

Race, Quality of Care, and Outcomes of Elderly Patients Hospitalized With Heart Failure

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HEART FAILURE IS A NATIONAL epidemic, affecting nearly 5 million persons in the United States, with an additional 550 000 diagnosed each year.¹ This burden is disproportionately borne by black Americans, who have a higher incidence and prevalence of heart failure than members of other racial groups.¹ Despite this greater burden, black patients may receive less intensive and poorer-quality care for heart failure than whites.²⁻⁵ Some studies, however, suggest that black patients receive similar quality of care as members of other racial groups.⁶⁻¹⁰ Because prior studies evaluated patients treated in selected centers or regions⁶⁻¹⁰ and assessed treatment or utilization patterns and not objective measures of quality of care,^{3,9,10} it is unclear if reported racial differences reflect shortfalls in care or appropriate treatment or are representative of current national practice patterns. A national evaluation of racial patterns of heart failure care is timely given the

Context Black patients hospitalized with heart failure reportedly receive poorer quality of care and have worse outcomes than white patients. Because previous studies have been based on selected patient populations treated more than a decade ago, it is unclear if racial differences in quality of care and outcomes currently exist in the United States.

Objective To evaluate differences in quality of care and patient outcomes between black and white Medicare beneficiaries hospitalized with heart failure.

Design Retrospective analysis of medical record data systematically collected for the National Heart Failure Project.

Setting and Patients Nationwide US sample of 29 732 fee-for-service Medicare beneficiaries hospitalized with heart failure in 1998 and 1999.

Main Outcome Measures Prescription of angiotensin-converting enzyme (ACE) inhibitors, measurement of left ventricular ejection fraction (LVEF), readmission within 1 year of discharge, and mortality within 30 days and 1 year of admission.

Results Black patients and white patients had similar crude rates of LVEF assessment (67.8% black vs 66.6% white; $P = .29$). Among patients classified as ideal for ACE inhibitor use, black patients had higher crude rates of ACE inhibitor use than white patients (81.0% vs 73.8% white; $P < .001$) but had similar rates of ACE inhibitor or angiotensin receptor blocker (ARB) use (85.7% black vs 82.5% white; $P = .08$). After multivariable adjustment, black patients had comparable rates of LVEF assessment (risk ratio [RR], 0.99; 95% confidence interval [CI], 0.95-1.03). Black patients remained more likely to be prescribed ACE inhibitors (RR, 1.22; 95% CI, 1.14-1.28) than were white patients in an adjusted analysis, but there were no significant racial differences in the prescription of ACE inhibitors or ARBs (black vs white, RR, 1.03; 95% CI, 0.97-1.07). Black patients had higher rates of readmission within 1 year of discharge (68.2% vs 63.0%; $P < .001$) but had lower crude 30-day (6.3% vs 10.7%; $P < .001$) and 1-year (31.5% vs 40.1%; $P < .001$) mortality rates than white patients. After multivariable adjustment, black patients had a slightly higher rate of readmission than white patients (RR, 1.09; 95% CI, 1.06-1.13) but remained at lower risk of 30-day mortality (RR, 0.78; 95% CI, 0.68-0.91) and 1-year mortality (RR, 0.93; 95% CI, 0.88-0.98).

Conclusions Black Medicare patients hospitalized with heart failure received comparable quality of care and had slightly higher rates of readmission but had lower mortality rates up to 1 year after hospitalization than did white patients.

JAMA. 2003;289:2517-2524

www.jama.com

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efforts under way to redress racial disparities in health care.¹¹

Concerns about poorer outcomes, including higher rates of readmission and mortality, have paralleled reports of poorer quality of care in blacks with heart failure.^{6,12-20} Based on a few studies,^{13,20,21} current American College of Cardiology/American Heart Association adult heart failure treatment guidelines state that "heart failure progresses more rapidly in black than white patients, as evidenced by a higher risk of initial hospitalization and recurrent hospitalization and death."²² However, the literature concerning race and outcomes among patients with heart failure is inconsistent. Some studies have reported that black patients hospitalized with heart failure have lower rates of rehospitalization,²⁵ mortality during rehospitalization,^{20,23,24,26} after discharge than white patients.^{20,21,23-25,27,28} In contrast, others have reported that race is not associated with mortality or readmission independent of other demographic and clinical factors.^{5,6,16,29-34} Thus, it is unclear whether race is associated with patient survival or readmission after hospitalization for heart failure or instead reflects racial differences in clinical characteristics.

Accordingly, we evaluated racial differences in treatment and outcomes in a nationally representative cohort of Medicare patients hospitalized for heart failure in 1998 and 1999 using data from the National Heart Failure (NHF) Project. The quality-of-care measures and clinical data collected as part of the NHF Project provided us a unique opportunity to assess the associations of patient race with quality of care and outcomes in a contemporary, national cohort of heart failure patients.

METHODS

NHF Project

The NHF Project is an ongoing Centers for Medicare & Medicaid Services initiative to improve quality of care for Medicare beneficiaries hospitalized with heart failure. Medicare fee-for-service beneficiaries hospitalized between March 1998 and April 1999 with a prin-

cipal discharge diagnosis of heart failure (*International Classification of Diseases, Ninth Revision, Clinical Modification* codes 402.01, 402.11, 402.91, 404.01, 404.91, or 428)³⁵ were identified. The NHF Project sample was restricted to single admissions of patients with valid Social Security numbers who were not receiving long-term hemodialysis and did not leave the hospital (transferred out or against medical advice) during treatment. All identified admissions within each state who met these initial criteria by screening of administrative data were sorted by age, sex, race, and hospital. Approximately 800 records were randomly sampled from each state's sorted cohort; states with fewer than 800 eligible records (Alaska, Hawaii, Idaho, Utah, Vermont, and Wyoming) were sampled in their entirety. Identified records were forwarded to 1 of 2 clinical data abstraction centers and each record underwent detailed systematic abstraction for clinical data including medical history, comorbidity, findings at admission, in-hospital course, status at discharge, medication and procedure use, and laboratory and other diagnostic evaluations. Trained reviewers, medical record abstraction software, and random record reabstraction were used to optimize data quality.³⁶

Study Cohort

The NHF Project produced an initial random sample of 39 477 medical records. Medical records meeting NHF Project exclusion criteria (chronic hemodialysis, patient left hospital, no or invalid Social Security number, readmission) were excluded (n=2054), leaving a cohort of 37 423 patients. Patients younger than 65 years (n=2909), those who arrived by interhospital transfer (n=1046), and those without heart failure on admission (n=2324) were also excluded to ensure examination of a representative cohort of older patients directly admitted with heart failure. Patients hospitalized outside of the 50 states and the District of Columbia (n=627) were excluded. Because we were primarily interested in examining quality-of-care differences be-

tween black patients and white patients, patients from other racial groups or those missing race data (n=1824) were excluded. In total, 7691 patients met 1 or more of these exclusions; the remaining 29 732 patients comprised the study cohort.

Additional Data Sources

Data from the NHF Project were linked with the American Medical Association Physician Masterfile using the unique physician identification number of the attending physician for each hospitalization in the NHF Project. Physician characteristics included self-reported specialty and board certification.³⁷ Hospital characteristics, including bed size, US census region, rural location, level of cardiac care facilities, ownership, and teaching status, were obtained by linking data from the 1998 American Hospital Association Annual Survey of Hospitals.³⁸

Quality of Care and Outcomes

The NHF Project's evaluation of patient treatment focused on prescription of angiotensin-converting enzyme (ACE) inhibitors and evaluation of left ventricular ejection fraction (LVEF), both widely accepted measures of heart failure quality of care.^{36,39} Prescription of ACE inhibitor therapy at discharge was assessed among ideal candidates, defined as patients with left ventricular dysfunction who had no contraindications to ACE inhibitor therapy. To account for the possible use of angiotensin receptor blockers (ARBs) in lieu of ACE inhibitors (a substitution not supported by current clinical guidelines), we also examined the use of ACE inhibitors or ARBs among ideal candidates for ACE inhibitors. Patients were considered to have undergone evaluation of LVEF if their medical record contained an LVEF value measured prior to hospitalization, their LVEF was measured during hospitalization, or the medical record contained a note of a planned postdischarge LVEF measurement. Quality-of-care indicators are described in the BOX.

Mortality within 1 year of admission and readmission within 1 year of

discharge were available for all patients and assessed using the Medicare Enrollment Database and billing records.⁴⁰

Statistical Analysis

Racial differences in patients' medical history, comorbidities, admission characteristics, and quality indicator eligibility were assessed using χ^2 and Wilcoxon rank sum tests.

Crude racial differences in quality of care and outcomes were evaluated using χ^2 tests. Multivariable analyses were performed to determine if racial differences in quality of care or outcomes were independent of other factors. Because of the hierarchical nature of the NHF Project cohort (patients clustered within hospitals), mixed-effects multilevel modeling was conducted. Multilevel logistic regression models adjusted for patient age, sex, medical history (coronary artery disease, diabetes, hypertension, chronic obstructive pulmonary disease, dementia, LVEF, and admission source), admission characteristics (heart rate, serum sodium, and serum creatinine levels), and severity of illness as measured by a modified version of the Medicare Mortality Prediction System score (including age, cancer, mobility, prior congestive heart failure, mean arterial pressure, heart rate, serum urea nitrogen, white blood cell count, and the Acute Physiology and Chronic Health Evaluation [APACHE] II score).⁴¹ Analyses also adjusted for physician specialty, physician board certification, and hospital characteristics including number of beds, rural location, US census region, ownership, teaching status, and level of cardiac care facilities. The model intercept and patient race were initially entered into all analyses as random effects. Patient race was treated as a fixed effect if the model did not converge; all other variables were modeled as fixed effects in all analyses. Dummy variables were used to denote patients with missing physician or hospital information. Missing continuous variables (heart rate, $n=41$; serum sodium level, $n=630$; and serum creati-

Box. Quality Indicator Eligibility Criteria*	
PRESCRIPTION OF ACE INHIBITORS†	
Eligibility	
	Patient alive at time of discharge
	Evidence of left ventricular systolic dysfunction during hospitalization (LVEF <40%)
	No moderate or severe aortic or bilateral renal artery stenoses
	No physician documentation of any reason for withholding ACE inhibitor therapy
	Patient not enrolled in ACE inhibitor or other clinical trials
	Serum creatinine level less than 2.0 mg/dL (177 μ mol/L)
	Systolic blood pressure at least 100 mm Hg throughout hospitalization
	Serum potassium level less than 5.5 mEq/L
Quality of Care Measurement	
	ACE inhibitor prescribed at discharge
CURRENT LVEF MEASUREMENT	
Eligibility	
	Patient alive at time of discharge
Quality of Care Measurement	
	Any 1 of the following 3:
	LVEF measured prior to hospitalization and noted in medical record
	LVEF measured during hospitalization
	Patient scheduled to have LVEF measured after discharge
*ACE indicates angiotensin-converting enzyme; LVEF, left ventricular ejection fraction.	
†The same criteria were used to evaluate prescription of ACE inhibitors and angiotensin receptor blockers.	

nine level, $n=696$) were replaced with the cohort's median value and a dummy variable indicating the replacement of missing data. Odds ratios were converted to estimated relative risks (RRs).⁴²

Racial differences in quality of care and outcomes were assessed by stratifying by other characteristics, including patient sex, age, previous LVEF, history of coronary artery disease, hypertension, diabetes, renal failure, specialty of attending physician (cardiologist vs other specialty), hospital location (rural vs urban; US census region), teaching status, ownership, and level of cardiac care facilities. Interactions were tested in hierarchical models.

Analyses incorporated probability weights based on the inverse sampling fraction for each state. Analyses were conducted using Stata version 7.0 (Stata Corp, College Station, Tex) and MLwiN 1.10 (Institute of Education,

London, England) and approved by the Yale University School of Medicine Human Investigation Committee.

RESULTS

Black patients accounted for nearly 12% of the study cohort, were younger than whites, and had higher rates of hypertension, diabetes, and peripheral edema but lower rates of coronary artery disease, prior revascularization, and angina compared with white patients (TABLE 1). Compared with white patients, black patients were hospitalized predominantly in the South and greater proportions were treated at larger urban teaching hospitals and by black and non-board-certified physicians (TABLE 2).

Overall, 94.8% of patients were eligible for assessment of LVEF measurement (96.5% black vs 94.5% white; $P<.001$) and 13.8% for evaluation of ACE inhibitor prescription (15.2% black vs 13.6% white; $P=.06$) or ACE

inhibitor or ARB prescription among patients classified as ideal for ACE inhibitor therapy. Among patients classified as ideal for ACE inhibitor prescription (LVEF <40% with no documented contraindications), black patients had higher crude rates of ACE inhibitor prescription than did white

patients (81.0% vs 73.8%; $P < .001$) but comparable rates of ACE inhibitor or ARB prescription (85.7% black vs 82.5% white; $P = .08$). There were no racial differences in the evaluation of LVEF (67.8% black vs 66.6% white; $P = .29$).

Although black patients had higher overall rates of ACE inhibitor use than

white patients, the racial difference was larger among patients with a history of hypertension (82.8% black vs 72.9% white; $P < .001$) compared with non-hypertensive patients (73.7% black vs 75.2% white; $P = .74$) ($P = .02$ for interaction). Racial differences in the prescription of ACE inhibitors were otherwise comparable when analyses were repeated stratifying by age, sex, LVEF, diabetes, history of coronary artery disease, and renal dysfunction.

The association of patient race and treatment varied based on hospital characteristics. Black patients had higher rates of ACE inhibitor prescription than did white patients when treated in cardiac surgery-capable hospitals (83.4% black vs 72.9% white; $P = .002$) and cardiac catheterization-capable hospitals (85.5% black vs 74.5% white; $P = .009$) compared with hospitals with no cardiac facilities (75.4% black vs 74.5% white; $P = .79$) ($P = .05$ for interaction). Black patients in the Midwest had higher rates of LVEF measurement than did white patients (72.3% vs 64.6%; $P < .001$), but there were no racial differences in LVEF measurement in the Northeast (75.4% black vs 72.7% white; $P = .19$), West (64.8% black vs 64.8% white; $P = .99$), or South (64.7% black vs 64.9% white; $P = .83$) census regions ($P = .05$ for interaction). Racial differences in LVEF measurement varied based on hospital ownership, with lower rates of LVEF measurement in black patients treated at for-profit hospitals (57.3% vs 63.6%; $P = .02$) compared with patients treated in public (62.4% black vs 56.1% white; $P = .007$) and not-for-profit (71.2% black vs 68.6% white; $P = .01$) hospitals ($P = .005$ for interaction). Racial differences in LVEF measurement similarly varied by physician specialty, with black patients having lower rates of treatment than white patients when treated by cardiologists (70.8% vs 74.4%; $P = .06$) but higher rates when treated by internists (70.1% vs 65.7%; $P < .001$) and no statistically significant difference when treated by family or general practitioners (55.2% black vs 58.9% white; $P = .09$) ($P < .001$ for interaction). The effect of race on quality of care was otherwise con-

Table 1. Patient Characteristics*

	White Patients (88.4%)	Black Patients (11.6%)	P Value
Age, mean (SD), y	79.8 (0.1)	77.2 (0.2)	<.001
Female	59.0	64.0	<.001
Admission characteristics			
Systolic BP, mean (SD), mm Hg	145.5 (0.3)	153.1 (0.8)	<.001
Diastolic BP, mean (SD), mm Hg	77.4 (0.2)	84.0 (0.5)	<.001
Heart rate, mean (SD), beats/min	90.7 (0.2)	92.4 (0.5)	.002
Peripheral edema	71.7	75.2	.002
Cardiac arrest	1.8	1.8	.90
Sodium level, mean (SD), mEq/L	138.4 (0.1)	140.3 (0.1)	<.001
Serum creatinine level, mean (SD), mg/dL	1.4 (0.01)	1.5 (0.02)	<.001
Admission source			
Home	68.2	74.3	<.001
Skilled nursing or other residential facility	11.6	8.7	
Physician's office/health clinic	15.2	13.3	
Other	5.0	3.8	
Medical history			
Congestive heart failure	71.7	76.5	<.001
Left ventricular ejection fraction, %			.05
≥40	15.1	17.2	
<40	11.8	10.1	
Unknown	73.1	72.7	
ACE inhibitors or ARBs prior to admission	47.4	53.4	<.001
Myocardial infarction	29.7	23.0	<.001
Coronary artery disease	58.9	46.0	<.001
Angina	18.6	12.8	<.001
Diabetes	37.4	47.6	<.001
Hypertension	59.9	78.9	<.001
CABG surgery	23.7	11.0	<.001
Percutaneous transluminal coronary angioplasty	9.1	4.6	<.001
Cerebrovascular disease	18.3	17.9	.67
Chronic obstructive pulmonary disease	33.8	30.8	.009
Dementia/Alzheimer disease	9.8	9.7	.90
Aortic stenosis	8.0	4.4	<.001
Mobility (self-ambulation)			
Independent	32.5	30.0	.007
Dependent	39.8	38.9	
Unknown	27.7	31.1	
Urinary continence			
Continent	54.2	52.6	.12
Incontinent	15.1	14.2	
Unknown	30.7	33.2	

Abbreviations: ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BP, blood pressure; CABG, coronary artery bypass graft.

SI conversion factor: To convert creatinine to $\mu\text{mol/L}$, multiply by 88.4.

*Data are presented as percentages unless otherwise specified. Analyses were conducted using χ^2 tests and analyses of variance with National Heart Failure Project sample weights.

sistent across hospital and physician characteristics.

Race had only a minimal association with quality of care after multivariable adjustment. Black patients had similar rates of LVEF measurement as white patients (black vs white, adjusted RR, 0.99; 95% confidence interval [CI], 0.95-1.03). Black patients classified as ideal for ACE inhibitor therapy were more likely to be prescribed ACE inhibitors than similarly classified white patients (black vs white, adjusted RR, 1.22; 95% CI, 1.14-1.28), even after accounting for racial differences in the prevalence of hypertension and diabetes. There were no racial differences in the composite end point of ARB or ACE inhibitor prescription among patients classified as ideal for ACE inhibitor therapy (black vs white, adjusted RR, 1.03; 95% CI, 0.97-1.07). The effect of patient race, however, varied by hospital, exhibiting a significant random effect for prescription of ACE inhibitors among ideal patients ($P < .001$) and measurement of LVEF ($P < .001$).

Black patients had higher crude 1-year readmission rates than white patients (68.2% vs 63.0%; $P < .001$). Racial differences in readmission rates were largest among patients aged 85 years or older (68.4% black vs 59.4% white; $P < .001$) compared with those younger than 75 years (68.8% black vs 64.5% white; $P = .002$) and those aged 75 to 84 years (67.5% black vs 64.5% white; $P = .03$) ($P = .05$ for interaction); those with an LVEF of 40% or higher (72.5% black vs 64.8% white; $P < .001$) vs those with an LVEF of less than 40% (66.0% black vs 62.6% white; $P = .002$) ($P < .001$ for interaction); and patients with renal failure (72.9% black vs 64.2% white; $P < .001$) compared with those with no renal failure (65.8% black vs 62.5% white; $P = .002$) ($P = .002$ for interaction) but were otherwise statistically comparable across patient characteristics. There were no racial differences in readmission rates among patients treated in the Northeast (64.7% black vs 64.6% white; $P = .96$) compared with the Midwest (69.1% black vs 61.3% white; $P < .001$), South (68.0%

black vs 64.2% white; $P = .002$), and West (73.5% black vs 60.7% white; $P < .001$) ($P = .004$ for interaction). Racial differences in the risk of readmission were reduced after multivariable adjustment (black vs white, RR, 1.09; 95% CI, 1.06-1.13), although the association of race with readmission varied by individual hospital ($P < .001$).

Mortality rates were lower among black patients ($P < .001$) (FIGURE). Black patients had lower crude mortality rates than white patients at 30 days (6.3% vs

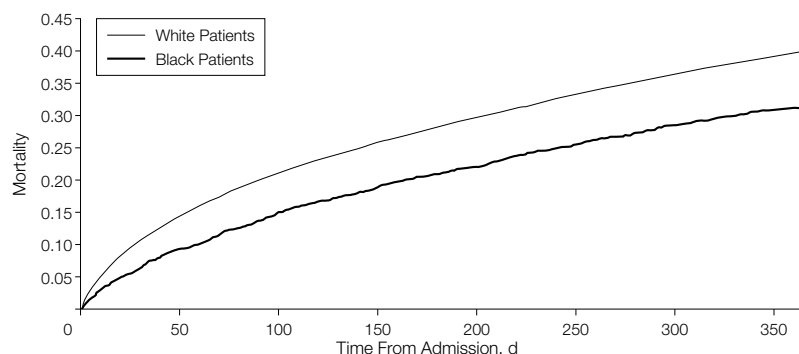
10.7%; $P < .001$) and 1 year (31.5% vs 40.1%; $P < .001$) after admission. Crude racial differences in 30-day mortality rates were greater among patients with hypertension (5.2% black vs 9.5% white; $P < .001$) compared with nonhypertensive patients (10.5% black vs 12.5% white; $P = .12$) ($P = .003$ for interaction) and among patients treated in cardiac surgery-capable hospitals (5.1% black vs 10.5% white; $P < .001$) compared with cardiac catheterization-capable hospitals (9.2% black vs 10.2%

Table 2. Physician and Hospital Characteristics*

	White Patients (88.4%)	Black Patients (11.6%)	P Value
Physician Characteristics			
Physician data available	88.5	85.8	.02
Female	7.4	8.4	.02
Race			
White	47.9	35.1	<.001
Black	0.7	7.6	
Other	13.4	15.3	
Unknown/missing	38.0	42.0	
Specialty			
Cardiology	22.0	19.2	<.001
Internal medicine	41.8	45.3	
Family practice	21.3	17.8	
Other	15.0	17.7	
Board certification	69.1	63.4	<.001
Foreign medical graduate	24.7	25.9	.02
Years in practice, mean (SD)	21.1 (0.1)	21.6 (0.3)	.05
Hospital Characteristics			
Hospital data available	96.4	96.2	.79
No. of beds, mean (SD)	286 (6)	363 (13)	<.001
Ownership			
Public	12.5	16.1	.03
Not for profit	72.4	66.8	
For profit	11.5	13.3	
Teaching status			
COTH member	10.7	23.9	<.001
Residency affiliated	20.4	22.7	
Nonteaching	65.3	49.5	
Cardiac care facilities			
Cardiac surgery suite	34.1	38.5	.10
Cardiac catheterization laboratory	20.4	20.9	
No invasive intervention facilities	41.9	36.8	
US census region			
Northeast	21.9	14.5	<.001
Midwest	27.8	20.6	
South	36.9	56.4	
West	9.9	4.7	
Location in urban area	71.7	78.9	<.001

Abbreviation: COTH, Council of Teaching Hospitals.

*Data are presented as percentages unless otherwise specified. Analyses were conducted using χ^2 tests and analyses of variance with National Heart Failure Project sample weights.

Figure. Kaplan-Meier Curve for 1-Year Mortality by Race

Crude proportion of cohort mortality. Because the NHF Project data are representative of a weighted sample, no actual numbers of patients at risk are presented.

white; $P = .37$) and hospitals with no cardiac care facilities (6.5% black vs 11.1% white; $P < .001$) ($P = .002$ for interaction). Similarly, racial differences in 1-year mortality were larger among men (32.7% black vs 44.3% white; $P < .001$) than among women (30.7% black vs 37.2% white; $P < .001$) ($P = .02$ for interaction); among patients aged 65 to 74 years (23.5% black vs 32.3% white; $P < .001$) compared with patients aged 75 to 84 years (33.0% black vs 38.6% white; $P < .001$) and patients aged 85 years or older (44.8% black vs 49.6% white; $P = .02$) ($P = .04$ for interaction); among patients with an LVEF of less than 40% (30.0% black vs 40.1% white; $P < .001$) compared with an LVEF of 40% or higher (38.8% black vs 46.8% white; $P < .001$) ($P = .03$ for interaction); among patients with renal failure (40.2% black vs 54.0% white; $P < .001$) compared with patients with no renal failure (27.1% black vs 34.0% white; $P < .001$) ($P = .004$ for interaction); and among patients with diabetes (27.8% black vs 40.7% white; $P < .001$) compared with those without diabetes (34.7% black vs 39.7% white; $P < .001$) ($P < .001$ for interaction). Mortality risks among black patients remained lower after multivariable adjustment at 30 days (black vs white, RR, 0.78; 95% CI, 0.68-0.91) and 1 year (black vs white, RR, 0.93; 95% CI, 0.88-0.98) after admission.

COMMENT

In contrast with previous evaluations of treatment and procedure use,²⁻⁵ we found no meaningful racial differences in the quality of care provided to Medicare beneficiaries hospitalized with heart failure. Black patients had modestly higher rates of ACE inhibitor use and comparable crude rates of LVEF measurement compared with white patients. Racial differences in treatment were attenuated by multivariable adjustment but also varied across individual hospitals and US census regions, indicating that the effects of race on quality of care are not consistent across all settings. Although black patients had a slightly higher risk of readmission, they had a lower risk of mortality than white patients up to 1 year after hospitalization. Our findings thus indicate that black patients hospitalized with heart failure receive comparable if not higher quality of care and have higher survival rates than white patients.

The similarity in quality of care between black patients hospitalized with heart failure and their white counterparts is reassuring and suggests that concerns about racial differences in quality of cardiovascular care² are not an issue for Medicare patients with heart failure. The absence of racial differences in quality of care may be attributable to several factors. All patients in the study cohort had Medicare insur-

ance (thus providing a common primary payer) and, by being hospitalized, had demonstrated access to the health care system. The quality-of-care assessments were based on treatments provided before or during hospitalization (LVEF measurement) or prescribed at discharge (ACE inhibitors), thereby providing multiple opportunities for receiving high-quality care. The higher prevalence of heart failure among blacks may make physicians particularly cognizant of providing quality care to black patients. Alternatively, race may have no independent influence on the quality of care provided to older patients hospitalized with heart failure. As such, these data would indicate that racial disparities in health care use are not observed for all clinical conditions.

Variation in racial differences in quality of care across hospitals demonstrates that the influence of race on treatment varies by individual hospital and across types of hospitals. Individual hospital variation in the association of race and treatment suggests that previous reports of racial differences in heart failure treatment³⁻⁵ may reflect hospital-specific practice patterns rather than a consistent phenomenon at all hospitals. The interactions between race and hospital cardiac care facilities, geographic location, and ownership suggests that some hospital attributes may accentuate or mitigate racial differences in treatment. In particular, the similarity of our findings with previous reports of geographic variations in racial differences in cardiovascular care suggests that region in particular may influence racial variations in practice.⁴³⁻⁴⁵

Black patients had a slightly higher risk of readmission than did white patients after accounting for racial differences in other patient characteristics. Previous studies indicate that higher rates of readmission in minority populations may reflect differences in adherence to pharmacotherapy and diet regimens.⁴⁶ Racial differences in heart failure symptom recognition may also result in black patients deferring care until initial problems are sufficiently advanced such that hospitalization is

required.⁴⁷ Either of these processes suggests that targeted educational interventions may benefit minority populations with heart failure. Alternatively, black patients may receive poorer-quality follow-up care after discharge. Race may also be a proxy for other unmeasured characteristics, including lower socioeconomic status and greater functional impairments, which are also associated with higher rates of heart failure readmission.⁴⁸ However, without detailed information concerning quality of postdischarge processes of care, it is unclear whether race is independently associated with readmission or reflects poorer-quality postdischarge care.

Our data indicate that black patients have lower mortality rates after hospitalization for heart failure than white patients, even after accounting for marginally higher rates of ACE inhibitor use. Epidemiological data suggest a crossover in black and white heart failure patient mortality risks at about age 65 years, with black patients having a higher mortality risk than white patients before age 65 years but a lower mortality risk than white patients after age 65 years.¹⁹ However, Jha and colleagues' evaluation²³ of veterans hospitalized for acute conditions including heart failure found lower rates of mortality among black patients younger than 65 years, although the extent to which this difference is attributable to heart failure, as opposed to other clinical conditions, was not reported. Racial differences in mortality may also reflect a survivor effect, whereby black patients who survive to age 65 years with heart failure represent a healthier cohort than white patients of the same age in ways that are unmeasured in this study. Similarly, black patients experiencing acute exacerbations of heart failure may be more likely to die before hospitalization than white patients, suggesting that black patients who are hospitalized may have less severe exacerbations than do white patients. Our analyses adjusted for history of coronary artery disease and hypertension, suggesting that racial dif-

ferences in mortality are not attributable to racial differences in heart failure etiology. Alternatively, racial differences in other unmeasured clinical characteristics may account for the survival advantage of black patients. Although the source of the apparent racial difference in mortality risk is not clear, our findings do not support the hypothesis that black Medicare patients hospitalized for heart failure have poorer outcomes than white patients.

The NHF Project represents the largest contemporary evaluation of elderly patients hospitalized with heart failure. The use of quality-of-care indicators and detailed clinical data also represents significant methodological improvements on prior evaluations of racial differences in treatment. However, our study has certain issues that merit consideration. We restricted our analysis to fee-for-service Medicare patients aged 65 years or older who were hospitalized with heart failure; thus, our findings may not be applicable to patients younger than 65 years or those enrolled in Medicare managed care. However, more than 80% of heart failure patients in the United States are aged 65 years or older¹ (although this proportion may be smaller for black patients who have an earlier median age of heart failure onset), and patients enrolled in Medicare managed care comprise less than 15% of Medicare beneficiaries,⁴⁹ suggesting that both exclusions may result in only a minor loss in study generalizability.

Our findings may not be applicable to patients who are not hospitalized or to practice patterns in the ambulatory setting. However, acute exacerbations of heart failure requiring hospitalization are common, particularly among elderly patients.⁵⁰ Patient race may influence quality of care in a manner not reflected in the quality-of-care measures we used, although these measures are currently used by the Centers for Medicare & Medicaid Services to assess quality of heart failure care.³⁶ Finally, we were unable to assess racial differences in quality of life or patient outcomes other than mortality. Although black patients hospitalized with heart failure may have

lower mortality rates than do white patients, increased survival may be offset by poorer quality of life or greater functional limitations due to heart failure.⁶

CONCLUSION

Black and white Medicare patients receive comparable quality of care during hospitalization for heart failure. Despite only small variations in quality of care, black patients had slightly higher readmission rates but lower mortality rates up to 1 year after hospitalization than white patients. Our findings contrast with previous reports of poorer quality heart failure care among black patients²⁻⁵ and suggest that elderly black patients may have a survival advantage compared with elderly white patients. Moreover, our results demonstrate that racial disparities in quality of care do not exist for all clinical conditions and thereby underscore the need to study patterns of care for individual clinical conditions. Efforts are needed to improve quality of heart failure care for both black and white patients.

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Obtained funding: Havranek, Ordin, Krumholz.

Administrative, technical, or material support: Havranek, Ordin, Krumholz.

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Funding/Support: The analyses on which this publication is based were performed under Centers for Medicare & Medicaid Services contract 500-02-CO-01, entitled "Utilization and Quality Control Peer Review Organization for the State of Colorado." Dr Masoudi is supported by National Institutes of Health Research Career Award K08-AG01011.

Disclaimer: The content of this publication does not necessarily reflect the views or policies of the US Department of Health and Human Services, nor does mention of trade names, commercial products, or organization imply endorsement by the US government. The authors assume full responsibility for the accuracy and completeness of the ideas presented. This article is a direct result of the Health Care Quality Improvement Program initiated by the Centers for Medicare & Medicaid Services, which has encouraged identification of quality improvement projects derived from analysis of patterns of care and therefore required no special funding on the part of this contractor. Ideas and contributions to the authors concerning experience in engaging with issues presented are welcomed.

Acknowledgment: We thank Debra Ralston and Nancy Susman for their support.

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