Racial Differences in the Association Between Self-Rated Health Status and Objective Clinical Measures Among Participants in the BARI 2D Trial

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Objectives. We explored whether and how race shapes perceived health status in patients with type 2 diabetes mellitus and coronary artery disease.

Methods. We analyzed self-rated health (fair or poor versus good, very good, or excellent) and associated clinical risk factors among 866 White and 333 Black participants in the Bypass Angioplasty Revascularization Investigation 2 Diabetes trial.

Results. Michigan Neuropathy Screening Instrument scores, regular exercise, and employment were associated with higher self-rated health ($P<.05$). Blacks were more likely than were Whites to rate their health as fair or poor (adjusted odds ratio [OR]=1.88; 95% confidence interval [CI]=1.38, 2.57; $P<.001$). Among Whites but not Blacks, a clinical history of myocardial infarction (OR=1.61; 95% CI=1.12, 2.31; $P<.001$) and insulin use (OR=1.62; 95% CI=1.10, 2.38; $P=.01$) was associated with a fair or poor rating. A post–high school education was related to poorer self-rated health among Blacks (OR=1.86; 95% CI=1.07, 3.24; $P<.001$).

Conclusions. Symptomatic clinical factors played a proportionally larger role in self-assessment of health among Whites with diabetes and coronary artery disease than among Blacks with the same conditions. (*Am J Public Health.* 2010; 100:S269–S276. doi:10.2105/AJPH.2009.176180)

Racial differences in rates of type 2 diabetes mellitus and coronary artery disease, access to medical care, and clinical outcomes have been well documented.[1] Racial differences in perceived health status have also been reported in several patient populations.[1–4] Understanding how the relationship between objective clinical factors and perceived health status is affected by race may add to the ongoing discussion of the significance of race/ethnicity and its effect on existing disparities in cardiovascular outcomes that persist in the United States.

Detrimental racial/ethnic effects are reflected in long-standing health disparities and the underrepresentation of racial/ethnic minority groups in clinical research.[5] Wyatt et al. theorized that racism affects cardiovascular risk factors on 3 levels: (1) institutionalized racism can affect socioeconomic status, (2) perceived racism acts as a psychophysiological stressor, and (3) internalized racism can give rise to risky health behaviors. Furthermore, the patient–provider relationship helps to mediate these pathways through (1) patterned disparities in treatments and interventions, (2) practitioner perceptual bias or stereotyping of patients, and (3) patient perceptions of bias in treatment.[6,7]

Gill and Feinstein conducted a critical appraisal of quality of life (QOL) measures used in the medical literature.[8] The authors concluded that QOL was an individual perception that signified the way that individual patients felt about their health status and nonmedical aspects of their lives. The authors reported that most measurements of QOL in the medical literature seemed to aim at the wrong target and that QOL could be properly assessed only by establishing the opinions of patients in place of, or as a supplement to, instruments developed by experts. This is the context in which culture may shape individual assessments of QOL and therefore reflect differences along racial lines.

McGee et al. investigated the relationship between self-rated health status and mortality by pooling data from the National Health Interview Surveys for 1986 to 1994 on more than 700 000 participants, with almost 17 000 Asian/Pacific Islanders, more than 90 000 Blacks, and more than 50 000 Hispanics. The authors found strong associations between self-rated health status and both socioeconomic status and subsequent mortality. They noted that "a self-report of fair or poor health was associated with at least a twofold increased risk of mortality for all racial/ethnic groups."[4(p41)]

We aimed to determine the extent to which racial/ethnic identity was associated with self-rated health status after adjustment for demographic characteristics, exercise, neuropathy, insulin use, and clinical measures such as angina and congestive heart failure. We also sought to determine whether any association between clinical factors and perceived health status was consistent between groups of diabetes patients as defined by race. We hypothesized that after control for clinical measures, race would be a determinant of self-rated health and that the magnitude of the association between these clinical factors and self-rated health would differ between races.

METHODS

The Bypass Angioplasty Revascularization Investigation 2 Diabetes (BARI 2D) trial is an ongoing randomized, multicenter clinical trial designed to compare early, elective revascularization combined with aggressive medical therapy and initial aggressive medical therapy alone with deferred revascularization as needed. BARI 2D is simultaneously comparing an insulin-providing with an insulin-sensitizing

strategy of glycemic control.[9] Eligibility criteria include a diagnosis of type 2 diabetes and coronary artery disease documented by angiography for which revascularization was not required for immediate control of severe or unstable angina. BARI 2D established sites in the United States, Brazil, Canada, Mexico, Czech Republic, and Austria, with a total of 2368 participants. Because of the marked social, political, and cultural differences across the clinical sites outside the United States, we analyzed data only from participants at US sites.

Participants self-reported race, according to the US Census classification system, as American Indian/Alaskan Native, Asian, Black/African American, Native Hawaiian/Pacific Islander, White, or other.[10] Anyone who identified as more than 1 race or none of the racial groups in the list was classified as other. Hispanic ethnicity was also self-rated and defined as persons of Latin/Spanish culture or origin, regardless of race. Our analysis was limited to non-Hispanic White and non-Hispanic Black (henceforth referred to as White and Black, respectively) randomized enrollees at the BARI 2D sites in the United States (n=1199).

Data Collection and Measures

At study entry (January 2001–March 2005), BARI 2D participants completed a comprehensive battery of baseline psychosocial and clinical assessment measures, including demographic descriptors; clinical history and current status; core angiographic, electrocardiogram, blood, and urine test results; and QOL and self-rated health scores. A significant lesion was defined as 50% or greater stenosis in a coronary artery. A score of 7 or higher (range 0–13) on the Michigan Neuropathy Screening Instrument indicated probable neuropathy.[11] Angina was assessed by the Canadian Cardiovascular Classification System of Angina Pectoris, which rates the severity of chest pain triggered by activity on a scale of 1 to 4.[12]

Health status was self-rated according to a scale from the Medical Outcomes Study.[13] Participants were asked to report their general state of health on a 5-point ordinal scale as excellent, very good, good, fair, or poor. Other BARI 2D assessments of self-rated health were the Duke Activity Status Index score,[13] which evaluates the functional capacity to perform various activities; the energy and health distress subscale, also from the Medical Outcomes Study, which is graded on a continuous scale of 0 (worst) to 100 (best); and the self-efficacy score, which is a measure of an individual's confidence regarding self-management of disease, ranging from 1 (not confident at all) to 10 (totally confident).[14]

Statistical Analysis

We compared baseline demographic, clinical, and QOL characteristics by race. We used the χ^2 statistic to compare categorical variables, the *t* test to compare normally distributed continuous variables, and a Wilcoxon statistic to compare nonparametric continuous variables. For self-rated health outcomes, we combined the responses into 2 categories, comparing fair and poor ratings with good, very good, and excellent ratings. Dichotomous covariates in the model were derived from reported nonmissing data; for example, history of myocardial infarction was actually known history of myocardial infarction. We replaced missing values for continuous variables with the mean value for the variables.

To examine independent predictors of fair or poor self-rated health, we constructed a multivariate logistic regression model for the outcome of fair or poor health. After adjusting for age and gender, we created a stepwise regression model ($P<.10$) for separate variable categories: (1) demographics; (2) clinical history; (3) physical characteristics; (4) biochemistry, electrocardiogram, and urine results; and (5) diabetes and cardiac symptoms. We incorporated the identified risk factors from each category into a single model and used backward stepwise regression to create a parsimonious multivariate model ($P<.05$). We added race to the model to determine the independent effect of race on self-rated health after adjustment for cardiac risk factors and symptom status. We also examined the interactions between race and other factors.

We created multivariate models for each race separately to explore the effect of objective risk factors on self-rated health within each racial group. We retained variables that were identified in either model and used them for multivariate models stratified by race. We determined the C statistic for each model to assess how well the model discriminated between fair or poor and good, very good, or excellent. We report odds ratios (ORs), 95% confidence intervals (CIs), and *P* values. We set statistical significance at $P\leq.05$ and performed all analyses with SAS version 9.2 (SAS Institute Inc, Cary, NC).

RESULTS

Among the non-Hispanic BARI 2D participants enrolled at US sites, 866 were White and 333 were Black, for a total of 1199 participants included in our analysis. The mean age at baseline was 63.2 ±9.2 years, with a mean diabetes duration of 10.8 ±9.0 years. Table 1 describes the participant demographic and clinical characteristics at study entry by race. We found numerous differences in risk factors by race. Whites were significantly more likely to be male, older, more educated, employed or retired, and married. Whites more often had elevated triglycerides, a clinical history of coronary artery bypass graft, and more significant coronary lesions. Blacks in BARI 2D had higher sitting blood pressure and low-density lipoprotein cholesterol, hemoglobin A1c, and creatine levels; greater prevalence of major electrocardiogram abnormalities; longer duration of diabetes; and greater likelihood of currently taking insulin and having micro- or macroalbuminuria.

Whites were more likely than were Blacks to be free from angina or anginal equivalents. Blacks more often had moderate to severe stable angina (Canadian Cardiovascular Classification System 3 and 4), unstable angina, and angina with myocardial infarction only. Whites were more likely to have significant left anterior descending lesions and totally occluded lesions, yet they less often had left ventricular ejection fraction (<50%) than did Blacks.

Quality of Life

Distribution of the health QOL measures by race/ethnicity is shown in Table 1. Whites had a higher mean functional capacity, as measured by the Duke Activity Status Index, and higher self-efficacy than did Blacks; Blacks had a higher energy score. We found no significant difference between races in the health distress score or the continuous health rating score. Blacks were significantly more likely than were Whites to rate their health as

TABLE 1—Baseline Demographic Characteristics, Clinical History, and Quality of Life Among Whites and Blacks With Type 2 Diabetes and Coronary Artery Disease: Bypass Angioplasty Revascularization Investigation 2 Diabetes Trial, January 2001–March 2005

	Total (n = 1199)	Whites (n = 866)	Blacks (n = 333)	*P*
Demographic characteristics				
Male, %	68.4	75.5	49.8	<.001
Age, %	63.2 (9.2)	63.9 (8.9)	61.4 (9.7)	<.001
Education, %				<.001
≤Some high school	19.6	15.0	31.6	
High school diploma	28.1	28.1	28.0	
Some college/associate's degree	31.5	31.9	30.4	
Bachelor's/advanced degree	20.9	25.1	9.9	
Primary insurance, %				.003
Medicare	35.9	37.1	32.8	
Other public	18.1	18.2	18.1	
Private	40.3	40.6	39.5	
None/self-pay	5.7	4.2	9.6	
Exercise regularly, %	25.8	25.7	26.2	
Employment status, %				<.001
Working/employed	41.9	43.3	38.2	
Retired	38.8	40.8	33.4	
Disabled	16.3	13.3	24.0	
Other	3.1	2.6	4.4	
Marital status, %				<.001
Never married	5.9	3.9	11.1	
Married/spouse-like relationship	65.9	73.4	46.2	
Widowed	11.1	9.4	15.6	
Divorced/separated	17.1	13.3	27.0	
Lifestyle characteristics				
BMI (kg/m^2), mean (SD)	33.2 (6.2)	33.1 (5.9)	33.3 (6.9)	
Average waist circumference, cm, mean (SD)	111.6 (14.3)	112.6 (14.0)	108.8 (14.8)	<.001
Smoking status, %				.001
Never	31.4	30.7	33.3	
Former	54.8	57.5	47.8	
Current	13.8	11.8	18.9	
Alcohol use, %				.15
None	76.0	74.6	79.6	
Regular	20.9	21.8	18.3	
Higher than recommended	3.2	3.6	2.1	
Sitting blood pressure 140/90 mm Hg, %	27.5	22.8	39.6	<.001
Cardiac characteristics				
Angina category 6 wk prior to study, %				.013
Stable CCS 1 & 2[a]	37.5	38.1	36	
Stable CCS 3 & 4[a]	7.7	6.9	9.6	
Unstable angina	12.1	10.4	16.5	
Angina equivalents	25.1	25.6	23.7	
No angina/equivalent or only with myocardial infarction	17.6	19.0	14.1	
History of myocardial infarction, %	30.4	31.6	27.3	.149
History of CABG, %	8.8	9.7	6.3	.063

Continued

poor (15% versus 11%, respectively) or fair (45% versus 30%; $P<.001$). After adjustment for significant demographic and clinical factors, Blacks were significantly more likely than were Whites to report their health as fair or poor (OR=1.88; 95% CI=1.38, 2.57; $P<.001$; Table 2).

Participants who were younger, had a blood pressure reading higher than 140/90 mm Hg, had a history of myocardial infarction, or had a higher Michigan Neuropathy Screening Instrument score were significantly more likely to rate their health as fair or poor and were less likely to be employed or to exercise regularly. The model provided 77% accuracy in discriminating between participants who rated their health as fair or poor and those who reported good, very good, or excellent health. The interaction between race/ethnicity and post–high school education was significant ($P=.05$); we therefore stratified the model by race/ethnicity.

Multivariate Analysis by Race/Ethnicity

We created multivariate logistic regression models for fair or poor self-rated health stratified by race/ethnicity (Table 3). Employment (full time or part time) was significantly associated with lower odds of a fair or poor health rating among both Blacks (OR=0.54; 95% CI=0.31, 0.94; $P=.03$) and Whites (OR=0.51; 95% CI=0.35, 0.73; $P<.001$). Among Blacks, a post–high school education significantly increased the odds of reporting fair or poor health (OR=1.86; 95%=1.07, 3.24; $P=.03$). Education was not significantly associated with self-rated health in Whites (OR=0.74; 95% CI=0.52, 1.05; $P=.09$). The neuropathy score from the Michigan Neuropathy Screening Instrument was significantly associated with worse self-rated health among both Blacks (OR=1.20; 95% CI=1.08, 1.33; $P<.001$) and Whites (OR=1.31; 95% CI=1.23, 1.40; $P<.001$). Classic angina and unstable angina were significantly associated with self-reported health among Whites ($P<.001$). Our model had a higher discrimination accuracy for Whites than it did for Blacks (C statistic=0.78 and 0.72, respectively).

Figure 1 illustrates the magnitude of the unadjusted effect of angina status, neuropathy, and insulin use on self-rated health among Whites and Blacks. Each of these symptomatic

TABLE 1—*Continued*

No. of coronary lesions, mean (SD)	4.8 (2.3)	4.9 (2.3)	4.5 (2.3)	.028
No. of significant coronary lesions, mean (SD)	2.6 (1.9)	2.6 (1.9)	2.4 (1.9)	.024
Proximal LAD disease, %	13.1	14.6	9.3	.015
Totally occluded lesion, %	37.8	39.9	32.1	.013
Abnormal LVEF, %	19.9	17.7	25.7	.002
Any major electrocardiogram abnormalities, %	26.3	20.7	40.7	<.001
Cholesterol, mean (SD)				<.001
Total	167.1 (40.7)	164.1 (39.3)	175.0 (43.3)	
Low-density lipoprotein	95.5 (34.8)	91.5 (32.6)	105.6 (38.1)	
High-density lipoprotein	38.1 (11.0)	35.8 (8.8)	43.8 (13.6)	
Triglycerides, median (Q1–Q3)	154 (109, 232)	167 (122, 263)	121 (86, 175)	<.001
Diabetes characteristics				
Duration of diabetes, y, mean (SD)	10.8 (9.0)	10.4 (8.7)	12.0 (9.6)	.01
Currently taking insulin, %	33.7	29.8	43.8	<.001
Hemoglobin A1c, mean (SD)	7.6 (1.6)	7.4 (1.4)	8.0 (1.8)	<.001
Chronic renal dysfunction, %	4.7	3.7	7.3	.009
High creatinine,[a] %	9.1	7.2	14.1	<.001
Micro- or macroalbuminuria, %	34.4	31.7	41.4	<.001
MNSI score, median (Q1–Q3)	3 (2–6)	3 (2–6)	4 (2–6)	
Quality of life				
Self-rated health, %				<.001
Excellent	1.3	1.3	1.5	
Very good	10.7	12.3	6.3	
Good	41.8	45.4	32.5	
Fair	34.3	30.3	44.6	
Poor	11.9	10.7	15.1	
Health rating,[b] mean (SD)	64.9 (19.0)	64.9 (19.0)	65.1 (19.0)	
Duke Activity Status Index,[c] mean (SD)	19.4 (14.0)	20.1 (14.4)	17.6 (13.0)	.01
Energy score,[b] mean (SD)	45.7 (21.6)	44.6 (22.1)	48.3 (20.0)	.01
Health distress score,[b] mean (SD)	57.4 (25.1)	57.6 (24.8)	56.9 (26.0)	
Self-efficacy score,[d] mean (SD)	7.9 (1.8)	8.0 (1.7)	7.6 (2.0)	<.001

Note. BMI = body mass index; CCS = Canadian Cardiovascular Classification System; CABG = coronary artery bypass graft; LAD = left anterior descending; LVEF = left ventricular ejection fraction; MNSI = Michigan Neuropathy Screening Instrument; Q1-Q3=first and third quartile. We included in our analysis only participants who identified themselves as non-Hispanic.
[a]Defined as > 1.5 for men, > 1.4 for women.
[b]Range = 0–100.
[c]Range = 0–58.2.
[d]Range = 1–10.

clinical risk factors was associated with greater odds of reporting fair or poor health among Whites than among Blacks, with or without adjustment for other factors. Among study participants with symptomatic risk factors, similar proportions of Whites and Blacks rated their health as fair or poor. However, among participants without symptomatic risk factors, more Blacks than Whites rated their health as fair or poor.

DISCUSSION

In BARI 2D participants with both known type 2 diabetes and documented coronary artery disease at baseline, Blacks were more likely than were Whites to rate their health as fair or poor. This racial disparity in self-rated health remained after we controlled for differences in clinical risk factors and symptoms. Most importantly, the magnitude of the influence of clinical risk factors on self-rated health was greater among Whites than it was among Blacks, indicating that Whites' perceived health status was more closely related to their objective clinical health status. Blacks with diabetes and coronary artery disease had relatively weak perceived health status regardless of clinical health status.

In a review of studies in which health self-rated as fair to excellent was used to predict subsequent mortality, Idler and Benyamini found that people who self-rated their health as poor had a significant increase in risk of death in 40 of the 46 studies.[15] They noted that self-rated health is "an irreplaceable dimension of health status" and, in fact, that "an individual's health status cannot be assessed without it."[15(p34)]

The strength of the association between risk factors and self-rated health, as shown by the ORs, was greater among Whites than among Blacks. These findings are consistent with past literature showing that fair or poor self-rated health was more strongly associated with poor clinical health status and mortality in Whites than in Blacks.[2,4,16] Ferraro described health pessimism as a state in which fairly healthy individuals regard their health as relatively poor.[17] Ferraro suggested that health pessimism experienced by Blacks adversely affects their expected health outcomes from medical management.[17] Blacks are twice as likely as Whites to report their health as fair or poor, but differences in their health status do not fully account for this difference in self-rated health.[2]

The reasons for these observations are likely multifactorial. It is well documented that despite high incidence and relatively poor outcomes of type 2 diabetes among Blacks, their use of diabetes screening, prevention, and care services is low.[18,19] Our analysis identified results from several variables that were consistent with these observations and that may help explain poorer self-reported health among Black participants even when socioeconomic and clinical health status were controlled. Measures taken at baseline that might predispose participants to report poorer health included socioeconomic (less education, unmarried status, being unemployed or disabled) and clinical (having less well-controlled diabetes, higher blood pressure, and higher levels of low-density lipoprotein

TABLE 2—Independent Predictors of Fair or Poor Self-Rated Health: Bypass Angioplasty Revascularization Investigation 2 Diabetes Trial, January 2001–March 2005

Variable (n = 1199)	OR (95% CI)	P
Black (vs White)	1.88 (1.38, 2.57)	<.001
Female	0.94 (0.70, 1.25)	.66
Age at study entry (per 5 y)	0.81 (0.75, 0.88)	<.001
Blood pressure >140/90 mm Hg	1.62 (1.20, 2.20)	.002
Post–high school education	0.94 (0.71, 1.25)	.67
MNSI score (per point)	1.27 (1.21, 1.34)	<.001
Exercise regularly	0.57 (0.42, 0.77)	<.001
Working/employed	0.52 (0.38, 0.69)	<.001
History of myocardial infarction	1.40 (1.05, 1.87)	.02
Stable CCS 1 or 2 angina	1.40 (1.04, 1.87)	.02
Stable CCS 3 or 4 or unstable angina	1.73 (1.21, 2.49)	.003
Coronary lesions, no.	1.37 (1.00, 1.87)	.05
Major electrocardiogram abnormality	1.43 (1.08, 1.89)	.01
Current insulin use	1.06 (1.00, 1.12)	.06
C statistic	0.77	

Note. OR = odds ratio; CI = confidence interval; MNSI = Michigan Neuropathy Screening Instrument; CCS = Canadian Cardiovascular Classification System. We included in our analysis only participants who identified themselves as non-Hispanic.

TABLE 3—Independent Predictors of Fair or Poor Self-Rated Health With Adjustment for Symptomatic Risk Factors: Bypass Angioplasty Revascularization Investigation 2 Diabetes Trial, January 2001–March 2005

	Whites (n = 866)		Blacks (n = 333)	
	OR (95% CI)	P	OR (95% CI)	P
Female	0.80 (0.55, 1.16)	.23	1.09 (0.66, 1.78)	.75
Age at study entry (per 5 y)	0.78 (0.70, 0.87)	<.001	0.89 (0.77, 1.02)	.10
Blood pressure >140/90 mm Hg	1.47 (0.99, 2.20)	.06	1.56 (0.92, 2.65)	.10
MNSI score (per point)	1.31 (1.23, 1.40)	<.001	1.20 (1.08, 1.33)	<.001
Post–high school education	0.74 (0.52, 1.05)	.09	1.86 (1.07, 3.24)	.03
Working/employed	0.51 (0.35, 0.73)	<.001	0.54 (0.31, 0.94)	.03
No insurance	1.39 (0.60, 3.22)	.44	2.76 (0.95, 8.04)	.06
Exercise regularly	0.58 (0.40, 0.85)	.005	0.58 (0.33, 1.01)	.05
History of myocardial infarctions	1.61 (1.14, 2.27)	.01	1.19 (0.68, 2.09)	.54
Stable CCS 1 or 2 angina (vs no angina)	1.65 (1.16, 2.36)	.01	1.02 (0.58, 1.81)	.94
Stable CCS 3 or 4 or unstable angina (vs no angina)	2.27 (1.43, 3.59)	<.001	1.08 (0.57, 2.06)	.82
Coronary lesions, no.	1.07 (1.00, 1.15)	.06	1.02 (0.92, 1.13)	.74
Current insulin use	1.68 (1.18, 2.39)	.004	1.21 (0.73, 2.02)	.46
Albumin creatinine ratio (log)	1.14 (1.04, 1.26)	.01	0.98 (0.87, 1.10)	.69
C statistic	0.78		0.72	

Note. OR = odds ratio; CI = confidence interval; MNSI = Michigan Neuropathy Screening Instrument; CCS = Canadian Cardiovascular Classification System. We included in our analysis only participants who identified themselves as non-Hispanic.

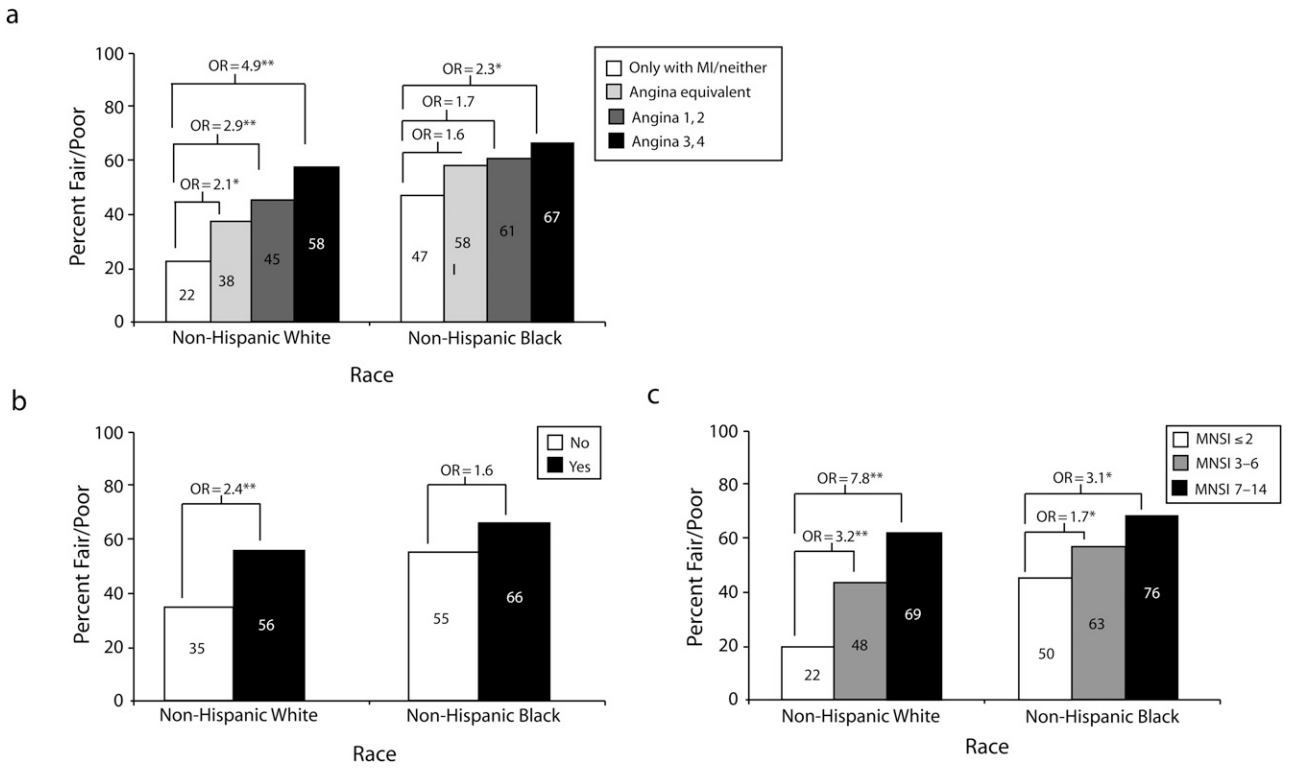
cholesterol) factors. Exploration of these issues remains a priority in light of evidence that Blacks have 2 to 3 times the cardiovascular mortality of Whites at any age.[20]

In general, Blacks had poorer objective clinical health status than did Whites. However, Blacks with a post–high school education were significantly more likely to rate their health as fair or poor than were Blacks with less education (Table 3). By contrast, education level had no significant effect on self-rated health scores for Whites.

Our present study was unique in examining the scope of symptomatic clinical risk factors. Interestingly, Blacks and Whites with symptomatic risk factors had similar perceived health status. However, among study participants without symptomatic risk factors, Blacks had worse perceived health status than did Whites. This may indicate that nonclinical factors play a proportionally larger role in self-assessment of health for Blacks than for Whites. A review of the literature reveals that multiple variables, such as nongenetic, physical, cultural, religious, and socioeconomic factors, are captured by racial categorization and could be at play in causing racial differences, but these were not directly measured in our study.[17, 21] Blacks may have worse self-rated health than do Whites for several very realistic reasons, including generally inferior access to cardiac care and shorter life expectancy.[22–24]

Perceptions of interpersonal and institutional maltreatment affect well-being, and other studies have linked health-related QOL to socioeconomic status, social disadvantage, and diminished optimism in the face of poverty and discrimination.[2,25,26] Moreover, in nationally representative surveys, among Blacks and Whites with higher socioeconomic status, Blacks reported less improvement in self-rated health than did Whites.[27]

Other variables that are likely to contribute to self-rated health disparities include health knowledge, attitudes, and beliefs. In a study assessing the health attitudes, beliefs, and behaviors of Blacks, 30% of the respondents indicated that their health was dependent on fate or destiny.[28] Blanchard et al. convened a focus group of Blacks with diabetes at a health facility in a suburb of Baltimore, Maryland, and reported significant



Note. CHF = congestive heart failure; MI = myocardial infarction; MNSI = Michigan Neuropathy Screening Instrument; OR = unadjusted odds ratio.
*$P < .05$; **$P < .001$.

FIGURE 1—Percentage of participants with fair or poor self-rated health by race and symptomatic risk factors: Bypass Angioplasty Revascularization Investigation 2 Diabetes Trial, January 2001–March 2005

differences between the services offered for diabetes education and the services desired by the participants.[29] These studies suggest that diabetes self-management education interventions need to be culturally sensitive and tailored to specific populations to be effective.

This premise can be applied to other cultural and socioeconomic factors associated with being Black, and further testing must be done to further understand the results. Race and ethnicity often appear as a proxy for many other variables that are often associated with race.[30] In addition, there may be a broad overlap in cultural factors that are correlated with ethnicity. Such cultural variables include perceptions about illnesses and when to seek treatment and problem-solving skills related to symptomatology. Walsh et al. also suggested that identification and measurement of ecocultural domains were necessary to explain ethnic or racial group differences.[30] Hill-Briggs et al. identified socioeconomic barriers influencing self-care among urban Blacks with type 2 diabetes and the relationship of these barriers to QOL.[3] They suggested that interventions in diabetes care needed to be tailored to meet the specific needs of inner-city, low-income minorities.

Limitations

Our study was cross-sectional rather than longitudinal. We used baseline data to look at the participants' status at study entry. Therefore, we could assess the association between clinical factors and QOL rather than the effect that these clinical factors might have on future QOL. Also, the study participants all had diabetes and heart disease; our findings therefore cannot be generalized to the healthy population. Another limitation was the different proportion of minorities at each site, which may have confounded the effect of race. The sample size of Whites was almost twice that of Blacks, increasing the statistical significance of clinical risk factors among Blacks compared with Whites; we therefore emphasized differences in the magnitude of the effect of these risk factors within the 2 racial groups. Our study captured complications and select comorbid diseases related to coronary artery disease and type 2 diabetes. It did not take into account other diseases that could affect the patients' QOL, such as arthritis, dental conditions, respiratory illnesses (e.g., rheumatism, lung cancer), and psychiatric disorders (e.g., depression).

We acknowledge the limitation inherent in the current standards for classification of race/ethnicity. According to the Institute of Medicine, human biodiversity cannot be adequately summarized according to the broad, presumably discrete categories assumed by a racial taxonomy.[28] Furthermore, racial groups, as defined by the US Office of Management and Budget (American Indian or Alaska Native, Asian or Pacific Islander, Black or African American, or White), and the

recognized ethnic group (Hispanic or non-Hispanic) are not discernible through genetic information.[10] However, race/ethnicity is still an important variable for understanding disparities in medical care and for the design of culturally tailored interventions to eliminate racial and ethnic health disparities in type 2 diabetes and coronary artery disease.[31]

Conclusions

Our findings address several potential reasons for health disparities found in patients with type 2 diabetes and coronary artery disease. First, numerous studies have established self-rated health as a valid and reliable link to objective health status and mortality, not only as an effect, but also as a cause.[2,4,6,7,15,32–35] These studies also document how self-rated health is associated with a less favorable risk factor profile in Black populations who report their health status as fair or poor. Our study provides a glimpse at the "bottom of the iceburg,"[15(p21)] highlighting the importance of investigating difference within a racial group (Blacks) in addition to comparisons with Whites.

Health status related to type 2 diabetes and coronary artery disease cannot be measured by clinical variables alone, especially in racially and ethnically diverse populations. Black BARI 2D participants were more likely to have fair or poor self-rated health. However, objective clinical factors were more strongly associated with self-rated health status among Whites. Further exploring the reasons for these associations through additional research may provide insight into the complex meanings of self-rated health among Blacks. Our study adds to the growing body of literature attempting to better understand psychosocial and clinical factors driving disparities in cardiovascular outcomes that persist between Black and White populations in the United States and thus to enable development of a long-term strategy to close the health disparity gap. ■

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Contributors

S.B. Thomas, BARI 2D coinvestigator and chair of the Race/Ethnicity Writing Team, developed hypotheses and interpreted data. V.V. Sansing and M. Mori Brooks, coprinicipal investigators of BARI 2D, analyzed and interpreted data. A. Davis, M. Magee, V.S. Srinivas, and T. Helmy interpreted data. All authors wrote, reviewed, and approved the article.

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Human Participant Protection

This study was approved by the University of Pittsburgh institutional review board and by all BARI 2D clinical sites.

References

1. Kaul P, Lytle BL, Spertus JA, DeLong ER, Peterson ED. Influence of racial disparities in procedure use on functional status outcomes among patients with coronary artery disease. *Circulation.* 2005;111(10):1284–1290.

2. Boardman JD. Health pessimism among Black and White adults: the role of interpersonal and institutional maltreatment. *Soc Sci Med.* 2004;59(12):2523–2533.

3. Hill-Briggs F, Gary TL, Hill MN, Bone LR, Brancati FL. Health-related quality of life in urban African Americans with type 2 diabetes. *J Gen Intern Med.* 2002;17(6):412–419.

4. McGee DL, Liao Y, Cao G, Cooper RS. Self-reported health status and mortality in a multiethnic US cohort. *Am J Epidemiol.* 1999;149(1):41–46.

5. Thomas SB. The color line: race matters in the elimination of health disparities. *Am J Public Health.* 2001;91(7):1046–1048.

6. Fincher C, Williams JE, MacLean V, Allison JJ, Kiefe CI, Canto J. Racial disparities in coronary heart disease: a sociological view of the medical literature on physician bias. *Ethn Dis.* 2004;14(3):360–371.

7. Wyatt SB, Williams DR, Calvin R, Henderson FC, Walker ER, Winters K. Racism and cardiovascular disease in African Americans. *Am J Med Sci.* 2003; 325(6):315–331.

8. Gill TM, Feinstein AR. A critical appraisal of the quality of quality-of-life measurements. *JAMA.* 1994; 272(8):619–626.

9. Brooks MM, Frye RL, Genuth S, et al. Hypotheses, design, and methods for the Bypass Angioplasty Revascularization Investigation 2 Diabetes (BARI 2D)Trial. *Am J Cardiol.* 2006;97(12A):9G–19G.

10. Office of Management and Budget. Revisions to the standards for the classification of federal data on race and ethnicity. 1997. Available at: http://www.whitehouse.gov/omb/rewrite/fedreg/ombdir15.html. Accessed December 23, 2009.

11. Feldman EL, Stevens MJ. Clinical testing in diabetic peripheral neuropathy. *Can J Neurol Sci.* 1994;21(4): S3–S7.

12. Campeau L. Grading of angina pectoris [letter]. *Circulation.* 1976;54:522–523.

13. Stewart AL, Ware JE. *Measuring Functioning and Well-Being: The Medical Outcomes Study Approach.* Durham, NC: Duke University Press; 1992.

14. Lorig K. *Outcome Measures for Health Education and Other Health Care Interventions.* Thousand Oaks, CA: Sage Publications; 1996.

15. Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behav.* 1997;38(1):21–37.

16. Lee SJ, Moody-Ayers SY, Landefeld CS, et al. The relationship between self-rated health and mortality in older Black and White Americans. *J Am Geriatr Soc.* 2007;55(10):1624–1629.

17. Ferraro KF. Are Black older adults health-pessimistic? *J Health Soc Behav.* 1993;34(3):201–214.

18. Kirk JK, Bell RA, Bertoni AG, et al. A qualitative review of studies of diabetes preventive care among minority patients in the United States, 1993–2003. *Am J Manag Care.* 2005;11(6):349–360.

19. LeMaster JW, Chanetsa F, Kapp JM, Waterman BM. Racial disparities in diabetes-related preventive care: results from the Missouri Behavioral Risk Factor Surveillance System. *Prev Chronic Dis.* 2006;3(3): A86.

20. Mensah GA, Brown DW. An overview of cardiovascular disease burden in the United States. *Health Aff (Millwood).* 2007;26(1):38–48.

21. Lewis RK, Green BL. Assessing the health attitudes, beliefs, and behaviors of African Americans attending church: a comparison from two communities. *J Community Health.* 2000;3(25):211–224.

22. Davis AM, Vinci LM, Okwuosa TM, Chase AR, Huang ES. Cardiovascular health disparities: a systematic review of health care interventions. *Med Care Res Rev.* 2007;64(5 Suppl):29S–100S.

23. Harper S, Lynch J, Burris S, Davey Smith G. Trends in the Black–White life expectancy gap in the United States, 1983–2003. *JAMA.* 2007;297(11):1224–1232.

24. Ostchega Y, Harris TB, Hirsch R, Parsons VL, Kington R. The prevalence of functional limitations and disability in older persons in the US: data from the National Health and Nutrition Examination Survey III. *J Am Geriatr Soc.* 2000;48(9):1132–1135.

25. Fiscella K. Ethnicity, poverty, health, and the American dream [commentary]. *Fam Syst Health.* 1996;14(3):361–364.

26. Skarupski KA, de Leon CF, Bienias JL, et al. Black–White differences in health-related quality of life among older adults. *Qual Life Res.* 2007;16(2):287–296.

27. Farmer MM, Ferraro KF. Are racial disparities in health conditional on socioeconomic status? *Soc Sci Med.* 2005;60(1):191–204.

28. Committee on Cancer Research Among Minorities and the Medically Underserved. Haynes MA, Smedley BD, eds. *The Unequal Burden of Cancer: An Assessment of NIH Research and Programs for Ethnic Minorities and the Medically Underserved.* Washington, DC: National Academies Press; 1999.

29. Blanchard MA, Rose LE, Taylor J, McEntee MA, Latchaw LL. Using a focus group to design a diabetes education program for an African American population. *Diabetes Educ.* 1999;25(6):917–924.

30. Walsh ME, Katz MA, Sechrest L. Unpacking cultural factors in adaptation to type 2 diabetes mellitus. *Med Care.* 2002;40(1 Suppl):I129–I139.

31. Bennett T. "Racial" and ethnic classification: two steps forward and one step back? *Public Health Rep.* 1997;112(6):477–480.

32. Benyamini Y, Idler EL. Community studies reporting association between self-rated health and mortality: additional studies, 1995 to 1998. *Res Aging.* 1999;21:392–401.

33. Franco OH, Steyerberg EW, Hu FB, Mackenbach J, Nusselder W. Associations of diabetes mellitus with total life expectancy and life expectancy with and without cardiovascular disease. *Arch Intern Med.* 2007;167(11):1145–1151.

34. Gitlin LN, Hauck WW, Dennis MP, Schulz R. Depressive symptoms in older African-American and White adults with functional difficulties: the role of control strategies. *J Am Geriatr Soc.* 2007;55(7):1023–1030.

35. Kressin NR, Glickman ME, Peterson ED, Whittle J, Orner MB, Petersen LA. Functional status outcomes among White and African-American cardiac patients in an equal access system. *Am Heart J.* 2007;153(3):418–425.