By Ashish K. Jha, E. John Orav and Arnold M. Epstein

Low-Quality, High-Cost Hospitals, Mainly In South, Care For Sharply Higher Shares Of Elderly Black, Hispanic, And Medicaid Patients

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ABSTRACT As policy makers design national programs aimed at managing the quality and costs of health care, it is important to understand the potential impact on minority and poor patients and the hospitals that provide most of their care. We analyzed a range of hospital data and assigned hospitals to various categories, including “best”—high-quality, low-cost institutions—and “worst”—where quality is low and costs high. We found that the “worst” hospitals—typically small public or for-profit institutions in the South—care for double the proportion (15 percent versus 7 percent) of elderly black patients as the “best” hospitals—typically nonprofit institutions in the Northeast. Similarly, elderly Hispanic and Medicaid patients accounted for 1 percent and 15 percent, respectively, of the patient population at the best hospitals, while at the worst hospitals, these groups represented 4 percent and 23 percent of the patients. Patients with acute myocardial infarction at the worst hospitals had 7–10 percent higher odds of death compared to patients with those conditions admitted to the best hospitals. Our findings have important implications for Medicare’s forthcoming value-based purchasing program. The worst institutions in particular will have to improve on both costs and quality to avoid incurring financial penalties and exacerbating disparities in care.

Disparities In Care

By Ashish K. Jha, E. John Orav, and Arnold M. Epstein

High and rising health care costs and uneven quality are two of the biggest challenges facing the US health care system. The Affordable Care Act of 2010 is projected to provide access to health insurance to an additional thirty-two million Americans, increasing the need to identify strategies to improve efficiency while delivering high-quality care. The act authorizes the Centers for Medicare and Medicaid Services (CMS) to make higher payments to hospitals that achieve better quality performance and to cut reimbursements to hospitals that fail to improve. Hospitals that can simultaneously provide high-quality care and manage costs are likely to come out ahead. Whether hospitals will be able to achieve both goals is unclear. Our prior work suggests that for at least some conditions, hospitals that provide higher-quality care have somewhat higher costs. However, work by Dartmouth researchers, using a different approach, found that high-cost hospitals tend to provide lower-quality care. This suggests that it may be possible to reduce costs without harming patient outcomes.

Prior studies have shown that minority and poor patients are more likely to receive care at low-quality hospitals. These results have been cause for concern that performance-based payments may widen disparities in care. However, we lack comparable data on care for minorities in hospitals with lower costs per case, often consid-
Empirical data are critical to informing policy makers as they design national programs aimed at managing quality and costs of care.

Despite widespread interest in understanding high-quality, low-cost providers, we are unaware of any previous studies that examined hospitals that were simultaneously on the extremes of both quality and cost. Therefore, in this study we sought to answer several questions: What are the structural characteristics of high-quality, low-cost US hospitals—the “best” hospitals? How do these best hospitals differ from other types of hospitals, especially high-quality, high-cost or low-quality, high-cost hospitals? Are underserved patients, such as minority and poor patients, more likely to receive care at one or more of these types of hospitals? And finally, how do clinical and patient-reported outcomes vary among these groups of hospitals?

Study Data And Methods

**DATA** We used six primary sources of data to create our key variables of interest: (1) the 2007 Hospital Compare data, described in the next section; (2) the 2005 Medicare Provider Analysis and Review (MedPAR) File linked with the 2005 Medicare Beneficiary File, which together contain inpatient claims for all fee-for-service Medicare beneficiaries and demographic data on all Medicare beneficiaries; (3) the 2007 American Hospital Association annual survey of hospitals, which contains data on hospital characteristics such as size and location; (4) the 2007 Medicare Impact File, which is created by CMS and contains hospital-specific information such as cost-to-charge ratios, the Disproportionate Share Index (which measures the proportion of a hospital’s patients who have low incomes), and the ratio of interns and residents to beds; (5) the 2007 Area Resource File, which has county-level variables such as poverty rate; and (6) the 2008 Hospital Consumer Assessment of Healthcare Providers and Systems survey, developed by the Agency for Healthcare Research and Quality, which contains data on hospitals’ performance on patient experience metrics. A detailed description of all data sources, pertinent variables, and the models in which we used them appears online, in Appendix Exhibit 1.8

**IDENTIFYING ‘BEST’ AND ‘WORST’** First, we examined quality performance using data from the Medicare Hospital Compare program. Hospital Compare reports hospitals’ performance on a set of process measures for acute myocardial infarction, congestive heart failure, pneumonia, and prevention of surgical complications. An example of a process measure is giving patients aspirin when they are admitted for acute myocardial infarction. The specific process measures for each condition are listed in Appendix Exhibit 2.8

For each of the 4,488 hospitals that reported process measures to Hospital Compare, we used a standard methodology prescribed by the Joint Commission—the nonprofit organization that certifies and accredits hospitals and health care organizations—to calculate summary scores for each condition, including only those hospitals with at least thirty patients for each condition to avoid problems with low sample size.2,9 We then calculated a single overall score for hospital-level quality by combining all four summary scores. We used this overall quality score to categorize hospitals as high or low performing.

CMS will use a subset of these process measures as the basis for its calculations of hospital incentive payments in its value-based purchasing program. Prior studies have shown that performance on the individual quality measures are not always well correlated with each other.10 Therefore, in sensitivity analyses, we built condition-specific quality measures to identify high- and low-performing hospitals. For each of the analyses built on performance on an individual condition, the results were qualitatively similar to those found using the global quality measure (see Appendix Exhibit 3).9

**MEASURING RISK-ADJUSTED COST** We calculated risk-adjusted cost for each hospital by building an overall cost model. Variables in determining the risk for each hospital were derived from Medicare data, the American Hospital Association survey, the Medicare Impact File, and the Area Resource File. First, we identified the 100 most common medical and surgical conditions (based on diagnosis-related groups) for Medicare patients in the MedPAR database. These conditions represent nearly 90 percent of all care provided to Medicare beneficiaries. Next, we built a risk-adjusted, condition-specific cost for each hospital.

The predicted cost models have been described previously.2 Briefly, hospitals report, for each discharge, the charges associated with that hospitalization. We converted those charges to costs using hospital-specific charge-to-cost ratios. We then built a model with the patient as the unit of analysis that predicts the costs for each hospital for each condition, based on three factors: patient mix—to account for the fact that some hospitals care for sicker patients than others—calculated using the Elixhauser comorbidity scheme, a measurement tool for combining co-existing medical conditions based on administrative data;9 teaching status, as measured by the ratios of interns and residents to beds and the Disproportionate Share Index; and a combina-
tion of community-level factors—the Medicare Wage Index, urban versus rural location, and proportion of poverty in the community derived from the Area Resource File. Our analyses excluded the approximately 1,200 very small hospitals reimbursed by Medicare on a cost basis.

After creating risk-adjusted, condition-specific costs, we aggregated them across all of the patients admitted for the 100 most common conditions to create hospital-level risk-adjusted costs. We weighted our cost calculations for the different mix of conditions across hospitals. We did this to ensure that we did not unfairly label a hospital as high cost if it specialized in very expensive procedures or treatments, such as bone marrow transplant.

We then examined each hospital’s observed costs and created a ratio of observed to expected cost. A ratio of 1.1 would mean that a hospital’s costs were 10 percent higher than would be expected given its patient mix, teaching status, and community-level factors.

**Categorizing Hospitals by Quality and Cost** We divided hospitals into four quartiles of performance based on their quality scores and cost ratios. We designated hospitals that were in both the highest quartile of quality and the lowest quartile of risk-adjusted costs as “best,” and those in both the lowest quartile of quality and the highest quartile of costs as “worst.”

We were also interested in two other groups of hospitals: those in the highest quartiles of quality and costs (high-quality, high-cost institutions) and those in the lowest quartiles of both metrics (low-quality, low-cost hospitals). Together with the “best” and the “worst,” these were the four hospital categories in our study.

**Hospital and Patient Characteristics** We used American Hospital Association survey data to focus on a set of key characteristics: size, defined by number of beds; census region; profit status; membership in the Council of Teaching Hospitals; location—that is, urban versus rural; membership in a system; nurse staffing levels, defined by the number of full-time equivalent nurses on staff divided by the number of inpatient days; the proportion of a hospital’s patients covered by Medicare; and the presence of a cardiac intensive care unit.

Because we were interested in whether certain types of hospitals disproportionately cared for minority and poor patients, we also calculated the mean proportion of elderly patients who were black or Hispanic and the mean proportion of Medicaid patients for each of the four hospital groups.

**Mortality Rates** We used data from MedPAR and the Medicare Beneficiary File to calculate each hospital’s thirty-day risk-adjusted mortality rate for acute myocardial infarction, congestive heart failure, and pneumonia (see Appendix Exhibit 4 for details of the codes used to identify the patients with these conditions). We focused on these conditions because they are common, expensive, associated with significant morbidity and mortality, and widely used to assess outcomes in US hospitals.

We used logistic regression models to calculate the rates, accounting for clustering of patients within hospitals with the Elixhauser risk-adjustment scheme.

**Patient Experience** We used data from the Hospital Consumer Assessment of Healthcare Providers and Systems survey to assess patient experience. The survey asks each patient discharged from an acute care hospital twenty-seven questions about his or her experience in the hospital, including two focused on overall experience: how the patient would rate the overall experience on a scale of 0 to 10, with 0 being the worst and 10 being the best; and whether he or she would recommend the hospital to family and friends.

**Limitations** There are limitations to our work. First, we defined high- and low-quality hospitals based on their performance on process measures. Although these measures are evidence-based and widely used, they represent only a small proportion of the care provided in a hospital.

Additionally, our method for calculating a summary score differs somewhat from the subset of these measures that CMS will use under value-based purchasing. However, we believe that our summary measures provide an important gauge of how well a hospital is functioning and its ability to provide evidence-based care.

Our measures of cost have limitations because they rely on unaudited data reported by hospitals to Medicare. Furthermore, our cost estimates may be less precise for small hospitals because of their smaller sample size.

Finally, our findings indicate associations and not necessarily causes. It may be tempting to conclude, for example, that caring for more poor patients leads some hospitals to be less efficient, charging more per case. However, it is also possible that hospitals that care for poor patients have been less focused on providing efficient, low-cost care.

**Analysis** We began by examining key characteristics of the hospitals in the four groups (best; worst; high-quality, high-cost; and low-quality, low-cost). We used standard statistical tests to compare whether the mean proportion of Medicaid patients or mean proportion of elderly black or Hispanic patients for each hospital cat-
category varied across the four groups. Although we examined data on Hispanic patients, our primary focus was on elderly black and Medicaid patients. Medicare data on Hispanics are generally less reliable, because studies suggest that nearly half of all Hispanics are classified as white.14

We used box plots to examine the range of proportions of elderly black and Medicaid patients across the hospitals (Appendix Exhibits 5 and 6) and to examine the range of quality scores in each group (Appendix Exhibit 7).8

We examined thirty-day risk-adjusted mortality rates across the hospital groups using standard statistical tests, including analyses of variance and multivariable linear regression models that adjusted for the key hospital characteristics described above. We focused on mortality, to determine whether patients who went to the best or worst hospitals had better or worse outcomes than those going to other hospitals.

Finally, we examined performance on the Hospital Consumer Assessment of Healthcare Providers and Systems survey across the four groups of hospitals using analyses of variance. We again built multivariable models to adjust for the same list of potential confounders described above, including hospital size, regional location, ownership, teaching status, and location (urban versus rural). Because the results from the multivariable models were nearly identical to those from the univariate analysis, we show only the univariate results here.

We chose to present those results because they are more consistent with the approach that CMS will use in its value-based purchasing program to

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**EXHIBIT 1**

Characteristics Of US Hospitals, Grouped By Quality And Cost Quartile

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Quartile</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>High quality, low cost, or “best” (n = 122)</td>
<td>High quality, high cost (n = 139)</td>
<td>Low quality, low cost (n = 132)</td>
<td>Low quality, high cost, or “worst” (n = 178)</td>
<td></td>
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<tr>
<td>Number of hospitalizations</td>
<td>328,989</td>
<td>356,926</td>
<td>209,013</td>
<td>255,797</td>
<td>—</td>
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<tr>
<td><strong>SIZE (NUMBER OF BEDS)</strong></td>
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<tr>
<td>Small (6–99)</td>
<td>15%</td>
<td>17%</td>
<td>27%</td>
<td>22%</td>
<td>&lt; 0.01</td>
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<tr>
<td>Medium (100–399)</td>
<td>74</td>
<td>63</td>
<td>66</td>
<td>69</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Large (400 or more)</td>
<td>11</td>
<td>21</td>
<td>7</td>
<td>8</td>
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<tr>
<td><strong>REGION</strong></td>
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<tr>
<td>Northeast</td>
<td>30%</td>
<td>17%</td>
<td>23%</td>
<td>11%</td>
<td>&lt; 0.001</td>
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<tr>
<td>Midwest</td>
<td>25</td>
<td>39</td>
<td>5</td>
<td>12</td>
<td></td>
<td></td>
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<tr>
<td>South</td>
<td>30</td>
<td>35</td>
<td>49</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>West</td>
<td>15</td>
<td>9</td>
<td>22</td>
<td>32</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td><strong>PROFIT STATUS</strong></td>
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<td></td>
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<tr>
<td>For-profit</td>
<td>14%</td>
<td>9%</td>
<td>23%</td>
<td>19%</td>
<td>&lt; 0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private nonprofit</td>
<td>82</td>
<td>81</td>
<td>55</td>
<td>56</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Public</td>
<td>4</td>
<td>11</td>
<td>22</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>OTHER</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching hospital</td>
<td>8%</td>
<td>14%</td>
<td>3%</td>
<td>10%</td>
<td>&lt; 0.01</td>
<td></td>
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</tr>
<tr>
<td>Urban location</td>
<td>98%</td>
<td>100%</td>
<td>90%</td>
<td>96%</td>
<td>&lt; 0.001</td>
<td></td>
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<tr>
<td>Has medical ICU</td>
<td>87%</td>
<td>86%</td>
<td>67%</td>
<td>85%</td>
<td>&lt; 0.001</td>
<td></td>
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<tr>
<td>Has cardiac ICU</td>
<td>49%</td>
<td>54%</td>
<td>23%</td>
<td>37%</td>
<td>&lt; 0.001</td>
<td></td>
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<td></td>
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<tr>
<td>Proportion of Medicare patients</td>
<td>46%</td>
<td>43%</td>
<td>47%</td>
<td>41%</td>
<td>&lt; 0.001</td>
<td></td>
<td></td>
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<tr>
<td>Proportion of Hispanic patients</td>
<td>1.1%</td>
<td>2.0%</td>
<td>2.4%</td>
<td>3.8%</td>
<td>0.001</td>
<td></td>
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</tr>
<tr>
<td>Nurse staffing level (mean)</td>
<td>6.2</td>
<td>7.2</td>
<td>5.4</td>
<td>5.9</td>
<td>&lt; 0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composite quality score (mean)</td>
<td>92</td>
<td>92</td>
<td>75</td>
<td>76</td>
<td>&lt; 0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk-adjusted cost ratio</td>
<td>0.8</td>
<td>1.2</td>
<td>0.8</td>
<td>1.2</td>
<td>&lt; 0.001</td>
<td></td>
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</tbody>
</table>

**SOURCE** Authors’ analysis of 2007 data from the Hospital Compare database, American Hospital Association annual survey, Medicare Impact File, and Area Resource File; and 2005 data from the Medicare Provider Analysis and Review (MedPAR) database. Notes: High quality is defined as the top quartile of quality performance on Hospital Compare process measures. High cost is defined as the top quartile of cost based on MedPAR data. Nurse staffing level is the number of full-time-equivalent nurses on staff divided by 1,000 inpatient days. Percentages may not sum to 100 because of rounding. ICU is intensive care unit.
which are generally not adjusted for hospital characteristics. The rates adjusted for hospital characteristics are presented in Appendix Exhibit 8.4.

Study Results

Enough data for us to create both cost and quality metrics were available for 3,229 hospitals. Of these, 122 were “best” hospitals—in the highest quartile of quality performance and the lowest quartile of risk-adjusted costs. There were 178 “worst” hospitals—in the lowest quartile of quality and the highest quartile of costs.

Compared with the worst hospitals, the best hospitals were less likely to be small or located in the South, and more likely to be located in the Northeast (Exhibit 1). The best hospitals were more likely to be nonprofit and to have a cardiac intensive care unit than the worst hospitals. And the best hospitals had a higher mean proportion of Medicare patients and a smaller mean proportion of elderly Hispanic patients than the worst hospitals.

We also found that the high-cost, high-quality hospitals were significantly more likely than any of the other three groups to be major teaching hospitals, be in urban areas, have cardiac intensive care units, and have higher nurse-to-patient ratios (Exhibit 1).

When we examined the patient population treated at these groups of hospitals, we found large differences. Only 6.8 percent of the patients discharged from the best hospitals, but nearly 15 percent of the patients discharged from the worst hospitals, were elderly black people (Exhibit 2). We found similar patterns for Medicaid patients, with the lowest percentage in the best hospitals and the highest percentage in the worst hospitals (Exhibit 3).

Patients with acute myocardial infarction or pneumonia who were admitted to low-cost, low-quality hospitals had 12–19 percent higher odds of death—and patients at the worst hospitals had 7–10 percent higher odds—compared to patients with those conditions admitted to the best hospitals (Exhibit 4). We found no meaningful difference in outcomes at the worst compared to the best hospitals among patients admitted with congestive heart failure. The results across all three conditions were similar after adjustment for hospital characteristics.

Patient experience varied widely based on the type of hospital. Patients discharged from the best hospitals were more likely to rate the hospital highly—9 or 10 on a 0–10 scale—and to “definitely” recommend the hospital than patients discharged from the worst hospitals (Exhibit 5). However, patients discharged from
Discussion

We identified US hospitals that were simultaneously high quality and low cost, as well as those that performed poorly on both measures and those that did well on just one of them. We found that the worst hospitals were far more likely than institutions in the other three groups to be small or public hospitals located in the South. We also found that the worst hospitals generally had a much higher proportion of both elderly black and Medicaid patients (Exhibits 2 and 3). These hospitals also had higher mortality rates for acute myocardial infarction and pneumonia (Exhibit 4). However, the high-cost, high-quality hospitals also had higher mortality rates for these conditions.

Several studies have shown that hospitals with a higher proportion of minority patients have somewhat lower performance on quality metrics.4,5 However, we are unaware of prior work that has directly examined how hospitals that manage both costs and quality effectively differ from others. The fact that the worst hospitals have more than twice the proportion of elderly black and Medicaid patients than the best hospitals (Exhibit 2) is both startling and previously unknown. Even among low-quality hospitals, those that are high cost have much higher rates of elderly black patients than those that are low cost.

Policy Implications

Our findings have important implications for the national value-based purchasing program, which CMS has recently finalized to alter the way it pays hospitals—implications that are particularly pertinent to potential disparities in care. The factors that the program currently uses focus primarily on quality. Yet Congress has asked CMS to pay closer attention to “efficiency” (often a way of describing costs per case) in its payment scheme, and we suspect that it will become a key part of future payment changes. Even if efficiency measures are not part of the system, reduced future payments to hospitals will necessitate a greater focus on efficiency. Many private payers are using both efficiency (costs) and quality metrics for “tiering,” in which they adjust copayments to steer patients away from high-cost, low-quality hospitals.

The institutions that perform worse on both quality and cost metrics care for greater numbers of elderly black and Medicaid patients, and they would probably have to improve on both of these metrics to achieve parity with other hospitals and avoid financial penalties. In the Premier Hospital Quality Demonstration—the largest na-
Disparities in Care

It is unclear why some hospitals are able to provide high-quality care at comparatively low cost, while other hospitals struggle to do so. It is tempting to assume that high-cost, low-quality hospitals are mismanaged, and this may be true. Whether having a greater proportion of minority and Medicaid patients puts these hospitals at a disadvantage is unclear. Caring for these populations may be expensive. In fact, this theory underlies the disproportionate-share hospital program run by CMS, which provides extra payments for hospitals that care for the poor. Our analyses of hospital costs controlled for disproportionate-share status. However, other related, unmeasured factors may account for the higher costs of care seen in the hospitals with a higher proportion of minority and poor patients. Either way, ensuring that these hospitals provide high-quality care is critical if we are to make major headway on reducing disparities.

Patient experience is a key component of patient-centered health care. We found that high-cost, high-quality hospitals had the best patient experiences, while low-cost, high-quality hospitals fared immediately and low-quality hospitals (irrespective of cost) fared poorly on this metric. This suggests that both costs and quality are related to how patients experience hospital care. In addition, high-quality, high-cost hospitals had much higher nurse-staffing levels. This factor may account for the difference: Prior work has found that higher nurse-staffing levels are correlated with better experience. It is also possible that nurse-staffing levels are simply an indication that a hospital is more committed to optimizing patient experience.

Prior studies have tried to clarify how costs and quality relate to each other. There is strong policy interest in determining how some hospitals manage to be both high quality and low cost. However, the evidence to date on how to achieve both of these goals is primarily anecdotal and needs to be tested more broadly. As hospital payments are reduced over time, becoming more efficient while maintaining quality will become even more important. Whether poor-performing hospitals will lose part of their reimbursement—possibly even going out of business as a result—or institute new and effective quality improvement efforts is unclear. As noted above, one recent study found that hospitals with a high proportion of poor patients fared well under pay-for-performance. Whether these findings will hold up nationally as CMS transitions to value-based purchasing is unknown.

The 1 percent of Medicare reimbursement at risk through the value-based purchasing program may appear modest. However, given that many hospitals are running at zero or even negative margins, even losing a portion of that 1 percent may put some hospitals at risk of financial failure. Given that low-quality hospitals often have lower margins than average, the impact on them could be particularly striking.

**Conclusion**

As the United States embarks on efforts to improve hospital care using value-based purchasing principles, we will need to help hospitals improve quality and efficiency simultaneously and to monitor the results of their efforts, so that we do not inadvertently worsen disparities in care.

The project was funded by the Commonwealth Fund.

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**NOTES**

8. To access the Appendix, click on the Appendix link in the box to the right of the article online.
11. Healthcare Cost and Utilization Project. Comorbidity software,

Werner RM, Bradlow ET. Relationship between Medicare’s Hospital Compare performance measures and mortality rates. JAMA. 2006; 296(22):2694–702.


ABOUT THE AUTHORS: ASHISH K. JHA, E. JOHN ORAV & ARNOLD M. EPSTEIN

In this month’s Health Affairs, Ashish Jha and coauthors report on their study analyzing hospital quality, costs, population and treatment disparities, and patients’ experiences of care.

Among other findings, they discovered that the nation’s “worst” hospitals—where quality is low and costs high, and which are typically small public or for-profit institutions in the South—care for double the proportion of elderly black patients as the “best” hospitals—where quality is high and costs low, typically nonprofit institutions in the Northeast.

They discuss the implications for Medicare’s value-based purchasing program, noting that the “worst” institutions in particular will have to improve on both costs and quality to avoid incurring financial penalties and exacerbating disparities in care.

Jha is an associate professor of health policy at the Harvard School of Public Health. His research focuses on such topics as quality improvement programs, patient safety, and patients’ experiences in hospitals that care mostly for blacks and Hispanics.

Jha holds a medical degree from Harvard Medical School and a master of public health degree from the Harvard School of Public Health.

E. John Orav is an associate professor of medicine at Harvard Medical School and a biostatistician at Brigham and Women’s Hospital. He specializes in working with physicians to provide biostatistics for quality improvement, patient safety, and medication safety research projects. He has a doctorate in statistics from Stanford University.

Arnold Epstein chairs the Department of Health Policy and Management at the Harvard School of Public Health. His research focuses on such topics as using large Medicare claims databases to understand the implications of patterns of care, the measurement of costs, and the quality of care. He has a medical degree from Duke University and a master’s degree in government from Harvard University.