range of patient characteristics, like insurance coverage, race/ethnicity, and medical and surgical services provided, and some patient characteristics may be too scantily represented in the data to draw solid conclusions. Clearly, this is an important area of research and there have been a

number of efforts to evaluate different aspects of the patients' care experience.^{69-72,77}

Another possible limitation of our study is the manner in which administrative data is generated. Because they are not collected for research purposes, administrative data can be difficult to use; their shortcomings include issues of generalizability, complexity, and differing definitions across datasets, as well as variations in insurance coverage, benefit restrictions, and coverage continuity.⁴⁹ Moreover, our data represent a single state, some of whose regulations, such as mandatory nurse staffing ratios⁷⁸⁻⁸⁰, could influence our results.

Statistical significance is not causation, and attributing changes and improvements in patients' experience of care exclusively to the PPACA may not be warranted. It is very likely that the PPACA has had an impact on hospitals and on their patients' care experience, but the payment incentives in the VBP program did not go into effect until the end of 2012—a year after our study's end date. Other national initiatives, like pay-for-performance^{81,82} and meaningful use⁸³⁻⁸⁶, are apt to affect patients' experiences of care.⁸⁷ Nevertheless, because the startup of the VBP program began in 2004^{22,23}, it is likely that hospitals' administrative efforts to evaluate their facilities, implement changes, and improve patients' care experience were already well under way.^{30,88,89} Elliott and colleagues note in their evaluation of nationwide improvements in HCAHPS scores in the 2008–2009 period that an improvement might be understated because of timing: hospitals were increasingly aware of their comparative standings on scales from numerous sources, information that would be likely to motivate stepped-up levels of action.³⁷

Concluding Comments

The importance of patient-centered care for evaluating hospital care and for judging exceptional hospital quality has been prioritized with passage of The Patient Protection and Affordable Care Act (PPACA) in 2010. An essential feature of PPACA, designed to improve hospital quality and potentially to lower costs, is the Medicare payment methodology known as value-based purchasing (VBP). The essence of VBP is to replace the current supply-side-driven payment paradigm with a system that pays for patient-centered health-care services on the basis of their value to the patient. An essential component of this shift is capturing the patient's health-care experience using the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey.

Our study evaluates patients' hospital-care experiences across two dimensions. First, we analyzed the extent of differences in experience-of-care scores at acute-care hospitals in a single year, 2011, by the hospitals' patient profiles, structural characteristics, and outcomes.⁵³

Second, we evaluated the extent of changes in patients' experience of care over the three-year period 2009–2011 by hospitals' characteristics.

Our results show that in 2011 many significant differences persist in experience-of-care scores associated with most important facets of hospitals' patient profiles and structural characteristics. Perhaps this result should not be surprising to anyone familiar with the U.S. healthcare system. For over 40 years researchers have been documenting extensive variations in virtually all aspects of health care.^{40,90,91} Our initial results for the 2009–2011 period appear to confirm that significant differences among hospitals persist, but that the best hospitals with the highest patient-satisfaction scores are not necessarily the best hospitals for all patients.

It is important to note that, though hospital and patient characteristics are associated with substantial differences on patient-experience measures in 2011, over the 2009–2011 period virtually all aspects of patients' experience of care show improvement. For virtually every patient and hospital characteristic we measured, patients' experience of care improved across all ten measures. These changes cannot be directly linked to the PPACA, but they are heartening.

Further research is needed to document trends in other states and to assess the overall impact of PPACA after implementation. And more research is needed to pinpoint how hospitals and policymakers can identify and better serve those whose hospital experiences are less than optimal.

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Table 2. Patients' Experience of Care with Hospital Stay in 2011 and Percent Change Over 3 Years by Selected Patient, Hospital, and Outcome Characteristics (2009 – 2011)

Patient and Hospital Characteristics	Overall Experience of Hospital Stay					Experience of Staff Communications								Experience of Hospital Stay Management				Experience of Facilities			
	Overall hospital rating		Recommend to family and friends			Doctors converse well		Nurses converse well		Converse about Medications		Converse discharge info		Hospital staff responsive		Pain was well controlled		Rooms were quite		Rooms were clean	
	High		Yes, definitely			Always		Always		Always		Yes		Always		Always		Always		Always	
	N	2011 mean	3 yr % chg	2011 mean	3 yr % chg	2011 mean	3 yr % chg	2011 mean	3 yr % chg	2011 mean	3 yr % chg	2011 mean	3 yr % chg	2011 mean	3 yr % chg	2011 mean	3 yr % chg	2011 mean	3 yr % chg	2011 mean	3 yr % chg
Patient Characteristics																					
Mean patient age <70	179	65.7	8.3	67.9	6.4	76.5	2.3	71.5	4.1	58.3	7.7	81.0	4.9	58.3 ^a	5.9	66.6	4.0	47.8 ^b	3.8	68.4	3.1
Mean patient age >=70	136	65.9	7.2	69.0	5.9	77.2	2.2	72.9	6.1	58.3	6.6	81.1	3.8	60.5	10.3	67.7	4.9	50.6	10.8	70.0	6.3
Gender: <60% female	160	64.9	7.4	67.8	6.2	76.4	2.1	71.5	4.9	58.0	6.7	80.9	4.1	58.6	7.3	66.5	4.3	48.7	8.3	68.4	4.3
Gender: >=60% female	155	66.7	8.4	68.9	6.1	77.2	2.5	72.7	5.1	58.6	7.9	81.2	4.8	59.7	8.2	67.7	4.4	49.3	5.1	69.7	4.5
Payer Source																					
Medicare: Low	79	66.7	9.2	67.0	6.4	76.1	1.9	71.5	3.6	58.9 ^a	10.2	80.4	5.9	59.0	6.9	66.9	4.2	49.5	5.4	68.6	2.6
Medicare: Middle	157	66.4	9.6	69.6	8.1	77.3	3.1	72.6	5.9	58.7	7.3	81.6	4.5	59.5	8.2	67.5	4.9	49.0	7.7	69.6	5.3
Medicare: High	79	63.4	2.6	67.1	1.6	76.4	0.7	71.6	4.5	56.7	3.8	80.6	2.5	58.6	7.6	66.4	3.4	48.4	6.0	68.3	4.5
Medicaid: Low	79	71.6 ^c	17.0 ^c	75.6 ^c	16.4 ^c	79.4 ^c	5.5 ^c	75.0 ^c	9.4 ^c	60.6 ^c	9.7	83.4 ^c	6.2	63.3 ^c	14.3 ^a	70.2 ^c	8.4 ^t	53.0 ^c	12.9 ^a	72.1 ^c	8.9 ^a
Medicaid: Middle	158	65.0	6.2	68.1	4.5	76.9	2.5	72.6	5.3	58.1	6.0	81.2	3.9	59.2	6.7	67.1	4.9	48.4	7.0	68.7	3.4
Medicaid: High	78	61.0	1.7	61.1	-1.1	73.7	-1.5	68.0	-0.4	56.2	7.2	78.3	3.6	54.8	2.8	63.7	-0.8	45.9	-0.2	66.5	1.7
Private/HMO: Low	78	60.0 ^c	-1.9 ^c	60.0 ^c	-8.1 ^c	73.9 ^c	-1.7 ^c	67.9 ^c	-0.1 ^b	55.8 ^c	2.5	77.6 ^c	1.5	54.9 ^c	2.7	63.3 ^c	-1.3 ^t	47.8 ^b	3.4	66.3 ^c	1.5
Private/HMO: Middle	159	65.3	8.0	68.3	7.8	76.7	2.8	72.7	6.1	58.5	8.7	81.6	5.1	59.9	9.0	67.5	5.9	47.9	5.9	69.5	5.0
Private/HMO: High	78	71.8	16.8	76.0	16.2	79.5	4.9	74.6	7.4	60.1	8.7	83.1	5.8	61.6	9.7	69.6	6.5	52.1	11.5	70.7	6.0
Other Insurance: Low	79	66.0	8.2	69.7	6.4	77.1	1.4	71.3	3.1	57.8	4.6	81.3	3.5	58.8	5.9	66.5	2.0	48.5	5.3	68.7	4.0
Other Insurance: Middle	158	65.5	7.6	68.1	5.4	76.7	2.8	72.6	6.5	58.0	6.0	80.8	3.8	58.6	7.3	67.4	5.6	48.8	6.8	69.0	5.2
Other Insurance: High	78	66.1	8.1	67.5	7.7	76.7	2.1	71.8	3.7	59.4	12.4	81.3	6.5	60.9	10.4	67.0	4.1	49.8	7.9	69.6	3.1

Race/Ethnicity

White: Low	78	62.6 ^c	4.7	63.2 ^c	1.8	74.2 ^c	-0.7 ^a	68.4 ^c	-0.2 ^c	56.2 ^c	6.7	78.7 ^c	3.4	55.6 ^c	3.2	64.1 ^c	0.3 ^a	47.6 ^c	2.8	66.9 ^c	1.8
White: Middle	158	65.4	8.7	68.6	7.5	77.0	2.8	71.9	5.9	57.7	6.9	81.0	4.4	58.5	8.0	66.9	5.2	47.8	6.5	68.5	4.2
White: High	79	70.1	9.7	73.4	8.2	79.1	4.6	76.5	8.9	61.8	8.8	83.9	5.6	64.8	12.4	70.6	7.3	53.1	12.1	72.8	8.1
Black: Low	78	68.0 ^b	5.7	69.7 ^a	4.3	78.2 ^b	2.5	74.8 ^c	5.1 ^b	61.5 ^c	12.4 ^a	82.9 ^c	6.0 ^a	64.1 ^c	11.6 ^a	68.9 ^c	4.3 ^a	52.3 ^b	8.3	72.3 ^c	7.5 ^b
Black: Middle	159	66.2	11.1	69.3	9.3	76.9	3.4	72.4	7.0	58.1	8.1	81.3	5.5	58.8	9.1	67.4	6.7	48.2	6.4	69.1	5.4
Black: High	78	62.9	3.0	65.2	1.4	75.4	-0.2	69.1	0.6	55.7	1.2	79.0	0.9	55.6	1.6	64.6	-0.4	47.7	6.1	66.0	-0.1
Hispanic: Low	78	68.2 ^b	9.9	72.1 ^c	10.6	78.2 ^c	4.0	74.6 ^c	7.7 ^a	59.9 ^a	7.6	83.1 ^c	6.0	62.6 ^c	11.3	69.3 ^c	6.8	50.8	8.2	70.8 ^a	5.4
Hispanic: Middle	159	66.1	9.3	69.3	7.8	77.1	2.8	72.2	5.8	58.1	6.6	81.3	4.5	59.1	7.9	67.1	4.8	48.9	8.2	69.1	5.2
Hispanic: High	78	63.0	3.3	63.0	-0.6	74.9	-0.2	69.6	1.1	57.2	8.4	78.8	2.9	56.2	4.5	65.0	1.4	47.5	2.7	67.5	2.0
Asian/PI: Low	78	66.7	7.0	67.5	5.0	77.9	2.9	74.2 ^b	6.7	61.3 ^c	13.8 ^a	82.0	6.7 ^a	63.9 ^c	13.8	68.9 ^b	5.6	52.6 ^c	13.5	71.7 ^c	7.1
Asian/PI: Middle	159	66.0	6.6	68.7	4.9	76.5	1.7	71.8	4.3	57.6	4.5	80.7	2.7	58.2	5.7	66.8	4.7	48.5	3.9	68.8	3.7
Asian/PI: High	78	64.5	11.1	68.4	9.7	76.3	2.8	70.8	4.9	57.0	7.3	81.0	5.8	57.1	6.6	65.9	2.6	46.7	6.8	67.2	3.5
Other race: Low	79	64.9	11.0	66.3	9.0	76.5	3.9	72.4	8.4	59.2	14.0 ^a	81.2	5.8	61.2 ^a	16.5 ^t	66.8	9.4 ^a	51.2 ^a	14.5 ^a	71.7 ^c	11.5 ^c
Other race: Middle	157	66.3	6.7	69.0	4.6	77.2	2.0	72.3	4.0	58.6	6.2	81.2	4.4	59.3	5.7	67.5	3.0	48.7	4.6	68.8	2.5
Other race: High	79	65.5	7.4	69.0	6.8	76.4	1.3	71.5	3.7	56.9	3.1	80.6	3.3	57.2	3.5	66.5	2.5	47.5	3.8	67.3	1.5

Patient Severity

Number of diagnoses: Low	78	65.0	7.0	65.0 ^b	4.6	76.1	1.9	71.4	3.6	59.5	11.4	80.4	4.8	60.8	8.9	66.8	4.1	50.3	5.6	69.6	4.3
Number of diagnoses: Middle	159	66.2	8.9	69.6	7.7	77.0	2.6	72.4	5.5	58.2	6.5	81.1	4.3	58.7	7.4	67.2	4.2	48.8	8.4	68.6	4.0
Number of diagnoses: High	78	65.6	6.5	69.0	4.7	77.0	2.0	72.0	5.3	57.3	4.5	81.7	4.3	58.5	7.1	67.1	5.0	48.2	4.2	69.5	5.4
Number of procedures: Low	78	62.1 ^c	2.6 ^c	62.2 ^c	-0.6 ^c	76.0 ^b	1.1 ^a	71.3 ^a	3.8 ^c	57.9 ^c	9.0	79.8 ^b	4.1	59.9	9.8	66.0 ^a	3.3	49.9 ^b	7.6	69.5	6.4
Number of procedures: Middle	158	65.1	5.7	68.0	3.3	76.4	1.2	71.8	3.8	58.0	5.4	81.2	4.2	58.1	5.4	66.7	3.1	47.5	4.4	68.5	3.5
Number of procedures: High	79	70.6	17.1	74.9	18.2	78.3	5.6	73.6	8.3	59.3	9.5	81.9	5.1	60.7	10.6	68.8	8.0	51.3	10.7	69.8	4.4
Number of chronic conditions: Low	78	64.2	2.5	64.4 ^c	-0.4	75.7	-0.3 ^a	70.5 ^a	0.2 ^b	58.3	6.9	79.8 ^b	2.9	58.2	2.1	66.1	1.3	48.1	-0.4 ^a	67.8	-0.4 ^a
Number of chronic conditions: Middle	158	66.9	11.2	70.1	9.4	77.3	3.8	73.0	7.1	58.8	8.7	81.7	6.0	59.8	10.5	67.6	5.8	49.6	10.4	69.6	6.1
Number of chronic conditions: High	79	65.0	6.1	68.4	5.8	76.7	1.6	71.7	5.0	57.2	4.7	80.9	2.6	58.8	7.2	66.9	4.3	48.6	6.0	69.3	5.3

Hospital Characteristics

Ownership: Government	63	62.8 ^c	-2.7 ^c	64.4 ^c	-2.7 ^b	76.1 ^c	-1.5 ^b	70.8 ^c	-1.8 ^c	57.6 ^b	5.7	80.1 ^c	2.9	57.7	0.0 ^a	65.8 ^b	-1.6 ^t	47.0	-2.2 ^a	65.6 ^c	-2.0 ^a
Ownership: Not-for-profit, non-govt.	148	68.1	13.8	71.5	12.4	78.0	4.4	73.5	7.9	59.4	9.8	81.9	5.6	60.3	10.3	68.3	7.5	49.6	9.1	70.5	6.3
Ownership: Religious	38	66.0	2.3	69.9	-0.4	76.4	0.7	72.6	3.8	58.5	4.1	81.9	2.6	58.6	4.0	66.6	0.1	46.9	2.4	69.2	5.7
Ownership: For-profit	66	63.0	6.3	63.8	3.2	75.0	1.3	69.8	4.4	56.3	4.7	79.5	4.0	58.2	10.0	65.7	4.4	50.5	10.9	68.8	4.5
Hospital size: >100 beds	73	68.0 ^b	7.3	69.7 ^c	3.7	78.5 ^a	4.0	75.2 ^c	7.8	61.6 ^c	8.8	83.1 ^c	5.0	65.7 ^c	14.9 ^a	69.2 ^b	7.1	55.3 ^c	17.7 ^t	73.6 ^c	10.1 ^a
Hospital size: 100-199 beds	102	63.1	4.9	64.8	2.3	75.9	1.3	70.7	4.7	57.2	8.6	80.1	4.9	57.7	9.0	65.8	3.8	46.9	1.7	68.7	3.7
Hospital size: 200-299 beds	55	65.4	8.3	68.7	7.3	76.7	3.2	71.4	4.1	57.5	6.6	80.7	4.6	57.7	5.0	66.8	3.2	46.4	0.8	67.3	3.3
Hospital size: 300+ beds	85	67.5	11.5	71.4	11.6	76.7	1.6	71.9	4.0	57.6	5.1	80.9	3.4	57.1	3.2	67.2	3.9	48.4	8.9	67.3	2.2
No teaching	235	64.7 ^c	5.7	67.0 ^c	3.8	76.5 ^a	2.1	72.1	5.3	58.1	7.7	80.8	4.4	59.3	9.2	66.9	4.2	49.3	7.1	69.4	5.1
Medical school	62	69.1	13.8	72.0	11.7	78.0	3.6	72.7	4.5	59.1	6.1	82.1	3.8	59.5	3.9	68.4	6.3	48.7	6.6	68.7	3.2
Council of Teaching Hospitals (COTH)	18	69.2	15.5	73.7	17.2	77.0	1.6	71.2	4.1	58.8	7.3	81.9	6.2	57.7	3.2	66.0	2.0	47.3	4.1	66.6	0.2
Not in any health system	107	64.4 ^c	3.5	65.6 ^c	0.0 ^a	76.6 ^c	1.0	71.7 ^c	2.4 ^a	58.5 ^c	4.3	80.1 ^c	2.8	59.7 ^b	6.2	66.4 ^c	1.1	49.9	5.9	69.3 ^a	3.1
Centralized health system	15	72.2	19.9	77.5	20.9	79.0	7.0	76.7	13.3	62.1	19.7	82.4	5.8	62.8	15.7	71.4	13.0	51.4	12.6	72.9	8.2
Moderate centralized health system	72	68.3	9.8	72.4	9.1	77.8	3.3	73.7	5.7	59.1	6.1	82.5	5.1	60.0	5.9	68.5	5.5	49.9	9.5	69.3	3.5
Decentralized health system-pay	73	67.3	12.5	70.6	12.9	78.1	4.0	72.9	7.2	59.3	12.8	82.7	6.5	59.9	11.6	68.0	6.5	48.1	6.3	69.4	7.4
Independent hospital system	39	60.9	5.5	61.5	1.1	73.5	1.4	67.9	5.0	54.2	5.4	78.3	5.2	55.0	7.6	64.1	6.6	45.8	3.4	66.3	3.4
FTE MD per bed: Low	84	68.9 ^c	11.2	73.0 ^c	10.7	77.5 ^a	2.5	73.9 ^c	6.1	59.4 ^a	7.6	81.9 ^a	4.5	60.0	7.6	68.2 ^a	5.0	50.2	9.6	70.0	4.6
FTE MD per bed: Middle	152	63.5	5.8	65.5	3.9	76.0	2.2	70.9	4.3	57.3	8.1	80.4	4.9	58.5	8.1	66.1	3.8	48.3	6.2	68.7	5.0
FTE MD per bed: High	79	66.6	8.3	68.8	5.8	77.5	2.2	72.4	5.0	58.9	5.2	81.5	3.3	59.7	7.2	67.7	4.8	48.9	4.8	68.7	3.2
FTE nurse per bed: Low	79	64.7 ^a	6.4	65.8 ^b	2.9	76.4	1.6	71.3	3.9	58.0	6.9	79.9 ^b	3.5	60.2	9.7	66.3	1.7	50.7 ^a	11.5	69.5	6.4
FTE nurse per bed: Middle	157	65.0	6.7	68.1	6.2	76.6	2.6	71.9	4.9	57.8	7.4	80.9	4.5	58.2	6.5	66.9	5.1	47.6	3.1	68.7	3.1
FTE nurse per bed: High	79	68.4	11.8	71.2	9.2	77.5	2.3	73.1	6.2	59.4	7.2	82.3	5.2	60.2	8.4	68.0	5.4	50.3	9.8	69.5	5.4
HHI for HRR:																					
Unconcentrated	212	64.5 ^b	7.3	67.0 ^b	5.6	76.0 ^c	1.3	70.6 ^c	3.3 ^a	56.7 ^c	5.7	80.1 ^c	3.8	57.5 ^c	6.2	65.9 ^c	2.9	48.1 ^a	5.8	67.9 ^c	3.3
HHI for HRR: Moderately concentrated	62	68.8	8.5	71.7	7.3	79.0	4.7	75.1	8.3	61.6	11.9	83.0	5.3	62.4	11.3	69.9	7.7	51.3	9.1	72.0	7.3
HHI for HRR: Highly concentrated	41	68.1	10.3	70.5	7.8	77.7	4.2	75.4	9.3	61.5	8.9	83.3	6.5	63.3	11.0	69.1	7.6	50.2	8.4	70.9	6.3

Hospital Outcomes

Total costs: Low	72	60.8 ^c	2.7	59.9 ^c	-2.2 ^a	74.4 ^c	-0.5 ^a	69.5 ^c	1.6 ^a	56.7 ^a	7.6	78.4 ^c	2.5	57.2	6.3	64.4 ^c	1.6	47.3	5.6	68.1	3.5
Total costs: Middle	145	65.4	6.1	68.4	4.5	76.4	1.8	72.0	4.2	57.9	5.2	81.0	4.3	58.5	5.7	67.1	3.8	49.3	6.4	69.2	4.8
Total costs: High	73	69.2	11.6	74.0	13.5	78.5	4.3	74.0	7.8	59.8	9.6	82.4	5.6	60.7	9.3	68.6	6.5	49.5	6.9	68.9	2.2
Length of stay: Low	79	69.6 ^c	15.1 ^a	71.3 ^b	12.8	78.7 ^c	5.8 ^b	74.9 ^c	9.1 ^a	60.8 ^c	14.6 ^a	82.7 ^c	7.1	63.6 ^c	15.2 ^t	69.3 ^c	9.6 ^t	53.3 ^c	13.9 ^a	72.4 ^c	8.4 ^a
Length of stay: Middle	158	64.7	5.2	67.8	3.5	76.4	1.6	71.7	4.0	57.7	4.7	80.8	3.6	57.7	4.7	66.9	3.7	46.8	3.1	68.0	2.6
Length of stay: High	78	63.8	5.8	66.2	4.7	75.3	-0.4	69.6	2.3	56.6	4.7	79.8	3.2	57.2	6.0	64.6	-0.3	49.0	6.9	67.7	4.0

AMI patients

30-day mortality: Low	67	67.6	9.0	71.0 ^a	7.7	76.8	2.3	72.3	4.7	57.8	6.7	80.7 ^a	3.5	58.8	6.9	66.9	3.2	50.2	10.8	69.7	6.4
30-day mortality: Middle	139	64.3	7.4	67.1	7.2	76.2	2.2	71.5	5.5	57.3	8.5	80.3	5.4	57.9	9.3	66.7	4.9	48.1	5.9	68.0	3.2
30-day mortality: High	62	65.0	9.3	67.1	5.4	76.7	2.6	71.9	4.5	59.5	7.3	82.0	3.9	59.0	6.3	66.8	4.1	48.1	6.8	68.6	4.6
30-day readmission rate: Low	63	69.1 ^c	9.0	72.9 ^c	6.7	78.2 ^c	2.9	73.7 ^c	4.7	59.9 ^b	8.7	81.8 ^c	4.0	60.3	5.7	68.4 ^a	4.4	50.0	10.6	70.2 ^b	4.9
30-day readmission rate: Middle	126	64.6	7.4	67.6	6.2	76.3	1.7	71.9	5.7	58.0	7.0	81.0	3.6	58.3	9.0	66.8	4.2	48.5	6.5	68.5	4.6
30-day readmission rate: High	63	62.7	5.7	64.7	6.1	75.0	1.9	69.9	2.7	56.2	8.0	79.1	5.3	56.4	6.1	65.4	3.3	47.2	4.8	66.7	2.1

Heart-failure patients

30-day mortality: Low	77	62.8 ^b	9.3	64.4 ^b	6.2	74.9 ^c	2.3	69.4 ^c	6.1	55.4 ^c	7.4	79.4 ^c	4.9	56.4	12.0	64.9 ^b	5.7	49.1 ^a	9.8 ^a	68.1	6.6
30-day mortality: Middle	151	66.8	8.5	69.4	7.6	77.2	2.2	72.8	4.9	59.1	8.4	81.1	4.3	59.7	7.1	67.5	4.2	49.7	9.0	69.4	3.9
30-day mortality: High	73	65.3	4.9	68.9	3.1	77.4	2.7	72.8	3.9	58.9	4.7	82.2	4.3	59.5	4.1	67.9	3.6	46.4	-1.4	68.6	2.8
30-day readmission rate: Low	76	67.2 ^b	8.4	70.0 ^b	4.8	77.4 ^b	2.5	72.9 ^b	4.9	58.6	5.6	82.0 ^b	3.8	59.9	6.4	67.8 ^b	5.7	48.2	4.5	69.2	2.2
30-day readmission rate: Middle	150	65.9	8.1	68.8	7.3	77.0	2.7	72.4	5.2	58.6	9.1	81.0	4.7	59.2	8.2	67.6	4.8	49.3	8.2	69.2	5.5
30-day readmission rate: High	76	62.8	7.1	64.6	5.5	75.3	1.5	70.1	4.8	56.7	5.5	79.8	4.6	57.1	8.0	64.8	2.7	48.3	6.4	68.0	4.2

Pneumonia patients

30-day mortality: Low	79	65.6	9.5	67.9 ^a	6.9	75.6 ^a	2.5	71.2	5.6	56.6 ^a	6.6	80.1	4.4	58.2	10.9	66.2	4.9	50.2	12.0	69.4	6.3
30-day mortality: Middle	148	66.3	9.1	69.4	8.4	77.3	2.9	72.7	5.8	58.9	9.2	81.5	4.6	59.4	8.8	67.7	6.1	48.5	6.0	68.9	4.2
30-day mortality: High	75	63.4	3.9	65.2	1.3	76.3	1.0	71.2	2.8	58.0	4.4	80.6	4.3	58.3	2.0	66.2	0.8	47.7	3.2	68.4	2.5
30-day readmission rate: Low	75	67.4 ^a	9.7	70.7 ^a	7.6	77.4 ^a	3.4	73.0 ^a	5.5	58.5	6.7	81.8 ^a	4.4	60.3	9.6	67.5	3.9	49.8	8.6	70.4 ^a	5.5
30-day readmission rate: Middle	149	65.5	6.3	67.7	3.6	77.0	2.2	72.1	4.6	58.2	5.9	81.0	4.1	58.9	5.7	67.1	4.2	47.9	3.1	69.0	3.8
30-day readmission rate: High	77	63.2	9.2	65.6	9.8	75.2	1.7	70.4	5.3	57.4	10.1	79.8	5.2	57.2	9.6	65.9	5.4	49.2	12.0	67.1	4.2

Significance Levels: a=<0.05 ; b=<0.01; c=<0.001