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Hospital resources are associated with value-based surgical performance



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ABSTRACT

Background: We have previously shown that inferior outcomes at safety-net hospitals are largely dependent on hospital factors. We hypothesized that hospitals providing “high value” care (low cost and better outcomes) would have advantages in human and financial resources.

Methods: The University HealthSystems Consortium Clinical Database and the American Hospital Association Annual Survey were used to examine hospitals performing eight complex surgical procedures from 2009 to 2013. Hospitals in the lowest quartiles of both mortality rate and cost were characterized as high value ($n = 45$), whereas those in the highest quartiles of both cost and mortality were low value ($n = 45$). Hospital size, staffing, and financial characteristics were compared between these two groups.

Results: On average, high-value hospitals had lower proportions of Medicaid patient days (17% versus 30%; $P < 0.01$), higher proportions of outpatient surgery (63% versus 53%; $P < 0.01$), and spent more on capital expenditures per bed (\$155,710 versus \$62,434; $P < 0.05$). Also, high-value hospitals employed more hospitalists (0.08 versus 0.04 per bed; $P < 0.01$), had more privileged physicians (2.04 versus 1.25 per bed; $P < 0.01$), and had more full-time equivalent personnel (8.48 versus 6.79 per bed; all $P < 0.05$). As a result, these hospitals appeared to be more efficient; high-value hospitals had more total admissions per bed (46 versus 38; $P < 0.01$), fewer days per admission (5.20 versus 5.77; $P < 0.01$), and more inpatient surgeries per bed (15.7 versus 12.6; all $P < 0.05$).

Conclusions: Hospitals that invest in more human resources and demonstrate increased throughput perform complex surgery at higher “value” (i.e., lower costs and mortality). Value-based purchasing initiatives that link hospital reimbursement to unadjusted surgical outcomes may exacerbate, rather than improve, disparities in surgical care that currently exist.

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Introduction

Healthcare policy and reimbursement in the United States are rapidly evolving. In an effort to improve quality and cost effectiveness, Medicare's Hospital Readmissions Reduction Program is penalizing hospitals with the highest readmission rates for given conditions.¹ Bundled care initiatives, such as the Comprehensive Care for Joint Replacement Model, aim to incentivize hospitals to provide comprehensive, high-quality care within a standardized cost structure.² One major problem with these programs is the lack of adequate risk-adjustment for patient factors. For example, the Comprehensive Care for Joint Replacement Model only adjusts for Diagnosis Related Group codes (three categories: no, minor, or major comorbidities and/or complications) and the presence or absence of a hip fracture.² Moreover, private insurers offer tiered networks based on unadjusted costs in an effort to steer patients toward "higher value" or less expensive providers.³

The assumption that the healthcare industry responds to market forces in the same way as other more capitalistic industries is controversial at best. Existing literature does not support this notion, suggesting that hospital financial health is related to patient outcomes.^{4–7} A particularly important focus of healthcare cost and effectiveness is safety-net hospitals, whose mission is to maintain an "open door policy" to the poor and underinsured. We have recently shown that safety-net hospitals provide surgical care with increased costs and inferior outcomes which are not entirely explained by the characteristics of their unique and vulnerable patient populations.⁸ We demonstrated that safety-net hospitals also have worse patient throughput and systems efficiency which may be because of inferior hospital finances and staffing.

The aim of the current analysis was to assess the correlation between hospital resources and performance of complex surgery. We sought to identify high- and low-value hospitals based on unadjusted outcomes, similar to aforementioned programs, and compare hospital characteristics between the two groups. We hypothesized that "high-value" hospitals would not only have lower risk patients and an advantageous payer mix, but that they would also have increased financial and human resources compared with hospitals with worse outcomes and higher costs.

Methods

Data sources

Two data sources were used for our analysis. The University HealthSystem Consortium (UHC) Clinical Database/Resource Manager includes 95% of the nation's major non-for-profit academic medical centers, approximately 118 academic medical centers and 298 of their affiliated hospitals. The Clinical Database/Resource Manager is an administrative data set that contains patient demographic, financial, ICD-9, procedure, and short-term outcome data provided by member medical centers. Second, we accessed the American Hospital Association (AHA) Annual Survey for 2013, which provides detailed characteristics about hospitals including their

facility, staffing, and financial data. Both broad categories, as reported in the Annual Survey, and simple ratios normalized to facility infrastructure (i.e., beds or operating rooms) are reported. Some of these ratios, such as days per admission and surgeries per operating room, quantify patient throughput and give insight into the efficiency with which hospitals see and treat patients. Specific AHA categories were selected for subsequent analysis based on clinical relevance and completeness of reporting.

We created patient cohorts based on eight complex surgical procedures performed and reported to UHC between 2009 and 2013, as identified in [Table 1](#). All cases during the study period were included, as identified by ICD-9 procedure codes. The following patient encounter data were collected from UHC: age, gender, race (white, black, Hispanic, Asian, and other), insurance type (private, Medicare, Medicaid, uninsured, and other), overall length of stay (LOS in days), intensive care unit LOS (days), in-hospital mortality, total direct cost, discharge disposition (home, rehabilitation, and other), and 30-day readmission. Patient severity of illness is derived from 3M All Payer Refined-Diagnosis Related Groups severity scores, validated in a nationwide data set including 8.5 million discharges from over 1000 hospitals.⁹ Total direct costs were calculated from hospital charges using institution-specific Medicare cost-to-charge ratios at the center level, and then, the labor portion of cost was adjusted with federally reported area wage indices to normalize for regional variation.^{10,11}

Identifying high- and low-value hospitals

For each procedure cohort, a mortality rate and median risk-adjusted direct cost for each hospital in the cohort were calculated. Next, we identified a median and interquartile range (IQR) for center mortality rates and costs for each procedure. We chose these outcomes to define the relative value of each hospital. Some hospitals perform complex surgery with low mortality and others perform surgery at low cost, but a more cost-effective hospital would provide both good quality and low cost. Hospitals with both a mortality rate and cost below the IQR for a given procedure were identified as the most cost-effective hospitals and labeled as "high-value" hospitals. Conversely, hospitals with costs and mortality above the IQR were identified as "low-value" hospitals. High and low performers for all eight procedures were then combined into two groups. Hospitals appearing more than once in a group were included in the analysis only once, and those that appeared as high performers in one procedure but low performers in another were excluded from the final hospital comparison.

These groups of high- and low-value hospitals were based on extremes of performance on unadjusted surgical outcomes, acknowledging the reality that hospitals are largely unable to adjust patient-specific risk and must treat the patients available to them, regardless of comorbidity. The purpose of using unadjusted outcomes was to simulate policies that similarly ignore the unique patient characteristics at each hospital. Although readmissions have been the focus of some policies, we have chosen instead to use mortality and cost as outcomes of interest. The reliability of readmissions as a

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