ORIGINAL CONTRIBUTIONS

Risk Factors for Coronary Heart Disease in African American Women

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There have been few studies of risk factors for coronary heart disease in African American women. The authors investigated factors associated with prevalent coronary heart disease in data provided by participants in the Black Women's Health Study. In 1995, 64,530 US Black women aged 21–69 years completed postal health questionnaires. The 352 women who reported having had a heart attack (cases) were frequency matched 5:1 on age with 1,760 women who had not (controls); medical record review for 35 cases indicated that two-thirds had had a heart attack and the remainder had other coronary heart disease. Odds ratios, obtained from multiple logistic regression analyses, were significantly elevated for cigarette smoking, drug-treated hypertension, drug-treated diabetes mellitus, elevated cholesterol level, and history of heart attack in a parent. High body mass index (kg/m²) was associated with coronary heart disease in the absence of control for hypertension, diabetes mellitus, and elevated cholesterol but not when they were controlled, suggesting that obesity may influence risk as a result of its effects on blood pressure, glucose tolerance, and cholesterol levels. Odds ratios increased with increasing parity and with decreasing age at first birth. These data suggest that important risk factors for coronary heart disease are similar in Black women and White women. Am J Epidemiol 1999;150:904–9.

blacks; coronary disease; myocardial infarction; risk factors; women

In the United States, the leading cause of death in Black persons, and the greatest contributor to their excess mortality in relation to White persons, is cardiovascular disease, of which coronary heart disease is the leading component (1–7). Although mortality from coronary heart disease has declined among Black men and women, the rate of decline has been lower than that among White men and women (8). Risk factors for coronary heart disease have been studied extensively in men and in White women but not in African American women (9, 10). Here we report findings from the first case-control study of risk factors for coronary heart disease in Black women, using baseline data collected from the 64,530 participants in the Black Women's Health Study.

MATERIALS AND METHODS

Data collection

The Black Women's Health Study began in 1995, when 445,000 questionnaires were mailed to subscribers to Essence magazine, whose readership consists largely of African American women, and to members of several professional organizations of African American women (11). Completed questionnaires were returned by 70,753 women. Respondents younger than age 21 years or older than age 69 years were excluded, leaving 64,530 women aged 21–69 years. The median age of respondents was 38 years, and the largest numbers were from California, Georgia, Illinois, Indiana, Louisiana, Maryland, Massachusetts, Michigan, New Jersey, New York, South Carolina, Virginia, and the District of Columbia. Virtually all participants had had contact with the medical care system in the previous 2 years: 96.0 percent had seen a physician, and 96.6 percent had had their blood pressure checked.

The questionnaire included items on demographic characteristics, reproductive history, medical history, and habits such as cigarette smoking. The women were asked if they had ever had any of a list of medical conditions, including heart attack, high blood pressure, diabetes, and high cholesterol. We plan to conduct a

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Abbreviations: CI, confidence interval; OR, odds ratio.

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long-term cohort study to follow the participants for
the occurrence of illness. This report is based on case-
control analyses of the prevalence data reported in the
1995 baseline questionnaire.

Cases and controls

Potential cases of coronary heart disease comprised
352 women who reported having had a heart attack
and who had not experienced a stroke or a blood clot
in the legs or lungs. We obtained hospital records for
35 of the women; for 23, the discharge summary or
other part of the medical record showed evidence for a
myocardial infarction (66 percent). Five of the remain-
ing 12 women had been treated for congestive heart
failure, 5 for unstable angina, and 2 for other cardio-
vascular diagnoses. The 352 cases were frequency
matched 5:1 in 5-year age groups with randomly
selected participants who did not report a heart attack,
stroke, or clot in the legs or lungs, for a total of 1,760
controls.

Data analysis

Unconditional multiple logistic regression analyses
were used to estimate odds ratios for the factors under
consideration (12). Terms for age, years of education,
cigarette smoking, hypertension, diabetes mellitus, ele-
vated cholesterol level, body mass index (kg/m²), history of heart attack
in a parent, and height—are given in table 2. There
were statistically significant elevations in the odds
ratios for current cigarette smoking (odds ratio (OR) =
1.6 for 1–14 cigarettes per day, OR = 2.3 for ≥15 ciga-
rettes per day) and past smoking (OR = 2.0), hyperten-
sion (OR = 3.1), diabetes mellitus (OR = 2.2), elevated
cholesterol level (OR = 2.9), and having a parent who
had a heart attack before age 50 years (OR = 2.7). Body
mass index was weakly related to coronary heart dis-
ease: the odds ratio for the highest category, ≥32.3,
relative to the lowest, <22.8, was 1.4 (95 percent CI: 0.8,
2.5). Odds ratio estimates for all height categories were
compatible with 1.0, and there was no trend in the odds
ratio across categories of height (p = 0.8).

We explored how inclusion in the logistic regression
of terms for hypertension, diabetes mellitus, and ele-
vated cholesterol level affected the odds ratio for body
mass index. When none of the factors was controlled
(table 4), the odds ratio increased as body mass index
increased (p < 0.05); the odds ratio for a body mass

| TABLE 1. Prevalence of self-reported coronary heart disease, by age, among participants in the Black Women's Health Study, United States, 1995 |
|-----------|----------------|----------------|---------------|
| Age (years) | Total no. | Coronary heart disease |
|            | No. | %  |
| <30 | 14,687 | 6 | 0.04 |
| 30–39 | 21,558 | 29 | 0.1 |
| 40–49 | 17,541 | 104 | 0.6 |
| 50–59 | 7,664 | 117 | 1.5 |
| 60–69 | 3,080 | 96 | 3.1 |

* Odds ratios were estimated from logistic regression equations that included terms for both factors in the table and for age, cigarette smoking, hypertension, diabetes mellitus, elevated cholesterol level, history of heart attack in a parent, height, age at menarche, parity, and age at first birth.
TABLE 3. Odds ratios for coronary heart disease, by cigarette smoking, hypertension, diabetes mellitus, elevated cholesterol level, body mass index, history of heart attack in a parent, and height, for participants in the Black Women's Health Study, United States, 1995

<table>
<thead>
<tr>
<th>Factor</th>
<th>Cases</th>
<th>Controls</th>
<th>Odds ratio*</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cigarette smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never smoked</td>
<td>107</td>
<td>853</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>143</td>
<td>536</td>
<td>2.0</td>
<td>1.4, 2.7</td>
</tr>
<tr>
<td>Current smoker</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–14 cigarettes/day</td>
<td>42</td>
<td>186</td>
<td>1.6</td>
<td>1.1, 2.5</td>
</tr>
<tr>
<td>≥15 cigarettes/day</td>
<td>38</td>
<td>106</td>
<td>2.3</td>
<td>1.4, 3.7</td>
</tr>
<tr>
<td>Hypertension</td>
<td>186</td>
<td>422</td>
<td>3.1</td>
<td>2.4, 4.2</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>59</td>
<td>86</td>
<td>2.2</td>
<td>1.4, 3.7</td>
</tr>
<tr>
<td>Elevated cholesterol level</td>
<td>174</td>
<td>439</td>
<td>2.9</td>
<td>2.2, 3.9</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;22.8</td>
<td>24</td>
<td>226</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>22.8–24.9</td>
<td>38</td>
<td>240</td>
<td>1.4</td>
<td>0.7, 2.5</td>
</tr>
<tr>
<td>25.0–27.2</td>
<td>52</td>
<td>304</td>
<td>1.3</td>
<td>0.8, 2.4</td>
</tr>
<tr>
<td>27.3–32.2</td>
<td>115</td>
<td>535</td>
<td>1.5</td>
<td>0.9, 2.6</td>
</tr>
<tr>
<td>≥32.3</td>
<td>107</td>
<td>379</td>
<td>1.4</td>
<td>0.8, 2.5</td>
</tr>
<tr>
<td>History of heart attack in a parent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>169</td>
<td>1,082</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>Yes: at age 50 years or older</td>
<td>91</td>
<td>329</td>
<td>1.4</td>
<td>1.0, 1.9</td>
</tr>
<tr>
<td>Yes: before age 50 years</td>
<td>53</td>
<td>106</td>
<td>2.7</td>
<td>1.8, 4.1</td>
</tr>
<tr>
<td>Height (inches)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;60</td>
<td>10</td>
<td>36</td>
<td>1.3</td>
<td>0.6, 3.1</td>
</tr>
<tr>
<td>60</td>
<td>8</td>
<td>55</td>
<td>0.8</td>
<td>0.3, 1.8</td>
</tr>
<tr>
<td>61,62</td>
<td>64</td>
<td>294</td>
<td>1.3</td>
<td>0.9, 1.9</td>
</tr>
<tr>
<td>63,64</td>
<td>82</td>
<td>450</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>65,66</td>
<td>91</td>
<td>454</td>
<td>1.0</td>
<td>0.7, 1.5</td>
</tr>
<tr>
<td>67,68</td>
<td>60</td>
<td>282</td>
<td>1.4</td>
<td>0.9, 2.1</td>
</tr>
<tr>
<td>≥69</td>
<td>23</td>
<td>132</td>
<td>0.9</td>
<td>0.5, 1.6</td>
</tr>
</tbody>
</table>

* Odds ratios were estimated from logistic regression equations that included terms for all factors in the table and for age, years of education, age at menarche, parity, and age at first birth.

TABLE 4. Odds ratios for coronary heart disease, by body mass index without control for hypertension, diabetes mellitus, and elevated cholesterol level, for participants in the Black Women's Health Study, United States, 1995

<table>
<thead>
<tr>
<th>Body mass index (kg/m²)</th>
<th>Cases</th>
<th>Controls</th>
<th>Odds ratio*</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;22.8</td>
<td>24</td>
<td>226</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>22.8–24.9</td>
<td>38</td>
<td>240</td>
<td>1.5</td>
<td>0.9, 2.7</td>
</tr>
<tr>
<td>25.0–27.2</td>
<td>52</td>
<td>304</td>
<td>1.5</td>
<td>0.9, 2.6</td>
</tr>
<tr>
<td>27.3–32.2</td>
<td>115</td>
<td>535</td>
<td>1.9</td>
<td>1.2, 3.1</td>
</tr>
<tr>
<td>≥32.3</td>
<td>107</td>
<td>379</td>
<td>2.3</td>
<td>1.4, 3.8</td>
</tr>
</tbody>
</table>

* Odds ratios were estimated from logistic regression equations that included terms for body mass index, age, years of education, cigarette smoking, history of heart attack in a parent, height, age at menarche, parity, and age at first birth.

The index of ≥32.3 relative to <22.8 was 2.3 (95 percent CI: 1.4, 3.8). The corresponding odds ratio was 1.6 when hypertension alone was controlled, 2.0 when diabetes mellitus alone was controlled, and 2.1 when elevated cholesterol level alone was controlled (data not shown).

Menstrual and reproductive factors are considered in table 5. The odds ratio for the highest category of age at menarche, ≥16 years, relative to the lowest, ≤10 years, was nonsignificantly elevated at 2.0 (95 percent CI: 0.9, 4.6); there was no trend across categories of age at menarche (p = 0.6). The odds ratio increased as parity increased (p < 0.05): for parity 1 to 4–6 relative to 0, the odds ratios ranged from 1.3 to 1.8; for parity 7 or more, the odds ratio was 5.4 (95 percent CI: 2.1, 14). The odds ratio increased as age at first birth decreased (p < 0.05); for women who gave birth to their first child at less than 20 years of age relative to age 30 years or older, the odds ratio was 1.8 (95 percent CI: 0.9, 3.4).

To assess consistency of the results across level of education, we repeated the main analyses within strata of years of education completed: ≤12 years (129 cases, 423 controls), 13–15 years (112 cases, 512 controls), and ≥16 years (100 cases, 761 controls). The results
from the overall data were generally consistent across strata of education. For example, the odds ratios for hypertension were 3.3 (95 percent CI: 2.0, 5.5), 3.6 (95 percent CI: 2.1, 6.1), and 3.4 (95 percent CI: 2.0, 5.9) among women with ≤12, 13–15, and ≥16 years of education, respectively; the comparable odds ratios for smoking ≥15 cigarettes per day were 1.7 (95 percent CI: 0.7, 4.2), 3.5 (95 percent CI: 1.4, 8.6), and 2.6 (95 percent CI: 1.0, 6.7) for women in those categories of education.

**DISCUSSION**

In the present study, positive associations with prevalent coronary heart disease were observed for cigarette smoking, hypertension, diabetes mellitus, elevated cholesterol level, and the occurrence of myocardial infarction in a parent before age 50 years. The odds ratios for current smoking of 15 or more cigarettes daily, hypertension, diabetes mellitus, elevated cholesterol, and heart attack in a parent before age 50 years all exceeded 2.0. In the absence of control for hypertension, diabetes mellitus, and elevated cholesterol level in the multivariate analysis, high body mass index was associated with a statistically significant doubling of the odds ratio. On the basis of these findings, it appears that the conventional risk factors for coronary artery disease operate in African American women (9, 10). The fact that control for hypertension, diabetes mellitus, and elevated cholesterol level in the logistic regression weakened the association with high body mass index suggests that obesity may increase the risk of coronary heart disease as a result of its influence on blood pressure, glucose tolerance, and cholesterol levels.

Several studies have found an increased risk of myocardial infarction in short men and White women relative to their taller counterparts (13–16). One explanation is that taller persons tend to have larger coronary arteries than shorter persons and therefore have a lesser risk of coronary occlusion. In the present study, all the height-specific odds ratios were compatible with 1.0, and there was no suggestion of a trend of reduced risk with increasing height.

In the present study, there were trends of an increasing odds ratio with decreasing age at first birth and increasing parity. High parity has been associated with lower levels of high density lipoprotein (17), and both high parity and early age at first birth have been associated in some studies, but not in others, with an increased risk of myocardial infarction, independent of obesity and educational attainment (17, 18). Age at first birth and parity are highly correlated with socioeconomic status. While the associations with early age at first birth and high parity in the present study were seen across levels of education, the possibility of confounding from uncontrolled factors related to socioeconomic status cannot be ruled out. The odds ratio for late age at menarche was elevated but not statistically significant, and there was no trend. While it might be proposed that women with a later onset of menstruation could have a higher risk because of less exposure to endogenous estrogen, previous studies have yielded mixed results and have not suggested a strong association with age at menarche (18, 19).

The odds ratio for coronary heart disease was increased for participants with lower educational attainment, measured by years of education completed, relative to those who were more educated. Numerous studies have found associations of higher cardiovascular risk with lower level of education or lower socioeconomic status (19–24), which become weaker as risk factors correlated with socioeconomic status are taken into account. In the United States, socioeconomic status makes an important contribution to the difference in cardiovascular mortality between Black persons and White persons (1, 5–7, 25): the difference in rates becomes much less marked when it is controlled (25).
An assessment of mortality from cardiovascular causes among Black residents of New York City, New York, found that rates varied according to place of birth after allowance for age, sex, and educational attainment (6). Mortality rates were highest among southern-born Black persons. In the present study, there was little variation in the prevalence of reported myocardial infarction according to place of current residence. We had no information on birthplace.

There is little previous work with which to compare the present results. Several small follow-up studies, which together included a few thousand Black women, have been conducted. In the Evans County, Georgia, follow-up study, higher systolic blood pressure was related to cardiovascular mortality (26). In the First National Health and Nutrition Examination Survey epidemiologic follow-up study, systolic blood pressure and cigarette smoking were associated with an increased incidence of cardiovascular disease (27). In the Charleston Heart Study (South Carolina), systolic blood pressure, serum cholesterol level, and history of diabetes were associated with cardiovascular mortality (28). Associations with other risk factors might have been missed because of small sample sizes, and numbers were insufficient to enable analyses to characterize the associations in detail.

In the present study, virtually all participants had visited a physician and had their blood pressure checked during the previous 2 years. Thus, it is likely that risk factors such as hypertension, diabetes mellitus, and elevated cholesterol level, and clinical events such as heart attacks, would have been detected in a high proportion of the women. Our review of hospital records of a sample of women who reported heart attacks suggested that about one-third had some other form of cardiovascular disease, a degree of nonclassification in accord with results on self-report from other studies (29, 30). Misclassification of the outcome, as well as misclassification of risk factors, if random, generally would have resulted in underestimation of true odds ratios (31, 32).

Because the present data are cross-sectional, there is uncertainty about the timing of the occurrence of some risk factors in relation to the occurrence of coronary heart disease. We assessed the established and suspected risk factors that we judged could reasonably be assessed with the information collected. For height and age at menarche, timing is not a problem because the occurrence of the factor clearly preceded the illness. The results for parity and age at first birth were probably also little affected by misclassification of the time sequence because very few heart attacks in participants occurred before age 40 years. For factors such as cigarette smoking and obesity, the time sequence is uncertain. However, misclassification of these factors would likely dilute an association rather than create a spurious one. Thus, women who had had heart attacks may subsequently have lost weight to reduce their risk of reinfarction, which would result in underestimation of the magnitude of an association with obesity. Similarly, if some women stopped smoking after their infarctions, the magnitude of the association with current smoking would have been underestimated (although the association with ex-smoking would have been overestimated). Some suspected risk factors, such as age at menopause, were not assessed because our data were too crude to allow for a meaningful assessment of the time sequence.

The participants in the Black Women's Health Study are not a representative sample of US Black women. Virtually all participants have completed high school compared with about 80 percent nationally, and over 40 percent have completed college compared with about 15 percent nationally (33). While the least-educated US Black women were not represented in the present study, the associations observed in the overall data generally were apparent across the levels of education represented.

Risk factors for nonfatal and fatal coronary heart disease are similar (9, 10). Thus, inclusion of only nonfatal heart attacks in the present study is not an important limitation. Selective participation by women with heart attacks according to particular risk factors could have distorted the associations of risk with those factors. We have no direct evidence to support or refute the presence of this potential bias. However, since the Black Women's Health Study cohort will be followed, in the future it will be possible to assess risk factors for incident disease with minimum concern about this sort of selection bias.

In conclusion, the present case-control study based on prevalence data suggests that important risk factors for coronary artery disease in African American women are similar to those in US White women. Once sufficient cases of new coronary heart disease have accrued during follow-up, we will reassess these factors on the basis of incident disease.

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REFERENCES


