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# Racial Differentials in the Identification of Hypercholesterolemia

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**Background.** African Americans have higher rates of cardiovascular disease than white Americans. To address this differential, barriers to cardiovascular risk reduction need to be identified. This study examines the association of race with the likelihood of screening for and diagnosis of hypercholesterolemia.

**Methods.** Possible associations between demographic variables and screening for and diagnosis of hypercholesterolemia were examined on data gathered in a prospective fashion in an office-based family medicine residency training program in Rochester, New York. A consecutive sample of all patients seen between December 15, 1988, and April 15, 1990, about whom there was complete data collection (age, sex, insurance, race, and other cardiovascular risk factors) were included in the multivariate analyses (N = 4256).

**Results.** After controlling for age, sex, insurance status, socioeconomic status, number of visits, and other car-

diovascular risk factors, it was found that minorities were less likely to have been screened for cholesterol levels than whites (adjusted odds ratio [AOR] = 0.84, 95% confidence interval [CI] = 0.98 to 0.72). The mean cholesterol level did not differ by race (mean cholesterol for whites, 204 mg/dL [5.28 mmol/L], and for minorities, 203 mg/dL [5.25 mmol/L],  $t = 0.7$ ,  $P = .47$ ). Among those screened, minorities were less likely than whites to have been diagnosed with hypercholesterolemia (AOR = 0.62, 95% CI = 0.86 to 0.44; and 0.47 [95% CI = 0.28 to 0.78] in those with a cholesterol level greater than 240 mg/dL [6.2 mmol/L]).

**Conclusions.** Our data suggest that provider behavior in diagnosing hypercholesterolemia varies by the race of the patient.

**Key words.** Cholesterol; preventive medicine; physician's practice patterns; African Americans. (*J Fam Pract* 1993; 36:425-430)

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The rate of mortality from cardiovascular disease is higher in African Americans than in white Americans. The age-adjusted relative risk of mortality due to cardiovascular disease is 1.5 for African American men and 2.2 for African American women compared with white men and white women, respectively.<sup>2</sup> African Americans also have a higher prevalence of major cardiovascular risk factors including smoking,<sup>3-5</sup> hypertension,<sup>6,7</sup> and obesity.<sup>8-10</sup>

To reduce the burden of cardiovascular disease among African Americans, the increased prevalence of mutable risk factors needs to be addressed. To have an impact, health professionals need to understand the causes of this increased cardiovascular risk. Studies of cardiovascular risk in African Americans have found a complicated group of associations. For example, the increased prevalence of smoking is associated with socioeconomic status, education, and other demographic factors<sup>4,5</sup> outside the sphere of traditional health care. The higher prevalence of hypertension in African Americans also has multiple associations including salt sensitivity,<sup>11,12</sup> skin color,<sup>13</sup> socioeconomic factors,<sup>14</sup> and response to stress.<sup>15</sup> Much less is known about the rela-

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tionships of race to the prevalence, diagnosis, and treatment of hypercholesterolemia.

Hypercholesterolemia has gained acceptance as an appropriate risk factor to screen for and treat. Studies show that physician diagnosis and treatment of elevated cholesterol levels has grown.<sup>16-18</sup> Patient awareness and concern about cholesterol has also changed,<sup>19-21</sup> but studies suggest less awareness and concern among African Americans.<sup>22-24</sup> It is uncertain whether there are racial differentials in this cardiovascular risk factor.<sup>25-27</sup> Although awareness of an elevated cholesterol level as a cardiovascular risk factor is growing, more attention must be paid to specific subgroups who are at increased cardiovascular risk.<sup>28,29</sup> African Americans have an increased risk for cardiovascular disease but there is little evidence that they have been specifically targeted for diagnosis and treatment of this remediable cardiovascular risk factor.

Because of the importance of identifying cardiovascular risk factors in populations known to be at high risk, we examined the factors affecting screening for and diagnosis of hypercholesterolemia in a family practice setting.

## Methods

This study used data collected as part of an office-based cardiovascular risk-reduction program at the Family Medicine Center in Rochester, New York. The center is the outpatient training site for a family medicine residency program and includes the part-time practices of 30 residents, 9 faculty and fellows, and 8 nurse practitioners.

Information was collected prospectively on all adult patients (over age 18 years) visiting the center from December 15, 1988, to April 15, 1990. At the time of each visit, the patient's height, weight, blood pressure, and smoking status were recorded on the encounter form by the nurse or medical assistant. These values were then entered into the database by a clerk. Cholesterol results from the daily log of all individual and panel laboratory tests were also incorporated into the database. A review of 100 charts of patients was done to validate the accuracy and completeness of the database. This showed that all patients had a blood pressure recorded during the study period. All cholesterol results recorded in the charts were found in the database.

Diagnostic information was based on diagnoses indicated by the provider on the encounter form at the time of each visit. Multiple diagnoses were permitted, and all relevant diagnoses were included using the Codes of the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM). Patients were desig-

nated as hypercholesterolemic if this diagnosis had been coded on the encounter form and there was any cholesterol value included in the database. Similarly, hypertension was defined by a recorded blood pressure included in the database and the diagnosis of hypertension indicated on an encounter form. Patients who had diabetes recorded on the encounter form on at least two occasions were designated as having diabetes mellitus.

Demographic data recorded at the time of registration included patient age, sex, and race. For the purpose of this study, race was dichotomized as white or minority (nonwhite). Insurance was verified and updated at each visit. Three categories of insurance were considered: none, Medicaid, or other. Individuals were considered to be uninsured (none) if they lacked insurance that paid for outpatient visits and laboratory tests. The total number of the following cardiovascular risk factors observed in each patient was recorded: smoking status, diagnosis of hypertension, diagnosis of diabetes mellitus, and obesity (>130% of ideal body weight).

Univariate relationships were examined using chi-square tests or *t* tests. The relationships of the independent variables to screening for and diagnosing hypercholesterolemia were explored using logistic regression analyses. For the regression analyses, insurance was analyzed using two dummy variables: Medicaid or not, and any insurance or none. The number of cardiovascular risk factors was dichotomized as less than two or two or more.

## Results

Of the total sample of 7705 individuals over 18 years of age, 4814 (62.5%) were women and the average age was 37.9 years. There were 1668 people (21.6%) without insurance and 1937 (25.1%) with Medicaid. The mean number of visits per year was 3.87 (SD = 3.77). Complete risk-factor information was available on 5458 persons (71%). Those with incomplete cardiovascular risk-factor information were less likely to have insurance (20% vs 25%), were younger (36.6 years vs 38.4 years), and had fewer visits (2.3 vs 4.5). There were no other statistically significant differences.

Race was recorded for 5995 individuals (77.8% of the sample). Of the group with identified race or ethnicity, 1372 (22.9%) were minorities, of whom 1093 (80.0%) were African American, 57 (4.2%) were Hispanic, and 218 (15.9%) were of other racial minority groups. A higher percentage of identified minorities were likely to be women, have Medicaid, be younger, have more cardiovascular risk factors (Table 1), and have made slightly more visits (4.2 vs 4.0, *t* = 1.4, *P* = .163).

Table 1. Relationships Between Cholesterol Screening, Diagnosis of Hypercholesterolemia, and Patient Characteristics

| Characteristic | Patients Screened for Cholesterol*<br>No. (%) | Screened Patients Who Have Diagnosis of Hypercholesterolemia*<br>No. (%) | Patients Identified as Minorities*<br>No. (%) |
|----------------|---|--|---|
| Sex            |   |  |   |
| Male           | 1179 (40.8)                                   | 211 (17.9)†  | 445 (20.5)‡                                   |
| Female         | 1894 (39.1)                                   | 276 (14.6)   | 927 (24.3)                                    |
| Race/ethnicity |   |  |   |
| White          | 1947 (42.1)‡                                  | 363 (18.6)‡  | —   |
| Minority       | 509 (37.1)                                    | 54 (10.6)  | —   |
| Insurance      |   |  |   |
| None           | 568 (34.0)‡                                   | 92 (16.2)‡   | 298 (27.4)‡                                   |
| Medicaid       | 822 (42.4)                                    | 85 (10.3)  | 491 (33.9)                                    |
| Other          | 1683 (41.1)                                   | 310 (18.4)   | 592 (18.2)                                    |
| Age group, y   |   |  |   |
| <45            | 2008 (34.4)‡                                  | 238 (11.8)‡  | 1085 (24.3)‡                                  |
| 45–65          | 711 (55.9)                                    | 176 (24.7)   | 810 (21.7)                                    |
| >65            | 354 (58.8)                                    | 73 (20.6)  | 63 (12.7)                                     |
| Risk factors§  |   |  |   |
| 0              | 795 (39.9)‡                                   | 124 (15.6)   | 316 (20.7)‡                                   |
| 1              | 1074 (45.7)                                   | 159 (14.8)   | 432 (23.5)                                    |
| 2              | 521 (57.8)                                    | 98 (18.8)  | 172 (23.8)                                    |
| 3              | 153 (77.3)                                    | 33 (21.6)  | 52 (32.1)                                     |
| 4              | 15 (100)                                      | 4 (26.7)   | 5 (41.7)                                      |

\*For example: 40.8% of all male patients compared with 39.1% of all female patients had a recorded cholesterol value; 17.9% of all male patients with a recorded cholesterol value compared with 14.6% of all female patients with a recorded cholesterol had a diagnosis of hypercholesterolemia; 20.5% of all male patients with identified race compared with 24.3% of all female patients with identified race were minorities.

†Chi-square test,  $P < .05$ .

‡Chi-square test,  $P < .01$ .

§Number of cardiovascular risk factors: smoking status, history of hypertension, history of diabetes mellitus, obesity (>130% of ideal body weight).

There was a recorded cholesterol value for 3073 (39.9%) of the patients. Of those whose cholesterol level was known, 487 individuals (15.8%) had the diagnosis of hypercholesterolemia. The mean cholesterol for those with a recorded cholesterol level was 204 mg/dL (5.28 mmol/L). Minorities had nonstatistically significant lower mean cholesterol levels (203 mg/dL vs 204 mg/dL [5.25 vs 5.28],  $t = 0.7$ ,  $P = .47$ ). Minorities with a diagnosis of hypercholesterolemia had a higher mean cholesterol level than whites, but the difference was not statistically significant (246 mg/dL vs 238 mg/dL [6.36 vs 6.15],  $t = 1.2$ ,  $P = .22$ ).

When compared with the total sample, the group of patients with unidentified race was younger (mean age = 35.9 years), more likely to have Medicaid (28.2%) more likely to be male (41.2%), and made significantly fewer visits per year (3.17). They had a similar mean cholesterol (201 mg/dL [5.20 mmol/L]) and a similar percentage were without insurance (21.9%). Patients with no race recorded were less likely to have a cholesterol value in the database (35.5%).

In the univariate analyses, variables statistically associated with a lower likelihood that a cholesterol value was in the database included minority status, patients less

than 45 years old, those with insurance, and those with fewer cardiovascular risk factors (Table 1). Those without a cholesterol recorded had fewer visits (mean 2.9 vs 5.4,  $t = 26.9$ ,  $P < .01$ ). A decreased probability of being diagnosed as hypercholesterolemic was found for women, minorities, persons with Medicaid, individuals less than 45 years old (Table 1), and those with fewer visits (5.2 vs 6.3,  $t = 5.0$ ,  $P < .01$ ).

After adjusting for all other independent variables, the unadjusted associations with having a lower rate of cholesterol recorded were preserved. Minorities were less likely than whites to have had their cholesterol checked, adjusted odds ratio (AOR) = 0.84 (95% CI = 0.98 to 0.72). In addition, women and those with Medicaid were statistically less likely to have a recorded cholesterol level than men and those without insurance, respectively (Table 2).

The unadjusted associations with a decreased probability of the diagnosis of hypercholesterolemia were preserved in the multivariate analysis (Table 2). Lacking insurance and having fewer risk factors were not predictors. Multivariate analysis restricted to those with serum cholesterol values greater than 240 mg/dL (6.2 mmol/L [n = 493]) also showed that minorities were less likely to

Table 2. Adjusted Odds Ratios (95% CI) for Cholesterol Testing (N = 4256) and the Diagnosis of Hypercholesterolemia (n = 2040)\*

| Variables                                   | Cholesterol Testing<br>AOR (95% CI) | Hypercholesterolemia<br>Diagnosis<br>AOR (95% CI) |
|---|-------------------------------------|---|
| Female sex                                  | 0.81 (0.93–0.70)                    | 0.69 (0.89–0.54)                                  |
| Minority                                    | 0.84 (0.98–0.72)                    | 0.62 (0.86–0.44)                                  |
| Medicaid                                    | 0.78 (0.92–0.66)                    | 0.44 (0.61–0.32)                                  |
| No insurance                                | 0.66 (0.78–0.56)                    | 0.99 (1.36–0.73)                                  |
| Age <45 years                               | 0.53 (0.62–0.46)                    | 0.48 (0.62–0.38)                                  |
| Less than 2 cardiovascular<br>risk factors† | 0.68 (0.80–0.57)                    | 0.89 (1.16–0.68)                                  |

\*Also adjusted for the number of visits.

†Cardiovascular risk factors: smoker, hypertension, diabetes mellitus, and obesity (>130% of ideal body weight).

AOR denotes adjusted odds ratio; CI, confidence interval.

have the diagnosis of hypercholesterolemia (AOR = 0.47, 95% CI = 0.28 to 0.78).

## Discussion

After adjusting for number of visits, several factors were associated with a reduced likelihood of being screened for hypercholesterolemia: female sex, age less than 45 years, having Medicaid, not having insurance, and being a minority. A differential based on race was also found for the diagnosis of hypercholesterolemia. Among those whose cholesterol had been determined, minorities were less frequently diagnosed, even though cholesterol levels were comparable in whites and minorities. A lower rate of diagnosis was also found among the subgroup with elevated cholesterol levels. In this study, the diagnosis of hypercholesterolemia was confirmed in writing by the health care provider on the encounter form. While there are uncertainties about the relationships among encounter form data, chart data, and the clinical encounter, the encounter form does provide a uniform measure of physician behavior.

Our data agree with those of previous studies in which a higher rate of cardiovascular risk factors was found in minority patients.<sup>3–10</sup> The National Cholesterol Education Program guidelines suggest that physicians routinely screen for elevated cholesterol in all adult patients, but clearly we should pay special attention to those with identified cardiovascular risk factors. The lower rate of screening and diagnosis in the group of patients with higher cardiovascular risk may be partly explained by visits focused on other acute health care needs. It remains

the physician's responsibility, however, to ensure that the patient receives optimal preventive care.

Unfortunately, our evidence that cholesterol screening is given a lower priority in minorities, persons with Medicaid, or persons with no insurance is consistent with other studies demonstrating "reverse targeting" of preventive care.<sup>30</sup> In other words, patients who are at increased risk are less likely to be screened. Together with the finding of lower screening and diagnostic rates in women, these results parallel other research demonstrating pervasive biases in the provision of health care for socioeconomically disadvantaged groups.<sup>22,31–38</sup>

To examine the possible effect of the missing data on the results, we compared the group of patients with unidentified race and missing risk-factor information with the total sample. The racially undefined group's attributes (age, sex, insurance status, visits per year) did not fit into a consistent pattern with respect to either racial subgroup. Recent articles have addressed the difficulties of collecting racial data and suggest that minorities are more likely to be misclassified than whites.<sup>39,40</sup> To examine how the missing data might bias the results, we repeated the multivariate analyses including the racially unidentified individuals as white. This is the most conservative assumption, biasing the results toward a smaller differential based on race than might be found if all the information had been captured. These analyses yielded comparable results. A series of analyses were also conducted in which the cardiovascular risk-factor information was omitted to examine possible bias introduced by missing risk-factor data. The results were similar to those reported, although the adjusted odds ratios for race and ethnicity were less marked.

Although bias may have been introduced by the use of a dichotomy for race, African Americans comprise 80% of the minorities in our sample; no other individual racial group constituted more than 15%. Combining several racial groups into one variable may have diluted the associations, but it is unlikely that 15% of the total minority sample could have accounted for the racial differential observed. We therefore attribute the racial differentials observed to a bias toward minorities who were primarily represented by African Americans.

Overall, our screening rate for cholesterol (40%) was similar to those found in other studies of screening in outpatient settings.<sup>20,22</sup> This supports using the presence of recorded cholesterol values as a surrogate for screening activity. The percentage of persons who were diagnosed with hypercholesterolemia (15.8%) in our practice was low, however, when compared with reports from other community and outpatient settings.<sup>26</sup> Although this lower rate may accurately reflect the demographic profile of our practice, there are confounding factors that may

have led to the lower rate of diagnosis. These include the underrecording of diagnoses on the encounter forms, which thus yielded a lower capture of diagnosis than if the study had used chart review. Also, the behavior patterns of resident physicians may have differed from those of more experienced physicians. That physicians need to improve their documentation of hypercholesterolemia has been shown.<sup>41</sup> The low rate of diagnosis, however, does not explain the observed racial differential, and suggests that the results represent underdiagnosis in minority patients rather than overdiagnosis in white patients.

Patient, physician, and institutional factors may influence whether screening occurs, but once the necessary data are obtained, diagnosis of the disease is the physician's responsibility. Although there are many reports that indicate racial differentials in the provision of health care,<sup>31,32</sup> few clearly demonstrate the role of individual provider behavior.<sup>42-45</sup> In our study, the underdiagnosis of hypercholesterolemia in minority patients suggests a difference in the behavior of health care providers toward white patients compared with African American patients.

The determination of cholesterol levels and the appropriate diagnosis of hypercholesterolemia by providers are necessary prerequisites for effective treatment. Given the high prevalence of hypertension and cardiovascular disease among African Americans, modification of other cardiovascular risk factors is of utmost concern. Underdiagnosis of hypercholesterolemia in this population, already at increased cardiovascular risk, will contribute to ongoing increased mortality. Despite the heightened attention applied to cholesterol, our study indicates that the specific health needs of African Americans are unmet for reasons other than structural barriers to health care and sociodemographic factors.

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