Physician Referral Patterns and Race Differences in Receipt of Coronary Angiography

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Objective. This study addresses the following research questions: (1) Is race a predictor of obtaining a referral for coronary angiography (CA) among patients who are appropriate candidates for the procedure? (2) Is there a race disparity in obtaining CA among patients who obtain a referral for the procedure?

Study Setting. Three community hospitals in Baltimore, Maryland.

Study Design. We abstracted hospital records of 7,927 patients from three hospitals to identify 2,653 patients who were candidates for CA. Patients were contacted by telephone to determine if they received a referral for CA. Logistic regression was used to assess whether racial differences in obtaining a referral were affected by adjustment for several potential confounders. A second set of analyses examined race differences in use of the procedure among a subsample of patients that obtained a referral.

Principal Findings. After controlling for having been hospitalized at a hospital with in-house catheterization facilities, ACC/AHA (American College of Cardiology/American Heart Association) classification, sex, age, and health insurance status, race remained a significant determinant of referral ($OR = 3.0, p < .05$). Additionally, we found no significant race differences in receipt of the procedure among patients who obtained a referral.

Conclusions. Our results demonstrate that race differences in utilization of CA tend to occur during the process of determining the course of treatment. Once a referral is obtained, African American patients are not less likely than white patients to follow through with the procedure. Thus, future research should seek to better understand the process by which the decision is made to refer or not refer patients.

Key Words. Racial differences, coronary angiography, referral patterns, physician behavior, surgical procedures

There is a large and growing literature in medicine and health services research showing that white patients are about twice as likely as African American patients to receive tertiary care cardiovascular procedures such as

coronary angiography (Carlise 1997; Ayanian et al. 1993; Franks et al. 1993; Maynard 1986; McBean 1994; Mirvis et al. 1994; Hannan et al. 1991; Wenneker and Epstein 1989; Whittle et al. 1993; Ford et al. 1989). Black-white differences have been found in bivariate as well as multivariate analyses that control for a variety of factors including clinical characteristics of the patient such as disease severity, income, insurance status, age, sex, and type of hospital visited.

Previous studies have not been able to address how much of the race difference in utilization of coronary angiography (CA) is due to physician referral bias versus patient treatment preferences. This is because most previous studies have relied solely on hospital discharge data, which typically covers diagnosis and procedures received but does not indicate whether patients were offered and subsequently refused services. The literature addressing referral versus receipt of the procedure is relatively small, but the available research suggests that at least part of the race difference in use of CA is due to bias in referral by physicians. For example, Finucane and Carrese (1990) showed that physicians take race into account in their presentation of cases. Their analysis showed that with black patients, doctors mentioned race much more frequently in case presentations, especially in conjunction with negative characteristics. Additionally, Schulman et al. (1999) used videotaped actors as patients presenting with symptoms suggesting the need for cardiac catheterization and found that physicians were less likely to refer black female patients compared with white male patients.

Others have documented race disparities in the management of heart disease as well. Johnson et al. (1993) found that black cardiac patients were less likely to be admitted to the hospital regardless of symptomatology. Maynard et al. (1986) found that physicians referred white patients for surgery after CA at a rate that was 13 percent higher than for black patients. Oberman and Cutter (1984) found that a lower percentage of black patients with coronary heart disease were recommended for CA than whites. And Yergan et al. (1987) demonstrated that African Americans received fewer services than whites during their hospital stay.

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Although race is the best-documented social factor leading to underutilization of cardiovascular surgical procedures, variation has been documented by other social characteristics as well. Perhaps the best documented of these is patient's sex. Previous studies have found that female patients are less likely to be referred for and to receive CA (Giles et al. 1995; Bickell et al. 1992; Tobin et al. 1987). Older patients are less likely to receive the procedure (Bearden et al. 1994). And Carlise et al. (1997) demonstrated that health insurance status was an important determinant of utilization of invasive cardiovascular procedures.

In this study we seek to extend the research literature on racial disparities in access to cardiovascular surgical procedures by examining whether disparities in use of CA can be ascribed to patient preferences. The specific research questions that will be assessed are: (1) Is patient race a predictor of obtaining a referral for coronary angiography among patients who are appropriate candidates for the procedure? (2) Is there a race disparity in obtaining CA among patients who obtain a referral for the procedure?

METHODS

Data for this study come from the Cardiac Access Longitudinal Study, an ongoing study of medical care access, utilization, and quality of life among white and African-American cardiac patients from three hospitals in Baltimore, Maryland. Two of the hospitals in the study have a cardiac catheterization laboratory, and the third hospital refers patients to other facilities to have the procedure done. The hospitals are located in close proximity and there is substantial overlap in their patient base, medical staff, and admitting physicians. Cardiology services are readily available at each facility.

The medical record of every patient discharged from the hospitals in 1995 and 1997 with at least one of the cardiac-related DRGs listed in Appendix 1 was abstracted to determine if the patient was an appropriate candidate for receipt of coronary angiography (CA). The set of diagnoses displayed in the Appendix was selected by a panel of board certified cardiologists with the goal of including a comprehensive list of all likely diagnoses for which CA may have been appropriate. Although we abstracted a broad range of diagnoses, the majority (80.1 percent) of patients received a smaller set of diagnoses, specifically circulatory disorders (20.2 percent), congestive heart failure (31.2 percent), arrhythmia (9.2 percent), angina pectoris (8.2 percent), and chest pain (11.3 percent). No other DRG comprised more than 5 percent of cases.

In all, records from 9,307 hospital discharges were abstracted, representing 7,929 patients. Trained reviewers abstracted each patient record and classified each patient as class 1, class 2, or class 3 for receipt of coronary angiography (CA) according to the criteria established by the American College of Cardiology (ACC) and the American Heart Association (AHA) (American College of Cardiology 1987). According to the ACC/AHA guidelines, class 1 patients (2,309, 29 percent) are patients for which there is general agreement that CA is indicated. Class 2 patients (344, 4 percent) are patients for which CA is frequently performed, but for which there was a divergence of opinion on the ACC/AHA panel that established the guidelines. Coronary angiography is not indicated for class 3 patients (5,276, 67 percent).

We attempted to follow all class 1 and class 2 patients ($n = 2,653$, 33 percent) by telephone to determine if they had received a referral for CA (if it was not noted in the patient record) and if they had received the procedure. The telephone survey resulted in 412 deaths (whites 13 percent, African Americans 18 percent), 214 refusals (whites 8 percent, African Americans 8 percent), and 191 respondents lost to follow-up (whites 3.8 percent, African Americans 10.9 percent). We successfully followed 1,836 respondents (whites 1,037 and African Americans 799). Informed consent was obtained by telephone. All interviews were conducted by trained telephone interviewers supervised by project staff. Telephone interviewers also verified demographic data abstracted from the medical record, such as the patient's race and sex.

The medical record abstractors were trained by a panel of board certified cardiologists, who closely monitored the medical record review process. Each record was reviewed by at least one board certified cardiologist and a 1.5 percent random sample of all records was reviewed by three cardiologists. This quality control test found 95 percent agreement between the trained abstractors and the panel of cardiologists.

Variables

The dependent variables in these analyses are: (1) whether or not the patient obtained a referral for CA, and (2) whether or not the patient received the procedure. Both variables are binary variables. Coronary angiography referral was derived from medical records (if noted). However, because medical records may be incomplete, we also asked patients if their physician had discussed the procedure with them. Patients were asked: "During your hospital

stay, did a doctor or nurse talk with you about heart catheterization? This is when a small tube (also called a catheter) is put into a vein in your leg and passed all the way to your heart. If so, did the doctor or nurse say that you needed it?"

If the respondent replied that they had been told that they needed the procedure, we considered this to be a referral even if it was not noted in the medical chart. Receipt of CA was ascertained from the hospital record. We also recorded the patient as having received CA if they indicated this in the telephone interview. We coded receipt and referral of CA in this way because this approach offers the greatest latitude in accounting for physicians who may have communicated to patients their need for the procedure, but who may not have noted it in the medical record.

Following Andersen's (1995) Behavioral Model of Health Service Use, the independent variables are conceptualized as need, predisposing, and enabling variables. The primary predisposing variable under investigation is patient race, which was abstracted from the medical record. Patient race was verified by telephone in cases where it was missing from the medical record. The ACC/AHA classification is an indicator of need as well as an adjustment for comorbidity. This is because all class 1 patients can be considered to be "in need" of the procedure. Moreover, the ACC/AHA classification guideline accounts for comorbid conditions (as significant comorbidities are a contra-indication for referral for CA). Patient sex and age are additional predisposing variables that are assessed. Both variables were abstracted from medical records and ascertained from the patient interview if medical records were not complete.

The enabling variables are whether the hospital has an on-site catheterization lab and patient insurance. Patient insurance was specified as a set of binary variables indicating Medicare, Medicaid, private insurance, and self-pay. Patients with both Medicare and Medicaid were coded as Medicaid.

ANALYSIS STRATEGY

In the first set of analyses, we test the dependent variables to determine if there are race differences in the reporting of receipt and/or referral of CA. The second set of analyses test for race difference across each independent variable. Finally, we test for race differences in referral and receipt of CA within multivariate models using logistic regression.

RESULTS

We first examined the extent to which patient reports of referral and receipt of CA in the telephone interview coincided with medical records. Sixty-eight percent of patients (73 percent of whites and 57 percent of African Americans) whose medical records indicated they had received CA correctly reported this in the telephone interview. One hundred twelve African American patients (14 percent of all African American patients) reported they had received CA while their hospital record did not record it. For white patients, the corresponding number was 51 patients (4.9 percent). For referral for CA, 56 percent of African American and 68 percent of white patients whose medical record indicated that they had been told they needed CA correctly reported this in the telephone interview. Seventy-two African American patients (9.0 percent of the African Americans in the sample) and 44 white patients (5 percent of all white patients) reported a referral for CA that was not noted in the medical record.

To further test for substantive differences that may result from race differences in noting referral and receipt of CA in medical records, we conducted all analyses using data from the medical record only and compared those results with analyses of CA referral and receipt data from the medical record or patient reports. We conducted additional analyses after removing from the analyses the subsample of respondents whose medical records did not note referral or receipt of CA, but who reported a referral and/or receipt for CA during the telephone follow-up. In each set of models, the substantive results were similar. In light of the high level of accuracy in reporting a referral that had been noted in the medical record, we elected to include respondents who reported referral or receipt during the telephone follow-up but whose medical records did not make note of it.

In Table 1, we display the distribution of the dependent variables and each independent variable by patient race. The table shows there are significant race differences in each variable. African American patients were 71 percent as likely as white patients to obtain a referral for CA, and 63 percent as likely to receive the procedure. White patients were significantly more likely to have been admitted to one of the two hospitals with an in-house catheterization lab. There were slight racial differences in ACC/AHA classification, with 87 percent of white patients and 84.5 percent of African American patients classified as class 1. African American patients were more likely to be female and were somewhat younger compared with white patients. Finally, white patients were more likely than African

Table 1: Variable Description and Frequency Distribution for Variables in the Analysis

<i>Variable Name</i>	<i>Black (n = 1,236)</i>	<i>White (n = 1,417)</i>	<i>Race Difference (B/W)</i>
Referred for CA	58.7%	82.4%	Rate ratio = .71 $X^2 = 178$ $p = .001$
Received CA	43.5%	69.6%	Rate ratio = .63 $X^2 = 181$ $p = .001$
Hospital has in-house catheterization lab	73.7%	93.3%	Rate ratio = .79 $X^2 = 382$ $p = .001$
ACC/AHA Classification 1	84.5%	87%	Rate ratio = .97 $X^2 = 3.22$ $p = .07$
Patient sex—female	58.3%	45.5%	Rate ratio = 1.28 $X^2 = 42.53$ $p = .001$
Patient age	mean = 63.4	mean = 66.6	$t = 6.4$ $p = .01$
Health insurance status			
Medicaid	7.7%	1.9%	$X^2 = 90.73$ $p = .001$
Medicare	12.9%	4.6%	
Private	73.7%	90.5%	
Self pay/charity	5.7%	2.9%	

American patients to be privately insured and less likely to have Medicare, Medicaid, or be self-pay (uninsured).

In Table 2 we display logistic regression analysis examining race differences in referral for coronary angiography after adjusting for covariates. Model 1 of Table 2 examines the effect of race controlling for whether or not the hospital where the patient was hospitalized has the facilities to conduct catheterization and ACC/AHA classification. In-house catheterization lab has an odds ratio of 1.98 ($p < .001$), and ACC/AHA classification has an odds ratio of 1.90 ($p < .001$). However, after controlling for having an in-house catheterization lab and ACC/AHA class, African American patients were still significantly less likely to receive a referral compared with white patients ($OR = .36$, $p < .001$).

In Model 2, we add patient's sex and age to Model 1. Patient sex is not a significant predictor of obtaining a referral; however, there are significant age effects. Older patients are significantly less likely to be referred. However, after controls for sex and age, race remains a significant predictor of CA referral ($OR = .32$, $p < .001$). Model 3 adds patient health insurance status. This analysis shows that patients who have private health insurance are more likely than uninsured patients to receive a referral. Medicaid and Medicare are not

Table 2: Odds Ratios from Multivariate Logistic Regression Models of Referral for Cardiac Catheterization, $n = 2,646$

<i>Variable</i>	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>
White	1.00	1.00	1.00
Black	.36**	.32**	.34**
No cath lab	1.00	1.00	1.00
Cath lab	1.98**	2.06**	1.76**
ACC/AHA Class 2	1.00	1.00	1.00
ACC/AHA Class 1	1.90**	1.95**	2.31**
Female		1.00	1.00
Male		.94	.99
Age < 50		1.00	1.00
Age 50–64		.95	1.13
Age 65–79		.72*	.89
Age 80+		.30**	.39**
Uninsured			1.00
Private insurance			1.61**
Medicare			.73
Medicaid			1.11
Chi square	239.44	311.22	214.47
df	3	7	10
Model significance	$p < .001$	$p < .001$	$p < .001$

** $p < .001$, * $p < .05$

statistically significant predictors. Controlling for health insurance did not affect the significant effect of patient race in predicting receipt of a referral for CA. In the final model controlling for all variables, African American patients are still significantly less likely to receive a referral compared with white patients (OR = .34, $p < .001$).

In Table 3, we conducted a set of analyses among the subset of patients who received a referral for CA ($n = 2,011$). Where the analyses in Table 2 examine factors that contribute to patients obtaining a referral, the analyses in Table 3 address patient outcomes after they have been referred. These analyses show that although African American patients were slightly less likely to receive CA compared with white patients, the race difference is not statistically significant. The finding of no race difference is consistent across each model with significant controls for being seen at a hospital that has a catheterization lab (OR = 3.77, $p < .001$), age older than 80 years (OR = .2, $p < .001$), and having Medicare as the primary source of health insurance (OR = 1.96, $p < .05$).

Table 3: Odds Ratios from Multivariate Logistic Regression Models of Predictors of Receipt of Coronary Angiography among Patients Who Received a Referral, $n = 2,011$

<i>Variable</i>	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>
White	1.00	1.00	1.00
Black	.78	.73	.70
No cath lab	1.00	1.00	1.00
Cath lab	4.95**	5.21**	3.77**
ACC/AHA Class 2	1.00	1.00	1.00
ACC/AHA Class 1	.91	.95	.89
Female		1.00	1.00
Male		.95	.92
Age < 50		1.00	1.00
Age 50–64		.76	.94
Age 65–79		.61	.45
Age 80+		.36**	.20**
Uninsured			1.00
Private insurance			.68
Medicare			1.96*
Medicaid			1.02
Chi square	97.01	118.47	59.07
df	3	7	10
Model significance	$p < .001$	$p < .001$	$p < .001$

** $p < .001$, * $p < .05$

DISCUSSION

Logistic regression analysis was used to assess a series of analytic models testing whether controls for correlates of referral and receipt of coronary angiography (CA) can account for observed race differences in obtaining a referral for the procedure. Our data analytic strategy examined factors hypothesized to eliminate or reduce the significant effect of patient race on obtaining a referral for CA. We then examined the subsample of patients who had received a referral to determine whether there were race differences in receipt of CA among patients who obtained a referral for the procedure.

Our analysis failed to fully account for race differences in receipt of a referral for CA. In our full model, which included all covariates (Table 2), we still found a significant effect of race. That is, African American patients were significantly less likely to obtain a CA referral compared to white patients. Further, analysis of the subset of patients who obtained a referral for CA found

that there was no race difference in receipt of the procedure once a referral had been obtained.

An interesting unanticipated finding is the large odds ratio for receiving care at a hospital with an in-house catheterization lab. Even after getting a referral, having to go to another hospital to have CA is an important barrier to receipt of the procedure. As Table 1 demonstrated, African American patients were more likely to be seen at the hospital that referred patients out for the procedure. We conducted analyses similar to those reported in Table 3 among the subset of patients from the hospitals that had an in-house catheterization lab. These analyses resulted in similar findings as the analyses presented in Table 3. Thus, although not going to a hospital with in-house catheterization facilities is a powerful barrier, the greater likelihood for African American patients to be seen at such hospitals does not account for the race differences in obtaining a referral for or receiving the procedure. An alternative explanation for the large effect of in-house catheterization facilities may be that CA receipt is underreported among patients at the hospital that lacked a catheterization lab. The inability to account for this possibility is a limitation of this study. Moreover, it is not possible to estimate the extent of underreporting of CA referrals among cases where the hospital record did not indicate a referral and the patient did not recall one. However, the high degree of concordance between patient reporting and hospital records of referral and receipt of CA lends some confidence that underreporting is not likely a severe problem.

While our study focuses on underutilization of CA, it is possible that there is overuse of the procedure among white patients. If this is the case, perhaps this overuse may be contributing to race disparities. However, as our study protocol did not include telephone follow-up with ACC/AHA class 3 patients, we are not able to address this issue.

Our study design did not allow for an assessment of the interpersonal interaction between the patient and providers during the hospitalization. Thus, it is not known to what extent racial differences in failure to refer appropriate candidates for the procedure is a function of patient preferences or physician bias. African American patients may be signaling to physicians (in direct or indirect ways) that they would be unwilling to submit to invasive procedures if recommended. Likewise, physicians may simply believe that African American patients are less willing to accept invasive procedures without patients actually communicating this. Whittle et al. (1997) conducted a study that bears on this question. They surveyed African American and white patients to determine their willingness to undergo coronary revascularization. They found no race differences in willingness to undergo revascularization

after controlling for familiarity with the procedure. Additionally, they found that lack of familiarity with revascularization was the strongest predictor of being unwilling to undergo the procedure. African American patients were less familiar with the procedure. If physicians hold an a priori belief that African American patients will not comply, this may be as important as true patient preferences in determining whether patients obtain a referral.

Cooper-Patrick et al. (1999) documented race differences in patient-provider communication during medical encounters. That study demonstrated that African American patients rate their visits with physicians as less participatory than white patients. However, patients seeing physicians of their own race rate their physicians' treatment style as more participatory. Chen et al.'s (2001) finding of a race disparity in CA among African American as well as white physicians may be viewed by some as evidence against the physician bias hypothesis. However, there is no logical reason that African American physicians could not be biased, as could physicians of other race groups. Moreover, Chen et al. (2001) did not examine physicians of other racial or ethnic groups or foreign trained physicians.

There is a need for further study of physician characteristics that predict referral and receipt of CA. It may be that physician characteristics account for variation in decision making. For example, how might physician attitudes about compliance among African American patients influence decision making? Would these results differ if patient and provider race were matched? What about physicians of other racial/ethnic groups (nonblack and nonwhite) or women physicians or foreign trained physicians? Does the degree of familiarity of the patient and provider play a role? Or perhaps the physician's level of experience? The nuances that affect the decision to refer patients for CA are numerous and complex. Such complexities are perhaps best addressed using qualitative research techniques.

Our examination of patients at a small number of hospitals has the advantage of providing depth, but this comes at the expense of generalizability. However, the fact that our findings are consistent with studies conducted in other settings (with the exception of the nonsignificant gender effect) adds confidence that our findings are not anomalous.

While the present study does not fully resolve the puzzle of racial disparities in the use of CA, our finding that once patients obtain a referral, black patients are equally likely to follow through with the procedure as white patients, suggests that better understanding of the process of obtaining a referral is a logical direction for future research and possible programmatic intervention.

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APPENDIX 1: DRGs used to select patients into the study

DRG	Description
115.	Perm cardiac pacemaker implant with ami, heart failure, or shock
116.	Perm cardiac pacemaker implant w/o ami, heart failure, or shock
117.	Cardiac pacemaker revision except device replacement
118.	Cardiac pacemaker device replacement
119.	Vein ligation & stripping
120.	Other circulatory system o.r. procedures
121.	Circulatory disorders with ami & c.v. comp disch alive
122.	Circulatory disorders with ami w/o c.v. comp disch alive
123.	Circulatory disorders with ami, expired
124.	Circulatory disorders except ami, with card cath & complex diag
125.	Circulatory disorders except ami, with card cath w/o complex diag
126.	Acute & subacute endocarditis
127.	Heart failure & shock
129.	Cardiac arrest, unexplained
132.	Atherosclerosis with cc
133.	Atherosclerosis w/o cc
134.	Hypertension
135.	Cardiac congenital & valvular disorders age > 17 with cc
136.	Cardiac congenital & valvular disorders age > 17 w/o cc
137.	Cardiac congenital & valvular disorders age 0-17
138.	Cardiac arrhythmia & conduction disorders with cc
139.	Cardiac arrhythmia & conduction disorders w/o cc
140.	Angina pectoris
141.	Syncope & collapse with cc
142.	Syncope & collapse w/o cc
143.	Chest pain
144.	Other circulatory system diagnoses with cc
145.	Other circulatory system diagnoses w/o cc