Concentration and Quality of Hospitals That Care for Elderly Black Patients

Ashish K. Jha, MD, MPH; E. John Orav, PhD; Zhonghe Li, MA; Arnold M. Epstein, MD, MA

Background: The reasons for racial differences in health care are not well known, but the characteristics of hospitals where people receive care may be an important factor in the quality of care that patients receive. Therefore, we sought to determine the proportion and volume of elderly black vs white patients treated at hospitals and examine the characteristics and performances of hospitals that care for disproportionately high volumes of black patients.

Methods: We used 2004 Medicare data to calculate, for each hospital in our study, the volume and proportion of black patients discharged. We then examined the hospitals’ structural characteristics and performances according to quality measures for patients with acute myocardial infarction, congestive heart failure, and pneumonia.

Results: The 5% of hospitals with the highest volume of black patients cared for nearly half of all elderly black patients, and the hospitals in the top quartile by volume of patients cared for nearly 90% of elderly black patients. Hospitals with a high volume of black patients were larger and were more often teaching hospitals located in the southern United States (P<.001 for each comparison) than those with a low volume of black patients. Hospitals with a high proportion of black patients had comparable characteristics. After adjusting for hospital characteristics, hospitals that treated a high vs low volume of black patients had worse performance summary scores for acute myocardial infarction (89.0 vs 90.7; P=.002) and pneumonia measures (76.9 vs 79.4; P<.001). Adjusting for hospital referral region eliminated the gap in performance scores for acute myocardial infarction but not for pneumonia. There were comparable differences in performance scores for hospitals that treated a high vs low proportion of black patients.

Conclusions: Hospital care for black patients in the United States is remarkably concentrated in a small percentage of hospitals, although the hospitals that care for a high proportion of black patients have only marginally worse quality of care than those that care for a low proportion of black patients. The level of concentration of black patients provides a fresh opportunity to improve care for black patients by targeting efforts toward a small group of hospitals.

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to identify which hospitals provide the bulk of care to elderly black patients and then assessed whether they differ from other American hospitals.

**METHODS**

**DATA**

We used the Medicare Part A “100% files” from 2004, which have data on all discharged Medicare beneficiaries enrolled in fee-for-service health care plans during that year, to calculate the volume and proportion of elderly black patients discharged from each hospital. These data include patient-level characteristics such as race and diagnosis codes. We used hospital quality data from the public release of the HQA (released on September 1, 2005, and October 1, 2006). These data report performance scores for acute care provided by hospitals during calendar years 2004 and 2005. Hospitals that do not report to the HQA are typically small or specialty hospitals that care for a very small number of patients with common medical conditions. Although the HQA now provides data on 20 process measures, we limited our analyses to the 10 measures known as the “starter set” because the Medicare Modernization Act of 2003 currently provides financial incentives for reporting only these measures. Therefore, although most hospitals report data on these 10 measures, a smaller number of hospitals also report data on the other 10. Hospitals undergo an extensive auditing program to ensure the accuracy of their self-reported data. Finally, we linked both sets of data to the American Hospital Association database, which has information on hospitals’ profit status, bed size, geographic location (region and urban vs rural setting), membership in the Council of Teaching Hospitals, percentage of Medicare and Medicaid recipients, nursing to census ratio (calculated by dividing the number of nurses on staff by 100 patient-days), and the presence of an intensive care unit.

**CATEGORIZING HOSPITALS**

Because our primary interest was in examining hospitals that have the largest impact on the health care of black patients, we first ranked each hospital by the volume of discharged black patients. We then chose 2 cutoff points. We identified hospitals in the top quartile of volume according to volume of black patients and identified an extreme subset containing the top 5% of volume of black patients. We defined the top 5% of hospitals as having a high volume and proportion of black patients. We then chose 2 cutoff points. We identified hospitals that care for the largest volume of black patients, and ranked them by their score on the HQA measures. The second set of models was adjusted for differences in hospital characteristics, including bed size, profit status, membership (public vs private), location (urban vs rural), teaching status (member of the Council of Teaching Hospital vs not a member), the presence or absence of a medical intensive care unit, the presence or absence of a cardiac intensive care unit, the percentage of patients who had Medicare insurance, and the percentage of patients who had Medicaid insurance. Finally, in our third set of models, we adjusted for each covariate in the second set of models as well as for hospital referral region (health care markets based on travel for tertiary care and previously described by the Dartmouth Atlas Project). Given that the population of black Americans is concentrated in certain geographic regions, the addition of hospital referral regions to the models adjusts for potential geographic differences in care.

By studying the 3 stages of the model, we hoped to determine whether quality deficits were present in hospitals that served a high volume of black patients (stage 1), whether specific hospital characteristics accounted for these deficits (stage 2), or whether quality deficits were simply endemic to certain geographic regions (stage 3). We alternatively specified volume (or proportion) as a categorical variable and a continuous variable in these analyses. Our results for volume and proportion were very similar.

To better understand the range of performance of the few hospitals that care for the largest volume of black patients, we performed subgroup analyses. We identified the 86 hospitals that had both a high proportion and a high volume of black patients and ranked them by their score on the HQA measures. We also examined hospital characteristics that might predict a higher performance among hospitals with a high volume of black patients by using multivariable models and tested whether the association differed by category of volume of black patients by using interaction terms.

Finally, we simulated the potential impact of improving the rates of 1 of the quality measures, ACE-inhibiting drug or ARB use in patients with AMI who also have left ventricular systolic dysfunction, among the poorly performing hospitals that treated a high volume of black patients. We examined the number of patients that would be affected and the potential number of lives that could be saved by improving care for this 1 measure in the 10% of hospitals (n=22) with a high volume of black patients that had the worst performance.

All analyses were conducted using SAS statistical software (version 9.1; SAS Inc, Cary, NC). The study was approved by the Joint Commission on the Accreditation of Healthcare Organizations. This approach suggests that the summary score should simply be the number of times a hospital performed the appropriate action across all measures for that condition divided by the number of opportunities the hospital had to provide appropriate care for that condition. Composite scores were calculated only if a hospital had at least 30 patients for at least 1 of the measures of each condition.

**STATISTICAL ANALYSES**

We used analysis of variance and χ² tests, as appropriate, to compare the characteristics of hospitals according to the volume and proportion of their black patients. We next created regression models using HQA summary scores as the outcome and the volume (or proportion) of black patients as the primary predictor. Our outcome variable, the HQA summary score, was weighted by the hospital’s sample size. The first set of models consisted of simple bivariate analyses that examined the unadjusted relationship between the volume of black patients and performance on HQA measures. The second set of models was adjusted for differences in hospital characteristics, including bed size, profit status, ownership (public vs private), location (urban vs rural), teaching status (member of the Council of Teaching Hospital vs not a member), the presence or absence of a medical intensive care unit, the presence or absence of a cardiac intensive care unit, the percentage of patients who had Medicare insurance, and the percentage of patients who had Medicaid insurance. Finally, in our third set of models, we adjusted for each covariate in the second set of models as well as for hospital referral region (health care markets based on travel for tertiary care and previously described by the Dartmouth Atlas Project). Given that the population of black Americans is concentrated in certain geographic regions, the addition of hospital referral regions to the models adjusts for potential geographic differences in care.

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RESULTS

In 2004, there were 4455 hospitals in the United States that provided medical or surgical care for Medicare patients. Of these, the subset of 222 hospitals (which is the 5% of all hospitals that we designated as high volume) cared for nearly 44% of all elderly black patients (Table 1). An additional 892 medium volume hospitals (20%) cared for an additional 44% of elderly black patients. Thus, the top quartile of hospitals with the largest volume of black patients provided care for nearly 90% of all elderly black patients. Similarly, the top 5% of hospitals with the highest proportion of black patients cared for approximately 23% of elderly black patients, and the top quartile of hospitals with the highest proportion of black patients cared for nearly 78% of all black patients (data are available from the authors). For comparison, we examined the concentration of white patients. The top 5% of hospitals with a high volume of white patients cared for 23% of white patients, and the top 5% of hospitals with a high population of white patients cared for 0.7% of white patients.

There was moderate overlap in the hospitals that were designated as high volume and those designated as high proportion. Approximately one third of high volume hospitals were also designated as high proportion, and nearly all were designated as at least medium proportion hospitals (Table 2). The \( \kappa \) statistic for agreement between the designations by volume vs proportion was 0.55 (\( P<.001 \)).

HOSPITAL CHARACTERISTICS

Hospitals that treated high and low volumes of black patients had substantially different characteristics (Table 3). Those that treated high volumes were more likely to be large, located in the South, urban, and members of the Council of Teaching Hospitals than those that treated low volumes. The former were less likely to be for-profit and cared for fewer Medicare patients and more Medicaid patients than the latter. Finally, hospitals that treated a high volume of black patients had a substantially lower nursing staff to patient census ratio (5.2:6.4; \( P<.001 \)) compared with those that treated low volumes of black patients. The differences in hospital characteristics between these 2 types of hospitals were qualitatively similar (data not shown).

QUALITY OF CARE

Of the 3711 hospitals for which we had HQA data, we were able to calculate AMI summary scores for 2761 hospitals, CHF summary scores for 3392 hospitals, and pneumonia summary scores for 3513 hospitals. Hospitals not reporting to HQA or those with numbers too inadequate to calculate a summary score were generally small rural hospitals. The hospitals reporting data that were adequate to allow for the calculation of a summary score cared for more than 96% of Medicare enrollees with these 3 conditions.

Hospitals with a high volume of black patients had a slightly lower performance on AMI quality measures and a modestly lower performance on pneumonia quality measures than hospitals with a low volume of black patients (Table 4). For example, after adjusting for hospital characteristics, hospitals with a high volume of black patients had lower AMI scores vs those with a low volume (89.0 vs 90.7; \( P=.002 \)). This effect disappeared after adjusting for the hospital referral region, which suggests that the small differences in care between these sets of hospitals were due to hospitals with a high volume of black patients being situated in geographical areas with generally lower quality of care. We found no evidence that hospitals with a high volume of black patients have worse performance on CHF measures (Table 4).

High volumes of black patients were strongly associated with lower pneumonia scores in each of the models we examined. Hospitals with a high vs low volume of black patients had substantially lower pneumonia performance in unadjusted analyses (76.1 vs 81.0; \( P<.001 \)), which persisted after adjusting for hospital characteristics (76.9 vs 79.4; \( P<.001 \)) as well as for hospital referral region (76.6 vs 79.8; \( P<.001 \) (Table 4). When we examined volume as a continuous variable, we found that a high volume of black patients was associated with worse care for AMI and pneumonia but not for CHF.

The analysis of differences in quality of care between hospitals with high vs low proportions of black patients was qualitatively similar for all 3 conditions (data not shown).

We examined the range of performance for hospitals classified as both high proportion and high volume and found substantial variation (Table 5). This small number of hospitals (86) cared for nearly 20% of black patients, and their performance summary scores for AMI ranged from nearly perfect (98.2; Sentara Caraplex Hospital, Hampton, Va) to substantially below the national...
We found a remarkable degree of concentration in where elderly black patients receive hospital care: just 5% of hospitals cared for nearly 45% of all black patients, and 23% of hospitals cared for nearly 90% of elderly black patients. Our examination of different metrics (volume or proportion of black patients) identified different sets of hospitals, although hospitals with either a high volume or a high proportion of black patients were more often large urban teaching hospitals. These hospitals often provided slightly worse care for AMI and modestly worse care for pneumonia.

Complex factors affect the quality of hospital care for black patients. We found that the differences in cardiac care were small and that location accounted for nearly the entire gap in performance for treatment of AMI between hospitals that cared for large volumes of black patients and those that did not. These findings suggest that hospitals with a high volume or proportion of black patients are likely to be located in regions that have pervasively poorer quality AMI care. For the pneumonia measures, the differences were larger and independent of region or commonly measured hospital factors. Our findings suggest that the disparities are much more likely to be found at the individual hospital level.

Our study is consistent with previous work that suggests black and white patients might receive care in different settings. Kahn and et al examined a small sample of hospitals and also found that black patients were more likely to receive care in urban teaching hospitals than white patients. Furthermore, they found that urban teaching hospitals, which cared for most black patients in the 5 states they examined, provided a higher quality of care. More recently, Lucas et al found that hospitals with a high proportion of black patients had higher overall sur-

### Table 2. Distribution of Hospitals by Proportion vs Volume of Black Patients Discharged

<table>
<thead>
<tr>
<th>Proportion of Black Patients Discharged</th>
<th>Volume of Black Patients Discharged, No.*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High (n = 222)</td>
</tr>
<tr>
<td>High</td>
<td>78</td>
</tr>
<tr>
<td>Medium</td>
<td>138</td>
</tr>
<tr>
<td>Low</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>222</td>
</tr>
</tbody>
</table>

*High refers to the 5% of hospitals with the largest proportion or volume of black patients discharged; medium, to rest of the top quartile of hospitals with the largest proportion or volume of black patients discharged; and low, to the second to fourth quartiles of hospitals with the largest proportion or volume of black patients discharged.

### Table 3. Characteristics of Hospitals by Volume of Black Patients Discharged

<table>
<thead>
<tr>
<th>Hospital Characteristic</th>
<th>Volume of Black Patients Discharged†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High (n = 222)</td>
</tr>
<tr>
<td>Bed size</td>
<td></td>
</tr>
<tr>
<td>&lt;100</td>
<td>0</td>
</tr>
<tr>
<td>100-400</td>
<td>92 (41.4)</td>
</tr>
<tr>
<td>&gt;400</td>
<td>130 (58.6)</td>
</tr>
<tr>
<td>Region</td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>5 (2.3)</td>
</tr>
<tr>
<td>Midwest</td>
<td>50 (22.5)</td>
</tr>
<tr>
<td>South</td>
<td>133 (59.9)</td>
</tr>
<tr>
<td>Northeast</td>
<td>34 (15.3)</td>
</tr>
<tr>
<td>Ownership</td>
<td></td>
</tr>
<tr>
<td>For-profit</td>
<td>21 (9.5)</td>
</tr>
<tr>
<td>Private not-for-profit</td>
<td>170 (76.6)</td>
</tr>
<tr>
<td>Public not-for-profit</td>
<td>31 (14.0)</td>
</tr>
<tr>
<td>Urban</td>
<td>210 (94.6)</td>
</tr>
<tr>
<td>Teaching status</td>
<td>94 (42.3)</td>
</tr>
<tr>
<td>Presence of cardiac ICU</td>
<td>178 (80.2)</td>
</tr>
<tr>
<td>Presence of medical ICU</td>
<td>212 (95.5)</td>
</tr>
<tr>
<td>Revenue source, mean (SD), %</td>
<td></td>
</tr>
<tr>
<td>Medicare</td>
<td>39.8 (10.9)</td>
</tr>
<tr>
<td>Medicaid</td>
<td>21.6 (11.7)</td>
</tr>
<tr>
<td>Nursing: census ratio, mean (SD)†</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.2 (1.5)</td>
</tr>
</tbody>
</table>

Abbreviation: ICU, intensive care unit.
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Average (69.8; South Shore Hospital, Chicago, Ill). The range was comparable for summary scores for CHF and pneumonia care.

Among hospitals with high volumes of black patients, we found that only teaching status predicted higher performance on AMI and CHF measures; teaching status was not associated with higher performance in pneumonia treatment. This relationship did not vary by category of volume of black patients (P > .10 for each condition).

Finally, we simulated the potential impact of improving care among the 10% of hospitals with a high volume of black patients and with the poorest performance summary score for the use of ACE-inhibiting drugs or ARB among patients with AMI. We found that these 22 hospitals successfully provided this therapy to 58.4% of eligible patients. Improving this rate to 95.8% (ie, achievement by the top 10% of hospitals with a high volume of black patients) would affect over 4% of all elderly black patients admitted for treatment of an AMI in the United States in 2004 and reduce their 30-day mortality rates by 7% to 20%.9

**COMMENT**

We found a remarkable degree of concentration in where elderly black patients receive hospital care: just 5% of hospitals cared for nearly 45% of all black patients, and 23% of hospitals cared for nearly 90% of elderly black patients. Our examination of different metrics (volume or proportion of black patients) identified different sets of hospitals, although hospitals with either a high volume or a high proportion of black patients were more often large urban teaching hospitals. These hospitals often provided slightly worse care for AMI and modestly worse care for pneumonia.

Complex factors affect the quality of hospital care for black patients. We found that the differences in cardiac care were small and that location accounted for nearly the entire gap in performance for treatment of AMI between hospitals that cared for large volumes of black patients and those that did not. These findings suggest that hospitals with a high volume or proportion of black patients are likely to be located in regions that have pervasively poorer quality AMI care. For the pneumonia measures, the differences were larger and independent of region or commonly measured hospital factors. Our findings suggest that the disparities are much more likely to be found at the individual hospital level.

Our study is consistent with previous work that suggests black and white patients might receive care in different settings. Kahn and et al examined a small sample of hospitals and also found that black patients were more likely to receive care in urban teaching hospitals than white patients. Furthermore, they found that urban teaching hospitals, which cared for most black patients in the 5 states they examined, provided a higher quality of care. More recently, Lucas et al found that hospitals with a high proportion of black patients had higher overall sur-
pical mortality rates, and this largely explained higher surgical mortality rates for black patients. Skinner et al\(^1\) found that higher mortality rates for black patients admitted with AMI was due in large part to the fact that hospitals with a high proportion of black patients have higher overall mortality rates from AMI. Bradley et al\(^1\) found that disparities in thrombolytic therapy and angioplasty between black vs white patients were attributable in large part to where patients received their care.

Barnato et al\(^1\) studied data from the mid 1990s and found a notable level of racial concentration in AMI care but few racial differences in medical treatment. Our study adds to these findings by examining a larger set of hospitals, using recent data, and demonstrating relatively minor differences in quality of care for AMI and CHF between hospitals that have a large volume of black patients vs those that have a large volume of white patients. We found modest differences in pneumonia care.

The level of concentration of hospital care provides an opportunity for addressing disparities in care. The volume and proportion of black patients can each be more appropriate concentration measure depending on the circumstances. The proportion of black patients may be particularly important in understanding how well a hospital provides patient-centered, culturally sensitive care. If the goal is to target quality improvement effort in a small group of hospitals where the impact on disparities can be the greatest, targeting the hospitals with a high volume of black patients may be most efficient. Because our focus was on the clinical quality of care, we chose volume as our primary measure. We found that the 2% of hospitals with the highest volume of black patients (89 institutions) cared for nearly 25% of elderly black patients.

The differences in the quality of care between hospitals that serve primarily black vs white patients were small and of marginal clinical significance, especially for sum-
mary scores for AMI and CHF. Given the modest relationship between these quality measures and clinical outcomes, small differences in these quality measures are unlikely to lead to important differences in clinical outcomes between hospitals with a high volume of black patients vs those with a low volume. In fact, the recent analysis by Bradley et al.\(^\text{12}\) found that hospitals in the top quintile of performance on AMI measures had only marginally better mortality rates than hospitals in the bottom quintile.

Hospitals that cared for large volumes of black patients did seem to be worse at providing pneumonia care. When we examined each of the individual measures that comprise the pneumonia summary score (initial timing of antibiotic drug treatment, pneumococcal vaccination, and oxygenation assessment), we found that hospitals with a high volume of black patients had worse summary scores in each of the 3 measures. However, even these differences were only modest in size. The reasons why hospitals with a high volume of black patients have worse performances on these measures is not clear. It might be that these measures are considered more discretionary, because none of them have been validated in randomized controlled trials and therefore are likely to have the least consensus behind them.\(^\text{17,18}\)

There are limitations to our study. First, we examined concentration only among elderly black patients, and although they represent an important and growing population, we could not adequately examine the concentration of care among nonelderly black patients. We used HQA data to examine the quality of care in these hospitals. These measures reflect care for only 3 conditions, and although these conditions are common and represent over 15% of all admissions for elderly patients, our study could not examine the quality of care provided by hospitals for other clinical conditions. We could examine quality scores only among the subset of hospitals that reported data with numbers that were adequate to create summary scores. Therefore, our findings should not be generalized to all US hospitals. Next, we analyzed only performance on the HQA program's starter set of measures because there is nearly universal reporting of performance for these measures. A small number of hospitals are voluntarily reporting their performance on the other measures. Furthermore, these starter set of measures vary in terms of clinical significance and the evidence that underlies their use. Although we chose to give each measure equal weight in our composite measure, it might be reasonable to focus on some measures more than others. We did not have patient-level data on quality measures and therefore could not examine whether there were important differences in the quality of care for black vs white patients within hospitals. Thus, although we may observe only modest differences in quality across hospitals that treat high vs low volumes of black patients, there may be more significant differences in quality of care received by black vs white patients within a particular hospital. Finally, we examined the process measures, which do not reflect clinical outcomes within these hospitals, although they are widely used measures of quality.

In summary, we examined the level of racial concentration of hospital care in the United States and found that a small number of hospitals care for a vast majority of black patients. These hospitals differ in their characteristics from those of other hospitals, and they often provide lower quality of care, especially for patients admitted with pneumonia. The variation in performance among hospitals that care for high volumes of black patients represents a critical opportunity: targeting quality improvement efforts to these hospitals can improve the care of all Americans who receive care in these hospitals and have a disproportionate impact on the health of black patients.

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Financial Disclosure: None reported.

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REFERENCES

10. Baicker K, Chandra A, Skinner JS, Wennberg JE. Who you are and where you receive care in these hospitals and have a disproportionate impact on the health of black patients.

**Correction**

Error in Acknowledgments. In the Original Investigation by Jha et al titled “Concentration and Quality of Hospitals That Care for Elderly Black Patients,” published in the June 11, 2007, issue of the Archives (2007;167[11]:1177-1182), the Funding/Support information paragraph in the acknowledgments section was missing and should have read as follows: “Funding/Support: This study was supported by the Robert Wood Johnson Foundation, Princeton, New Jersey.” The online version of this article was corrected on June 11, 2007.