Outcomes for Whites and Blacks at Hospitals That Disproportionately Care for Black Medicare Beneficiaries

Lenny López and Ashish K. Jha

Objective. Hospital care for blacks is concentrated among a small number of hospitals and whether they have worse outcomes across common medical conditions is unknown.

Data Source. We used the 2007 100% Medicare file to calculate 30- and 90-day mortality rates for white and black patients admitted for acute myocardial infarction (AMI), congestive heart failure (CHF), or pneumonia.

Study Design. We ranked all hospitals in the country by their proportion of discharged black patients and identified the top 10 percent of these hospitals as black serving. We examined race-specific adjusted mortality rates and adjusted for differences in hospital characteristics.

Principal Findings. At 30 days, black-serving hospitals had, compared with nonblack-serving hospitals, similar mortality for AMI, lower mortality for CHF, and higher mortality for pneumonia. At 90 days, mortality was higher at black-serving hospitals for both AMI and pneumonia and comparable for CHF compared with non-black-serving hospitals. White patients had worse outcomes at black-serving hospitals for two conditions at 30 days and all three conditions at 90 days. Blacks also had worse outcomes at black-serving hospitals.

Conclusions. Hospitals with a high proportion of black patients had worse outcomes than other hospitals for both their white and black elderly patients.

Key Words. Black-serving hospitals, mortality, disparities

Racial and ethnic disparities in care are well known, although the reasons underlying them are still not well understood (Smedley, Stith, and Nelson 2002). Prior studies have found that care for minorities is highly concentrated, with a large proportion of minority patients receiving care from a small number of providers who generally provide a somewhat lower quality of care, at least as measured by process indicators (Bach et al. 2004; Baicker

et al. 2004; Hasnain-Wynia et al. 2007; Jha et al. 2007a, b; Jha et al. 2008). In addition, prior research has focused on mortality for a single disease process using older Medicare data. Whether these hospitals have worse outcomes across multiple medical conditions, at least as measured by mortality rates, is not fully known. Finally, the heterogeneity in hospital characteristics of hospitals that care for a disproportionate number of blacks has not been fully explored.

Understanding outcomes at hospitals that disproportionately care for minorities is important, especially in light of the national Value-Based Purchasing (VBP) effort by the Centers for Medicare and Medicaid Services, which will now use mortality rates as part of its payment scheme. If hospitals that disproportionately care for minority patients have worse outcomes, they are likely to be penalized under the scheme. Furthermore, if they do have worse outcomes, understanding why their outcomes are worse is critically important for any quality improvement effort. For instance, if the hospitals that disproportionately care for minority patients provide worse care for all their patients, then targeting quality improvement efforts at these providers will likely have an important effect. Alternatively, if these hospitals provide largely similar care and any gaps between whites and minorities represent “within” hospital differences, then the interventions needed will be very different and likely require efforts such as cultural competency training for staff. Yet we are unaware of any data that examine how mortality rates vary between minority-serving and nonminority-serving institutions and what explains any gaps in mortality that might exist between these two types of hospitals. Empirical data here are critically important for understanding how these hospital might fare under VBP and what we might do to improve care at these institutions.

Therefore, in this study, we sought to answer three questions: First, do hospitals with a high proportion of black patients generally have worse outcomes than hospitals with fewer black patients? Second, can these gaps, if any, be explained by differences in key structural characteristics between black-serving and nonblack-serving hospitals? And finally, if black-serving hospitals (BSHs) do have worse outcomes, do these differences in outcomes extend to white patients, black patients, or both?

Address correspondence to Lenny López, M.D., M.P.H., Mongan Institute for Health Policy and Department of Medicine, Disparities Solutions Center, Massachusetts General Hospital, 50 Staniford St., Ninth Floor, Boston, MA 02114, e-mail: llopez1@partners.org. Ashish K. Jha, M.D., M.P.H., is with the Department of Health Policy and Management, Harvard School of Public Health, 677 Huntington Avenue, Boston, MA.

METHODS

We used the 2007 100% MedPAR file, which contains hospitalization information for all Medicare beneficiaries enrolled in the fee-for-service program, to calculate 30- and 90-day mortality rates for white and black patients admitted for one of three common medical conditions: acute myocardial infection (AMI), congestive heart failure (CHF), and pneumonia. We limited our analyses to enrollees age 65 or older. All rates were calculated using patient-level data. The MedPAR discharge dataset was linked to the 2007 annual survey of the American Hospital Association, and we excluded those hospitals that did not provide care to general medical or surgical patients. We examined a total of approximately 8.74 million discharges from 4,495 acute-care hospitals. We used risk-adjustment software developed by Elixhauser to calculate risk-adjusted mortality rates for all patients, as well as white and black patients separately, for each acute-care hospital (Elixhauser et al. 1998). In addition, we assessed the addition of race and disease code interactions to assess any significant change in the originally calculated patient-level Elixhauser adjusted mortality rates. The models calculating the hospital mortality rates using patient-level data were performed with generalized estimating equations (GEEs) to account for the clustering effect of patients within each hospital, thereby correcting standard errors for any resulting within-hospital correlation (clustering) in patient mortality rates (Zeger and Liang 1986).

To identify black-serving hospitals, we ranked all hospitals in the country by their proportion of discharged black patients and identified the top 10 percent of these hospitals as “black-serving hospitals” based on prior work (Jha et al. 2007a, b). This subset encompassed 449 hospitals. We categorized all other hospitals in our sample as “nonblack-serving hospitals.”

We used *t*-test and χ^2 tests, as appropriate, to compare the characteristics of black-serving and nonblack-serving hospitals. Bivariate analyses were conducted that examined the relationship between black-serving and nonblack-serving hospitals and mortality. We then created regression models using mortality rates as the outcome and the proportion of black patients as the primary predictor.

To examine whether there were racial disparities in care, we performed a two-stage model. The first model was a patient-level model estimating the overall mortality rate disparity between blacks and whites. We then added the hospital fixed effects (4,495 indicator variables for each hospital) to the first model to calculate the within-hospital effect. Subsequently, we fitted a

hospital-level random-effects logistic regression using PROC GLIMMIX in SAS (xtlogit command in STATA; SAS Institute Inc, Cary, NC, USA). This model not only adjusts for all patient characteristics but also assesses the extent to which between-hospital differences in quality of care explain the observed differences in mortality rates (Snijders and Bosker 1999). In the final set of models, we conducted the previous analyses with and without the percent of Medicaid patients a hospital serves to assess whether Medicaid proportion might explain any observed differences between black-serving and nonblack-serving hospitals. The results from these models are presented in the attached Appendix S1.

Next, we were interested in whether white patients seen in a black-serving hospital had worse outcomes than white patients seen in a nonblack-serving hospital and similarly interested in whether black patients' outcomes would vary between these two types of hospitals. Therefore, we built bivariate and multivariate race-specific models where the outcome was mortality and the primary predictor of interest was whether the hospital was a black-serving hospital or not, similar to the above analyses.

We examined interactions to assess whether the relationships between being a black-serving hospital and outcomes were modified by hospital size, profit, and teaching status. We conducted sensitivity analyses where we examined the proportion of black patients as a continuous variable as well as using alternative cut-points for being a black-serving hospital (top 5 percent, top 25 percent). Finally, to address the heterogeneity of the large number of non-black-serving hospitals, we created a propensity score of the probability of a hospital being categorized as a black-serving hospital or a nonblack-serving hospital based on hospital characteristics (i.e., size, location, etc.). We used a 2 : 1 nearest neighbor matching algorithm with excellent matching results between the two groups ($p > 0.05$ for comparison of the two groups for each hospital characteristic listed in Table 1). All analyses were conducted using SAS software, version 9.1; SAS Institute Inc.

RESULTS

Of 4,495 acute-care hospitals, there were 449 black-serving and 4,046 non-black-serving hospitals. Black-serving hospitals had a mean higher number of black patients compared with nonblack-serving hospitals (467.8 vs. 75.0), and the inverse was true for the mean number of white patients (746.3 vs. 1,293.8). Compared with nonblack-serving institutions, black-serving hospitals were

Table 1: Characteristics of Black-Serving and Non-Black-Serving Hospitals

<i>Hospital Characteristics</i>	<i>Black-Serving Hospitals (N = 449)</i>		<i>Nonblack-Serving Hospitals (N = 4,046)</i>		<i>p-value</i>
	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	
Size					
<100 beds	156	34.7	1,978	48.9	< .001
100–399 beds	210	46.8	1,710	42.3	
≥ 400 beds	83	18.5	358	8.8	
Region					
Northeast	46	10.3	540	13.4	< .001
Midwest	64	14.3	1,285	31.8	
South	315	70.5	1,390	34.4	
West	22	4.9	829	20.5	
Ownership					
For-profit	93	20.7	589	14.6	< .001
Private nonprofit	215	47.9	2,493	61.6	
Public	141	31.4	964	23.8	
Urban	351	78.2	2,970	73.4	.03
Teaching	81	18.0	194	4.8	< .001
Presence of cardiac ICU	142	31.6	1,269	31.4	.91
Presence of medical ICU	262	58.4	2,670	66.0	.001
	<i>%</i>		<i>%</i>		
Percent Medicare	44.2		49.5		< .001
Percent Medicaid	23.1		15.6		< .001
Nurse-staffing ratio	5.9		7.4		< .001

Notes. Black-serving hospitals refer to those hospitals in the top 10 percent by proportion of black patients served. Nonminority-serving hospitals refer to the rest of the hospitals. Percent Medicare and percent Medicaid refer to the percentage of patients with each type of insurance, respectively. Nurse-staffing ratio is per 100 patient days. ICU, intensive care unit.

primarily urban, public nonprofit, medium- and large-sized hospitals, located in the South (Table 1). Black-serving hospitals were also more likely to be academic teaching hospitals (18 percent vs 4.8 percent, $p < .001$) and serve a higher percent of Medicaid patients (23.1 percent vs 15.6 percent, $p < .001$). Black-serving and nonblack-serving hospitals had similar rates of cardiac ICUs (31.6 percent vs. 31.4 percent, $p = .91$) but had lower rates of medical ICUs (58.4 percent vs. 66.0 percent, $p = .001$) and nurse-staffing ratio (5.9 percent vs. 7.4 percent, $p < .001$).

Risk-adjusted 30-day mortality rates were comparable at black-serving and nonblack-serving hospitals for AMI (14.0 percent vs. 13.8 percent, $p = .75$, Table 2), although black-serving hospitals had worse outcomes at

Table 2: Adjusted Mean Mortality Rates for Black- and Nonblack-Serving Hospitals

	Risk-Adjusted Rates (%) [*]			Risk-Adjusted Rates for Hospital Characteristics (%) [†]		
	Black-Serving Hospitals	Nonblack-Serving Hospitals	Odds Ratio (95% CI)	p	Black-Serving Hospitals	Nonblack-Serving Hospitals
30-day mortality rates						
Acute myocardial infarction	14.0	13.8	1.01 (0.96, 1.06)	.75	13.2	13.1
Congestive heart failure	9.0	9.7	0.91 (0.88, 0.95)	< .001	8.7	9.4
Pneumonia	10.5	9.7	1.09 (1.04, 1.14)	< .001	10.1	9.5
90-day mortality rates						
Acute myocardial infarction	21.1	20.0	1.07 (1.02, 1.12)	.01	19.9	18.9
Congestive heart failure	19.2	19.5	0.98 (0.94, 1.01)	.16	18.6	19.2
Pneumonia	19.9	17.5	1.17 (1.13, 1.22)	< .001	19.2	17.4

^{*}Risk adjusted via standard Elixhauser method.

[†]Adjusted for U.S. region, urban versus rural location, presence of MICU, presence of CICU, hospital size, profit status, percent Medicaid, percent medicare, nurse-staffing ratio.

90 days (21.1 percent vs. 20.0 percent, $p = .01$). For CHF, we found a different pattern: lower mortality at 30 days (9.0 percent at black-serving vs. 9.7 percent at nonblack-serving hospitals) and comparable mortality at 90 days (19.2 percent vs. 19.5 percent, $p = .16$). For pneumonia, black-serving hospitals had worse outcomes at 30 and at 90 days (Table 2). We found our mortality rates to be quantitatively similar with and without the race Elixhauser interactions, demonstrating that there are no significant race-specific mediated differences in underlying comorbidities. This is consistent with prior research that has demonstrated that race-specific models have been shown not to perform better than conventional models, demonstrating that racial disparities in care are unlikely to be an artifact of misspecified models (Jha et al. 2007a, b).

When we examined outcomes for black and white patients separately in black-serving versus nonblack-serving hospitals, we found that both black and white patients generally had worse outcomes in black-serving hospitals compared with nonblack-serving hospitals (Table 3). At 30 days after hospitalization, white patients in black-serving hospitals had 9 percent higher odds of death for AMI (odds ratio [OR] 1.09, 95 percent confidence interval [CI], 1.03–1.16) and 13 percent higher odds of death for pneumonia (OR 1.13, 95% CI 1.07–1.19). These findings for white patients were comparable and somewhat more pronounced at 90 days after hospitalization for both AMI patients (OR 1.11, 95% CI 1.05–1.18) and pneumonia patients (OR 1.17, 95% CI 1.12–1.22). At 90 days, white patients admitted to black-serving hospitals with CHF now had higher odds of death as well (OR 1.06, 95% CI 1.02–1.10).

Black patients had overall lower mortality at 30 and 90 days compared with whites (Table 3). However, black patients had higher mortality rates at both 30 and 90 days at black-serving hospitals than nonblack-serving hospitals, at least for pneumonia and CHF, although the differences were not consistently significant (Table 3). For example, for black patients admitted for CHF, those admitted to a black-serving hospital had 8 percent higher odds of death (OR 1.08, 95% CI 1.01–1.15) at 30 days and 6 percent higher odds of death at 90 days (OR 1.06, 95% CI 1.01–1.11). Similarly for pneumonia, black patients admitted to a black-serving hospital had modest, nonsignificantly higher mortality for pneumonia at 30 days (OR 1.05, 95% CI 0.98–1.12, $p = .23$) and a significantly higher mortality at 90 days (OR 1.09, 95% CI 1.03–1.15). The patterns for AMI care were not consistent with the findings for CHF and pneumonia and were nonsignificant (Table 3).

Finally, when we examined differences between black-serving and nonblack-serving hospitals for both overall and for individual racial groups

Table 3: Mean Risk-Adjusted Mortality Rates by Race*

	White Patients				Black Patients		
	Black-Serving Hospitals	Nonblack-Serving Hospitals	Odds Ratio (95% CI)	p	Black-Serving Hospitals	Nonblack-Serving Hospitals	Odds Ratio (95% CI)
30-day mortality rates							
Acute myocardial infarction	14.9	13.8	1.09 (1.03, 1.16)	.004	12.7	13.4	0.95 (0.87, 1.04)
Congestive heart failure	10.3	10.2	1.01 (0.96, 1.06)	.70	6.2	5.8	1.08 (1.01, 1.15)
Pneumonia	10.9	9.8	1.13 (1.07, 1.19)	< .001	9.5	9.1	1.05 (0.98, 1.12)
90-day mortality rates							
Acute myocardial infarction	21.7	19.9	1.11 (1.05, 1.18)	< .001	20.4	20.3	1.0 (0.94, 1.08)
Congestive heart failure	21.3	20.3	1.06 (1.02, 1.10)	< .001	14.6	13.9	1.06 (1.01, 1.11)
Pneumonia	20.0	17.6	1.17 (1.12, 1.22)	< .001	19.9	18.6	1.09 (1.03, 1.15)

*Risk adjusted via standard Elixhauser method and for hospital characteristics (U.S. region, urban vs rural location, presence of MICU, presence of C ICU, hospital size, profit status, percent Medicaid, percent medicare, nurse-staffing ratio).

adjusted for key hospital characteristics, the results were essentially unchanged (Tables 2–3). Results of our two-stage modeling strategy demonstrated that the patient-level mortality rates were attenuated with the addition of the hospital fixed effect characteristics. The random effect analyses confirm our fixed effect findings by adjusting for observed and unobserved similarities that may exist among patients treated by the same hospital and for individual hospital effects that may correlate with race. Our findings are consistent with prior work (Barnato et al. 2005; Hasnain-Wynia 2010).

In addition, there were no significant differences in our results when alternative cut-points for being a black-serving hospital (top 5 percent, top 25 percent) were used. We found no significant interactions with hospital characteristics that modified the relationship between black-serving status and outcomes either overall or in race-specific analyses. Our propensity score results were quantitatively similar to the OLS regression models, confirming that even with comparably matched hospitals, black-serving hospitals have higher mortality rates compared with nonblack-serving hospitals (Cepeda et al. 2003).

DISCUSSION

We found that hospitals that cared for a large proportion of black patients generally had comparable overall mortality rates, but this was due in part to the fact that black patients generally have lower 30-day mortality rates. In race-specific analyses, we found that black-serving hospitals had worse outcomes for both black and white patients, suggesting systemic issues among these hospitals and an urgent need to target interventions to improve their care.

Risk-adjusted mortality rates are, in many ways, the bottom line when it comes to assessing health care quality. Although processes are often evidence based, they capture only a small proportion of the care a patient receives in the hospital. Further, patients care most about mortality, and therefore, as a quality measure, it has substantial face validity. While the current efforts to measure and publicly report quality have primarily focused on process measures, they have begun to increasingly focus on outcomes measures. In addition, hospital performance measures have been shown to predict differences in hospital risk-adjusted mortality rates (Peterson et al. 2006; Werner and Bradlow 2006). We found that the within-hospital effects account for most of the observed mortality differences. Because the observed mortality rate disparity between black-serving hospitals and nonblack-serving hospitals

decreased with hospital adjustment, one may conclude that blacks, on average, went to hospitals that provided worse care.

Our race-specific analyses provide potentially important insights. They suggest that the reason why black-serving hospitals seem to have comparable overall outcomes is because a large proportion of their patients are black, and blacks, paradoxically, have better outcomes than do white patients. These findings are consistent with other studies that have found that black patients have lower mortality rates than white patients (Jha et al. 2001; Polsky et al. 2007, 2008; Volpp et al. 2007; Chen 2011). This mortality benefit may be counterintuitive given that blacks generally have more barriers to care than whites (Smedley, Stith, and Nelson 2002), have lower life expectancy (Centers for Disease Control and Prevention [CDC] 2011; Harper et al. 2007; Levine et al. 2010), receive lower intensity of recommended therapies (Sonel et al. 2005), and may be sicker at admission than whites (Sonel et al. 2005).

The fact that black-serving hospitals have worse outcomes may also be counterintuitive: a large proportion of them are academic teaching institutions that are generally considered to deliver a higher quality of care (Allison et al. 2000; Popescu et al. 2010). Adjusting further for hospital characteristics only had a small impact on our findings, and we found no consistent evidence of effect-modification, suggesting that even among subgroups like teaching hospitals, those that care for more black patients generally had worse outcomes than those that cared for fewer black patients. In addition, our matched propensity analyses demonstrate that black-serving hospitals have worse outcomes even when matched on all 10 hospital characteristics compared with nonblack-serving hospitals implying that these hospitals are worse for reasons that are not immediately clear.

There are important implications of our work. The first is that given the well-described and substantial racial differences in outcomes, examining a hospital's overall mortality rate may be misleading. Two hospitals that have comparable outcomes for blacks and comparable outcomes for whites but have a different mix of blacks and whites will necessarily have different overall outcomes. This may suggest that we should consider publicly reporting race-specific mortality rates or at least adjusting for racial mix in the models. Second, although the overall mortality rates for black-serving hospitals appear to be comparable with nonblack-serving hospitals, they do seem to provide worse care, at least as measured by risk-adjusted outcomes. These findings underscore that the site of care likely plays an important role in disparities in care, even if black patients seem to have better outcomes than white patients. Finally, we found that the gaps in mortality rates between black-serving and

nonblack-serving hospitals seemed to widen over time, suggesting that the outpatient care associated with black-serving hospitals may be less effective. Future studies need to better understanding why these gaps widen.

There are limitations to our study. First, as in any observational study, there may be unmeasured confounders that might explain the relationship between being a black-serving hospital and risk-adjusted mortality. The most important may be unmeasured severity: it is possible that both white and black patients who receive care at black-serving hospitals are generally sicker or present at a later part of their condition. While we attempted to account for severity in our risk-adjustment scheme, these approaches are inherently limited, especially given that our approach used administrative data. However, we used a well-validated risk-adjustment model designed specifically for use with administrative data (Elixhauser et al. 1998; Stukenborg, Wagner, and Connors 2001; Southern, Quan, and Ghali 2004), and recent research has validated administrative claims-based modeling as producing estimates of risk-standardized mortality that are good surrogates for estimates calculated directly from data in medical records (Krumholz et al. 2006a, b). In addition, these administrative data are increasingly used for both measuring and publicly reporting provider performance. Second, we lacked patient-level socioeconomic data with which to evaluate the independent impact of socioeconomic status on outcomes and could only adjust for Medicaid case mix at the hospital level. Third, our risk-adjusted mortality rate estimates were based only on Medicare beneficiaries rather than all payers. However, Medicare beneficiaries make up more than 50 percent of hospital admissions for the conditions in this study and hospital quality research based on Medicare data may be generalizable to the broader U.S. population (Needleman et al. 2003). Finally, our findings are not generalizable to the Medicare Advantage population, which may have a different distribution of underlying comorbidities and be differentially distributed nationally compared with the general Medicare population.

In conclusion, we found that hospitals that disproportionately care for black patients had worse outcomes for both their black and white patients. Calculating and reporting risk-adjusted mortality at the hospital level has become a key part of the national policy effort to improve quality of care. Targeting quality and financial incentive improvement efforts for black-serving hospitals could improve care for all patients who receive care at these hospitals. Increased efforts are needed to increase posthospital quality and environmental factors that likely contribute to observed postdischarge mortality rates.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.

Appendix S1: Propensity Score Matched Regression Analyses of 30 and 90 Day Mortality Rates.

Appendix S2: Patient Level Analysis on Risk-Adjusted Mortality Rates by Race.

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