Sustaining and Improving Hospital Performance: The Effects of Organizational and Market Factors

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Abstract: Using data from hospitals in ten states, this study examines the effects of organizational and market factors on the likelihood of becoming high-quality/low-cost providers during the period of 1997–2001. The findings highlight the important role of previous performance, internal operations, and market competition in hospital performance improvement. Achieving high-quality/low-cost performance is also incidentally found to be associated with improved profit margins.

Cost and quality of care are two dimensions of hospital performance with critical importance to policymakers, purchasers, and health care executives. The Center for Medicare and Medicaid Services (CMS), for instance, is funding a number of demonstration projects that aim to lower health care costs through incorporating quality improvement into reimbursement, namely, "pay-for-performance."[1] The Leapfrog Group, a coalition of large employers, has also initiated a program to reward top-cohort hospitals defined by high quality and efficiency with bonus payments.[2] For health care executives, the decisions to adopt particular strategies can impact both the cost and quality of care and, subsequently, the survival of their institutions in a competitive environment.

Previous research on this topic generally has been cross-sectional, has examined absolute rather than relative levels of hospital cost and quality, and has examined hospital cost and quality separately rather than jointly. However, it is also important to explicitly measure a hospital's cost and quality of care relative to those of other hospitals and to understand the changes made by hospitals over time along these two dimensions. This is particularly relevant in light of the future development of pay-for-performance. Experts speculate that although most current pay-for-performance initiatives reward historically high-performing providers, the next generation of pay-for-performance will more directly reward improvements made over time by low-performing providers.[3]

Using data from hospitals in ten states, we categorize hospital performance in terms of relative cost and quality of care and assess a hospital's likelihood of achieving

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high-quality/low-cost performance over time. We are interested not only in hospitals that are persistently high-performing providers but also in hospitals that successfully move into the high-performing group over time. Changes in market structure and hospital operational characteristics are examined. In addition, we offer evidence on the issue of the profitability of high-performing hospitals. We focus on the post-Balanced Budget Act (BBA) period of 1997 to 2001. The BBA of 1997 represented the biggest change in Medicare payment policy since the implementation of the Prospective Payment System in the mid-1980s. The BBA, intended to slow the growth of Medicare expenditures, resulted in considerable financial pressures for hospitals. Thus, the post-BBA period provides an appropriate time window to observe changes in hospital operations and the impact on quality-cost performance. The findings of this study will inform health care executives of the effectiveness of various strategies in enhancing their hospitals' performance and also help policymakers to better understand what drives organizational improvements.

CONCEPTUAL FRAMEWORK

A strategic adaptation perspective links organizational performance with environmental conditions and strategic choice.[4] This perspective suggests that in response to environmental discontinuities, organizations undertake strategic changes to enhance their survival. Through intentional strategic changes, organizations seek to align internal operations, with new expectations imposed by the environment. Those that adapt successfully achieve better organizational performance. In addition, most versions of strategic adaptation framework note the influence of previous performance on strategic choice.[5] In other words, regardless of whether there is any environmental necessity for change, top management may implement strategic changes to achieve specific performance goals. Low-performing organizations, for instance, may be more likely to undertake strategic changes than do high-performing organizations.

We use a conceptual model drawn from the above tenets to guide our investigation of the likelihood of achieving high-quality/low-cost hospital performance in relation to changes in organizational and market characteristics. We propose that internal operational changes are contingent on environmental changes and/or the hospital's previous performance and that changes in operational characteristics can significantly influence subsequent performance. Hospitals may be driven to perform better by either market forces or by strategic decisions to "do better" or to "sustain excellence" based on internal assessments of performance.

In the hospital industry, payment policy and market structure represent two major sources of environmental changes. During the period of 1997 to 2001, few hospitals were immune to the financial pressures from the BBA due to reduced Medicare payments. At the same time, changes in the local environment for individual hospitals have varied in terms of the level of competition among providers and the extent of managed care penetration. Managed care organizations demanded high-quality and low-cost services through selective contracting, use of capitation and performance-based payments, and, more recently, tiered provider networks.[6] Empirical evidence has shown the positive impact of managed care penetration on reducing hospital admission rates and lowering the growth of hospital expenditures.[7,8] Closely related to growth in managed care was the increase in hospital competition, another key element of environmental instability. Achieving high performance in both quality and cost allows hospitals to better position themselves in a highly competitive environment. Previous studies have confirmed the positive effect of hospital competition on cost reduction but are inconclusive about the effect on quality.[9–11]

Hospital operational changes to improve performance can be grouped into two general categories: those aimed to control costs (e.g., reduced staffing) and those intended to enhance revenues (e.g., diversification of services).[12–15] Previous research found that in coping with the BBA, hospitals were likely to implement a number of operational changes, including controlled cost growth for Medicare patients, reduced staffing, expanded outpatient services, and increased inpatient volume.[16] Likewise, faced with competitive pressures in the local markets, hospitals may strive to become more efficient in their operations and/or more diversified in their service domain to achieve competitive advantages.[17]

In this study, we selected a number of operational changes that have been examined in empirical research and that reflect the two strategic categories mentioned above: cost containment and revenue enhancement. These operational changes include adjustments in nurse staffing, plant investment, high-technology and relatively profitable services, outpatient activities, payer mix, and patient volume. Although mainly aimed to control cost and enhance revenue, they may also affect quality. For instance, reducing nurse staffing level and skill mix help lower costs but could lead to poor patient outcomes.[18,19] Investing in new facility/equipment incurs additional costs but may improve quality of care. Understaffing and underinvestment in capital assets have been shown to be linked to poor quality.[20] Increasing high-technology, relatively profitable services and outpatient activities help enhance revenues and generate resources for quality improvement. Adjusting payer mix is an effective strategy to improve revenues, whereas changes in patient volume may influence both cost and quality.

Subject to a set of common operational factors, quality and cost are inextricably linked to each other. Therefore, unlike the conventional approach in separating quality and cost, we define hospital performance combining both dimensions and examine the movement over time. Empirical evidence indicates that hospitals that produce better quality of care can also achieve lower costs[21,22]; furthermore, higher quality and lower costs lead to higher operating margins.[20,23] Higher quality can contribute to higher profitability through reduced costs associated with fewer mistakes and less waste, increased patient volume and market share, and higher prices that patients are willing to pay for the quality. Therefore, those hospitals that successfully become high-quality/low-cost providers are likely to achieve better financial performance than other hospitals.

METHODS

DATA SOURCES AND SAMPLE

The study population consists of nonfederal, general acute hospitals in ten states (Arizona, California, Colorado, Florida, Georgia, Illinois, Iowa, New York, Tennessee, and Wisconsin) that contributed complete discharge data to the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases in both 1997 and 2001.* In combination, these ten states provide a reasonable representation of hospitals in different geographic regions, market conditions, and structural categories. The final sample contains 934 hospitals after the exclusion of hospitals that merged/closed during the study period or opened in 2001, hospitals with missing data in the American Hospital Association (AHA) Annual Survey or the CMS Medicare Cost Report, and hospitals that were outliers in patient volume, risk-adjusted mortality rate, or severity-adjusted cost.†

MEASURES

Quality and Cost Measures. Hospital quality of care was measured by ten mortality indicators drawn from the AHRQ Inpatient Quality Indicators (IQIs), which cover six common medical conditions and four surgical procedures‡ and incorporate risk-adjustment by All Patient Refined DRGs (APR-DRGs), age, and gender.[24] Only adult, nonmaternal patients were included. After obtaining risk-adjusted rates for each individual indicator, we constructed a composite as the weighted average of all ten indicators, with weights equal to the proportion of patients for each individual condition or procedure. This approach allows control for differences in both case mix and severity of illness across hospitals.

Cost per discharge was estimated by applying the cost-to-charge ratios to the discharge data. The cost-to-charge ratios were developed from hospital-specific accounting data collected and released by CMS.[25] Area wage indices were used to adjust for geographic differences in input prices. Cost was further adjusted for principal diagnosis, age, admission source, APR-DRG severity subclass, and comorbidities through hospital fixed-effect models. Only patients at risk for the ten mortality IQIs were included in the cost estimation.§

Market Structure. Market structure characteristics include hospital competition and managed care penetration. We define hospital market area based on actual patient flows by using the patient zip code information available in the HCUP discharge data. We followed the method developed by Friedman et al.,[26] which identifies a hospital's market area consisting of those leading zip codes that account for 90 percent of the hospital's patient volume. Herfindahl-Hirschman Index (HHI) was computed as the sum of squared market shares, including the hospital and its major competitors only.‖ The HHI is a concentration index, and we subtracted it from 1 to derive the hospital competition measure. Managed care penetration was measured by the percentage of health

*Sponsored by the Agency for Healthcare Research and Quality (AHRQ), HCUP is a federal-state–industry partnership to build all-payer, multistate, standardized health care databases. The State Inpatient Databases include discharge abstracts on all inpatient stays from virtually all community hospitals in the participating states.

†Hospitals that were in the lowest 5 percent of total patient volume at risk for the ten mortality indicators (or less than eighty patients) were dropped. Outliers for risk-adjusted mortality and severity-adjusted cost were defined as four times the interquartile range above the median.

‡The IQI mortality indicators cover six medical conditions (acute myocardial infarction, congestive heart failure, gastrointestinal bleeding, hip fracture, pneumonia, and stroke) and seven procedures (abdominal aortic aneurysm repair, coronary artery bypass graft, craniotomy, hip replacement, esophageal resection, pancreatic resection, and pediatric heart surgery). Esophageal resection and pancreatic resection were dropped because of extremely low volumes across hospitals. Pediatric heart surgery was dropped to restrict the sample to adult patients. For patients who overlap between the medical and surgical indicators (e.g., a heart attack patient receiving bypass surgery), we modified the IQI software to assign those patients to the surgical class only.

§The cost per discharge estimated from the IQI sample is highly correlated with the estimate based on all nonmaternal adult patients ($r > .90$).

‖The average hospital's share of the market is 24 percent. Any hospital that captures a market share of at least 10 percent is defined as a major competitor. For small hospitals that account for less than 10 percent share of their market, major competitors are defined as those with a market share of at least 5 percent. Overall, the number of major competitors identified for every hospital ranges from 0 to 10, with an average of 2.8.

maintenance organization (HMO) enrollment and number of HMOs, obtained from the InterStudy HMO County Surveyor.

Hospital Operations. Variables measuring hospital operational characteristics were derived from multiple data sources. The AHA survey contains data on nurse staffing, service mix, and outpatient activities. For nurse staffing, we converted the number of full-time equivalents to hours by multiplying the number by 2,080 hours (a standard year of 52 weeks at 40 hours per week). The AHA survey also reports adjusted patient days (APD) that have taken into account both inpatient and outpatient activities. Using these data, we developed two measures of nurse staffing—total number of hours by licensed nurses (registered nurses [RNs] and licensed practical nurses [LPN]) per APD and the proportion of RNs among licensed nurses, with the former measuring staffing level and the latter indicating skill mix. Among a number of relatively profitable services identified in a recent study,[27] nine were considered as being high-technology and relevant to adult patients.[¶] A count of these services was used to measure a hospital's service mix. Shifting to outpatient activities was measured by the percentage of total surgeries performed in the outpatient setting.

The age of the plant, which reflects the extent of a hospital's investment in new facilities and equipment, was measured by the ratio of accumulated to current depreciation, using data from the CMS Medicare Cost Report. Payer mix (proportion of Medicaid/uninsured patients, proportion of Medicare patients) and IQI patient volume were generated from the HCUP discharge data, including only nonmaternal adult patients. IQI patient volume was measured as the total number of discharges at risk for any of the ten mortality indicators divided by the number of beds.

Hospital Structure. Several structural characteristics of hospitals are used as control variables. Derived from the AHA survey are a number of hospital structural variables, including size (number of beds), ownership (public, nonprofit, or for-profit), location (urban or rural), teaching status, and system affiliation. To address missing values and potential data errors, teaching status was defined as meeting any two of these criteria: (*a*) being a member of the Council of Teaching Hospitals, (*b*) having residency programs approved by the American Medical Association, and (*c*) having a resident-to-bed ratio greater than 0.25.

Hospital Profitability. Hospital profitability was measured by operating margin and total margin, based on data from the CMS Medicare Cost Report. Operating margin equals net patient revenue less total operating expenses, divided by net patient revenue. Total margin equals total net income less total expenses, divided by total net income. Operating margin is most directly associated with serving patients and succeeds on the basis of cost and quality. Total margin is also important because hospitals do serve other "stakeholders," such as charitable contributors and government agencies, that grant funds; these other incomes can be vital to the success of some hospitals. Therefore, it is worthwhile to examine whether both profitability measures change in the same direction as a hospital changes performance.

ANALYTIC APPROACH

We first classified hospitals based on performance in both risk-adjusted mortality and cost, using median as the stratification criterion (i.e., above or below the median). Four mortality/cost quadrants were defined: low-mortality/low-cost, low-mortality/high-cost, high-mortality/low-cost, and high-mortality/high-cost. Each hospital was assigned to a mortality/cost quadrant for 1997 and 2001, respectively.

We then used logistic regression to examine a hospital's likelihood of persistently staying in or moving to the low-mortality/low-cost quadrant over time in relation to operational and market variables. To assess the likelihood of persistently being in the low-mortality/low-cost quadrant, the explanatory variables include operational and market characteristics for 1997 only. This choice is based on the assumption that variation in the absolute levels of operational and market characteristics at time 1 decisively differentiates persistently high-performing hospitals from all others. To examine a hospital's likelihood of moving to the high-performing quadrant over time, the key variables of interest are changes in market structure and hospital operations over time. Taking into consideration the hospital's previous performance as discussed in the model, we conducted the analysis separately for each group of hospitals stratified by their 1997 performance—low-mortality/high-cost, high-mortality/low-cost, and high-mortality/high-cost. We fitted all the models through STATA software to correct standard errors for clustering by state.

Lastly, using *t*-tests, we compared the differences in profitability between hospitals persistently in the low-mortality/low-cost (high-performing) quadrant and hospitals persistently in the high-mortality/high-cost (low-performing) quadrant, as well as between hospitals moving to the high-performing quadrant and hospitals not making the move. This study is not intended to thoroughly investigate the determinants of profitability. Nevertheless, these profitability measures are subject to

[¶]*These nine services include coronary artery bypass graft, angioplasty, cardiac catheterization, extracorporeal shock-wave lithotripsy, and five diagnostic imaging—computed tomography (CT) scanner, diagnostic radioisotope, magnetic resonance imaging, positron emission tomography, and single photon emission CT.*

substantial variability, and thus, any comparison of differences should start with at least a univariate *t*-test before considering whether differences are interesting enough to warrant further attention.

RESULTS

For both years, as expected, hospitals in the low-mortality/low-cost quadrant had the lowest average mortality and cost (Table 1). In 1997, the average risk-adjusted mortality and cost were 38 percent and 27 percent lower, respectively, for the low-mortality/low-cost group of hospitals than those in the high-mortality/high-cost quadrant (5.75 percent vs. 9.23 percent for mortality, and $6,043.22 vs. $8,225.57 for cost). Similar patterns were observed in 2001.

Overall, approximately half (n = 470) of the hospitals remained in the same mortality/cost quadrants in both 1997 and 2001. Specifically, 15 percent (n = 142) of the hospitals persistently stayed in the low-mortality/low-cost quadrant, whereas 14 percent (n = 131) persistently fell into the high-mortality/high-cost quadrant. Table 2 presents the results of logistic regression for a hospital's likelihood of being persistently in the low-mortality/low-cost quadrant over time in relation to market and organizational characteristics in 1997. We found that the likelihood of being persistently in the low-mortality/low-cost quadrant was positively associated with the number of HMOs in the market, the percentage of Medicare patients, and patient volume covered by the ten quality indicators but was negatively associated with the nurse staffing level (not skill mix). Moreover, investor-owned hospitals or hospitals with system membership were more likely to be persistently in the low-mortality/low-cost quadrant over time. Many of these findings are consistent with those reported recently in another study based on data of a single state.[28]

Approximately 11 percent (n = 106) of the hospitals moved from other quadrants in 1997 to the low-mortality/low-cost quadrant in 2001. The rate of moving to the low-mortality/low-cost quadrant varies by the hospital baseline performance—21 percent for those initially in the low-mortality/high-cost quadrant, 18 percent for those in the high-mortality/low-cost quadrant, and 11 percent for those in the high-mortality/high-cost quadrant. Table 3 presents the results of logistic regression for a hospital's likelihood of moving to the low-mortality/low-cost quadrant in relation to changes in market structure and hospital operations.

First, we consider hospitals that moved from the low-mortality/high-cost quadrant in 1997 to the low-mortality/low-cost quadrant in 2001. As shown in Table 3 (results of the first column), hospitals in markets with increased hospital competition and a higher number of HMOs but decreased HMO penetration during this time period were more likely to achieve the goal of cost containment. The positive effects of hospital competition and number of HMOs on cost reduction are consistent with the findings of previous research. The negative effect of HMO penetration may reflect that with increased HMO penetration, controlling for the number of HMOs, health plans became more restrictive on hospital admissions and sicker patients were admitted to the hospital, making it more difficult to reduce average cost of inpatient care and/or mortality. As for internal operational characteristics, these hospitals were more likely to reduce both the nurse staffing level and skill mix and the number of high-technology, profitable services. Reducing nurse staffing has been a common strategy for cost containment. But interestingly, even with such operational changes, this group of hospitals was able to maintain its relatively low mortality rates. The high-technology and relatively profitable services are also high cost. Thus, it is not surprising that hospitals also cut back on providing these services on their own, probably through consolidation or outsourcing.

Among hospitals in the high-mortality/low-cost quadrant in 1997, no significant market force was found to be associated with a hospital's likelihood of moving to the low-mortality/low-cost quadrant (see results of the

TABLE 1

Average Mortality and Cost by Mortality/Cost Quadrant (N = 934)

	1997			2001		
Mortality/Cost Quadrant	No. of Hospitals (%)	Average Mortality (%)	Average Cost ($)	No. of Hospitals (%)	Average Mortality (%)	Average Cost ($)
Low mortality/low cost	267 (28.6)	5.75	6,043.22	248 (26.6)	5.24	7,980.88
Low mortality/high cost	199 (21.3)	6.04	8,275.90	219 (23.4)	5.42	10,928.99
High mortality/low cost	200 (21.4)	9.15	6,059.03	219 (23.4)	8.60	8,017.60
High mortality/high cost	268 (28.7)	9.23	8,225.57	248 (26.6)	8.68	11,015.95

TABLE 2

Results of Logistic Regression for Persistently Being in the Low-Mortality/Low-Cost Quadrant for Both Years (1997 and 2001, N = 934)

Explanatory Variable (1997)	Coefficient
Market structural characteristics	
Hospital competition (1-HHI)	0.130
HMO penetration	0.488
No. of HMOs	0.072**
Hospital operational characteristics	
(RN + LPN) hours per APD	−0.079**
% RNs	−1.563
Age of plant	−0.042
No. of high-technology, relatively profitable services	−0.040
% Outpatient surgeries	0.124
% Medicaid and uninsured patients (log)	−0.309
% Medicare patients	2.476*
No. of IQI discharges per bed	0.217**
Hospital structural attributes	
Nonteaching, medium (150–249 beds)	0.259
Nonteaching, large (250+ beds)	0.757
Teaching	0.412
Urban	0.274
Public	0.059
For-profit	1.018*
System	0.436**
Pseudo R^2	0.186
Hosmer-Lemeshow χ^2	4.94 (p = .764)
C statistic: area under ROC curve	0.802

Notes: HHI = Herfindahl-Hirschman Index; HMO = health maintenance organization; RN = registered nurse; APD = adjusted patient days; IQI = Inpatient Quality Indicator; ROC = receiver operating characteristic.

*p < .05.

**p < .01.

second column in Table 3). Nevertheless, higher nurse staffing levels, with no changes in skill mix, significantly increased a hospital's likelihood of moving from high to low mortality while keeping cost of care relatively low. In addition, hospitals that were able to move to the low-mortality/low-cost quadrant experienced significant increases in the percentage of Medicare, Medicaid, and uninsured patients and in the patient volume covered by the quality indicators. It is possible that these observed changes in patient mix and volume may result from demographic changes in a hospital's service area and/or deliberate strategic changes pursued by the hospital. As low-cost providers, increasing patient volume, particularly of Medicare, could help these hospitals offset payment reductions due to the BBA, which, in turn, improves their financial condition and allows for hiring more nurses. Increasing nurse staffing level is important to quality improvement.

Lastly, among hospitals with high mortality and high costs in 1997, again, we found no significant market forces associated with performance improvement (see the last column in Table 3). The only significant operational changes associated with a hospital's likelihood of moving from the worst to the best quadrant were increases in the number of high-technology, relatively profitable services and in the percentage of outpatient surgeries. Both are mainly revenue-enhancing strategies. Although faced with poor quality and high costs in 1997, these hospitals did not make any significant adjustment in nurse staffing probably because increasing nurse staffing would incur even higher costs, whereas reducing nurse staffing could further hurt quality. It is thus not surprising that these hospitals resorted to revenue-enhancing strategies. An earlier study found that shifting to outpatient services can result in improved operating efficiency and operating margin.[14] Our finding here suggests that these strategies also can be concurrent with quality improvement in inpatient care.

In terms of financial performance, Table 4 shows that both operating and total margins were significantly higher in both years for hospitals persistently in the low-mortality/low-cost quadrant compared with hospitals persistently in the high-mortality/high-cost quadrant. Furthermore, hospitals that were able to move to the low-mortality/low-cost quadrant over time achieved significantly higher operating and total margins in 2001 than did those that did not move to the best quadrant, although there was no significant difference in either of the profitability ratios between the two groups of hospitals in 1997.

CONCLUSIONS

The findings of this study demonstrate that achievement of high-quality/low-cost hospital performance is systematically related to organizational and market characteristics. First, hospitals that stayed in the high-performance category in both 1997 and 2001 were more likely to be investor owned and system affiliated. They had a higher share of Medicare patients but lower nurse staffing levels and were located in markets with more HMOs. These hospitals would be at distinctive advantage if pay-for-performance was designed to reward fixed performance levels.

Second, among hospitals not classified as high-performing initially, the effectiveness of strategies in

TABLE 3

Results of Logistic Regression for the Likelihood of Moving to the Low-Mortality/Low-Cost Quadrant Between 1997 and 2001

	Among Hospitals in the Following Quadrant		
	Low Mortality/ High Cost, 1997 (n = 199)	High Mortality/ Low Cost, 1997 (n = 200)	High Mortality/ High Cost, 1997 (n = 268)
Explanatory Variable	Coefficient	Coefficient	Coefficient
Changes in market structure, 1997–2001			
Hospital competition (1-HHI)	3.191*	0.510	0.953
HMO penetration	−7.792**	−3.040	−0.671
No. of HMOs	0.193*	0.113	0.187
Changes in hospital operations, 1997–2001			
(RN + LPN) hours per APD	−0.132**	0.243**	0.110
% RNs	−4.663*	0.932	2.684
Age of plant	−0.095	−0.260	0.005
No. of high-technology, relatively profitable services	−0.191**	0.036	0.145*
% Outpatient surgeries	0.039	3.136	5.117*
% Medicaid and uninsured patients (log)	−0.762	1.860**	0.364
% Medicare patients	4.459	4.553*	−1.418
No. of IQI discharges per bed	0.089	0.288**	0.014
Pseudo R^2	0.345	0.206	0.168
Hosmer-Lemeshow χ^2	5.61 (p = .691)	11.12 (p = .195)	11.11 (p = .196)
C statistic: area under ROC curve	0.883	0.810	0.792

Note: Also included as control variables but not reported here are the 1997 values of market structural and hospital operational characteristics and hospital structural attributes.

HHI = Herfindahl-Hirschman Index; HMO, = health maintenance organization; RN = registered nurse; APD = adjusted patient days; IQI = Inpatient Quality Indicator.

*p < .05.

**p < .01.

improving performance differed depending on the hospital's baseline performance. Specifically, we found that for hospitals in the high-cost category at baseline, cost-containment strategies (e.g., reduced nurse staffing) were helpful to those hospitals with low mortality, whereas revenue-enhancing strategies (e.g., shifting

TABLE 4

Comparison of Profitability

		1997		2001	
	n	Operating Margin	Total Margin	Operating Margin	Total Margin
For both years, persistently in the following quadrant					
Low mortality/low cost	142	2.10%	2.12%	0.65%	1.66%
High mortality/high cost	131	−2.71%	−0.51%	−3.30%	−2.12%
p Value		p < .01	p < .05	p < .01	p < .01
Moving to the low-mortality/low-cost quadrant					
Yes	106	−0.13%	1.69%	0.12%	0.83%
No	561	−0.88%	1.25%	−3.01%	−1.72%
p Value		p > .25	p > .30	p < .01	p < .05

to outpatient services) were helpful to those hospitals with high mortality. In awareness of their hospital's relative performance, top management may implement certain operational changes for performance improvement and can do so independently of environmental incentives. For example, among hospitals with high mortality initially, changes in market characteristics were not associated with the likelihood of moving into the high-performing category. In only one of the three categories (low-mortality/high-cost hospitals) were any of the market force changes associated with movement over time into the high-performing category.

Third, consistent with earlier work on nurse staffing, this study confirms the important role of nurse staffing level and skill mix in quality and cost performance. Being able to reduce nurse staffing without compromising quality of care or to increase nurse staffing without incurring higher costs was found to be one of the significant attributes characterizing those hospitals that successfully moved into the high-performing group.

Lastly, the results of this study indicate that achieving high-quality/low-cost performance is linked to better financial performance. It further suggests that extra payment incentives may not always be necessary for motivating hospitals to achieve high performance in both quality and cost. Hospitals that have historically performed in the top category or hospitals that have made improvement over time and emerged among the top have already been rewarded with higher revenue margins.

This study extends previous research on performance improvement in a number of ways, which include applying measures of quality that incorporate sophisticated risk adjustment and cover multiple clinical areas, utilizing national data drawn from ten states, and focusing on a more current time period. Nonetheless, the operational changes examined here are limited to those that can be measured with data from the AHA Annual Survey or the CMS Medicare Cost Report. To identify additional key organizational strategies, future study of this topic should include case studies of hospitals that have made significant improvements in both quality and cost rankings or have maintained high rankings over time. In future secondary data–based studies, alternative measures of cost and quality performance should be examined, as well as hospitals in a wider range of locations.

For leaders of hospitals, we offer a cautiously optimistic interpretation of the results of this study. Leaders can examine their hospital's performance standing and implement changes in operations that improve quality and/or lower costs, and these changes can lead to enhanced profits. Among the operating characteristics we examined, changes in nurse staffing levels seemed to be the most directly linked to performance outcomes, with differential effects on cost and quality performance. This indicates the importance of monitoring and optimizing this key operating feature, taking into account the need to balance its impact on cost and quality.

For health policy makers, the concurrent effects of market forces should be considered in evaluating pay-for-performance programs. If managers constantly seek adaptation to environmental changes, then, in areas where market forces have been strong and hospitals already have moved in the direction of lower costs and higher quality, the response to pay-for-performance may be relatively weak. Conversely, the effects may be more striking where market forces have been weak.

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