Racial Variations in Treatment and Outcomes of Black and White Patients With High-Risk Non–ST-Elevation Acute Coronary Syndromes

Insights From CRUSADE (Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes With Early Implementation of the ACC/AHA Guidelines?)

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Background—Black patients with acute myocardial infarction are less likely than whites to receive coronary interventions. It is unknown whether racial disparities exist for other treatments for non–ST-segment elevation acute coronary syndromes (NSTEMI) and how different treatments affect outcomes.

Methods and Results—Using data from 400 US hospitals participating in the CRUSADE (Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes with Early Implementation of the ACC/AHA Guidelines?) National Quality Improvement Initiative, we identified black and white patients with high-risk NSTEMI (positive cardiac markers and/or ischemic ST-segment changes). After adjustment for demographics and medical comorbidity, we compared the use of therapies recommended by the American College of Cardiology/American Heart Association guidelines for NSTEMI and outcomes by race. Our study included 37,813 (87.3%) white and 5,504 (12.7%) black patients. Black patients were younger; were more likely to have hypertension, diabetes, heart failure, and renal insufficiency; and were less likely to have insurance coverage or primary cardiology care. Black patients had a similar or higher likelihood than whites of receiving older ACS treatments such as aspirin, β-blockers, or ACE inhibitors but were significantly less likely to receive newer ACS therapies, including acute glycoprotein IIb/IIIa inhibitors, acute and discharge clopidogrel, and statin therapy at discharge. Blacks were also less likely to receive cardiac catheterization, revascularization procedures, or smoking cessation counseling. Acute risk-adjusted outcomes were similar between black and white patients.

Conclusions—Black patients with NSTEMI were less likely than whites to receive many evidence-based treatments, particularly those that are costly or newer. Longitudinal studies are needed to assess the long-term impact of these treatment disparities on clinical outcomes. (Circulation. 2005;111:1225-1232.)

Key Words: ethnic groups ■ coronary disease ■ therapy ■ myocardial infarction

Numerous advances have been made in recent years in the treatment of patients with acute coronary syndromes (ACS). Despite these advances, long-term mortality for patients with non–ST-segment elevation (NSTEMI) ACS is higher than for those with ST-segment elevation myocardial infarction (MI).1,2 The American College of Cardiology (ACC)/American Heart Association (AHA) Guidelines for the Management of Unstable Angina and Non–ST-Segment Elevation Myocardial Infarction (NSTEMI) were developed to assist healthcare professionals in making evidence-based decisions for managing patients with NSTEMI.3 The most recent version of these guidelines emphasized recommendations for early invasive management and the use of antiplatelet agents.4 Although recent quality-improvement efforts have focused on improving adherence to published guidelines,5–9 significant gaps continue to exist between guideline recom-
mendations and the actual treatment of patients with NSTE ACS.10–12

Patient-related factors, such as age, race, sex, geographic location, marital status, socioeconomic status, medical insurance status, and comorbid disease conditions, may be associated with reduced rates of adherence to evidence-based treatment strategies in patients with ischemic heart disease.12–18 Studies have consistently shown that black patients with acute MI are less likely than white patients to receive invasive coronary interventions,12,13,19–24 but there are relatively few data evaluating the medical treatment of black patients with NSTE ACS relative to white patients.25–29

We examined the association of race with guideline-recommended patient management strategies in patients with NSTE ACS across 400 US hospitals. We compared differences in patient and hospital factors, rates of invasive and noninvasive interventions, and adjusted and unadjusted clinical outcomes in black and white patients.

**Methods**

**Data Source**

CRUSADE (Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes with Early Implementation of the ACC/AHA Guidelines?), a National Quality Improvement Initiative, is a voluntary observational study designed to promote evidence-based treatment of hospitalized patients with high-risk NSTE ACS. Medical records of patients with suspected high-risk NSTE ACS are reviewed to determine whether they meet eligibility criteria. All data are abstracted by chart review at each hospital by a trained clinical data abstractor using standard predefined data definitions. The institutional review board at each hospital approved participation in the CRUSADE Initiative.

**Study Population**

We included black and white patients enrolled in CRUSADE between January 2, 2002, and February 13, 2003, from 400 US hospitals. Because CRUSADE is a multidisciplinary registry for patients with NSTE ACS, study participants were not randomly assigned to any groups. Patients were included if they had ischemic symptoms at rest lasting ≥10 minutes within 24 hours of hospital presentation and had either ischemic ECG changes (ST-segment depression ≥0.5 mm or transient ST-segment elevation lasting less than 30 minutes) or elevated cardiac markers (troponin T or I or creatine kinase-MB greater than the upper limit of normal). Patients transferred from an outlying hospital >24 hours after onset of the most recent ischemic symptoms were excluded. We also excluded patients transferred out of a CRUSADE hospital, because outcomes data could not be completed because of current US privacy laws. Finally, we excluded patients with missing race data and those coded with a race other than black or white.

**Study Variables and Definitions**

The CRUSADE case report form contains demographic and clinical information including age, self-reported race, sex, insurance status, medical history, clinical presentation, acute medications, interventional treatments, discharge therapies, the presence or absence of contraindications to therapies, and in-hospital outcomes. Acute medication use was defined as use of medications within the first 24 hours after admission. Composite adherence scores were also calculated as the percentage of patients who received class I ACC/AHA guideline–recommended treatments out of the total number of patient care opportunities (eligible for treatment).31 Acute composite adherence score summarized use of aspirin, heparin, β-blockers, and glycoprotein (GP) IIb/IIIa inhibitors within 24 hours. Discharge adherence composite scores summarized use of aspirin, β-blockers, ACE inhibitors, and lipid-lowering therapy. Overall composite scores included acute and discharge composite results.

Care patterns were also compared among different patient risk groups. Risk categories were based on a modified version of the PURSUIT 30-day mortality risk model for NSTE ACS.30 This model predicts the likelihood of in-hospital mortality based on baseline clinical factors (age, sex, signs of congestive heart failure [CHF] at presentation, ST-segment depression, systolic blood pressure, heart rate, MI, and interaction between heart rate and MI). Patients were classified as low-risk (<1%), intermediate-risk (<1% to 3%), or high-risk (≥3%) by use of a modified version of the PURSUIT 30-day mortality risk model for NSTE ACS.30

Outcomes within CRUSADE were limited to in-hospital events as classified by CRUSADE investigators, without central adjudication. Outcomes collected were all-cause mortality, postadmission infarction, and red blood cell transfusion.

**Statistical Analyses**

Our primary goal was to examine the racial disparities in the treatment of black and white patients with high-risk NSTE ACS. A secondary goal was to relate potential disparities with patient outcomes.

For descriptive analyses, comparisons between black and white patients were made on the basis of baseline characteristics, treatment profiles, procedure use, and clinical outcomes. Mean or median values were used to describe continuous variables, and percentages were reported for categorical variables. The Wilcoxon test for continuous variables and the χ² statistic for categorical variables were used to determine significance. At the hospital level, we also compared overall, acute, and discharge adherence scores after categorizing hospitals on the basis of the percentage of black patients treated.

Outcomes were tested by use of a method that controlled for potential site confounding, whereby sites that treat a higher percentage of black patients may also be sites that have a lower or higher level of compliance.31 Specifically, odds ratios (ORs) were derived from a generalized linear mixed model with “hospital” as a random effect and also included a hospital-level variable that reflected the percentage of black patients treated at a site. Thus, adjusted ORs from this model reflect the within-site effect of being black versus white on various outcomes.

Patient and hospital characteristics adjusted for in all analyses included age, sex, body mass index, race, insurance status (Medicare/ Medicaid, self-insured, or health maintenance organization [HMO] insured), family history of coronary artery disease, hypertension, diabetes, current/recent smoker, hypercholesterolemia, previous MI, previous percutaneous coronary intervention (PCI), previous coronary artery bypass graft surgery (CABG), previous CHF, previous stroke, renal insufficiency, blood pressure, heart rate, ST-segment (depression, elevation, neither), signs of CHF at presentation, positive cardiac markers, physician specialty (cardiologist, internist), hospital region (West, Northeast, Midwest, and South), facility type (no services, cardiac catheterization laboratory only, percutaneous but no surgical revascularization capability), and hospital type (academic versus nonacademic). We also formally tested whether the effect of race on treatment decisions varied as a function of hospital academic affiliation, facility type (access to diagnostic cardiac catheterization, percutaneous coronary revascularization, and/or bypass surgery), and geographic region (Northeast, South, Midwest, West). A 2-sided probability value of P<0.05 was established as the level of statistical significance for all tests. All statistical analyses were performed by use of SAS software (version 8.2, SAS Institute).

**Results**

**Study Population**

The CRUSADE database included 54 042 patients with high-risk NSTE treated between January 2, 2002, and February 13, 2003. We excluded 3185 patients with race other
than black or white, 646 patients with missing race information, and 6894 patients who were transferred out within 24 hours of the onset of their most recent symptoms. The resulting study population of 43,317 patients included 5504 (12.7%) black and 37,813 (87.3%) white patients.

Baseline Characteristics
Black patients were younger and were more likely to be female and to have hypertension, diabetes mellitus, renal insufficiency, history of smoking, history of CHF, and history of stroke. Black patients were less likely than white patients to present with ST-segment depression or positive cardiac markers but more likely to present with signs of CHF. Black patients were also less likely to carry HMO or private insurance plans and were more likely than whites to be self-insured or not insured at all. Black patients were more likely to receive care in an academic institution and less likely to have a cardiologist as their primary provider during hospitalization (Table 1).

In-Hospital Acute Treatment
After adjustment for baseline variables, medical history, presenting features, and hospital characteristics, black patients were as likely as white patients to receive unfractionated or low-molecular-weight heparin and β-blockers and more likely to receive aspirin during the first 24 hours after presentation. On the other hand, black patients were less likely than white patients to receive clopidogrel and GP IIb/IIIa inhibitors (Table 2).

Black patients were significantly less likely than white patients to undergo diagnostic cardiac catheterization or PCI during hospitalization. These disparities were present regardless of the patients’ risk of adverse cardiac events. High-risk black patients were also significantly less likely to undergo CABG surgery compared with high-risk white patients (Table 3).

Black patients receiving an early invasive strategy (with cardiac catheterization within <48 hours of presentation) were less likely to receive intravenous (IV) GP IIb/IIIa inhibitors (51% versus 54%, P=0.0026; adjusted OR, 0.86; 95% CI, 0.77 to 0.97). Similarly, among those receiving an early invasive strategy, blacks were less likely to receive acute clopidogrel (54% versus 63%, P<0.0001; adjusted OR, 0.82; 95% CI, 0.73 to 0.91). Black and white patients not receiving an early invasive strategy were unlikely to receive IV GP IIb/IIIa inhibitors within 24 hours of presentation (16% versus 17%; adjusted OR, 0.89; 95% CI, 0.77 to 1.02). Among those not receiving acute intervention, blacks remained less likely to receive clopidogrel (24% versus 33%, P<0.0001; adjusted OR, 0.88; 95% CI, 0.80 to 0.98).

Black patients were as likely as white patients to receive aspirin and β-blockers at discharge and were more likely to receive ACE inhibitors at discharge. Conversely, blacks were significantly less likely to receive clopidogrel and lipid-lowering agents at the time of discharge compared with white patients. Despite being equally likely to be counseled for dietary modification and being referred for cardiac rehabilitation, blacks were less likely to be counseled for smoking cessation (Table 4).

We also investigated whether blacks were cared for preferentially at hospitals where care was sub par relative to peer

| TABLE 1. Clinical Characteristics and Hospital Features |
|-----------------|-----------------|-----------------|
| Characteristic  | Overall (n=43,317) | White (n=37,813) | Black (n=5504) |
| Age, y, median  | 69               | 70               | 61               |
| Female, %       | 40.6             | 39.6             | 47.7             |
| Hypertension, % | 68.6             | 66.7             | 81.4             |
| Diabetes, %     | 32.0             | 30.7             | 40.5             |
| Smoking, %      | 27.6             | 26.6             | 34.6             |
| Hypercholesterolemia, % | 46.1           | 47.1             | 38.7             |
| Renal insufficiency, % | 13.6           | 12.3             | 22.3             |
| Previous MI, %* | 31.4             | 31.7             | 29.7             |
| Previous CHF, % | 19.0             | 18.1             | 24.9             |
| Previous PCI, % | 21.7             | 22.2             | 18.4             |
| Previous CABG, % | 20.5             | 21.7             | 12.8             |
| Presenting features, % | 40.3           | 40.8             | 36.9             |
| ST-segment depression | 87.6           | 88.0             | 85.3             |
| Signs of CHF    | 22.5             | 22.2             | 24.8             |
| Insurance, %    | 44.8             | 46.3             | 34.7             |
| HMO/private     | 48.5             | 47.9             | 52.7             |
| Medicare/Medicaid | 7.8             | 7.1              | 12.8             |
| Self/none       | 5.9              | 5.2              | 11.0             |
| Hospital factors, % | 59.3           | 60.1             | 53.7             |
| Primary MD cardiologist | 28.5           | 24.9             | 52.8             |
| No. of beds, median | 378            | 374              | 427             |
| No catheterization laboratory | 4.0          | 4.0              | 3.7              |
| Catheterization laboratory only | 7.8          | 7.1              | 12.8             |
| PCI capable, not CABG capable | 4.1         | 4.2              | 3.9              |
| PCI and CABG capable | 84.1          | 84.7             | 79.6             |
| Region          |                  |                  |                  |
| West            | 8.4              | 9.0              | 4.7              |
| South           | 33.8             | 32.4             | 43.1             |
| Midwest         | 37.1             | 37.1             | 37.2             |
| Northeast       | 20.7             | 21.5             | 15.0             |

All data are percentages except age and No. of beds. All P values <0.0001 unless otherwise indicated.

*P=0.003.

hospitals. Overall, there was wide variability in the percentage of blacks treated at a given CRUSADE center (Figure). Nevertheless, the mean acute, discharge, and overall composite use of class I ACC/AHA medications was similar among hospitals regardless of percentage of black hospitals constituting their population. We also formally tested whether the effect of race on treatment decisions varied as a function of hospital academic affiliation, facility type (access to diagnostic cardiac catheterization, percutaneous coronary revascularization, and/or bypass surgery), and geographic region (Northeast, South, Midwest, West) and found that that the effect of race on treatment decision was consistent across centers regardless of academic affiliation, facility type, or geographic region.
In-Hospital Outcomes

After adjustment for the percentage of black patients at the hospital, demographics, medical history, presentation symptoms, and hospital characteristics, black patients had similar in-hospital mortality compared with white patients with high-risk NSTE ACS. Black patients were less likely to develop cardiogenic shock and equally likely to receive a red blood cell transfusion during hospitalization (Table 5).

Discussion

We believe that our study adds significantly to the large body of literature on racial disparities observed in the provision of cardiac care. In this large national observational study, we carefully evaluated multiple indicators of quality of care given to patients presenting with NSTE ACS. Our results are mixed. The use of certain well-established ACS therapies (aspirin, β-blockers, ACE inhibitors) in blacks was equal to or greater than that seen in whites, but the use of newer or more resource-intensive therapies tended to be lower among blacks compared with whites.

Previous studies evaluating racial disparities in acute MI have suffered from several important limitations. First, many studies have relied on administrative databases rather than direct chart abstraction. In addition, some studies draw from limited geographical regions or limited populations, such as elderly Medicare beneficiaries or patients cared for by the Veterans Health Administration. In contrast, our sample represents a variety of hospital types (community, academic, Veterans Administration) and is a nationally representative sample. We used direct chart abstraction rather than relying on administrative data. Previous studies have generally focused on STEMI and not the broader population with NSTE ACS, the most common type of ACS. Earlier studies evaluating racial disparities in the treatment of MI have focused primarily on invasive procedures. We examined a broad...
range of guidelines consisting of acute and discharge care measures, including acute medical therapies, invasive management strategies, discharge medications, and behavioral modification interventions, such as dietary counseling and smoking cessation counseling, as well as cardiac rehabilitation.

Many investigators have found that blacks receive fewer invasive cardiac procedures than whites in a variety of settings. Our findings confirm that blacks with NSTE ACS are also less likely to undergo cardiac catheterization and both surgical and percutaneous revascularization. The magnitude of the observed disparity in our study is similar to that in previous publications, with 20% to 40% lower likelihood of cardiac catheterization and revascularization among blacks even after adjustment for various baseline patient and hospital variables. Paradoxically, a lower proportion of both black and white patients underwent cardiac catheterization and revascularization with increasing risk of adverse cardiac outcomes. Nevertheless, disparities in cardiac catheterization and revascularization were apparent in patients at low, intermediate, or high risk for cardiac events. As a result, significant disparities exist even in patients who are most likely to benefit from an invasive management strategy. Furthermore, disparities are present in both overall and early use of these procedures as recommended in the guidelines, despite the fact that early invasive management is more likely to affect outcomes in these patients.

Less information is available on racial disparities in the medical treatment of ACS. Studies have shown that blacks with acute MI were less likely to be treated with reperfusion therapy, aspirin, and β-blockers. Other recent publications have demonstrated similar rates in use of aspirin, β-blockers, and ACE inhibitors by race in the treatment of acute MI and CHF. We found that blacks with high-risk

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<th>TABLE 4. Treatment and Recommendations at Discharge</th>
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<tr>
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<td>Medications</td>
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<tr>
<td>Aspirin</td>
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<td>β-Blocker</td>
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<td>ACE inhibitor*</td>
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<tr>
<td>Clopidogrel</td>
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<tr>
<td>Any lipid-lowering agent†</td>
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<tr>
<td>Statin†</td>
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<tr>
<td>Recommendations</td>
</tr>
<tr>
<td>Smoking cessation counseling‡</td>
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<tr>
<td>Dietary modification counseling</td>
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<tr>
<td>Cardiac rehabilitation referral§</td>
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</tbody>
</table>

Odds ratio (OR) for effect of race (reference is white) within site adjusted for % black at site, age, sex, race, body mass index, family history of coronary artery disease, hypertension, diabetes, current/recent smoker, hypercholesterolemia, previous MI, previous PCI, previous CABG, previous CHF, previous stroke, renal insufficiency, ST-segment depression, transient ST-segment elevation, positive cardiac markers, signs of CHF, heart rate, systolic blood pressure, insurance status, No. of hospital beds, geographical region, hospital services, and hospital academic status.

*Only for patients with CHF, ejection fraction <40%, hypertension, or diabetes mellitus.
†Only for patients with LDL >125 mg/dL.
‡Only for current smokers.
§Only for patients with positive markers.

<table>
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<th>TABLE 5. In-Hospital Outcomes</th>
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<tr>
<td>Outcome</td>
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<tr>
<td>Death</td>
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<tr>
<td>Death or postadmission infarction</td>
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<tr>
<td>Cardiogenic shock</td>
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<td>RBC transfusion</td>
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RBC indicates red blood cell. Odds ratio (OR) for effect of race (reference is white) within site adjusted for % black at site, age, sex, race, body mass index, family history of coronary artery disease, hypertension, diabetes, current/recent smoker, hypercholesterolemia, previous MI, previous PCI, previous CABG, previous CHF, previous stroke, renal insufficiency, ST-segment depression, transient ST-segment elevation, positive cardiac markers, signs of CHF, heart rate, systolic blood pressure, insurance status, No. of hospital beds, geographical region, hospital services, and hospital academic status. Death was all-cause mortality. Postadmission infarction was defined as clinical signs and symptoms of a new infarction or repeat infarction that is distinct from the presenting ischemic event.
Our results show that disparities exist in the use of newer therapies. Ideally, results of well-designed clinical trials using newer therapies should be incorporated into explicit clinical practice guidelines, followed by quality assessment and performance improvement initiatives to standardize the care of patients; however, there may be a number of challenges to the implementation of this model. Studies have shown that adoption of evidence-based therapies is slow initially but improves over time.44,45 This diffusion of therapies may be hindered in certain subgroups of patients who may have been excluded or underrepresented in the clinical trials or observations supporting the use of newer agents. One reason for the disparities we have observed may be different expectations in terms of the impact of administering newer antiplatelet agents in blacks. The reported proportion of blacks participating in recent major clinical trials evaluating treatments for NSTE ACS ranges from 4% to 11%.46,47 Whether favorable results from these highly selected study populations can be replicated in black patients in the clinical setting remains to be proven; however, the ACC/AHA guidelines do not distinguish use of interventions by race, nor is there evidence that blacks with NSTE ACS should not be given GP IIb/IIIa inhibitors, especially with an early invasive management strategy.

Physician attitudes and communication with patients may have also played a role in these disparities. Previous studies have shown that physicians use information about patients’ ethnicity, age, lifestyle, and social structure to make decisions about cardiac interventions and other treatments.48–50 A number of studies have shown that blacks have different attitudes about procedural risk and may be less willing to undergo invasive procedures.50–52 It has also been suggested that physicians may carry inappropriate expectations that all black patients may be less likely to prefer invasive treatments.18,53 Studies evaluating racial disparities in cardiac procedure use that have included patient preference information have found that patient preferences by themselves do not adequately explain disparities in procedure use.50,51

Despite these observed disparities, blacks were not more likely to have adverse outcomes. Indeed, for heart failure, cardiogenic shock, and postadmission MI, outcomes were actually better in black patients. These are only acute inpatient findings, however. In a study of MI patients treated in the VA hospitals, Peterson and colleagues21 found that lower insurance status was associated with poorer outcomes during intermediate or long-term follow-up.

Limitations of the Study

Our analyses have attempted to adjust for demographic variables that could affect management decisions and outcomes. It is possible that other unmeasured variables were not
accounted for and may account for some of the observed differences. For example, race may be a surrogate for other socioeconomic factors that may have contributed to these disparities. The use of an early invasive management strategy and revascularization were not randomized, so unmeasured treatment biases may have also confounded treatments and outcomes. Hospitals voluntarily participate in CRUSADE and are not randomly selected, so urban centers that treat a greater percentage of black patients may be underrepresented in CRUSADE; therefore, our results may be biased because of hospital selection. Finally, our outcomes data are limited to in-hospital events and do not evaluate the longer-term differences in outcomes that may be associated with these disparities in patient care.

In conclusion, black patients with NSTE ACS are less likely than whites to receive invasive treatment options and some medical treatments. There were no significant differences in use of lower-cost medications, but blacks were significantly less likely to receive recommended, more expensive pharmacotherapy. Despite receiving these evidence-based interventions less often, black patients had similar or better outcomes. Further research is needed to identify the causes of these disparities and to determine the impact on outcomes over a longer period of time after hospitalization.

Future Directions

Efforts to reduce disparities in evidence-based management should focus on eliminating any uncertainties in the practice of medicine by providing evidence to make treatment decisions clear. Research should focus on evaluating the role of newer evidence-based therapies in black patients. Through health services research, we should identify the best methods to implement evidence-based care in clinical practice. This should be supported by initiatives to educate providers about the cultural sensitivities of their patients and to improve patients’ understanding of their disease process so they may actively participate in their care. Clinical guidelines should be updated frequently, and quality improvement programs should be used to increase the use of guideline recommendations in clinical practice. This would result in improved care for all patients regardless of ethnic origin and would reduce disparities in care.

Acknowledgments

CRUSADE is funded by Millennium Pharmaceuticals, Inc, Cambridge, Mass, and Schering Corp, Kenilworth, NJ. BMS/Sanofi provides an unrestricted grant in support of the program.

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_Circulation_. 2005;111:1225-1232
doi: 10.1161/01.CIR.0000157732.03358.64

_Circulation_ is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0009-7322. Online ISSN: 1524-4539

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