THE EFFECT OF RACE AND SEX ON PHYSICIANS' RECOMMENDATIONS FOR CARDIAC CATHETERIZATION

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ABSTRACT

Background Epidemiologic studies have reported differences in the use of cardiovascular procedures according to the race and sex of the patient. Whether the differences stem from differences in the recommendations of physicians remains uncertain.

Methods We developed a computerized survey instrument to assess physicians' recommendations for managing chest pain. Actors portrayed patients with particular characteristics in scripted interviews about their symptoms. A total of 720 physicians at two national meetings of organizations of primary care physicians participated in the survey. Each physician viewed a recorded interview and was given other data about a hypothetical patient. He or she then made recommendations about that patient's care. We used multivariate logistic-regression analysis to assess the effects of the race and sex of the patients on treatment recommendations, while controlling for the physicians' assessment of the probability of coronary artery disease as well as for the age of the patient, the level of coronary risk, the type of chest pain, and the results of an exercise stress test.

Results The physicians' mean (±SD) estimates of the probability of coronary artery disease were lower for women (probability, 64.1±19.3 percent, vs. 69.2±18.2 percent for men; P<0.001), younger patients (63.8±19.5 percent for patients who were 55 years old, vs. 69.5±17.9 percent for patients who were 70 years old; P<0.001), and patients with non-anginal pain (58.3±19.0 percent, vs. 64.4±18.3 percent for patients with possible angina and 77.1±14.0 percent for those with definite angina; P<0.001). Logistic-regression analysis indicated that women (odds ratio, 0.60; 95 percent confidence interval, 0.4 to 0.9; P=0.02) and blacks (odds ratio, 0.60; 95 percent confidence interval, 0.4 to 0.9; P=0.02) were less likely to be referred for cardiac catheterization than men and whites, respectively. Analysis of race–sex interactions showed that black women were significantly less likely to be referred for catheterization than white men (odds ratio, 0.4; 95 percent confidence interval, 0.2 to 0.7; P=0.004).

Conclusions Our findings suggest that the race and sex of a patient independently influence how physicians manage chest pain. (N Engl J Med 1999; 340:618-26.)

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EPIDEMIOLOGIC studies have identified differences according to race and sex in the treatment of patients with cardiovascular disease in the United States.[1-18] Some studies have found that blacks and women are less likely than whites and men, respectively, to undergo cardiac catheterization or coronary-artery bypass graft surgery when they are admitted to the hospital for treatment of chest pain or myocardial infarction.[1-5,7,8,10,11,13,14] In contrast, other studies were unable to confirm that invasive procedures are underused in women.[15,16]

Racial differences in the treatment of cardiovascular disease may be explained by financial and organizational barriers,[13] clinical differences among patients,[17] preferences of the patients,[7,8,10,12] and the amount of contact the patients have with the health care system or hospitals that offer invasive cardiovascular services.[18] Most studies that have controlled for the insurance status of patients[1,5,7,9-13] or have assessed patients already within the health care system[1-3,5,7-14] still found significant effects of race. However, one study has reported that there were no effects of race among patients with private insurance.[13]

Sex differences in the treatment of cardiovascular disease are less well established. Sex differences persist despite the poorer prognosis for women after myocardial infarction[19,20] and the higher likelihood that they will have had greater functional disability due to angina before myocardial infarction.[4] Differences in treatment may be related to a lack of research on cardiovascular disease in women,[21] differ-

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ences in physicians' interpretations of women's and men's symptoms,[6] time of presentation for treatment with respect to the progression of disease,[22] or the recommendations of physicians.[23]

One question that has not been addressed directly by previous studies is the extent to which physicians are responsible for the differences in treatment recommendations with respect to race and sex. The goal of this study was to assess, in a controlled experiment, physicians' treatment recommendations for patients presenting with various types of chest pain. We hypothesized that the race and sex of the patients would influence the physicians' recommendations regarding cardiac catheterization.

METHODS

Survey Instrument

We developed a computerized survey instrument, incorporating video recorded interviews and text, to present descriptions of patients with chest pain to clinicians and to assess clinicians' decisions about how to manage such symptoms. We constructed 144 descriptions using all possible combinations of six experimental factors: race (black or white), sex, age (55 or 70 years), level of coronary risk (low or high), type of chest pain (definite angina, possible angina, or nonanginal pain), and the results of an exercise stress test with thallium (moderate inferolateral ischemia, moderate anterolateral ischemia, or multiple severe ischemic defects). In addition, each description included the same results of electrocardiography (nonspecific T-wave changes).

The survey was administered by means of a multimedia computer program developed for this study. The instrument included a video recorded interview of a patient with chest pain and was designed to assess the physicians' management recommendations and judgment of the characteristics of the patient, and to record the demographic characteristics of the physicians.

The recorded component consisted of a scripted interview with a patient. Three scripts were developed, one for each type of chest pain. Each script contained information on the presenting symptom, associated cardiac symptoms, relief of symptoms, and duration of symptoms. The scripts were reviewed by four cardiologists, who independently used established criteria to classify the features of the pain described in each interview as definite angina, possible angina, or nonanginal chest pain.[24] The rate of agreement among the classifications made by the cardiologists on the basis of the scripts was greater than 75 percent.

Eight actors representing each of the possible combinations of race, sex, and age were recruited to portray the patients in the interviews (Fig. 1). Actors were used because they were considered better able than patients to express a consistent range of emotions and to read the scripts verbatim for recording. The interviews were recorded at a single studio, with the actors following a particular set of directions for each script. The hand motions used by the actors were identical for each script, the actors were dressed in identical gowns, and the camera position was the same for all interviews. The video recordings were produced by a company with experience in the production of educational medical video products (Interactive Drama, Bethesda, Md.).

The video segment was introduced by a screen that listed the patient's type of insurance (Blue Cross–Blue Shield indemnity insurance for the 55-year-old patients and Medicare and Blue Cross–Blue Shield supplemental insurance for the 70-year-old patients) and occupation (assembly supervisor for the 55-year-old patients, retired assembly supervisor for the 70-year-old patients). The patients were considered to be at low risk or at high risk for coronary disease on the basis of blood pressure (low risk, 133/81 mm Hg; high risk, 145/86 mm Hg), blood cholesterol

concentrations (low risk: low-density lipoprotein [LDL], 146 mg per deciliter [3.8 mmol per liter] and high-density lipoprotein [HDL], 59 mg per deciliter [1.5 mmol per liter]; high risk: LDL, 158 mg per deciliter [4.1 mmol per liter] and HDL, 46 mg per deciliter [1.2 mmol per liter]), and smoking history (low risk, no smoking; high risk, smoking one pack of cigarettes a day for 30 years). None of the patients had diabetes, and all had a father who had had a myocardial infarction at the age of 75 years. These characteristics were based on those of the subjects in the 20th to 30th percentiles for the risk of coronary artery disease (low risk) and those in the 70th to 80th percentiles (high risk) in the Framingham Study.[25]

To assess their decisions about management, the physicians were asked to characterize the type of chest pain described by the patient and to estimate the probability that he or she had clinically significant coronary disease (defined as ≥70 percent narrowing of an epicardial coronary artery). The physicians were then asked if they wished to order further cardiac evaluations for the patient and were given four options: no stress test, regular stress test, stress test with thallium, and other types of functional cardiac assessment (e.g., stress echocardiography). The physicians were then shown the results of one of three stress tests with thallium, asked to estimate the probability of coronary disease on the basis of the results of the stress test, and asked whether they wished to refer the patient for cardiac catheterization.

The section on patient assessment included a two-part survey to be completed by the physician, modified from the instrument developed by van Ryn (van Ryn M: personal communication). The first component of the survey was a 10-item scale, which included items assessing the physicians' judgments of the emotional, intellectual, and communication characteristics of patients; these factors are believed to be predictive of patient compliance and treatment outcomes. The personal characteristics of the patients were evaluated by the physicians on a seven-point Likert scale that rated the strength and direction of the attributes within the domain, with scores ranging from −3 (negative attributes) to 3 (positive attributes). The second component of the instrument included six individual assessment items evaluated on a five-point Likert scale, with 1 representing "very unlikely" and 5 representing "very likely." The physicians were asked to predict the likelihood that the patient seen in the interview had overreported his or her symptoms, the likelihood that the patient would miss follow-up appointments, the likelihood that the patient would participate in treatment, the likelihood that the patient would sue for malpractice, the likelihood that the patient would comply with therapy, and the likelihood that the patient would benefit from a revascularization procedure (coronary angioplasty or coronary-artery bypass surgery). Finally, the survey asked the physicians to report their age, race or ethnic group, sex, specialty and subspecialty, and year of graduation from medical school.

The software program required that all the components of the 10-minute survey instrument be presented to each physician and that the physician see the entire interview before answering questions. The interactive programs were developed with the use of Combersim, a proprietary software program designed by Interactive Drama for the creation of standardized multimedia patients on a personal computer for training purposes.

Study Subjects and Data Collection

Physicians who were in full-time clinical practice and who attended the 1997 annual meeting of the American College of Physicians (ACP) or the 1996 annual meeting of the American Academy of Family Practice (AAFP) were eligible to participate in the survey. Physicians who registered for the meetings in advance were mailed a postcard inviting them to participate in the survey, with the incentive of an offer of a food gift. The physicians were told they were participating in a study of clinical decision making but were not told that the primary purpose of the study was to assess the effects of patients' race and sex on decision making.

Figure 1. Patients as Portrayed by Actors in the Video Component of the Survey.

Panel A shows a 55-year-old black woman, Panel B a 55-year-old black man, Panel C a 70-year-old black woman, Panel D a 70-year-old black man, Panel E a 55-year-old white woman, Panel F a 55-year-old white man, Panel G a 70-year-old white woman, and Panel H a 70-year-old white man.

The surveys were administered in a booth located in the main exhibit hall of each meeting with six individual computer stations. The computer stations were designed to offer privacy to the physicians and to prevent them from viewing other participants while they were completing the survey.

The physicians were randomly assigned to view 1 of 144 possible cases according to the full-factorial experimental design (i.e., all the possible combinations of race, sex, age, risk level, type of chest pain, and stress-test results). After each replication of the study design was completed, the randomized scheme began again for a new replicate of 144 cases. Sample-size calculations required a minimum of two replicates (288 subjects) from each meeting for the study to achieve 80 percent power to detect a 15 percent difference in referral decisions at a level of significance of 0.05. We collected data for three replicates at the AAFP meeting (432 subjects) and for two replicates at the ACP meeting (288 subjects).

Statistical Analysis

We performed univariate analyses to assess differences in the physicians' responses when different values of the experimental factors were used to construct the case descriptions. Differences in the means of continuous variables were evaluated with t-tests or analysis of variance, and differences in proportions were evaluated with chi-square tests.

In addition, we used multivariable logistic-regression analyses to assess the effect of the race and sex of the patient on the decisions of physicians regarding referral for cardiac catheterization, with adjustment for the other experimental variables and additional potential confounding variables. We included the race and sex of the patient in the regression models, using two approaches: analyzing the main effects of race and sex only, and analyzing the main effects of race and sex plus a race–sex interaction. The second approach enabled us to assess treatment recommendations for four combinations of race and sex (white man, black man, white woman, and black woman).

In our main analyses, the covariates in the regression models were the age of the patient, the level of risk, the type of chest pain (as classified by the study cardiologists), the results of the exercise stress test with thallium, and the physician's estimate of the probability of coronary disease after the stress test. We also assessed whether the results remained robust after the following changes were made to the models: replacing the type of chest pain as classified by the study cardiologists with the type of chest pain as

E

F

G

H

classified by the physicians; replacing the probability of disease after the results of the stress test were known with the probability before they were known; omitting estimates of the probability of disease altogether; adding the responses of the physicians regarding the personal characteristics of the patients to the covariates in the model; adding the physicians' responses to the individual assessment items to the covariates in the model; and adding the characteristics of the physicians, including race and sex, to the model.

Preliminary analyses showed no difference in survey responses between the physicians at the AAFP meeting and those at the ACP meeting and similar effects of the race and sex of the patient at the two meetings. Consequently, we pooled the data from both meetings in all subsequent analyses. We converted logistic-regression coefficients to odds ratios and calculated 95 percent confidence intervals, using standard methods.

RESULTS

The only characteristic of the 720 physicians that differed with respect to the race and sex of the patient was the sex of the physician, with more fe-male physicians assigned to black female patients (P=0.02) (Table 1).

The physicians' estimates of the probability of coronary artery disease before the results of the stress test were known differed according to the sex, age, level of risk, and type of chest pain of the patient (Table 2). The patterns of the differences were consistent with the known prevalence of coronary disease in various groups of patients (e.g., older patients have higher rates of coronary disease than younger patients). As expected, these estimates of probability did not differ according to the results of the stress test, which were unknown to the physicians at the time the assessments were made.

For all categories of all experimental factors, the probabilities of disease assigned after the results of the stress test were known were consistently greater than those assigned before the results were known

TABLE 1. Characteristics of the Physicians According to the Race and Sex of the Patient.*

Characteristic	White Male Patient	Black Male Patient	White Female Patient	Black Female Patient	P Value
No. of physicians	180	180	180	180	
Mean age — yr	44.2	43.6	42.9	42.8	0.57
Sex — no. (%)					0.02
Male	130 (72.2)	131 (72.8)	126 (70.0)	107 (59.4)	
Female	50 (27.8)	49 (27.2)	54 (30.0)	73 (40.6)	
Race or ethnic group — no. (%)					0.41
White	148 (82.2)	136 (75.6)	139 (77.2)	137 (76.1)	
Black	7 (3.9)	8 (4.4)	7 (3.9)	11 (6.1)	
Hispanic	5 (2.8)	8 (4.4)	7 (3.9)	8 (4.4)	
Aleut	0	4 (2.2)	0	0	
Asian	16 (8.9)	13 (7.2)	20 (11.1)	17 (9.4)	
Don't know or no answer	4 (2.2)	11 (6.1)	7 (3.9)	7 (3.9)	
Specialty — no. (%)					0.97
Internal medicine	68 (37.8)	67 (37.2)	69 (38.3)	71 (39.4)	
Family medicine	104 (57.8)	106 (58.9)	101 (56.1)	103 (57.2)	
Other	8 (4.4)	7 (3.9)	10 (5.6)	6 (3.3)	
Board certified — no. (%)					0.63
Yes	164 (91.1)	166 (92.2)	159 (88.3)	162 (90.0)	
No	16 (8.9)	14 (7.8)	21 (11.7)	18 (10.0)	

*Because of rounding, percentages may not total 100.

TABLE 2. Physicians' Estimates of the Probability of Coronary Artery Disease According to Experimental Factors.*

Experimental Factor and Category	Estimate of Probability before Stress Test (%)	P Value	Estimate of Probability after Stress Test (%)	P Value
Sex		<0.001		0.15
Male	69.2±18.2		87.5±13.7	
Female	64.1±19.3		86.1±13.3	
Race		0.120		0.26
White	65.5±20.5		87.4±13.7	
Black	67.7±17.1		86.2±13.3	
Age		<0.001		0.03
55 yr	63.8±19.5		85.7±14.0	
70 yr	69.5±17.9		87.9±12.9	
Risk level		<0.001		0.05
Low	63.5±20.4		85.8±14.0	
High	69.8±16.8		87.8±12.9	
Type of chest pain		<0.001		<0.001
Nonanginal pain	58.3±19.0		84.5±14.0	
Possible angina	64.4±18.3		86.2±13.7	
Definite angina	77.1±14.0		89.7±12.3	
Stress-test result		0.77		<0.001
Inferolateral ischemia	67.3±19.3		87.5±15.9	
Anterolateral ischemia	66.1±18.8		84.1±11.7	
Multiple ischemic defects	66.5±18.7		88.8±12.1	

*The results of stress tests were not presented to the physicians for the initial assessment of the probability of disease but were presented for the final assessment. Plus–minus values are means ±SD.

(Table 2). This finding was expected, because all the patients had a positive stress test. The probabilities assigned after the results of the stress test were known differed according to age, the type of chest pain, and the results of the exercise stress test.

Overall, the physicians classified 30.6 percent of the patients as having definite angina, 65.0 percent as having possible angina, and 4.4 percent as having nonanginal chest pain. There were no differences in the assessments of chest pain according to the combined race and sex of the patient (P=0.20). The overall rate of agreement with the expert classification was 51 percent and varied from 48 percent to 55 percent for the various combinations of race and sex. Stress tests were recommended for 93.3 percent of white men and white women and for 97.8 percent of black men and black women (P=0.04).

The physicians' perceptions of the personal characteristics of the patients differed significantly in 7 of the categories measured on the 10-item scale according to the combined race and sex of the patient (P<0.05). However, in no category was the difference greater than 0.87 point on the 7-point Likert scale (Table 3). In addition, the responses with respect to the individual assessment of the predicted behavior of the patients differed significantly for three of the six categories according to the combined race and sex of the patient (P<0.02); in no category was the difference greater than 0.27 point on a 5-point Likert scale (Table 3).

In univariate analyses, the race and sex of the pa-

TABLE 3. PHYSICIANS' ASSESSMENTS OF THE CHARACTERISTICS OF THE PATIENTS ACCORDING TO CATEGORY OF RACE AND SEX.*

CHARACTERISTIC	WHITE MALE PATIENT	BLACK MALE PATIENT	WHITE FEMALE PATIENT	BLACK FEMALE PATIENT	P VALUE
Personal characteristics†					
Hostile–friendly	1.81±1.06	1.99±1.06	1.66±1.09	2.23±0.90	0.001
Unintelligent–intelligent	1.91±0.90	1.89±0.97	2.05±0.83	2.00±0.84	0.29
Lacking self-control–self-controlled	2.17±0.98	2.25±0.95	2.28±0.89	2.35±0.79	0.31
Ignorant–knowledgeable	1.31±1.13	1.56±0.93	1.58±1.08	1.51±1.08	0.06
Poor communicator–good communicator	1.61±1.40	1.94±1.21	1.93±1.20	1.94±1.21	0.03
Dependent–independent	1.52±1.20	1.91±1.11	1.45±1.35	1.83±1.10	0.001
Sad–happy	0.24±1.38	0.44±1.50	−0.20±1.45	0.67±1.33	0.001
Negative affect–positive affect	0.14±1.37	0.51±1.44	−0.14±1.54	0.51±1.44	0.001
Worried–indifferent	−0.76±1.65	−1.18±1.58	−1.29±1.42	−0.97±1.49	0.005
Low socioeconomic status–high socioeconomic status	0.69±1.06	−0.09±1.03	0.76±1.01	0.14±1.04	0.001
Individual assessment of predicted behavior					
Likely to overreport symptoms‡	2.04±0.79	1.79±0.60	2.05±0.65	1.84±0.51	0.001
Likely to miss appointments‡	2.04±0.79	2.21±0.83	2.04±0.84	2.04±0.79	0.12
Likely to participate‡	3.88±0.98	3.78±0.88	4.00±0.90	3.81±1.00	0.12
Likely to sue‡	2.54±0.85	2.27±0.84	2.46±0.81	2.32±0.83	0.01
Likely to comply with treatment‡	4.04±0.80	3.97±0.70	4.20±0.63	4.06±0.77	0.02
Likely to benefit from invasive procedure§	3.47±0.72	3.38±0.65	3.44±0.76	3.30±0.75	0.12

*Plus–minus values are means ±SD.

†Patients' personal characteristics were rated on a seven-point Likert scale, with scores ranging from −3 to 3. A higher score indicates a stronger relation with the positive (second listed) characteristic.

‡Physicians were asked to rate patients on a five-point Likert scale, with 1 representing "very unlikely" and 5 representing "very likely."

§Physicians were asked to rate patients on a five-point Likert scale, with 1 representing "much less than average" and 5 representing "much greater than average."

tient were significantly associated with the physicians' decisions about whether to make referrals for cardiac catheterization, with men and whites more likely to be referred than women and blacks, respectively (Table 4). For the other experimental factors, only the type of chest pain was a significant predictor of whether the patient would be referred for cardiac catheterization.

Table 5 shows the results of the multivariable logistic-regression analyses. In the model that included only the main effects of race and sex, we found that both variables were significant predictors of rates of referral for cardiac catheterization. Men and whites were significantly more likely to be referred than women and blacks. These results indicate that the differences with respect to race and sex were not simply due to the differences in the probabilities of disease assigned by the physicians. We then examined the interaction of race and sex in terms of referral for cardiac catheterization (P=0.06 for the interaction). Black women were the only patients who were significantly less likely to be referred for cardiac catheterization than white men, who served as the reference category. In addition, age and the type of chest pain were significant predictors of referral for cardiac catheterization, with the odds ratios for all factors similar to those in the univariate results. Sensitivity analyses (alternative model specifications) did not change the results of the main analyses.

DISCUSSION

We found that the race and sex of the patient affected the physicians' decisions about whether to refer patients with chest pain for cardiac catheterization, even after we adjusted for symptoms, the physicians' estimates of the probability of coronary disease, and clinical characteristics. Our findings are most striking for black women. Epidemiologic studies have reported differences in treatment according to race and sex,[1-18] but they could not assess whether these differences were due to differences in the clinical presentation of the patients. This study directly addressed this issue by using actors to represent patients with identical histories and controlling for characteristics reflective of their personalities. Our findings are consistent with the results of

TABLE 4. Referral for Cardiac Catheterization According to Experimental Factors.

Experimental Factor and Category	Mean Referral Rate	Odds Ratio (95% CI)*	P Value
	%		
Sex			
Male	90.6	1.0	
Female	84.7	0.6 (0.4–0.9)	0.02
Race			
White	90.6	1.0	
Black	84.7	0.6 (0.4–0.9)	0.02
Age			
55 yr	89.7	1.0	
70 yr	85.6	0.7 (0.4–1.1)	0.09
Risk level			
Low	88.9	1.0	
High	86.4	0.8 (0.5–1.2)	0.31
Type of chest pain			
Nonanginal pain	83.8	1.0	
Possible angina	90.0	1.7 (1.0–3.0)	0.04
Definite angina	89.2	1.6 (0.9–2.7)	0.08
Stress-test result			
Inferolateral ischemia	86.3	1.0	
Anterolateral ischemia	86.7	1.0 (0.6–1.6)	0.89
Multiple ischemic defects	90.0	1.4 (0.8–2.5)	0.20

*CI denotes confidence interval.

TABLE 5. Predictors of Referral for Cardiac Catheterization.*

Model and Variable	Odds Ratio (95% CI)†	P Value
Race and sex as separate factors		
Sex		
Male	1.0	
Female	0.6 (0.4–0.9)	0.02
Race		
White	1.0	
Black	0.6 (0.4–0.9)	0.02
Interaction of race and sex		
White male	1.0	
Black male	1.0 (0.5–2.1)	0.99
White female	1.0 (0.5–2.1)	>0.99
Black female	0.4 (0.2–0.7)	0.004

*Both models included all experimental factors as covariates, as well as the probability of coronary artery disease as estimated after the results of the stress tests were known. The first analysis included only the main effects. The second analysis explored a race–sex interaction.

†CI denotes confidence interval.

epidemiologic studies in which the lowest rates of cardiovascular procedures were among nonwhite women.[5,9]

The physicians' recommendations for cardiac catheterization could have reflected their perceptions of the personalities rather than the race or sex of the patients. To assess this possibility, we collected detailed information on the physicians' perceptions of the patients' personalities and other attributes with the use of a 10-item scale and six individual assessment questions. Incorporating this information into the analysis did not change the main results. Also, because we used a balanced, randomized design, the statistical tests of the experimental factors, including the race and sex of the patient, remain valid even if the patients' personality traits and attributes were imperfectly captured by our methods.[26]

Our findings suggest that a patient's race and sex may influence a physician's recommendation with respect to cardiac catheterization regardless of the patient's clinical characteristics. Alternatively, these findings may be the result of other factors not included in the information we presented to the physicians. For example, data on bypass surgery and angioplasty suggest that women may have worse outcomes than men,[27-30] although these effects may be due to differences in other confounding variables rather than to the sex of the patient.[28,30] Why these clinical effects would influence recommendations for black women and not white women is unclear. We did not find lower rates of referrals for stress tests among women or blacks.

Our study design has several strengths. By having actors pose as patients, clothed in an identical manner and having identical insurance and occupations, we removed the effects of differing socioeconomic status and insurance from our experiment. By providing the actors with identical scripts, by having them present in hospital gowns under identical direction, and by creating the program in a fixed format, we removed the effects of differences in the presentation of clinical symptoms by patients from our assessment. Finally, by asking the physicians for their estimates of the probability of coronary artery disease, we were able to control for differences in their perceptions of the prevalence of disease according to the race and sex of the patients. Although the physicians' estimates of the probability of disease before the results of the stress test were known were higher than the values for nonanginal pain reported in the literature,[31,32] these estimates are most relevant in the analysis of the treatment recommendations. Physicians' tendency to overestimate the probability of coronary artery disease in patients from groups with a low prevalence of disease has been documented previously.[33]

Our finding that the race and sex of the patient influence the recommendations of physicians independently of other factors may suggest bias on the part of the physicians. However, our study could not assess the form of bias. Bias may represent overt prejudice on the part of physicians or, more likely, could be the result of subconscious perceptions rather than deliberate actions or thoughts.[34,35] Subconscious bias occurs when a patient's membership

in a target group automatically activates a cultural stereotype in the physician's memory regardless of the level of prejudice the physician has.[35]

Our study has two main limitations. First, we assessed the management decisions of physicians using video recordings of actors portraying patients and a computerized survey instrument. Several reports support the use of case vignettes to assess clinical decision making by physicians.[36-40] In two studies of the external validity of case vignettes, assessments made on the basis of written case descriptions correlated highly with those made on the basis of examinations of patients with equivalent symptoms seen in person.[37,38] Video recordings rather than written case presentations may increase the accuracy of the probability estimates made by physicians.[40]

Second, the recruitment of physicians at national meetings of major professional organizations may have resulted in nonrepresentative samples. Physicians who attend professional meetings may be better informed than those who do not attend. Also, the physicians who volunteered for this project may have had a greater interest than others in coronary heart disease.

Our findings indicate that the race and sex of patients independently influence physicians' recommendations for the management of chest pain. They suggest that decision making by physicians may be an important factor in explaining differences in the treatment of cardiovascular disease with respect to race and sex.

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