Do Race and Gender Influence the Use of Invasive Procedures?

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OBJECTIVE: **To assess the influence of race and gender on the use of invasive procedures in patients with acute myocardial infarction (AMI) in community hospitals.**

DESIGN: **Prospective, observational.**

SETTING: **Five mid-Michigan community hospitals.**

PATIENTS: **All patients (838) identified with AMI between January 1994 and April 1995 in 1 of these hospitals.**

MEASUREMENTS AND MAIN RESULTS: **After adjusting for age, hospital of admission, insurance type, severity of AMI, and comorbidity, using white men as the reference group, the rate of being offered cardiac catheterization (CC) was 0.88 (95% confidence interval [CI], 0.60 to 1.29) for white women; 0.79 (95% CI, 0.41 to 1.50) for black men; and 1.14 (95% CI, 0.53 to 2.45) for black women. Among patients who underwent CC, after also adjusting for coronary artery anatomy, the rate of being offered angioplasty, using white men as the reference group, was 1.22 (95% CI, 0.75 to 1.98) for white women; 0.61 (95% CI, 0.29 to 1.28; *P* = .192) for black men; and 0.40 (95% CI, 0.14 to 1.13) for black women. The adjusted rate of being offered bypass surgery was 0.47 (95% CI, 0.24 to 0.89) for white women; 0.36 (95% CI, 0.12 to 1.06) for black men; and 0.37 (95% CI, 0.11 to 1.28) for black women.**

CONCLUSIONS: **Our study shows that white women are less likely than white men to be offered bypass surgery after AMI. Although black men and women with AMI are less likely than white men to be offered percutaneous transluminal coronary angioplasty or coronary artery bypass grafting in both unadjusted and adjusted analyses, these findings did not reach statistical significance. Our study is limited in power due to the small number of blacks in the sample.**

KEY WORDS: **heart catheterization utilization; angioplasty, transluminal, coronary, utilization; coronary artery bypass utilization; sex factors; blacks.**
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Since the early 1980s, reports suggesting that race and gender influence the utilization of invasive cardiac procedures have inspired efforts to identify the reasons for these observed differences. Because coronary heart disease (CHD) is the leading cause of death for both black and white Americans, male and female,[1] these reported differences have become potential targets for improvements in the quality of care. From 1980 to 1990, there was a 34% decline in CHD mortality.[2] Improvements in the treatment of patients with CHD is thought to be the major factor in this decline, not primary or secondary risk factor reductions.[2] The rate of decrease in mortality from CHD has been greater for whites than blacks.[3,4] One possible explanation for this difference is decreased access to effective evaluation and treatment, including cardiac catheterization (CC), percutaneous transluminal coronary angioplasty (PTCA), and coronary artery bypass grafting (CABG). It is important to understand the sources of variation in procedure use from the standpoint of equity in the delivery of health care services and their impact on mortality and morbidity. The Michigan State University Inter-Institutional Collaborative Heart Study (MICH) investigation assesses utilization rates and sources of variability by race and gender in these three procedures in 5 mid-Michigan community hospitals.

The MICH study improves on the approach of earlier studies by accounting for comorbidity, severity, and coronary artery anatomy in the analyses of both race and gender. The study investigates a cohort of adults in a defined geographic area in the Midwest in a largely fee-for-service environment.

METHODS

Patients and Setting

The MICH study is a registry-based investigation of the management and outcomes following acute myocardial infarction (AMI). We enrolled all patients prospectively identified with AMI between January 1994 and April 1995 in 1 of 5 mid-Michigan hospitals. The Institutional Review Boards of Michigan State University and of all participating hospitals approved this study. At the time of the study, all participating hospitals were certified to offer CC and cardiac surgery. None offered immediate angioplasty as initial management of AMI. In 1 community, 20% of the residents are black. In the other, 17% are black.

We screened ward logs and medical records in all units likely to manage AMI patients (intensive and coronary care

units and surgical intensive care units) to establish eligibility for the study. The entry criteria were either: (1) typical symptoms of AMI plus elevated cardiac enzymes, defined as elevation of creatine kinase and MB fraction more than 1.2 times the upper limit of normal within 48 hours of onset of symptoms or acute event or elevation of aspartate aminotransferase or lactate dehydrogenase more than 2 times the upper limit of normal within 72 hours of onset of symptoms or acute event; or (2) electrocardiographic (ECG) findings of AMI. The typed chart ECG interpretation had to state "acute myocardial infarction." Study cardiologists read the ECGs of patients who did not meet enzyme criteria to decide eligibility for inclusion.

Data collectors completed extensive chart reviews for all admitted patients who met study eligibility criteria. Almost all chart reviews were performed by 3 trained, full-time research registered nurses. They were not blinded to the study objective.

To determine the effectiveness of our mechanism for identifying AMI patients, we compared the hospital computerized discharge diagnosis record with our MICH population. We reviewed 596 patients with the discharge diagnosis of AMI and found that 134 were not in our MICH database. On review of those charts, 51 did not meet our AMI criteria. Some actually had old myocardial infarctions, with no AMI during this hospitalization, but were coded at discharge as AMI. Eighty three (13.9%) met our criteria for AMI but were not in our database. Two full-time registered nurses served as chart abstractors; one covered 3 hospitals in one city, the other covered 2 hospitals in the other city. They did not work on weekends or holidays, and had vacations and sick time. Chart abstractions were not done on those days. This is the most probable explanation for the missed AMI patients.

As a measure of the accuracy of data abstraction, we selected 85 charts arbitrarily and reabstracted whether an angiotensin-converting enzyme inhibitor was prescribed during the hospitalization. There was 94% agreement, and κ was 0.636. One of our full-time study nurses did the reabstraction. The present analysis uses data from the chart review only. It focuses on the 838 patients who were admitted directly to 1 of the 5 study hospitals, not transferred from outlying hospitals.

Statistical Methods

In addition to race and gender, variables considered in analytic models included indicator terms for: age (in decades); initial admitting hospital (A to E); primary insurance provider (Medicare, Medicaid, commercial provider, other); evidence of congestive heart failure (CHF) on chest x-ray; location of AMI (anterior, other, nondiagnostic/unavailable ECG); coronary anatomy; whether a thrombolytic was given; length of stay; and Charlson comorbidity index (based on the presence of conditions on admission).[5] A set of socioeconomic and clinical characteristics were identified and tested individually for their relationship to each of the study outcomes. The complete set was then entered into multiple regression models, regardless of the strength or significance of their bivariate relationship.

A "chest x-ray diagnosis of CHF" was defined as a typed chest x-ray report in the chart containing any or the following phrases: (1) "congestive heart failure"; (2) "pulmonary edema"; (3) "pulmonary vascular congestion"; (4) "pulmonary venous cephalization"; and (5) "Kerly B lines."

An AMI was considered "anterior" if this term was used in the description of the AMI in the typed ECG report on the chart. When comparing rates of PTCA and CABG, we also adjusted for coronary artery anatomy (number of vessels with significant stenosis and whether there was severe disease, defined as either 3-vessel disease or left main stenosis). Our sources for the angiographic data were the official typed CC reports in the charts. Significant left main stenosis was defined as 40% or more. For all other coronary arteries, significant stenosis was defined as 50% or more. The primary hypothesis was that women and blacks were less likely to receive CC, PTCA, and CABG than men and white patients, independent of the distribution of these covariates.

Our dependent variables were CC offered, PTCA offered, and CABG offered. This was defined as a recommendation to the patient to have these procedures during the hospitalization. A plan for a stress test after discharge with procedures depending on those results was coded as no procedures offered. Patients who were discharged with a plan for a CC were coded as no procedures offered.

There were 31 atherectomies, and these were coded as PTCAs. Atherectomies were treated as PTCAs in our analysis and will be referred to as PTCAs throughout the paper.

We used multiple logistic regression to identify independent predictors of CC to the 838 patients who met study eligibility criteria. Among those patients who underwent CC, we employed multiple polychotomous logistic regression to identify characteristics of individuals who were offered CABG, PTCA, or atherectomy. Polychotomous logistic regression is a statistical technique that permits analyses of determinants of multiple, mutually exclusive, and exhaustive outcomes simultaneously. In the present case, possible outcomes are CABG, PTCA, or neither procedure.

In our models of determinants of revascularization, 2 sets of odds were calculated: the odds of being offered CABG as the first treatment option relative to not being offered any revascularization, and the odds of being offered PTCA as the first treatment option relative to not being offered any revascularization. For each outcome, the odds are presented as odds ratios, with white men as the reference population.

A few individuals (23 of 616 who received CC) had been offered both procedures. We considered these patients to have been offered the procedure that the treating physician intended to be performed first. The underlying treatment plan could not be reconstructed from the chart review for 2 of these patients. We excluded them from the analysis. We implemented all analyses in SPSS version 7.5 (SPSS

Table 1. Patient Characteristics

	White Men (*n* = 443)	White Women (*n* = 264)	Black Men (*n* = 79)	Black Women (*n* = 49)	*P* Value*
Age, *n* (%)					.375
<45 y	55 (12.4)	13 (4.9)	10 (12.7)	≥7 (14.3)	
45–54 y	82 (18.5)	24 (9.1)	24 (30.4)	8 (16.3)	
55–64 y	105 (23.7)	48 (18.2)	20 (25.3)	12 (24.5)	
65–74 y	113 (25.5)	65 (24.6)	17 (21.5)	8 (16.3)	
75 y	88 (19.8)	114 (43.2)	8 (10.1)	14 (28.6)	
Admission hospital, *n* (%)					<.001
A	52 (11.7)	38 (14.4)	45 (57.0)	29 (59.2)	
B	206 (46.2)	114 (43.2)	14 (17.7)	9 (18.4)	
C	34 (7.6)	23 (8.71)	9 (11.3)	3 (6.1)	
D	122 (27.4)	80 (30.3)	8 (10.1)	5 (10.2)	
E	29 (6.5)	9 (3.4)	3 (3.8)	3 (6.1)	
Insurance provider, *n* (%)					<.001
Commercial	202 (45.6)	68 (25.8)	32 (40.5)	15 (30.6)	
Medicare	206 (46.5)	181 (68.3)	35 (44.3)	29 (59.2)	
Medicaid	6 (1.36)	6 (2.3)	9 (11.4)	4 (8.2)	
Self or none	23 (5.2)	8 (3.0)	3 (3.8)	0 (0.0)	
Missing	6 (1.4)	1 (0.4)	0 (0.00)	1 (0.2)	
Congestive heart failure, *n* (%)	83 (18.7)	76 (28.8)	16 (20.3)	6 (12.2)	.005
Comorbidity score, *n* (%)					<.001
1	173 (38.8)	54 (20.4)	22 (27.9)	8 (16.3)	
2	155 (35.0)	93 (35.2)	27 (34.2)	13 (26.5)	
3	71 (16.0)	62 (23.5)	17 (21.5)	13 (26.5)	
4	21 (4.5)	33 (12.5)	8 (10.1)	2 (4.1)	
≥5	24 (5.5)	22 (8.3)	5 (6.3)	13 (26.5)	
Length of stay, *n* (%)					.080
0–2 days	22 (5.0)	15 (5.7)	2 (2.5)	4 (8.2)	
3–6 days	112 (25.3)	41 (15.5)	20 (25.3)	8 (16.3)	
7–13 days	221 (50.0)	134 (50.8)	36 (45.6)	25 (51.0)	
14–90 days	87 (19.6)	74 (28.0)	21 (26.6)	11 (22.5)	
≥90 days	1 (0.2)	0 (0.0)	0 (0.00)	1 (2.0)	
Thrombolytic therapy given, *n* (%)	229 (51.7)	108 (40.9)	29 (36.7)	13 (26.5)	<.001
Cardiac catheterization offered, *n* (%)	347 (78.3)	174 (67.8)	54 (68.4)	34 (69.4)	<.006

* *Significance of χ^2 test for inequality of distribution of parameter across race and gender categories.*

Inc., Chicago, Ill) and Stata version 5.0 (StataCorp, College Station, Tex).

RESULTS

Demographic Characteristics

Table 1 presents selected characteristics of the study patients. In age and gender, our patients were typical of AMI patients seen in other studies. The racial distribution broadly reflects that of the underlying population of the 2 communities, as enumerated in the 1990 Census. No statistically significant difference between the 4 race/gender groups in angiographic findings was demonstrated (see Table 2).

Differences in admission patterns are evident. Over half of the black patients were admitted to hospital A, and almost half of the white patients to hospital B. Hospital D also admitted a higher proportion of white

Table 2. Significant Findings Among 593 Patients With Acute Myocardial Infarction*

	White Men (*n* = 340)	White Women (*n* = 170)	Black Men (*n* = 52)	Black Women (*n* = 31)	*P* Value†
Left main artery ≥40% stenosed, *n* (%)	31 (9.1)	16 (9.4)	4 (7.7)	5 (16.1)	.474
Vessels ≥50% stenosed, no left main, *n* (%)					.153
0	12 (3.5)	8 (4.7)	1 (1.9)	5 (16.1)	
1	115 (33.8)	47 (27.7)	16 (30.8)	13 (41.9)	
2	92 (27.1)	56 (32.9)	16 (30.8)	3 (9.7)	
Severe disease‡, *n* (%)	121 (35.6)	59 (34.7)	19 (36.5)	10 (32.3)	.813

* *Among 611 patients who received cardiac catheterization, vessel data are not available for 18 patients.*

† *Significance of χ^2 test for inequality of proportions across race and gender categories.*

‡ *Left main artery ≥40% stenosed and/or 3 or more vessels ≥50% stenosed.*

Table 3. Bivariate Associations of Baseline Characteristics and Probability of Being Offered Cardiac Catheterization (CC)*

	Number (%) Offered CC	*P* Value
Hospital		
A	107 (65.2)	.0415
B	264 (77.0)	
C	48 (69.6)	
D	169 (78.6)	
E	34 (77.3)	
Age, y		
<45	76 (89.4)	<.0001
45–54	121 (86.2)	
55–64	155 (83.8)	
65–74	151 (74.4)	
≥75	121 (54.0)	
Insurance provider		
Commercial	286 (89.9)	<.0001
Medicare	291 (64.5)	
Medicaid	17 (68.0)	
Self or none	25 (71.0)	
Congestive heart failure on x-ray		
Present	112 (61.9)	<.0001
Absent	512 (78.0)	
Comorbidity score		
1	224 (87.2)	<.0001
2	217 (75.0)	
3	113 (69.3)	
4	34 (52.4)	
≥5 or higher	36 (56.3)	
Thrombolytic therapy		
Given	329 (86.5)	<.0001
Not given	295 (64.5)	

* *Among 835 patients with acute myocardial infarction.*

patients than would be expected. The race- and gender-specific age differences largely account for the variation in the proportion insured through Medicare or Medicaid.

Course of Treatment

Approximately 45% of patients received thrombolytic therapy (TT). This proportion was highest for white men, lower for white women and black men, and lowest for black women.

The distribution of days of hospitalization did not differ notably across race and gender groups. In-hospital mortality was lowest for white men (8.8%) and highest for white women (16.0%) and black women (12.5%).

Cardiac Catheterization

Physicians offered CC to 72.9% of patients. In the unadjusted analysis, the race/gender groups differed in the likelihood of being offered this procedure, from a high of 78.3% (white men) to a low of 65.9% (white women). The black men and women were intermediate at 68.3% and 69.4% ($P = .003$).

Table 3 shows other bivariate predictors of CC. After adjustment for potential confounding factors, the association between the 4 race/gender groups and the likelihood of receiving CC was no longer seen (see Table 4).

Angioplasty and Coronary Artery Bypass Grafting

Among the 611 patients who underwent CC, there was no statistically significant difference between the 4 race/gender groups in the rates of being offered PTCA (see Table 4). The unadjusted analysis, with white men as the reference group, found the rate of being offered PTCA was 1.11 (95% confidence interval [CI], 0.72 to 1.69) for white women; 0.59 (95% CI, 0.30 to 1.15) for black men; and 0.44 (95% CI, 0.18 to 1.06) for black women. After adjustment for potential confounding factors, the rate of being offered PTCA was 1.22 (95% CI, 0.75 to 1.98) for white women; 0.61 (95% CI, 0.29 to 1.28) for black men; and 0.40 (95% CI, 0.14 to 1.13) for black women.

Table 4. Probabilities of Being Offered Cardiac Catheterization (CC) During the Initial Hospital Admission

		Unadjusted			Multiple-Adjusted		
		OR	95% CI	*P* Value*	OR	95% CI	*P* Value*
CC†	White men	1.00	(reference)		1.00	(reference)	
	White women	0.54	0.38 to 0.75	.000	0.88	0.60 to 1.29	.502
	Black men	0.60	0.36 to 1.01	.057	0.79	0.41 to 1.50	.465
	Black women	0.63	0.33 to 1.20	.162	1.14	0.53 to 2.45	.733
PTCA‡	White men	1.00	(reference)		1.00	(reference)	
	White women	1.11	0.72 to 1.69	.625	1.22	0.75 to 1.98	.416
	Black men	0.59	0.30 to 1.15	.124	0.61	0.29 to 1.28	.192
	Black women	0.44	0.18 to 1.06	.068	0.40	0.14 to 1.13	.084
CABG‡	White men	1.00	(reference)		1.00	(reference)	
	White women	0.76	0.47 to 1.21	.246	0.47	0.24 to 0.89	.021
	Black men	0.47	0.22 to 1.00	.050	0.36	0.12 to 1.06	.065
	Black women	0.52	0.22 to 1.23	.138	0.37	0.11 to 1.28	.118

* *Significance of χ^2 test for inequality of odds ratios across categories of parameter of interest. OR indicates odds ratio; 95% CI, 95% confidence interval; PTCA, percutaneous transluminal coronary angioplasty; CABG, coronary artery bypass graft.*

† *Among 835 patients with acute myocardial infarction before and after adjusted using logistic regression models for severity, comorbidity, and other demographic characteristics.*

‡ *Among 611 patients who underwent CC before and after adjusting for coronary artery anatomy.*

Table 5. Bivariate Associations of Baseline Characteristics and Type of Procedure Offered During Initial Hospitalization*

	Number (%) Not Offered Either Procedure (*n* = 230)	Number (%) Offered PTCA First (*n* = 216)	Number (%) Offered CABG First (*n* = 165)	*P* Value†
Age, y				.001
<45	35 (46.1)	30 (39.5)	11 (14.5)	
45–54	46 (38.3)	52 (43.3)	22 (18.3)	
55–64	56 (38.8)	58 (38.2)	38 (25.0)	
65–74	53 (36.3)	38 (26.0)	55 (37.7)	
≥75	40 (34.2)	38 (32.5)	39 (33.3)	
Gender				.291
Male	149 (37.0)	138 (34.2)	116 (28.8)	
Female	81 (38.9)	78 (37.5)	49 (23.6)	
Race				.016
White	185 (35.4)	192 (36.7)	146 (27.9)	
Black	45 (51.1)	24 (27.3)	19 (21.6)	
Congestive heart failure on x-ray				.001
Present	36 (33.3)	21 (19.4)	51 (47.2)	
Absent	194 (38.6)	195 (38.8)	114 (22.7)	
Comorbidity score				.069
1	82 (37.1)	97 (43.9)	42 (19.0)	
2	81 (38.0)	74 (34.7)	58 (27.2)	
3	41 (36.9)	30 (27.0)	40 (36.0)	
4	11 (35.5)	7 (22.6)	13 (41.9)	
5	15 (42.9)	8 (22.9)	12 (34.3)	
Severe disease‡				.001
Present	68 (32.5)	29 (13.90)	112 (53.6)	
Absent	154 (40.1)	183 (47.7)	47 (12.2)	
Left main stenosis ≥40%				.001
Present	16 (28.6)	4 (7.1)	36 (64.3)	
Absent	206 (38.4)	208 (38.7)	123 (22.90)	
Number of vessels stenosed ≥50%, no left main stenosis§				
0	21 (80.8)	5 (19.2)	0.0	.001
1	75 (39.3)	112 (58.6)	4 (2.1)	
2	58 (34.7)	66 (39.5)	43 (25.8)	

** Among 611 patients with myocardial infarction. PTCA indicates percutaneous transluminal coronary angioplasty; CABG, coronary artery bypass graft.*

† Significance of χ^2 test for inequality of proportions of patients receiving procedures across categories of parameter of interest.

‡ Left main artery ≥40% stenosed and/or 3 or more vessels ≥50% stenosed.

§ Among 611 patients who received cardiac catheterization, vessel data are not available for 18 patients.

Among the patients who underwent CC, the unadjusted analysis found that black men were less likely to be offered CABG than white men (see Table 4). After adjustment for potential confounding factors, white women were less likely to be offered CABG than white men. The unadjusted rate of being offered CABG, with white men as the reference group, was 0.76 (95% CI, 0.47 to 1.21) for white women; 0.47 (95% CI, 0.22 to 1.00) for black men; and 0.52 (95% CI, 0.22 to 1.23) for black women. After adjusting for potential confounding factors, the rate of being offered CABG was 0.47 (95% CI, 0.24 to 0.89) for white women; 0.36 (95% CI, 0.12 to 1.06) for black men; and 0.37 (95% CI, 0.11 to 1.28) for black women.

The selection of revascularization was driven by hospital of admission, CC findings, presence of CHF, and age (Table 5). Absence of vessel disease increased the likelihood that no therapeutic procedure would be offered. Moderate vessel disease was predictive of being offered PTCA. Severe vessel disease (at least 40% stenosis in the left main artery, or 3 or more vessels with at least 50% occlusion) was predictive of being offered CABG. Patients with CHF were more likely to be offered CABG than those without CHF. Age was differentially associated with the choice of procedures. Younger patients receiving a procedure were more likely to be offered PTCA, while older patients were more likely to be offered CABG. This probably reflects the increasing prevalence of coronary artery disease associated with increased age. Five factors persisted as statistically significant predictors of procedures: race, gender, hospital of initial admission, presence of CHF on the initial chest x-ray, and overall severity of disease as determined from the CC.

DISCUSSION

Our study shows that white women are less likely than white men to be offered bypass surgery after AMI. Although black men and women with AMI are less likely than white

Table 6. Examples of Previous Studies

Author	Study Population	Study Years	Key Findings	Comments
Oberman[7]	Alabama	1970–1978	CABG W > B	Data before 1980
Maynard[8]	USA Canada	1974–1979	CABG W > B	Data before 1980
Gillum[9]	USA	1979–1983	CC and CABG W > B, M >F	Data before 1990; adjusted only for age
Ayanian[18]	USA	1987–1988	PTCA and CABG W > B	Data before 1990
Wenneker[10]	Massachusetts	1985	CC and CABG W > B	No adjustment for severity or comorbidity
McBean[22]	USA	1990	PTCA and CABG W > B	Only adjusted for age, no patients <65 years
Stone[25]	USA	1990–1993	CC and PTCA W > B, M > F	No adjustment for severity or comorbidity
Udvarhelyi[14]	USA	1987	PTCA and CABG W > B	No adjustment for severity; no patients < 65 years
Whittle[16]	VA, USA	1987–1991	CC, PTCA, and CABG W > B	VA patients only; no adjustment for severity
Peterson[21]	VA, USA	1988–1990	CC, PTCA, and CABG W > B	VA patients only; no adjustment for severity

CABG indicates coronary artery bypass graft; CC, cardiac catheterization; PTCA, percutaneous transluminal coronary angioplasty; B, black; W, white; F, female; M, male.

men to be offered PTCA or CABG in both unadjusted and adjusted analyses, these findings did not reach statistical significance. Our study is limited in power due to the small number of blacks in the sample.

Previous studies have consistently found that whites with CHD are more likely to undergo cardiac procedures than blacks.[1,6–31] Many of these studies, however, have significant limitations. Table 6 lists some representative studies and their limitations. Some studies used pre-1980 data[7,8,29] or pre-1990 data[6,9–15,18,19,21–24] so may not reflect current practice patterns. Some studies were unable to identify clinical factors contributing to observed differences, because they were not adjusted for differences in severity of heart disease, comorbidity, or coronary anatomy.[10,16,20,22,25,29,31] Some studies were limited to Medicare beneficiaries[14,19,23] and some were limited to VA hospital databases.[16,20,21,30]

Although individual studies have given widely differing results, overall blacks and women appear to receive CC less often than whites and men.[9,14,23–26,32–54] Several studies have found that whites undergo PTCA and/or CABG more frequently than blacks.[7–10,14,16,18,21,22,25] Our finding that white women were less likely to be offered CABG than white men was not surprising, because 2 other studies that adjusted for comorbidity and/or age had similar findings.[14,24] But other studies found no differences by gender in rates of PTCA and/or CABG.[14,24,27,33,35,39,42,45,49,51–53]

Why might race and gender influence the decision to offer invasive procedures to patients with AMI? A recent study sheds some light on this.[55] Primary care physicians viewed videotaped interviews of actors complaining of chest pain, then were asked to make recommendations about each patient's care. The actors read identical scripts verbatim, had identical hand motions, and were dressed in identical gowns. They found that women and blacks were less likely to be referred for CC than men and whites. The authors suggest that these findings could be the result of subconscious perceptions rather than deliberate actions or thoughts. They also suggest that subconscious bias occurs when a patient's membership in a target group automatically activates a cultural stereotype in the physician's memory.

Limitations

Our study is limited by the small sample size of blacks, single geographic location, atypical practice style (high CC rate), lack of inclusion of all AMIs during the time period, and our inability to know the appropriateness of procedure use. Whether white women were receiving too few CABGs and black men and women were receiving too few PTCAs and CABGs or whether white men were receiving too many cannot be determined. We presented and analyzed the number of procedures offered, not the procedures performed. This eliminates the possibility that any differences seen are due to patient refusals.

Our analyses show that some of the racial and gender differences in the probability of being offered cardiovascular procedures are explained by clinical confounders. However, the odds of being offered PTCA and CABG remained lower for black men and women compared to white men, even after adjustment for clinical factors. Although these findings did not reach statistical significance, we believe them to be a true effect because of their similarity to previous studies and their consistency across procedures. Our study contributes to the literature on racial and gender variation in cardiac procedure use by reflecting 1990s practice in a community hospital setting and by adjusting for clinical confounders (severity, comorbidity, and coronary artery anatomy).

Procedure rates in AMI patients have increased in the last decade. It will be important to learn whether differences in procedure rates by race and gender will increase or

decrease as cost pressures drive these rates lower in the future. Future research should also examine the appropriateness of the use of CC, PTCA, and CABG in AMI patients of both sexes and all races.

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