

# COMPARATIVE FREQUENCY OF ANGIOGRAPHIC CORONARY ARTERY DISEASE IN AFRICAN AMERICANS AND HISPANICS

**Background:** African Americans and Hispanics are the two largest racial minority groups in the United States. Both groups have a high prevalence of cardiovascular disease risk factors, and African Americans have the highest mortality from cardiovascular disease of any racial group in the United States. Whereas a large body of clinical data compares African Americans and Whites or Hispanics and Whites with regard to coronary artery disease (CAD), limited data are available for such comparison between African Americans and Hispanics.

**Methods and Results:** We retrospectively reviewed the angiographic and clinical data of 480 consecutive patients who underwent coronary angiography for suspected CAD in an inner city hospital between January 1997 and December 1998 in order to ascertain the frequency of CAD. One hundred eighty-nine (189) African Americans and 163 Hispanics met the inclusion criteria. The mean ages of African-American and Hispanic patients were similar,  $56.3 \pm 10.9$  years vs  $55.6 \pm 11.4$  years, respectively,  $P=.59$ . The frequency of angiographic CAD was 56.6% for African Americans and 54.6% for Hispanics, odds ratio [OR] 0.92, 95% confidence interval [CI] 0.60–1.41,  $P=.71$ . Coronary artery disease (CAD) involving the left anterior descending coronary artery occurred significantly more in Hispanic compared to African-American patients (44.8% vs 33.7%, OR 1.58, 95% CI 1.03–2.44,  $P=.04$ ). Coronary artery disease (CAD) risk factors occurred more in Hispanics compared to African Americans.

**Conclusion:** The frequency of angiographic CAD was not different for African-American and Hispanic patients (56.6% vs 54.6%, OR 0.92, 95% CI 0.60–1.41,  $P=.71$ ) even though differences were seen in CAD risk factors. (*Ethn Dis.* 2006;16:58–63)

**Key Words:** African Americans, Coronary Artery Disease, Ethnicity, Hispanics, Race

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## INTRODUCTION

African Americans and Hispanics have a high prevalence of risk factors for coronary artery disease (CAD).<sup>1</sup> African Americans have the highest overall mortality from cardiovascular diseases, including CAD, than any other race in the United States.<sup>1</sup> Mortality from coronary heart disease is also higher for African Americans and Hispanics compared to Whites.<sup>1–3</sup> Such disparities in cardiovascular disease morbidity and mortality have been reviewed in several published reports that compared the prevalence of risk factors for CAD, severity of angiographic CAD, and morbidity and mortality from CAD between African Americans and Whites and between Hispanics and Whites.<sup>3–11</sup> Despite the potential to contribute to an understanding of the differential impact of cardiovascular risk factors on cardiovascular disease prevalence among two of the nation's largest minority populations, such comparative data are lacking for African Americans and Hispanics. We therefore reviewed the clinical and angiographic data of consecutive patients referred for coronary angiography for suspected CAD in order to determine the differences in the distribu-

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## METHODS

We retrospectively reviewed the medical records and angiographic data of a consecutive series of African-American and Hispanic patients who had coronary angiography performed for suspected CAD from January 1997 to December 1998 in the cardiac catheterization laboratory of an urban teaching hospital in the United States. The patients were  $\geq 18$  years of age and were referred for coronary angiography for suspected CAD. Prior to cardiac catheterization, each patient was evaluated by a physician who documented the medical history, in-

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cluding CAD risk factors, medications, and physical examination findings. The clinical variables considered in this study were age, sex, risk factors for CAD, and race. The CAD risk factors assessed were hypertension, diabetes, hypercholesterolemia, and cigarette smoking. Hypertension was determined to be present if it was included in the patient's list of medical diagnoses or the patient was taking antihypertensive medication at the time of cardiac catheterization. Similarly, diabetes and hypercholesterolemia were considered to be present if they were included in the list of medical conditions or the patient was taking the medications for the respective condition at the time of cardiac catheterization. Smoking was determined to be present if it was documented in the medical record. Race was determined by self-report. Other cardiovascular disease risk factors, such as left ventricular hypertrophy and socioeconomic status, were not adequately captured.

For the purpose of this study, CAD was defined as  $\geq 50\%$  luminal diameter narrowing of any major coronary artery. The severity of CAD was determined by selecting the most severe luminal diameter narrowing after viewing multiple standard angiographic projections of the coronary arteries. We recorded CAD as present in any one of the main coronary arteries if a  $\geq 50\%$  luminal diameter narrowing was present in either the main coronary artery or any of its major branches. We recorded multiple lesions in a coronary artery as one lesion for that particular coronary artery. The main coronary arteries were left main, left anterior descending, left circumflex, and right coronary arteries. We excluded patients who had previous coronary revascularization, incomplete records, or were of neither African American nor Hispanic origin. Because the data on ventricular function were not available for all patients and even when available were not obtained in a uniform way in every patient, they were not included in the analysis.

**Table 1. Characteristics of study population**

	AA	H	OR (95% CI)	P Value
Age (Mean $\pm$ SD)	56.26 + 10.86	55.63 + 11.36		NS
Sex				
Men: <i>n</i> (%)	115 (60.9)	80 (49.1)		.027
Diabetes: <i>n</i> (%)	49 (25.9)	60 (36.8)	1.66 (1.06–2.62)	.028
Hypertension: <i>n</i> (%)	144 (76.2)	131 (80.4)	1.28 (.77–2.13)	NS
Hypercholesterolemia: <i>n</i> (%)	55 (29.1)	77 (47.2)	2.18 (1.41–3.39)	.001
Cigarette smoking: <i>n</i> (%)	115 (60.9)	56 (34.4)	.34 (.22–.52)	.001
One vessel CAD	43 (22.8)	30 (18.4)		NS
Two vessel CAD	26 (13.8)	20 (12.3)		NS
Three vessel CAD	35 (18.5)	34 (20.9)		NS

NS=not statistically significant ( $P>.05$ ); AA=African American; H=Hispanic; OR=odds ratio; CI=confidence interval; CAD=coronary artery disease.

## STATISTICAL METHODS

The medical charts were reviewed by experienced physicians who double entered data in order to eliminate data entry errors. Continuous variables were summarized as mean plus or minus standard deviation while categorical variables were summarized as counts and percentages. Test of significance was performed by using the chi-square analysis for categorical variables and Student *t* test for differences in means between two groups. Logistic regression models were fitted to assess the relationship between the presence of angiographic CAD and CAD risk factors. All tests of significance were two-sided, and the nominal cut-off for significance was set at .05.

## RESULTS

After review of the angiographic and clinical data of 480 consecutive patients who underwent coronary angiography between January 1997 and December 1998, 352 patients (189 African Americans and 163 Hispanics) met the inclusion criteria and were enrolled in the study. We excluded eight patients who were neither African-American nor Hispanic and 120 patients because of incomplete records. Characteristics of the sample are shown in Table 1. African-American men and women had mean ages of  $55.7 \pm 11.2$  years

and  $57.0 \pm 10.4$  years, respectively ( $P=NS$ ) compared to Hispanic men  $53.6 \pm 11.2$  years and Hispanic women  $57.5 \pm 11.2$  years ( $P=NS$ ). Likewise, no significant difference in the mean age was observed between African-American and Hispanic patients whose indication for cardiac catheterization was chest pain ( $55.9 \pm 10.8$  years vs  $55.7 \pm 11.6$  years) or had CAD ( $58.2 \pm 10.5$  years vs  $59.2 \pm 10.4$  years, respectively). Patients who had CAD were older than their counterparts without CAD,  $58.2 \pm 10.5$  years vs  $53.7 \pm 10.8$  years,  $P=.005$  for African Americans and  $59.2 \pm 10.4$  years vs  $51.3 \pm 11.0$  years,  $P=.001$  for Hispanics.

The frequency of CAD was 56.6% for African Americans and 54.6% for Hispanics. The difference was not statistically significant, ( $P=.7$ ). Similarly, differences in CAD frequency for men and women across both races were not statistically significant, as shown in Table 2. Overall no difference was seen in the occurrence of multivessel CAD between African-American and Hispanic patients (Table 1); however, coronary artery disease that involved the left anterior descending coronary artery was observed significantly more in Hispanic men and women compared to their African-American counterparts (for men 81.3% vs 59.5%,  $P=.01$  and for women 82.9% vs 60.6%,  $P=.03$ ). Also, the distribution of significant CAD did not differ for African-Amer-

**Table 2. Frequency of coronary artery disease**

	AA n (%)	Hispanic n (%)	OR (95% CI)	P Value
All	107 (56.6)	89 (54.6)	0.92 (0.60–1.41)	NS
Men	74 (64.4)	48 (60.0)	0.83 (0.46–1.50)	NS
Women	33 (44.6)	41 (49.4)	1.21 (0.05–2.27)	NS

NS=not statistically significant ( $P>.05$ ); AA=African American; CI=confidence interval.

ican men and women, but Hispanic men had significantly more lesions in the right coronary artery compared to Hispanic women (70.8% vs 48.8%,  $P=.03$ ). Table 1 shows the occurrence of the major risk factors for CAD in the study population. Although hypertension was present more in Hispanic compared to African-American patients (80.4% vs 76.2%), the difference was not statistically significant. Diabetes (36.8% vs 25.9%,  $P=.028$ ) and hypercholesterolemia (47.2% vs 27.9%,  $P=.001$ ) occurred significantly more in Hispanics compared to African Americans while African Americans were more likely to smoke cigarettes (60.9% vs 34.4%,  $P=.001$ ). In the subgroup of patients with CAD

(Table 3), no significant differences were observed in the occurrence of major risk factors except for cigarette smoking; African-American men and women with CAD were more likely to smoke cigarettes compared to their Hispanic counterparts. In additional analysis, we observed a similar distribution of CAD risk factors in the subgroup of patients whose indication for cardiac catheterization was chest pain as in the whole study sample.

Chest pain was the primary indication for cardiac catheterization in 258 patients, which represented 73% of the study sample. The remaining indications for cardiac catheterization were heart failure in 67 patients (19%), valvular heart disease in 20

patients (6%), and cardiac dysrhythmias in seven patients (2%). African-American men (58.7%) and Hispanic women (54.6%) were significantly more likely to present with chest pain than their corresponding race and sex,  $P=.03$ . The frequency of CAD in the subgroup of patients with chest pain was 62.7% for African Americans and 58.3% for Hispanics,  $P=.47$ . In Table 4 the angiographic results in patients with chest pain were recorded according to the number of diseased coronary arteries. We did not observe any statistically significant differences between African Americans and Hispanics. However, left anterior descending coronary artery disease occurred significantly more often in Hispanics compared to African Americans ( $P=.04$ ), as shown in Table 5.

## DISCUSSION

This study sought to describe race-related differences in the frequency and distribution of CAD as well as the

**Table 3. Comparison of CAD risk factors in African-American and Hispanic patients with CAD**

	Men				Women			
	AA n (%)	Hispanic n (%)	Odds Ratio (95% CI)	P Value	AA n (%)	Hispanic n (%)	Odds Ratio (95% CI)	P Value
Hypertension	59 (79.7)	37 (77.1)	.86 (.35–2.06)	NS	26 (78.8)	37 (90.2)	2.49 (.66–9.39)	NS
Diabetes mellitus	19 (25.7)	17 (35.4)	1.59 (.72–3.49)	NS	16 (48.4)	27 (65.9)	2.05 (.80–5.24)	NS
Hypercholesterolemia	23 (31.1)	22 (45.8)	1.87 (.88–3.97)	NS	17 (51.5)	25 (70.0)	1.47 (.58–3.71)	NS
Cigarette smoking	55 (74.3)	27 (56.3)	.44 (.20–.96)	.04	16 (48.5)	8 (19.5)	.26 (.09–.72)	.008

NS=not statistically significant ( $P>.05$ ); AA=African American; CI=confidence interval; CAD=coronary artery disease.

**Table 4. Angiographic CAD in 258 African-American and Hispanic patients undergoing diagnostic catheterization for chest pain**

Number of Diseased Vessels	AA			H		
	Men	Women	Total n (%)	Men	Women	Total n (%)
0	20	27	47 (37)	22	33	55 (42)
1	18	13	31 (25)	11	13	24 (18)
2	16	4	20 (16)	6	11	17 (13)
3	19	7	26 (21)	18	13	31 (24)
4	1	1	2 (2)	3	2	5 (4)

AA=African American; H=Hispanic.

Number of diseased vessels: 1=either right, left circumflex, left anterior descending, or left main coronary artery; 2=any two of the above vessels; 3=any three of the above vessels; 4=any four of the above vessels.

**Table 5. Site of coronary artery disease in African-American and Hispanic patients**

Coronary Vessel	AA n (%)	H n (%)	OR (95% CI)	P Value
LAD	64 (33.7)	73 (44.8)	1.58 (1.03–2.44)	.04
LCX	66 (34.9)	56 (34.4)	.96 (.63–1.52)	NS
RCA	74 (39.2)	54 (33.1)	.77 (.49–.19)	NS
LM	8 (4.2)	9 (5.5)	1.32 (.50–3.51)	NS

NS=not statistically significant ( $P>.05$ ); LAD=left anterior descending artery; LCX=left circumflex artery; RCA=right coronary artery; LM=left main coronary artery; AA=African American; H=Hispanic; OR=odds ratio; CI=confidence interval.

occurrence of risk factors for CAD in African-American and Hispanic patients undergoing coronary angiography for suspected CAD. The primary findings of the study were: 1) in an inner-city adult patient sample that underwent coronary angiography, the frequency of CAD is similar in African Americans and Hispanics; 2) the observed similarity in frequency of CAD occurred despite the greater occurrence of diabetes and hypercholesterolemia in Hispanic patients; and 3) Hispanic men and women were significantly more likely than their African-American counterparts to have CAD that involved the left anterior descending coronary artery. We also observed similar findings for the subgroup of patients who presented to the cardiac catheterization laboratory with chest pain (including unstable angina and myocardial infarction).

Our study is unique in that it examines the frequency of CAD in two groups with a high burden of cardiovascular disease risk factors that are not usually compared. While many published data compare CAD occurrence between African Americans and Whites as well as between Hispanics and Whites,<sup>3–11</sup> data on similar comparisons between African Americans and Hispanics are lacking, despite the high prevalence of CVD risk factors in both populations. We are struck by the lack of difference in the occurrence of CAD in African Americans and Hispanics despite an observed greater CAD risk factor burden in the Hispanic

sample in this study. In a relatively high percentage of our study population (45%), angiographic CAD as defined by luminal diameter narrowing of greater than or equal to 50% was absent. This finding may be due in part to the fact that in 27% of the study sample, chest pain was not the primary indication for cardiac catheterization. Other studies have documented a higher coronary heart disease mortality in African Americans compared to Hispanics.<sup>1,2,12</sup> Such an observation suggests either a greater burden of CAD or greater case-fatality for coronary heart disease in African Americans. However, these studies did not report on the frequency of CAD or risk factors for CAD in African Americans and Hispanics. We observed a higher frequency of diabetes and hypercholesterolemia in Hispanics compared to African Americans. Both risk factors are closely associated with coronary artery disease. Diabetes is considered a coronary heart disease equivalent in treatment guidelines for hyperlipidemia in adults.<sup>13</sup> Diabetes is also closely associated with dyslipidemia. In the United Kingdom Prospective Diabetes Study (UKPDS),<sup>14</sup> both low-density lipoprotein cholesterol (LDL-C) and glycosylated hemoglobin (HbA1C) levels were more predictive of CAD compared to blood pressure and cigarette smoking in patients with type 2 diabetes. No significant difference in the occurrence of hypertension was seen between African Americans and Hispanics in this study. This observa-

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tion is in contrast to published epidemiologic reports that show African Americans have a higher frequency of hypertension compared to Hispanics and Whites.<sup>1</sup> Small sample size and selection bias may partly account for this unexpected finding. Furthermore, African Americans residing in the same geographic location where this study was performed have been reported to have a higher cardiovascular disease mortality compared to other African-American populations of varying socioeconomic status<sup>15</sup> and perhaps higher CAD risk factor burden. We postulate that a similar pattern may exist for Hispanics in this area as well, and this fact may help explain the unexpected finding of similar frequency of hypertension in African Americans and Hispanics in our study cohort, in contrast to published nationwide data.

We do not know the reasons for the absence of a difference in CAD frequency between African Americans and Hispanics in this study, despite a greater frequency of CAD risk factors in Hispanics. However, in addition to such factors as sample size and selection bias, which may play a role, differences between African Americans and Hispanics in the interaction of CAD risk factors could also lead to variable manifestation of CAD. Whites have a higher frequency of CAD compared to African Americans and Hispanics.<sup>1</sup>



This trend is partly due to the fact that African Americans die disproportionately more at younger age from other noncoronary disease causes than Whites; therefore, African Americans do not live long enough for CAD to manifest. This impact of age on the frequency of CAD is not a critical factor in our study because the mean age of the African-American and Hispanic patients studied were not significantly different. However, neither African Americans nor Hispanics are homogeneous as a group. Studies have shown, for example, a particularly high prevalence of diabetes in Mexican Americans compared with other Hispanic populations.<sup>16</sup> Consequently, this factor should be taken into account in interpreting these data. The findings in this study contribute to the body of knowledge in cardiovascular disease, particularly as it relates to ethnic or racial differences of coronary artery disease in minority subgroups of the US population.

## LIMITATIONS

A relatively large number of patients were excluded because of incomplete data, particularly with respect to smoking status. In our analysis we considered three categories of smokers, namely current, previous, and nonsmokers. We performed all analysis involving smokers first with current smokers alone and then with both current and previous smokers. No differences in the results were seen by using either approach. The rationale for conducting the analysis in this fashion was to avoid diluting the impact of smoking as a risk factor for CAD, as it was significantly more frequent in African Americans compared to Hispanics. The excluded patients were older than those enrolled in the study for both racial groups; however, the pattern of age distribution was similar. Furthermore, our analysis for the remaining

CAD risk factors and angiographic CAD in the excluded patients did not reveal significant differences between African Americans and Hispanics. Consequently, their exclusion does not change the main results of this study. Also, even though the study sample was largely of low socioeconomic status (SES), some differences may exist in SES between the two groups. We did not evaluate SES in this study but speculate that any difference in the occurrence of CAD resulting from differences in SES in the African-American and Hispanic patients in this study is minimal. Another limitation is the fact that the criteria for CAD risk factors may exclude patients with hypertension, hypercholesterolemia, or diabetes who were either undiagnosed or not on medications at the time of the pre-cardiac catheterization evaluation. Also, this study was retrospective and has inherent limitations, including the fact that quantitative coronary angiography was not performed. Quantitative coronary angiography is more rigorous compared to the visual method to determine the severity of coronary artery disease. In addition, because the patients referred for cardiac catheterization are never drawn randomly from the population, our cohort may not be representative of the pattern of CAD risk factor distribution in the general population. Moreover, the cohort is a selective one, as it derives exclusively from patients presenting to a single, urban hospital. Finally, the inclusion of a Caucasian comparator group could have provided for a much stronger study. We suggest that these limitations should be taken into account in interpreting our findings and future studies.

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