Racial Differences in Mortality among Men Hospitalized in Military Hospitals

James F. Meyers, DrPH MHA; Anthony S. Robbins, MD PhD†; Ginny L. Gildengorin, PhD†;
J. Kevin Grayson, DVM PhD†*

ABSTRACT   A comparative study was conducted on patients in military hospitals in response to recent studies at veterans' hospitals showing the possibility that access to an equal-access health care system may reduce or reverse racial differences in mortality outcomes. Using a cohort study of 14,122 military retirees admitted to military hospitals with any of six common medical diagnoses between October 2000 and September 2004, we evaluated differences in patient and hospital characteristics and evaluated race-specific hospital mortality. Despite long-term equal access to comprehensive medical care, there were significant racial differences in patient- and hospital-level risk factors among male military retirees hospitalized with common medical diagnoses. In unadjusted analyses, risk of hospital mortality was significantly lower in African Americans and other non-Caucasians when compared to Caucasians, but differences disappeared after adjustment for all risk factors.

INTRODUCTION

Racial disparities in health in the United States are well known.[1–3] Most previous studies that have focused on racial disparities in hospital mortality have examined outcomes for a single disease[4] and have historically been compromised by the inability to adequately control for study subjects' varying long-term access to health care and health insurance.[4–6] Additionally, accounting for mortality differences related to patient and/or hospital characteristics has not been adequately addressed. The purpose of this article is to report on our research into the role that race has on inpatient mortality after controlling for patient and hospital characteristics in a cohort of men who have had equal access to a comprehensive health system for all or nearly all of their adult lives.

Two earlier studies attempted to look at racial disparities in hospital mortality for common medical diagnoses in patients who had at least short-term equality in access to health insurance.[4,7] Both studies found mortality rates were lower for African Americans after adjusting for patient, then hospital, and then combined patient and hospital characteristics. This included a study of veterans admitted for six common medical diagnoses in Veterans Affairs (VA) hospitals. Both studies differed from most of the previous research where African Americans[8–10] and other non-Caucasians[11] usually had worse clinical outcomes. To enable cross-comparison, our study used similar methodologies to the VA study published in the *Journal of the American Medical Association*[6] with the inclusion of a more robust accounting for comorbidities. We investigated whether African-American male military retirees—after having uninterrupted access to comprehensive care for all or nearly all of their adult lives—would have the same comparative outcome as the African-American men in the VA study. Specifically, the research questioned whether participation in this military long-term uninterrupted comprehensive health care system in the United States would eliminate or greatly reduce racial differences in health outcomes.

We conducted a retrospective cohort study of 14,122 male military retirees admitted to 54 military hospitals in the United States for one of six common high-risk medical diagnoses over 4 years. We evaluated racial differences in hospital admission characteristics, salient hospital characteristics and their effect on mortality. Subjects had, on average, over 40 years of uninterrupted equal access to comprehensive preventive and curative health care provided through both U.S. military and civilian institutions via U.S. Government-funded insurance plans (CHAMPUS and TRICARE).[12–14]

METHODS

Subjects

We obtained data on 14,729 retired military members admitted to 1 of 54 hospitals in the Direct Care System (DCS) of the Military Health System (MHS) at least once between October 1, 2000 and September 30, 2004. The DCS consists of government-owned hospitals and clinics where care is provided to beneficiaries by employees or contractors of the U.S. government. The study included data from DCS facilities in the continental United States. We used clinical classification software to include patients with a primary diagnosis of angina, congestive heart failure, acute myocardial infarction, gastrointestinal hemorrhage, stroke, or diabetes. These diagnoses were selected based on their frequency in the DCS and risk of in-hospital mortality. For patients with more than one admission, we selected the last one. Due to statistical size, we excluded women ($n = 176$, 1.2%) and patients with unknown or missing race ($n = 431$, 2.9%) leading to a final study group of 14,122.

*DrPH Program Director, School of Public Health, University of California, Berkeley, 452 Rich Street, Oakland, CA 94609.

†Clinical Investigation Facility, David Grant Medical Center, 101 Bodin Circle, Travis AFB, CA 94535-1800.

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Measurements

The source of data for this study was the MHS Management and Reporting Tool (M2). Race was recorded at admission to the hospital as Caucasian, African American, Asian, Native American, or other non-Caucasian (including Hispanic). To adjust for comorbidities, we used a method based on the presence or absence of 30 separate conditions; each having independent effects on outcomes and not simplified as an index.[15]

We also obtained data on hospital characteristics including the number of hospital beds,[16] the total number of patients seen annually at the hospital, the proportion of patients with these six diagnoses who were non-Caucasian, and whether the hospital was capable of performing coronary artery bypass surgery. We designated a hospital as "urban" if it was located in a metropolitan area with a population of 1 million or more. We assigned hospitals to four geographic regions based on U.S. Census definitions.

Statistical Methods

Descriptive statistics were computed for each of the independent variables and the key dependent variables by race (Caucasian, African American, other non-Caucasian). Bivariate analyses used the Student t test and the χ^2 test to assess the significance of racial differences between Caucasians and each of the two non-Caucasian groups. All analyses were performed using SAS version 8.02 (SAS Institute, Cary, North Carolina).

We used logistic regression to perform racial comparisons of the risk of hospital death, before and after adjustment for patient and hospital characteristics. Results are reported as odds ratios (ORs) and 95% confidence intervals, with Caucasians as the referent group. Before analyzing all diagnoses combined, we performed preliminary analyses stratified by diagnosis. In these analyses, we tested for and failed to find any statistically significant interaction between race and age. These analyses also revealed that the ORs for African American and other non-Caucasian race did not materially differ by diagnosis. Thus, we proceeded to perform analyses using all diagnoses combined.

We included the following patient-level variables in our multivariate models: age, fiscal year, race (Caucasian, African American, other non-Caucasian), military rank (commissioned officer vs. other), marital status (married vs. other), presence of individual comorbid conditions (any of 30 conditions), length of stay, and primary admission diagnosis. The following hospital-level variables were included: number of hospital beds, number of patients treated annually, availability of coronary artery bypass surgery, urban location, proportion of patients with these six diagnoses who were non-Caucasian, and region of the country. We used stepwise regression to aid in the selection of variables for the final multivariate model; all variables with p values ≤ 0.10 were included. We considered a $p \leq 0.05$ to be statistically significant.

TABLE I. Patient and Hospital Characteristics of Study Subjects, by Race

	Caucasian (n = 10,253)	African American (n = 2,172)	Other (n = 1,697)	*p* African American vs. Caucasian	Other vs. Caucasian
Patient characteristics					
Age (years), mean	66.9	61.5	61.7	<0.001	<0.001
Commissioned officer (Second Lieutenant to General) (%)	24.2	5.8	10.1	<0.001	<0.001
Married (%)	84.0	80.2	87.4	0.001	<0.001
Length of stay (days), mean	4.4	4.4	3.9	0.95	<0.001
Primary admission diagnosis (%)					
Angina	41.3	26.8	40.1		
Congestive heart failure	16.8	17.4	10.8		
Acute myocardial infarction	15.0	10.4	14.8	<0.001	<0.001
Gastrointestinal hemorrhage	9.9	13.3	13.3		
Stroke	10.2	12.2	11.0		
Diabetes	6.9	20.1	10.0		
Hospital characteristics					
No. of beds (mean)	194.8	193.1	270.1	0.57	<0.001
No. of patients (in thousands), mean	87.8	90.2	103.4	0.001	<0.001
Availability of bypass surgery (%)	63.6	57.9	69.2	<0.001	<0.001
Urban location (%)	59.9	59.4	73.9	0.68	<0.001
Proportion of treated patients who were non-Caucasian (%)	26.0	30.3	32.2	<0.001	<0.001
Region (%)					
West	46.5	34.7	68.3		
Southeast	30.3	37.3	21.2		
District of Columbia	8.7	14.6	5.7	<0.001	<0.001
Northeast	8.3	9.3	3.7		
Midwest	6.3	4.2	1.1		

RESULTS

At the time of hospital admission, there were large racial differences in baseline characteristics (Table I). When compared with Caucasians, African Americans were younger, less likely to be commissioned officers, less likely to be married, less likely to be admitted for acute myocardial infarction, and more likely to be admitted for gastrointestinal hemorrhage, stroke, or diabetes. The hospitals that African Americans were admitted to had higher numbers of patients, lower availability of bypass surgery, higher proportions of non-Caucasian patients, and tended to be located in the Southeast and the District of Columbia. Other non-Caucasians also differed in patient- and hospital-level characteristics from Caucasian patients.

We found significant racial differences in the distribution of common comorbid conditions (Table II). Of the 10 most common comorbidities shown in the table, 7 had significantly higher prevalence in African Americans than Caucasians. Other non-Caucasians also had higher rates of hypertension when compared with Caucasians.

A comparison was made of racial differences in the risk of hospital mortality, by diagnosis, both before and after adjustment for patient and hospital characteristics (Table III). There was significantly lower unadjusted odds of mortality for other non-Caucasians over Caucasians in acute myocardial infarction, African Americans over Caucasians in diabetes, African Americans over Caucasians in gastrointestinal hemorrhage, and African Americans and other non-Caucasians over Caucasians when all diagnosis were combined. In every comparison, the significance of the difference was gone after adjusting for patient and hospital characteristics.

TABLE II. Common Comorbidities of Study Subjects, by Race

Comorbidity (10 most common)	% Caucasian ($n = 10,253$)	% African American ($n = 2,172$)	% Other ($n = 1,697$)	*p* African American vs. Caucasian	Other vs. Caucasian
Hypertension	57.2	67.1	60.0	<0.001	0.03
Diabetes without chronic complications	22.0	25.1	23.9	0.001	0.08
Chronic pulmonary disease	13.9	9.6	9.0	<0.001	<0.001
Deficiency anemias	7.4	9.9	6.3	<0.001	0.10
Fluid and electrolyte disorders	6.9	10.0	5.5	<0.001	0.04
Peripheral vascular disease	7.1	5.2	4.6	0.001	<0.001
Hypothyroidism	4.5	2.5	3.2	<0.001	0.02
Renal failure	3.5	6.0	4.0	<0.001	0.31
Diabetes with chronic complications	2.9	4.9	3.2	<0.001	0.52
Alcohol abuse	2.2	4.4	2.2	<0.001	0.95

TABLE III. Racial Differences in Risk of Hospital Death, by Diagnosis, before and after Adjustment for Patient and Hospital Characteristics

Diagnosis	Race	Crude Risk of Hospital Death (%)	OR for Death (95% confidence interval) Unadjusted	Adjusted[a]
Acute myocardial infarction	Caucasian	9.9	1.00 (referent)	1.00 (referent)
	African American	6.7	0.65 (0.38–1.13)	0.79 (0.42–1.47)
	Other[b]	5.6	0.54 (0.31–0.95)	0.87 (0.44–1.74)
Angina	Caucasian	1.7	1.00 (referent)	1.00 (referent)
	African American	1.4	0.81 (0.39–1.68)	1.25 (0.56–2.79)
	Other	1.0	0.60 (0.28–1.31)	0.81 (0.34–1.92)
Congestive heart failure	Caucasian	7.4	1.00 (referent)	1.00 (referent)
	African American	4.8	0.63 (0.38–1.05)	0.77 (0.43–1.37)
	Other	6.0	0.80 (0.43–1.52)	1.22 (0.60–2.48)
Diabetes	Caucasian	2.7	1.00 (referent)	1.00 (referent)
	African American[b]	0.5	0.17 (0.04–0.71)	0.27 (0.06–1.21)
	Other	2.4	0.87 (0.29–2.58)	1.19 (0.34–4.10)
Gastrointestinal hemorrhage	Caucasian	5.2	1.00 (referent)	1.00 (referent)
	African American[b]	2.1	0.39 (0.16–0.91)	0.63 (0.23–1.69)
	Other	3.1	0.58 (0.26–1.29)	1.18 (0.45–3.08)
Stroke	Caucasian	11.4	1.00 (referent)	1.00 (referent)
	African American	10.6	0.92 (0.60–1.43)	1.01 (0.61–1.67)
	Other	7.5	0.63 (0.36–1.13)	0.95 (0.49–1.84)
All diagnoses combined	Caucasian	5.3	1.00 (referent)	1.00 (referent)
	African American[b]	3.6	0.66 (0.52–0.84)	0.95 (0.72–1.26)
	Other[b]	3.4	0.62 (0.47–0.82)	1.01 (0.73–1.40)

[a] Adjusted for patient and hospital characteristics. All covariates other than age were selected by stepwise logistic regression.
[b] Value of $p < 0.05$ compared to Caucasians.

A comparison of differences in the risk of hospital death across several characteristics used in the study's multivariate model was reviewed after adjusting for patient and hospital characteristics (Table IV). Multivariate modeling with adjustment for these characteristics revealed no significant difference in the odds of hospital death among Caucasians, African Americans, and other non-Caucasians with the Caucasians as the referent group. Other characteristics highlighted from the model in Table IV include age, fiscal year of admission, length of stay, admission diagnosis, total beds of the admission hospital, and proportion of patients seen in the hospital who were non-Caucasian and comorbid conditions. As expected, risk of mortality increased with age and was highest on admissions day. Patients experienced significantly higher odds of death if their stay exceeded 5 days.

The data show angina admissions held significantly lower rates of death than acute myocardial infarction, congestive heart failure, and stroke but not significantly different than death from diabetes and gastrointestinal hemorrhage. As the total beds increased for the admission hospital, risk of death increased, likely indicating a pattern of admitting and keeping sicker patients at hospitals with a larger number of beds and increasingly greater tertiary care services. Of note was a significant decrease in the odds of death for all patients as the proportion of non-Caucasian patients seen in the hospital increased.

Comorbid conditions upon admission had a varied effect on the OR of death. Compared to having no comorbid conditions at all, if patients had one of the following, there was a greater likelihood of death: congestive heart failure, other neurological disorders (excludes paralysis), chronic pulmonary disease, renal failure, liver disease, human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS), metastatic cancer, solid tumors without metastasis, coagulation deficiency, fluid, and electrolyte disorders or blood loss anemia. A patient was less likely to die with one of the following comorbidities compared to having no comorbidity at all: hypertension (uncomplicated and complicated), diabetes without chronic complications, hypothyroidism, deficiency anemia, or alcohol abuse.

DISCUSSION

Despite long-term equal access to comprehensive medical care, there were still significant racial differences in patient- and hospital-level risk factors among male military retirees hospitalized with common medical diagnoses. After adjustment for these differences, race was not an independent predictor of hospital mortality. Congruent with recent findings in civilian patients,[4,17] Medicare patients,[18,19] and VA patients,[6,20] our study found that patient- and hospital-specific characteristics have a distinct impact on racial disparities in mortality outcomes.

Our unadjusted findings parallel those from two earlier studies from equal access health care systems,[4,6] which found that African Americans had significantly lower risk of hospital mortality than Caucasians after admission with common

TABLE IV. Multivariate Model of Risk of Hospital Death (*N* = 14,122)

Characteristic	OR for Death (95% confidence interval)
Race	
Caucasian	1.00 (referent)
African American	0.95 (0.72–1.26)
Other	1.01 (0.73–1.40)
Quintile of age (years)	
1 (≤54)	1.00 (referent)
2 (55–62)	1.73 (1.12–2.68)
3 (63–68)	2.68 (1.77–4.05)
4 (69–76)	3.89 (2.61–5.80)
5 (≥77)	5.94 (4.02–8.79)
Fiscal year	
2000	1.00 (referent)
2001	0.91 (0.70–1.19)
2002	0.84 (0.64–1.09)
2003	0.64 (0.49–0.85)
2004	0.43 (0.32–0.57)
Quintile of length of stay (days)	
1 (1)	1.00 (referent)
2 (2)	0.46 (0.33–0.63)
3 (3)	0.53 (0.38–0.74)
4 (4–5)	0.46 (0.33–0.63)
5 (≥6)	1.30 (1.02–1.65)
Admission diagnosis	
Angina	1.00 (referent)
Acute myocardial infarction	4.80 (3.62–6.37)
Congestive heart failure	2.55 (1.89–3.45)
Diabetes	0.81 (0.49–1.34)
Gastrointestinal hemorrhage	1.41 (0.97–2.06)
Stroke	4.74 (3.51–6.40)
Quintile of total beds (no.)	
1 (≤89)	1.00 (referent)
2 (90–149)	2.23 (1.59–3.13)
3 (150–216)	2.37 (1.68–3.34)
4 (217–297)	3.01 (1.98–4.59)
5 (≥298)	3.26 (2.12–5.02)
Quintile of proportion of patients who were non-Caucasian (%)	
1 (≤18.7)	1.00 (referent)
2 (18.8–23.2)	0.82 (0.60–1.13)
3 (23.3–31.7)	0.86 (0.62–1.19)
4 (31.8–36.8)	0.55 (0.38–0.81)
5 (≥36.9)	0.61 (0.42–0.90)
Comorbid conditions	
None	1.00 (referent)
Congestive heart failure	2.37 (1.66–3.39)
Hypertension (uncomplicated and complicated)	0.46 (0.39–0.56)
Other neurological disorders (excludes paralysis)	1.82 (1.11–2.97)
Chronic pulmonary disease	1.36 (1.09–1.70)
Diabetes without chronic complications	0.69 (0.54–0.88)
Diabetes with chronic complications	0.58 (0.35–0.97)
Hypothyroidism	0.43 (0.23–0.78)
Renal failure	4.29 (3.23–5.71)
Liver disease	3.51 (2.06–6.00)
HIV and AIDS	7.57 (0.82–69.79)
Metastatic cancer	3.95 (2.48–6.31)
Solid tumors without metastasis	2.38 (1.58–3.60)
Coagulation deficiency	3.28 (2.36–4.55)
Fluid and electrolyte disorders	2.43 (1.91–3.08)
Blood loss anemia	1.70 (1.01–2.88)
Deficiency anemias	0.62 (0.45–0.87)
Alcohol abuse	0.52 (0.28–0.99)

medical diagnoses. However, these earlier studies found the African-American survival advantage persisted after multivariate adjustment, whereas we found that the lower mortality for non-Caucasians dissipated after adjustment. Our comorbidity adjustment methodology[15] was based on a more recent and more comprehensive process than the simpler indexing processes used in most of the previous studies in this area and might have more completely accounted for comorbidity confounders.

Our study had important limitations, including the exclusive use of inpatient administrative data from military hospitals. In addition, we were unable to measure mortality after discharge.[6] We did not estimate racial differences in those who decided to seek care outside of the military hospital, who decided to request do-not-resuscitate orders, or who voluntarily terminated hospital treatment. Additionally, our study lacks complete generalization because our population are male military retirees, have annual military retirement pension income averaging approximately $35,000 for officers and $17,000 for enlisted, and are more highly educated, on average, than the general U.S. population.[12,13] The study ultimately did not use officer vs. enlisted previous active duty status as a proxy for socioeconomic status due to the relative inexactness of this variable option as a predictor of overall retiree income.

Overall, our study failed to find a difference in hospital mortality rates due simply to race among patients with long-term access to health care. Our study suggests that this uninterrupted access to comprehensive long-term health care may be a factor in ensuring equal outcomes for acute illnesses. This study also suggests that health care practices in military hospitals result in equally protected outcomes for all races. Of note was the significant improvement of the odds of death if patients were seen in hospitals where the proportion of patients who were non-Caucasian exceeded 32% when compared to hospitals that normally see patients who are >80% Caucasian. This suggests that the study hospitals may be adapting successfully to differing admission characteristics among races. Further study of practices in these hospitals may disclose hospital-level interventions that could reduce hospital quality differences and their short-term outcome disparities.[18,21]

ACKNOWLEDGMENTS

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