

Black-White Differences in Incident Fatal, Nonfatal, and Total Coronary Heart Disease

BACKGROUND: Blacks have higher coronary heart disease (CHD) mortality compared with whites. However, a previous study suggests that nonfatal CHD risk may be lower for black versus white men.

METHODS: We compared fatal and nonfatal CHD incidence and CHD case-fatality among blacks and whites in the Atherosclerosis Risk in Communities study (ARIC), the Cardiovascular Health Study (CHS), and the Reasons for Geographic and Racial Differences in Stroke study (REGARDS) by sex. Participants 45 to 64 years of age in ARIC (men=6479, women=8488) and REGARDS (men=5296, women=7822), and ≥65 years of age in CHS (men=1836, women=2790) and REGARDS (men=3381, women=4112), all without a history of CHD, were analyzed. Fatal and nonfatal CHD incidence was assessed from baseline (ARIC=1987–1989, CHS=1989–1990, REGARDS=2003–2007) through up to 11 years of follow-up.

RESULTS: Age-adjusted hazard ratios comparing black versus white men 45 to 64 years of age in ARIC and REGARDS were 2.09 (95% confidence interval, 1.42–3.06) and 2.11 (1.32–3.38), respectively, for fatal CHD, and 0.82 (0.64–1.05) and 0.94 (0.69–1.28), respectively, for nonfatal CHD. After adjustment for social determinants of health and cardiovascular risk factors, hazard ratios in ARIC and REGARDS were 1.19 (95% confidence interval, 0.74–1.92) and 1.09 (0.62–1.93), respectively, for fatal CHD, and 0.64 (0.47–0.86) and 0.67 (0.48–0.95), respectively, for nonfatal CHD. Similar patterns were present among men ≥65 years of age in CHS and REGARDS. Among women 45 to 64 years of age in ARIC and REGARDS, age-adjusted hazard ratios comparing blacks versus whites were 2.61 (95% confidence interval, 1.57–4.34) and 1.79 (1.06–3.03), respectively, for fatal CHD, and 1.47 (1.13–1.91) and 1.29 (0.91–1.83), respectively, for nonfatal CHD. After multivariable adjustment, hazard ratios in ARIC and REGARDS were 0.67 (95% confidence interval, 0.36–1.24) and 1.00 (0.54–1.85), respectively, for fatal CHD, and 0.70 (0.51–0.97) and 0.70 (0.46–1.06), respectively, for nonfatal CHD. Racial differences in CHD incidence were attenuated among older women. CHD case fatality was higher among black versus white men and women, and the difference remained similar after multivariable adjustment.

CONCLUSIONS: After accounting for social determinants of health and risk factors, black men and women have similar risk for fatal CHD compared with white men and women, respectively. However, the risk for nonfatal CHD is consistently lower for black versus white men and women.

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Clinical Perspective

What Is New?

- The incidence of nonfatal coronary heart disease (CHD) is consistently lower among black versus white men, although the former have a higher burden of unfavorable social determinants of health and cardiovascular risk factors and higher fatal CHD incidence.
- After adjustment for social determinants of health and cardiovascular risk factors, black men and women have a similar risk for fatal CHD but lower risk for nonfatal CHD compared with white men and women, respectively.
- Blacks with incident CHD have a higher case fatality compared with whites, and the difference remains similar after adjustment for social determinants of health and cardiovascular risk factors.

What Are the Clinical Implications?

- The mechanisms leading to the apparent lower risk for nonfatal CHD among black versus white men and women need to be further elucidated.
- Blacks have a higher risk for their initial CHD event being fatal compared with whites, highlighting the need for reinforcing primary prevention in this population.

Blacks have higher coronary heart disease (CHD) mortality compared with whites.^{1–4} However, black-white differences in CHD incidence have been less well investigated. A prior analysis of participants ≥ 45 years of age from the nationwide Reasons for Geographic and Racial Differences in Stroke study (REGARDS) showed that black men have twice the risk for incident fatal CHD compared with white men but lower nonfatal CHD incidence.⁵ In contrast, incidence rates for fatal and nonfatal CHD were consistently higher among black versus white women.

The origin of the lower incidence of nonfatal CHD among black versus white men is unclear. The prior analysis of the REGARDS cohort only provided ≤ 7 years of follow-up.⁵ Also, the REGARDS study uses participant self-report without active surveillance to identify nonfatal CHD events, which may result in some events not being detected.

We compared the incidence of fatal, nonfatal, and total CHD and CHD case fatality among black versus white men and women in REGARDS with ≤ 11 years of follow-up. The extended follow-up provided a larger number of events to investigate racial differences in CHD incidence and case fatality by sex. We also conducted similar analyses in the Atherosclerosis Risk in Communities study (ARIC) and the Cardiovascular Health Study (CHS). ARIC and CHS included

active surveillance and serial electrocardiograms to detect CHD events that might be missed through participant self-report. We also repeated analyses in REGARDS using Medicare claims (ie, administrative data collected for reimbursement) to identify CHD events that were not detected through study procedures. Analyses in ARIC and CHS, and using Medicare claims in REGARDS, present little threat for spurious findings because of differential reporting of events by race.

METHODS

Study Populations

The ARIC study enrolled 15 792 black and nonblack participants 45 to 64 years of age in 1987 to 1989 from Forsyth County, NC, Jackson, MS, suburbs of Minneapolis, MN, and Washington County, MD.⁶ CHS enrolled 5201 participants ≥ 65 years of age in 1989 to 1990 from the Health Care Financing Administration's Medicare eligibility list in Forsyth County, NC, Sacramento County, CA, Washington County, MD, and Pittsburgh, PA.^{7,8} An additional group of 687 blacks were enrolled in 1992 to 1993 from counties in North Carolina, California, and Pennsylvania.⁹ The REGARDS study enrolled 30 239 blacks and whites ≥ 45 years of age from all 48 contiguous US states and the District of Columbia in 2003–2007.¹⁰ Data from the REGARDS study participants were linked with Medicare claims using Social Security number with linkages confirmed by birthdate and sex.¹¹

We used ARIC and CHS publicly available datasets, which exclude 60 and 93 participants, respectively, who did not allow their data to be released.¹² The REGARDS dataset excludes 56 participants because of anomalies in their informed consent. We further excluded 39 CHS participants who were nonblack/nonwhite. As reported elsewhere, few ARIC participants ($<1\%$) were from a race/ethnicity other than black or white.¹³ Whites and nonblack/nonwhite participants are defined as nonblack in the ARIC publicly available dataset, preventing their identification. For the current analysis, all nonblack participants in ARIC were included as whites. REGARDS study participants ≥ 65 years without Medicare Part A (hospitalization insurance) fee-for-service coverage at baseline were excluded. Medicare provides insurance coverage for US adults ≥ 65 years of age or with a disability or end-stage renal disease. Therefore, we did not require Medicare coverage for REGARDS participants <65 years of age because this represents a select population. Last, we excluded ARIC, CHS, and REGARDS participants with a baseline history of CHD, as defined below, and those without follow-up for incident CHD. After these criteria were applied, 14 967 ARIC participants, 13 118 REGARDS participants 45 to 64 years of age, 4626 CHS participants, and 7493 REGARDS participants ≥ 65 years of age were included in the analyses (Figures I and II in the online-only Data Supplement).

ARIC and CHS analyses were approved by the Institutional Review Board at the University of Alabama at Birmingham.¹⁴ The REGARDS study was approved by the Institutional Review Boards governing research in human subjects at the participating centers, and all participants provided written informed consent.¹⁰

Baseline Assessment

Methods for baseline assessment in ARIC,⁶ CHS,^{15,16} and REGARDS^{10,17} have been described elsewhere. In brief, an in-home interview and an in-clinic examination were conducted at baseline in ARIC and CHS. In REGARDS, a telephone interview and an in-home examination were conducted. Self-reported information collected in each study interview included age, race, sex, education, annual household income, alcohol consumption, physical activity, current smoking, history of diabetes mellitus, atrial fibrillation (except in ARIC), CHD and stroke, medication use including antihypertensive medication, and health insurance. We defined having no alcohol consumption in ARIC, CHS, and REGARDS as reporting 0 drinks per week, moderate alcohol consumption as >0 to 7 drinks per week for women and >0 to 14 drinks per week for men, and heavy alcohol consumption as >7 drinks per week for women and >14 drinks per week for men. In ARIC, low physical activity was defined by self-reporting not engaging in any exercise or sport. In CHS, participants were asked whether they participated in any of 15 leisure-time activities over the past 2 weeks and about their usual pace of walking when outside the home.¹⁶ For this analysis, CHS participants were defined as having low physical activity if they reported not participating in any of the leisure-time activities and walking for exercise at a casual or strolling pace (<2 mph or <3.2 kmph). Low physical activity in REGARDS was defined by self-reporting not engaging in any weekly activity intense enough to work up a sweat. In ARIC, current smoking was defined as having smoked >400 cigarettes in lifetime and currently smoking cigarettes. In CHS, current smoking was defined as having smoked >100 cigarettes in lifetime and having smoked in the past 30 days.¹⁸ In REGARDS, current smoking was defined as having smoked >100 cigarettes in lifetime and currently smoking cigarettes, even occasionally.

During examinations, health professionals measured participants' waist circumference, performed blood pressure measurements that were averaged, obtained blood samples and an electrocardiogram (ECG), and conducted a medication inventory. History of CHD was defined by a self-report of a prior myocardial infarction (MI), coronary artery bypass or coronary angioplasty during the study interview, or evidence of a previous MI on the study ECG. History of CHD in CHS also included a self-reported history of angina and was confirmed by medical records and medication review.^{15,19} Total and high-density lipoprotein cholesterol, glucose, and creatinine were measured using blood samples. We defined diabetes mellitus by a fasting glucose ≥ 126 mg/dL, a nonfasting glucose ≥ 200 mg/dL, or self-report of a prior diagnosis with current antidiabetes mellitus medication use.²⁰ Creatinine in ARIC and CHS was calibrated as described elsewhere.²¹ Estimated glomerular filtration rate was calculated using the Chronic Kidney Disease Epidemiology Collaboration equation based on creatinine,²² with estimated glomerular filtration rate <60 mL/minute/1.73 m² defined as reduced. Left ventricular hypertrophy (LVH) was defined using the study ECG and the Cornell definition in ARIC and CHS. In REGARDS, LVH was defined using the Cornell definition for participants with a 12-lead ECG and a modified Cornell definition for $\approx 30\%$ of participants with a 7-lead ECG.¹⁷ Atrial fibrillation was defined using the study ECG or self-report in CHS and REGARDS. As described

elsewhere, few ARIC participants (n=37) had atrial fibrillation on their baseline study ECG.²³ These data were not included in the ARIC publicly available dataset and were not analyzed.

Follow-Up Assessment

Participants or their proxies were contacted once a year in ARIC and twice a year in CHS and REGARDS to identify CHD-related hospitalizations and to confirm vital status.^{5,6,8} CHD-related hospitalizations and deaths were also detected by active surveillance through field center investigations in ARIC and CHS.^{6,24–26} The National Death Index and online sources (eg, Social Security Death Index) were used for death detection in REGARDS.⁵ CHD-related hospitalizations and cause of death were adjudicated by experts in ARIC, CHS, and REGARDS following similar approaches.^{5,6,25}

For the main analysis, the primary definition of fatal CHD includes a definite or probable fatal MI (ie, expert-adjudicated definite or probable MI followed by death within 28 days) or CHD death (ie, death from MI not meeting the criteria for definite, probable, or sudden death preceded by cardiac symptoms or signs without evidence of noncoronary causes [eg, stroke]).²⁷ The primary definition of nonfatal CHD includes a definite or probable nonfatal MI. Among REGARDS participants ≥ 65 years of age, a secondary definition of fatal and nonfatal CHD was also used, including CHD events by the primary definition, or a Medicare claim for an overnight hospitalization with an International Classification of Disease, Ninth revision diagnosis code of 410.XX, except 410.X2, in any position.²⁶ Events detected through Medicare claims were classified as fatal if participants died ≤ 28 days after admission.

Some participants have MIs with no or mild symptoms, which may not be clinically recognized and therefore may not be detected through study procedures (ie, unrecognized MIs). Unrecognized MIs are associated with coronary artery disease and a higher risk for future cardiac events and mortality.^{28,29} Follow-up ECGs to detect unrecognized MIs were obtained in 1990 to 1992, 1993 to 1995, and 1996 to 1998 in ARIC and annually through 1999 in CHS. For secondary analyses in ARIC and CHS, we defined nonfatal CHD as a definite or probable nonfatal MI or an unrecognized MI detected through follow-up ECGs.

For secondary analyses in REGARDS, fatal CHD events were classified as out of hospital if the death occurred before hospital admission (eg, in the emergency department) or as postadmission if the death occurred during or after hospitalization. Information on whether CHD deaths occurred before or after hospital admission was not available in the publicly available ARIC and CHS datasets. Follow-up data in ARIC, CHS, and REGARDS were available through December 31, 2001, June 30, 2010, and December 31, 2013, respectively.

Statistical Analysis

Analyses described below were conducted stratified by sex and among ARIC participants, REGARDS participants 45 to 64 years of age, CHS participants, and REGARDS participants ≥ 65 years of age, separately. We calculated baseline characteristics by race. Also, we conducted time-to-event analyses to compare the incidence of fatal, nonfatal, and total (ie, fatal and nonfatal) CHD among blacks and whites. Restricted to

participants with incident CHD, we also compared the risk for having their incident event classified as fatal (ie, case fatality) among blacks and whites. Secondary analyses were conducted using different analytic approaches and including supplementary CHD outcomes (eg, unrecognized MIs) to assess the robustness of the main results. Further details about statistical analyses are provided below.

For the main analysis, participants were followed through the first CHD event by the primary definition (and secondary definition among REGARDS participants ≥ 65 years of age) or non-CHD death. Participants lost to follow-up without a CHD event were censored on the last day known to be alive. The maximum follow-up available in REGARDS was 11 years. Therefore, we censored ARIC and CHS participants who remained alive and free of CHD after 11 years of follow-up to obtain comparable estimates across studies.

In time-to-event analyses, we calculated the incidence rate for fatal, nonfatal, and total CHD and non-CHD mortality by race. We also calculated the cumulative incidence function for fatal, nonfatal, and total CHD by race considering competing risk as described by Fine and Gray.³⁰ Fatal CHD analyses included competing risk for nonfatal CHD and non-CHD death (ie, death because of cardiovascular causes other than CHD or noncardiovascular causes). Analyses of nonfatal CHD included competing risk for fatal CHD and non-CHD death. Total CHD analyses included competing risk for non-CHD death. Using competing risk regression, we estimated hazard ratios (HRs) and 95% confidence intervals (CIs) for fatal, nonfatal, and total CHD among blacks versus whites. Regression models included progressive adjustment for age, education, annual household income, region of residence (in REGARDS), alcohol consumption, physical activity, waist circumference, smoking, diabetes mellitus, estimated glomerular filtration rate, history of stroke, systolic blood pressure, antihypertensive medication, total and high-density lipoprotein cholesterol, lipid-lowering medication use, and health insurance. LVH is associated with a higher risk for arrhythmias, including atrial fibrillation,^{31–34} which can be potentiated by ischemia.³⁵ LVH is more common among blacks compared with whites^{36,37} and could contribute to the racial differences in fatal CHD.³⁸ Therefore, a final model included adjustment for covariates listed above plus LVH and atrial fibrillation.

Restricted to participants with incident CHD, we calculated the case fatality by race. Case fatality was calculated as the number of participants with incident fatal CHD divided by the total number of participants with incident CHD (fatal or nonfatal). We used Poisson regression with robust variance estimates and progressive adjustment for covariates described above to calculate the case-fatality ratio and 95% CIs comparing blacks versus whites.³⁹ We compared HRs for incident fatal, nonfatal, and total CHD and case-fatality ratios associated with black race among men and women by including interaction terms between sex and race in regression models.

We conducted secondary analyses in ARIC, CHS, and REGARDS to explore whether results would remain similar after removing competing risk. Specifically, we used Cox regression to estimate HRs for incident fatal, nonfatal, and total CHD censoring participants on the date of a competing event. We also conducted secondary analyses in ARIC and CHS to estimate HRs for incident CHD accounting for competing risks and case-fatality ratios using all available

follow-up and separately, including unrecognized MIs in the definition of nonfatal CHD. In REGARDS, we conducted secondary analyses to estimate HRs for out-of-hospital and postadmission fatal CHD. Analyses were conducted using competing risk regression to account for postadmission and out-of-hospital fatal CHD as appropriate and nonfatal CHD and non-CHD death.

We used multiple imputation by chained equations to impute missing covariates (Table 1 in the online-only Data Supplement).^{40,41} All analyses were performed in Stata 13 (Stata Corp) using a 2-sided level of significance $\alpha < 0.05$.

RESULTS

Table 1 and Table II in the online-only Data Supplement show participant characteristics with and without multiple imputations, respectively. Within each study, black men and women were more likely to have less than a high school education, $< \$25\,000$ annual income, low physical activity, diabetes mellitus, reduced estimated glomerular filtration rate, history of stroke, and higher systolic blood pressure levels compared with white men and women, respectively. The prevalence of current smoking and high-density lipoprotein cholesterol levels were higher for blacks versus whites among men but similar among women. Waist circumference was higher for blacks versus whites among women but similar among men.

CHD Incidence and Case Fatality Among Men

Among men 45 to 64 years of age in ARIC and REGARDS, blacks had a higher incidence of fatal CHD and a lower incidence of nonfatal CHD compared with whites (Figure 1 and Table III in the online-only Data Supplement, Left). Incidence of total CHD was higher for black versus white men in REGARDS but similar in ARIC. Non-CHD mortality was higher for black versus white men in both studies. Among men ≥ 65 years of age in CHS and REGARDS, blacks had a higher incidence of fatal CHD, a lower incidence of nonfatal CHD, and a similar incidence of total CHD compared with whites (Figure III and Table III in the online-only Data Supplement, Right). Non-CHD mortality was higher for black versus white men ≥ 65 years of age in CHS and REGARDS.

After age adjustment, black men had higher risk for fatal CHD compared with white men in all analyses (Table 2), although the association was numerically lower and not statistically significant in CHS (HR, 1.32; 95% CI, 0.86–2.03). Black men also had a similar or lower age-adjusted risk for nonfatal CHD and a similar age-adjusted risk for total CHD compared with white men. After multivariable adjustment, black men had a similar risk for fatal CHD compared with white men in

Table 1. Baseline Characteristics of Participants Included in the Analysis, by Race and Sex

Baseline Characteristics	45–64 y of Age				≥65 y of Age			
	ARIC		REGARDS		CHS		REGARDS	
	Blacks	Whites	Blacks	Whites	Blacks	Whites	Blacks	Whites
Men, N	1534	4945	2044	3252	277	1559	997	2384
Age, y, mean (SE)	53.7 (0.15)	54.6 (0.08)	57.2 (0.11)	57.6 (0.08)	72.2 (0.35)	72.7 (0.15)	71.9 (0.18)	72.4 (0.12)
Region of residence, %*								
Stroke belt (buckle states)	NA	NA	18.6	20.3	NA	NA	14.5	21.3
Stroke belt (nonbuckle states)	NA	NA	36.7	34.0	NA	NA	31.8	37.1
Other contiguous US states	NA	NA	44.7	45.8	NA	NA	53.6	41.7
Less than high school education, %	43.8	17.0	10.8	4.0	46.2	27.6	26.2	7.5
Annual household income <\$25,000, %	61.2	20.3	27.5	10.8	71.3	50.5	40.1	16.6
Alcohol consumption, %								
None	55.1	45.6	56.5	41.9	51.3	39.5	63.7	52.1
Moderate	34.3	43.2	39.4	51.6	39.4	48.0	32.9	42.8
Heavy	10.5	11.2	4.1	6.5	9.4	12.5	3.4	5.1
Low physical activity, %	52.4	29.3	26.7	23.4	58.1	50.4	31.7	25.6
Current smoking, %	38.1	24.6	24.7	15.1	21.7	10.4	12.5	7.9
Diabetes mellitus, %	16.4	8.3	26.3	13.0	23.5	15.3	31.7	16.1
Reduced eGFR, %	2.9	2.2	5.2	2.7	23.7	27.5	14.9	13.8
History of stroke, %	3.4	1.2	5.8	2.8	10.8	4.0	10.8	5.9
Waist circumference, cm, mean (SE)	96.7 (0.31)	99.5 (0.14)	99.6 (0.34)	100.1 (0.24)	96.6 (0.64)	97.6 (0.25)	98.8 (0.43)	99.8 (0.25)
SBP, mm Hg, mean (SE)	130.3 (0.55)	120.2 (0.23)	130.3 (0.36)	124.6 (0.25)	138.6 (1.26)	136.2 (0.54)	133.6 (0.55)	129.4 (0.32)
Taking antihypertensive medication, %	32.9	18.2	53.1	33.0	48.9	35.9	62.3	45.6
Total cholesterol, mg/dL, mean (SE)	210.9 (1.13)	210.3 (0.55)	189.5 (0.89)	192.1 (0.67)	192.2 (2.19)	201.6 (0.90)	183.8 (1.27)	181.7 (0.71)
HDL cholesterol, mg/dL, mean (SE)	50.9 (0.45)	43.1 (0.18)	47.8 (0.32)	44.2 (0.23)	52.1 (0.83)	48.0 (0.32)	49.2 (0.48)	45.3 (0.28)
Taking lipid-lowering medications, %	1.1	2.9	28.6	31.6	3.2	3.1	35.9	37.6
Health insurance, %	76.5	95.4	84.0	92.5	NA	NA	NA	NA
Left ventricular hypertrophy, %	5.6	1.0	3.6	0.7	5.8	3.3	4.4	2.2
Atrial fibrillation, %†	NA	NA	4.6	4.7	5.8	6.0	5.3	9.0
Women, N	2551	5937	3729	4093	448	2342	1590	2522
Age, y, mean (SE)	53.3 (0.11)	53.9 (0.07)	56.9 (0.08)	57.0 (0.08)	72.3 (0.27)	71.6 (0.11)	72.1 (0.15)	72.6 (0.12)
Region of residence, %*								
Stroke belt (buckle states)	NA	NA	20.1	25.9	NA	NA	21.8	26.4
Stroke belt (nonbuckle states)	NA	NA	37.1	36.0	NA	NA	33.0	38.1
Other contiguous US states	NA	NA	42.8	38.0	NA	NA	45.1	35.5
Less than high school, %	40.0	16.3	12.9	5.0	43.3	24.3	26.8	8.3
Annual household income <\$25,000, %	75.9	31.5	41.3	19.0	83.7	61.1	59.6	36.7
Alcohol consumption, %								
None	84.9	66.4	75.1	57.8	72.9	51.1	84.1	68.8
Moderate	12.4	26.0	22.9	36.6	24.2	37.5	14.4	27.1
Heavy	2.7	7.6	2.0	5.6	2.9	11.5	1.6	4.1
Low physical activity, %	59.4	31.9	37.4	34.3	66.3	58.1	45.6	39.3

(Continued)

Table 1. Continued

Baseline Characteristics	45–64 y of Age				≥65 y of Age			
	ARIC		REGARDS		CHS		REGARDS	
	Blacks	Whites	Blacks	Whites	Blacks	Whites	Blacks	Whites
Current smoking, %	24.6	24.9	19.1	16.2	13.0	12.8	10.5	8.5
Diabetes mellitus, %	18.5	6.9	26.4	10.2	21.7	10.5	30.0	12.8
Reduced eGFR, %	3.9	2.4	5.2	2.7	21.6	20.2	19.8	16.9
History of stroke, %	1.9	0.9	4.9	2.8	4.0	2.3	8.0	4.9
Waist circumference, cm, mean (SE)	100.4 (0.32)	93.1 (0.19)	97.8 (0.27)	89.1 (0.25)	98.3 (0.61)	90.5 (0.25)	95.9 (0.36)	88.0 (0.29)
SBP, mm Hg, mean (SE)	127.9 (0.42)	117.0 (0.23)	127.8 (0.28)	119.8 (0.23)	143.9 (1.14)	135.5 (0.44)	132.2 (0.45)	127.2 (0.32)
Taking antihypertensive medication, %	44.0	19.0	61.9	33.5	63.2	38.9	72.2	50.8
Total cholesterol, mg/dL, mean (SE)	217.3 (0.93)	218.1 (0.55)	199.3 (0.67)	204.2 (0.62)	212.4 (1.96)	224.9 (0.78)	199.1 (1.10)	200.6 (0.77)
HDL cholesterol, mg/dL, mean (SE)	58.0 (0.36)	57.5 (0.22)	56.3 (0.26)	57.6 (0.26)	61.6 (0.76)	59.4 (0.33)	58.8 (0.43)	58.3 (0.35)
Taking lipid-lowering medication, %	1.5	3.1	27.7	25.6	6.9	5.0	39.0	36.6
Health insurance, %	76.3	95.0	82.5	90.9	NA	NA	NA	NA
Left ventricular hypertrophy, %	5.2	0.9	7.9	2.3	9.2	4.7	13.3	6.3
Atrial fibrillation, %†	NA	NA	7.4	5.5	3.3	4.4	5.5	9.9

Analyses were conducted using multiple imputations for missing data. ARIC indicates Atherosclerosis Risk in Communities; CHS, Cardiovascular Health Study; eGFR, estimated glomerular filtration rate; HDL, high-density lipoprotein; NA, not applicable; REGARDS, Reasons for Geographic and Racial Differences in Stroke; SBP, systolic blood pressure; and SE, standard error.

*Stroke belt (buckle states) includes coastal North Carolina, South Carolina, and Georgia. Stroke belt (nonbuckle states) includes the remaining parts of the stroke buckle states and Tennessee, Mississippi, Alabama, Louisiana, and Arkansas.

†Data on atrial fibrillation at baseline was not included in the publicly available ARIC dataset.

all analyses but a lower risk for nonfatal CHD (which was not statistically significant in CHS; HR, 0.83; 95% CI, 0.57–1.21). A trend appeared for a lower risk for total CHD among black versus white men after multivariable adjustment, which was statistically significant in ARIC (HR, 0.74; 95% CI, 0.57–0.95).

Among men with incident CHD, blacks had higher age-adjusted case fatality compared with whites (Table 3), although the difference was not statistically significant in CHS (case-fatality ratio, 1.27; 95% CI, 0.93–1.74). The case-fatality ratio for blacks versus whites remained higher and statistically significant after multivariable adjustment in ARIC and among REGARDS participants 45 to 64 and ≥65 years of age. In CHS, the multivariable-adjusted case-fatality ratio was 1.03 (95% CI, 0.73–1.45).

CHD Incidence and Case Fatality Among Women

Among women 45 to 64 years of age, blacks had a higher incidence of fatal, nonfatal, and total CHD and higher non-CHD mortality compared with whites (Figure 2 and Table IV in the online-only Data Supplement, Left). A similar pattern was present among black and white women ≥65 years of age in CHS and REGARDS (Figure IV and Table IV in the online-only Data Supplement, Right).

After age adjustment, black women 45 to 64 years of age in ARIC and REGARDS had a higher risk for fatal and total CHD compared with white women (Table 4, Left). Black women also had a higher age-adjusted risk for nonfatal CHD compared with white women, which was not statistically significant in REGARDS (HR, 1.29; 95% CI, 0.91–1.83). After multivariable adjustment, HRs (95% CI) comparing black versus white women in ARIC and REGARDS were 0.67 (0.36–1.24) and 1.00 (0.54–1.85), respectively, for fatal CHD, 0.70 (0.51–0.97) and 0.70 (0.46–1.06), respectively, for nonfatal CHD, and 0.69 (0.51–0.92) and 0.78 (0.55–1.09), respectively, for total CHD. Age-adjusted HRs for fatal, nonfatal, and total CHD comparing black versus white women ≥65 years of age were not statistically significant, except for fatal CHD in REGARDS (Table 4, Right). Specifically, the age-adjusted HR for fatal CHD among black versus white women ≥65 years of age in REGARDS was 1.57 (95% CI, 1.01–2.43) when using the primary definition of CHD. HRs for fatal, nonfatal, and total CHD comparing black versus white women ≥65 years of age in CHS and REGARDS were not statistically significant after multivariable adjustment.

Among women with incident CHD in ARIC, blacks had higher age-adjusted case fatality compared with whites (case-fatality ratio, 1.57; 95% CI, 1.00–2.46; Table 5), which was attenuated after multivariable adjustment (case-fatality ratio, 1.09; 95% CI, 0.65–1.82).

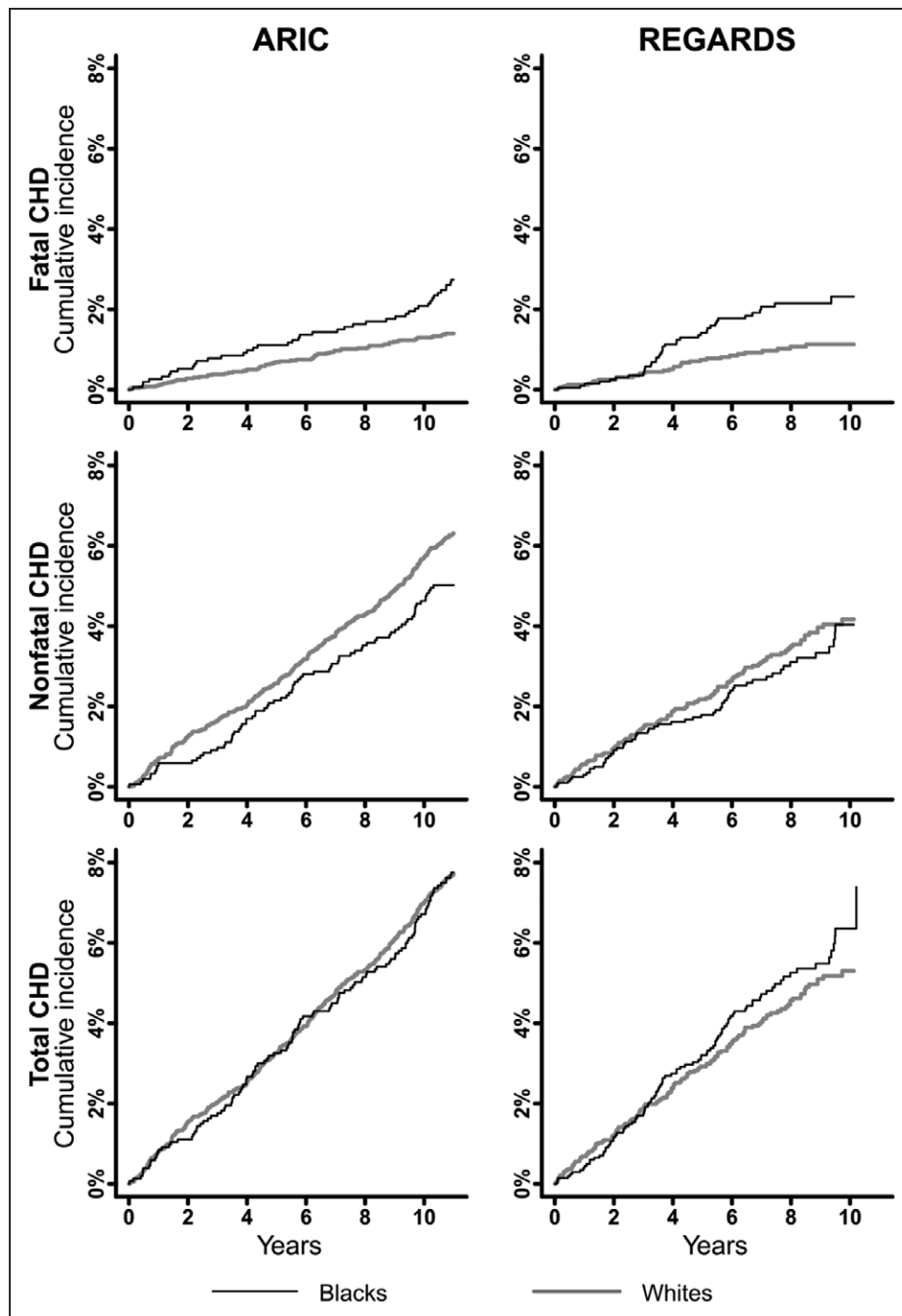


Figure 1. Cumulative incidence of fatal, nonfatal, and total CHD among black and white men 45 to 64 years of age in ARIC study (Atherosclerosis Risk in Communities) and REGARDS study (Reasons for Geographic And Racial Differences in Stroke).

The maximum follow-up for all analyses was 11 years. Mean follow-up was 10.2 years in ARIC and 7.3 years in REGARDS. CHD indicates coronary heart disease.

Crude case fatality was higher among black versus white women 45 to 64 and ≥ 65 years of age in REGARDS. Case-fatality ratios in REGARDS remained numerically similar but were not statistically significant after progressive adjustment for social determinants of health and cardiovascular risk factors. No racial differences in case fatality were present in CHS.

Black-White Disparities in CHD Incidence and Case Fatality by Sex

Within each cohort, age- and multivariable-adjusted HRs for fatal CHD associated with black race were similar among men and women (Figure V in the online-only Data Supplement, Top). Age-adjusted HRs for nonfatal and total CHD associated with black race tended to be

Table 2. Hazard Ratios for Fatal, Nonfatal, and Total CHD Among Black Versus White Men

	45–64 y of Age		≥65 y of Age		
	ARIC (N=6479)	REGARDS (N=5296)	CHS (N=1836)	REGARDS* (N=3381)	REGARDS† (N=3381)
Fatal CHD, events	111	71	145	118	120
Hazard ratio (95% CI)					
Model 1	2.09 (1.42–3.06)	2.11 (1.32–3.38)	1.32 (0.86–2.03)	1.72 (1.19–2.48)	1.67 (1.16–2.40)
Model 2	1.90 (1.26–2.87)	1.65 (1.01–2.69)	1.18 (0.76–1.83)	1.38 (0.94–2.03)	1.33 (0.90–1.95)
Model 3	1.88 (1.25–2.83)	1.57 (0.95–2.57)	1.17 (0.76–1.81)	1.35 (0.93–1.97)	1.30 (0.89–1.89)
Model 4	1.30 (0.82–2.04)	1.16 (0.66–2.03)	1.02 (0.64–1.62)	1.16 (0.78–1.71)	1.13 (0.76–1.68)
Model 5	1.22 (0.76–1.97)	1.14 (0.65–2.00)	NA	NA	NA
Model 6	1.19 (0.74–1.92)	1.09 (0.62–1.93)	0.99 (0.63–1.57)	1.21 (0.81–1.80)	1.17 (0.78–1.75)
Nonfatal CHD, events	389	172	249	187	238
Hazard ratio (95% CI)					
Model 1	0.82 (0.64–1.05)	0.94 (0.69–1.28)	0.85 (0.59–1.22)	0.55 (0.38–0.80)	0.71 (0.53–0.97)
Model 2	0.67 (0.51–0.89)	0.84 (0.60–1.18)	0.85 (0.58–1.24)	0.59 (0.39–0.89)	0.69 (0.49–0.97)
Model 3	0.65 (0.49–0.86)	0.80 (0.57–1.12)	0.85 (0.59–1.25)	0.58 (0.38–0.88)	0.68 (0.49–0.96)
Model 4	0.64 (0.47–0.86)	0.70 (0.50–0.99)	0.83 (0.57–1.21)	0.54 (0.35–0.83)	0.64 (0.45–0.91)
Model 5	0.64 (0.48–0.87)	0.70 (0.49–0.98)	NA	NA	NA
Model 6	0.64 (0.47–0.86)	0.67 (0.48–0.95)	0.83 (0.57–1.21)	0.53 (0.35–0.82)	0.63 (0.44–0.90)
Total CHD, events	500	243	394	305	358
Hazard ratio (95% CI)					
Model 1	1.04 (0.85–1.28)	1.20 (0.93–1.56)	1.02 (0.77–1.35)	0.92 (0.71–1.18)	0.98 (0.78–1.24)
Model 2	0.88 (0.70–1.11)	1.03 (0.79–1.35)	0.97 (0.73–1.30)	0.86 (0.65–1.13)	0.88 (0.68–1.13)
Model 3	0.85 (0.68–1.07)	0.98 (0.75–1.29)	0.96 (0.72–1.29)	0.85 (0.64–1.11)	0.87 (0.68–1.11)
Model 4	0.76 (0.59–0.97)	0.81 (0.60–1.08)	0.88 (0.66–1.19)	0.76 (0.57–1.01)	0.79 (0.61–1.02)
Model 5	0.75 (0.58–0.96)	0.80 (0.60–1.07)	NA	NA	NA
Model 6	0.74 (0.57–0.95)	0.78 (0.58–1.04)	0.88 (0.65–1.18)	0.76 (0.57–1.01)	0.79 (0.60–1.02)

Analyses were conducted using competing risk regression and multiple imputations for missing data. The maximum follow-up for all analyses was 11 y. Mean follow-up was 10.2 y in ARIC, 7.3 y among participants 45–64 y of age in REGARDS, 8.3 y in CHS, and 7.1 y among participants ≥65 y of age in REGARDS when using the primary and secondary definitions of CHD. Model 1 adjusts for age. Model 2 adjusts for age, education, and income levels (and region of residence in REGARDS). Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference, and current smoking. Model 4 adjusts for covariates in Model 3 plus diabetes mellitus, reduced eGFR, stroke, SBP, use of antihypertensive medications, total and HDL cholesterol, and use of lipid-lowering medication. Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 y of age (all participants ≥65 y of age had Medicare). Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation (except in ARIC). ARIC indicates Atherosclerosis Risk in Communities; CHD, coronary heart disease; CHS, Cardiovascular Health Study; CI, confidence interval; eGFR, estimated glomerular filtration rate; HDL, high-density lipoprotein; MI, myocardial infarction; NA, not applicable; REGARDS, Reasons for Geographic and Racial Differences in Stroke; and SBP, systolic blood pressure.

*Using the primary definition of CHD.

†Using the secondary definition of CHD, which includes MI hospitalizations detected through Medicare claims.

lower for men compared with women within each cohort, but sex differences disappeared after multivariable adjustment. Case-fatality ratios associated with black race were consistent among men and women with incident CHD within each cohort (Figure V in the online-only Data Supplement, Bottom).

Secondary Analyses

Black-white differences in CHD incidence among men and women were consistent with the main results in secondary analyses removing competing risk (Tables V and VI in the online-only Data Supplement). Results in

ARIC and CHS were also consistent with the main analysis when using all available follow-up (Tables VII and VIII in the online-only Data Supplement) and including unrecognized MIs (Tables IX and X in the online-only Data Supplement). In REGARDS, out-of-hospital and postadmission fatal CHD incidence were consistently higher among black versus white men, and differences were attenuated after multivariable adjustment (Table XI in the online-only Data Supplement). Incidence of out-of-hospital fatal CHD was higher among black versus white women 45 to 64 years of age in REGARDS, whereas incidence of postadmission fatal CHD was higher for black versus white women ≥65 years of age

Table 3. Case Fatality Among Black Versus White Men With Incident CHD

	45–64 y of Age		≥65 y of Age		
	ARIC	REGARDS	CHS	REGARDS*	REGARDS†
Case fatality (fatal CHD/total CHD)					
Blacks	35.3% (42/119)	39.0% (39/100)	44.1% (26/59)	57.8% (48/83)	47.1% (48/102)
Whites	18.1% (69/381)	22.4% (32/143)	35.5% (119/335)	31.5% (70/222)	28.1% (72/256)
Case-fatality ratio (95% CI)‡					
Model 1	1.97 (1.42–2.71)	1.77 (1.19–2.62)	1.27 (0.93–1.74)	1.84 (1.41–2.41)	1.67 (1.26–2.23)
Model 2	2.09 (1.47–2.97)	1.69 (1.13–2.52)	1.21 (0.88–1.66)	1.59 (1.19–2.12)	1.49 (1.10–2.02)
Model 3	2.17 (1.52–3.09)	1.77 (1.18–2.65)	1.16 (0.84–1.61)	1.58 (1.19–2.09)	1.49 (1.11–2.01)
Model 4	1.70 (1.16–2.48)	1.61 (1.03–2.51)	1.06 (0.75–1.49)	1.49 (1.09–2.03)	1.44 (1.05–1.99)
Model 5	1.64 (1.11–2.42)	1.60 (1.02–2.51)	NA	NA	NA
Model 6	1.63 (1.10–2.40)	1.60 (1.03–2.50)	1.03 (0.73–1.45)	1.49 (1.09–2.04)	1.44 (1.04–2.00)

Analyses were conducted using multiple imputations for missing data. Model 1 adjusts for age. Model 2 adjusts for age, education, and income levels (and region of residence in REGARDS). Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference, and current smoking. Model 4 adjusts for covariates in Model 3 plus diabetes mellitus, reduced eGFR, stroke, SBP, use of antihypertensive medications, total and HDL cholesterol, and use of lipid-lowering medication. Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 y of age (all participants ≥65 y of age had Medicare). Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation (except in ARIC). ARIC indicates Atherosclerosis Risk in Communities; CHD, coronary heart disease; CHS, Cardiovascular Health Study; CI, confidence interval; eGFR, estimated glomerular filtration rate; HDL, high-density lipoprotein; MI, myocardial infarction; NA, not applicable; REGARDS, Reasons for Geographic and Racial Differences in Stroke; and SBP, systolic blood pressure.

*Using the primary definition of CHD.

†Using the secondary definition of CHD, which includes MI hospitalizations detected through Medicare claims.

‡Case-fatality ratios were calculated comparing blacks versus whites (reference group).

(Table XII in the online-only Data Supplement). Differences in out-of-hospital and postadmission fatal CHD among black versus white women 45 to 64 and ≥65 years of age in REGARDS were not statistically significant after multivariable adjustment. Black-white differences in case fatality among men and women in ARIC and CHS were consistent with the main analysis when using all available follow-up (Tables XIII and XIV in the online-only Data Supplement) and including unrecognized MIs (Tables XV and XVI in the online-only Data Supplement).

DISCUSSION

We compared the incidence of fatal, nonfatal, and total CHD among black and white men and women in 3 US cohorts. After age adjustment, black men had a higher risk for fatal CHD but a similar or lower risk for nonfatal and total CHD compared with white men. In contrast, black women had a higher risk for fatal, nonfatal, and total CHD versus white women, particularly among those <65 years of age. After multivariable adjustment, including social determinants of health and cardiovascular risk factors, black men and women had a similar risk for fatal CHD, with a lower risk for nonfatal and total CHD compared with white men and women, respectively. Results from the current analysis also suggest that among men and women with incident CHD, blacks have a higher case fatality compared with whites, which is not completely explained by

social determinants of health and cardiovascular risk factors.

The similar or lower risk for nonfatal and total CHD comparing black versus white men after age adjustment appears inconsistent with the higher burden of unfavorable social determinants of health and cardiovascular risk factors among the former. Also, this finding appears inconsistent with the higher age-adjusted risk for fatal CHD among black versus white men and for fatal, nonfatal, and total CHD among black versus white women. Initially, we considered that the current results could have been attributed to black men being more likely to have undetected nonfatal MIs compared with white men. In REGARDS, nonfatal MIs may not be detected if CHD-related hospitalizations are not reported by participants. We previously showed that, like other large cohorts, the REGARDS study did not detect ≤25% of nonadjudicated events present in Medicare claims.^{42,43} However, results among REGARDS participants ≥65 years of age were similar after including unreported events detected through Medicare claims. Also, a similar pattern was found in ARIC and CHS, which include an active surveillance component for the detection of unreported events. Nonfatal MIs could have also been undetected if these events were not clinically recognized. Black men have been reported to be less engaged in health care than women or white men, especially at younger ages.^{44–46} Also, in a prior analysis in ARIC, the incidence of clinically unrecognized MIs from baseline through visit 4 (1996–1998) was higher among black versus white men, although the difference was not statistically significant.⁴⁷ In the current

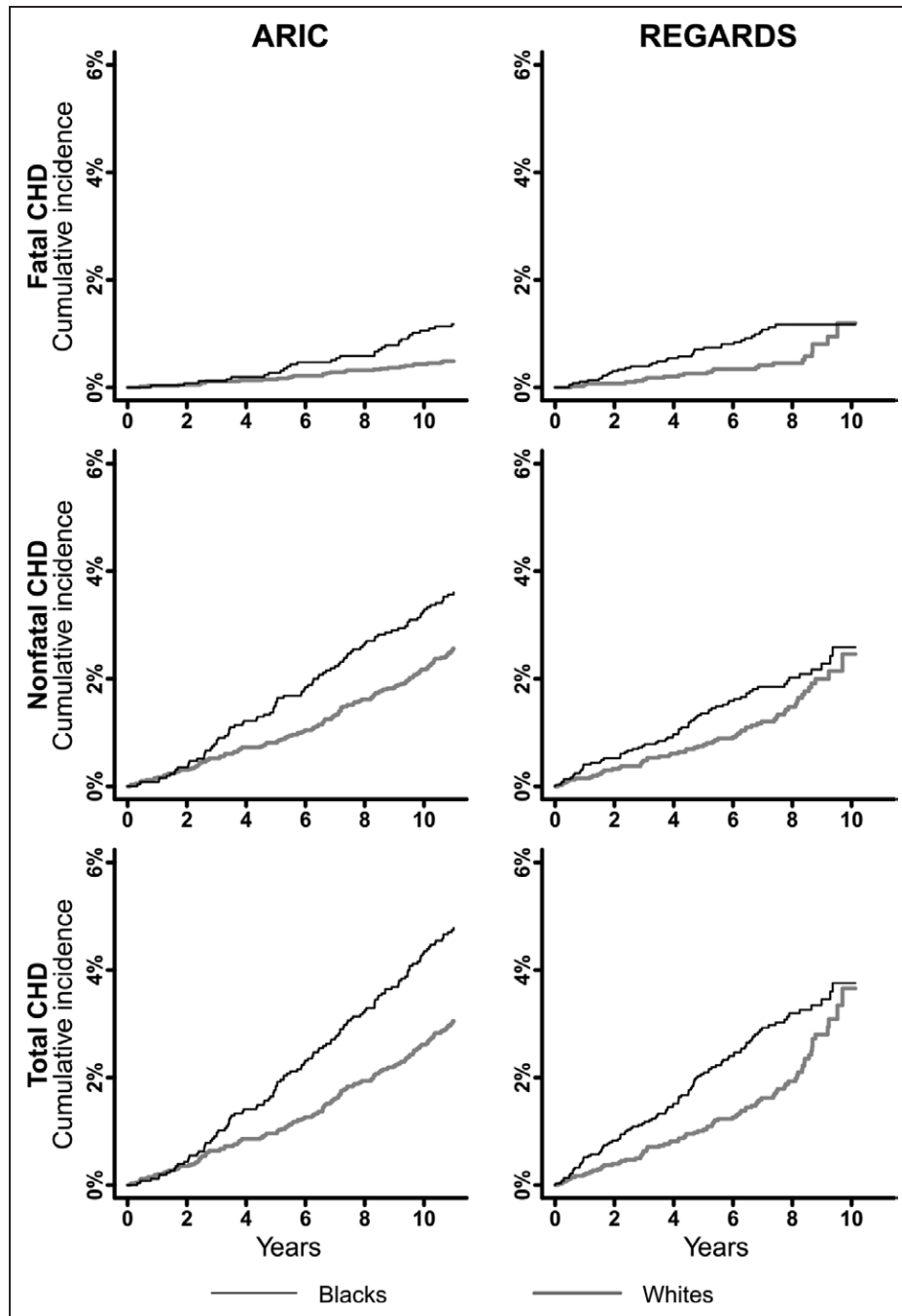


Figure 2. Cumulative incidence of fatal, nonfatal, and total CHD among black and white women 45 to 64 years of age in ARIC study (Atherosclerosis Risk in Communities) and REGARDS study (Reasons for Geographic And Racial Differences in Stroke).

The maximum follow-up for all analyses was 11 years. Mean follow-up was 10.5 years in ARIC and 7.0 years in REGARDS. CHD indicates coronary heart disease.

analysis, results in ARIC and CHS remained similar after including clinically unrecognized MIs. Taken together, results from the current study suggest that the similar or lower risk for nonfatal and total CHD comparing black versus white men after age adjustment is unlikely to be explained by racial differences in the occurrence of undetected nonfatal MIs.

After multivariable adjustment, black men and women had a lower risk for nonfatal and total CHD compared with white men and women, respectively. Mechanisms leading to this finding warrant further investigation. It is notable that multivariable-adjusted HRs for nonfatal and total CHD associated with black race were numerically similar comparing men and women.

Table 4. Hazard Ratios for Fatal, Nonfatal, and Total CHD Among Black Versus White Women

	45–64 y of Age		≥65 y of Age		
	ARIC (N=8488)	REGARDS (N=7822)	CHS (N=2790)	REGARDS* (N=4112)	REGARDS† (N=4112)
Fatal CHD, events	59	59	145	81	81
Hazard ratios (95% CI)					
Model 1	2.61 (1.57–4.34)	1.79 (1.06–3.03)	1.23 (0.82–1.84)	1.57 (1.01–2.43)	1.41 (0.91–2.19)
Model 2	1.35 (0.82–2.24)	1.38 (0.79–2.41)	1.00 (0.66–1.54)	1.37 (0.85–2.23)	1.26 (0.77–2.05)
Model 3	1.26 (0.73–2.16)	1.08 (0.62–1.88)	0.82 (0.53–1.26)	1.19 (0.74–1.91)	1.06 (0.65–1.71)
Model 4	0.77 (0.42–1.40)	1.00 (0.54–1.83)	0.74 (0.46–1.19)	1.07 (0.65–1.76)	0.98 (0.59–1.63)
Model 5	0.72 (0.40–1.31)	1.00 (0.55–1.84)	NA	NA	NA
Model 6	0.67 (0.36–1.26)	1.00 (0.54–1.85)	0.75 (0.46–1.20)	1.08 (0.65–1.82)	0.99 (0.59–1.66)
Nonfatal CHD, events	244	128	201	129	192
Hazard ratios (95% CI)					
Model 1	1.47 (1.13–1.91)	1.29 (0.91–1.83)	1.21 (0.85–1.72)	0.86 (0.60–1.23)	1.14 (0.85–1.52)
Model 2	0.98 (0.73–1.31)	1.04 (0.71–1.53)	1.09 (0.76–1.56)	0.76 (0.53–1.10)	0.98 (0.73–1.31)
Model 3	0.93 (0.68–1.25)	0.95 (0.65–1.41)	0.96 (0.67–1.39)	0.69 (0.47–0.99)	0.90 (0.67–1.22)
Model 4	0.74 (0.54–1.02)	0.74 (0.49–1.11)	0.97 (0.66–1.44)	0.67 (0.45–0.98)	0.84 (0.61–1.15)
Model 5	0.72 (0.52–0.99)	0.74 (0.49–1.11)	NA	NA	NA
Model 6	0.70 (0.51–0.97)	0.70 (0.46–1.06)	0.96 (0.65–1.42)	0.68 (0.46–1.01)	0.86 (0.63–1.19)
Total CHD, events	303	187	346	210	273
Hazard ratios (95% CI)					
Model 1	1.66 (1.32–2.09)	1.44 (1.08–1.92)	1.23 (0.94–1.60)	1.10 (0.83–1.45)	1.22 (0.96–1.55)
Model 2	1.05 (0.81–1.36)	1.14 (0.83–1.56)	1.06 (0.81–1.39)	0.97 (0.72–1.29)	1.06 (0.82–1.36)
Model 3	0.99 (0.76–1.29)	0.99 (0.72–1.35)	0.90 (0.68–1.19)	0.86 (0.64–1.14)	0.95 (0.73–1.22)
Model 4	0.74 (0.56–0.98)	0.81 (0.58–1.14)	0.87 (0.65–1.18)	0.81 (0.60–1.09)	0.88 (0.68–1.15)
Model 5	0.71 (0.53–0.95)	0.81 (0.58–1.14)	NA	NA	NA
Model 6	0.69 (0.51–0.92)	0.78 (0.55–1.09)	0.87 (0.64–1.17)	0.82 (0.61–1.12)	0.90 (0.69–1.18)

Analyses were conducted using competing risk regression and multiple imputations for missing data. The maximum follow-up for all analyses was 11 y. Mean follow-up was 10.5 y in ARIC, 7.0 y among participants 45–64 y of age in REGARDS, 9.5 y in CHS, and 7.0 y among participants ≥65 y of age in REGARDS when using the primary and secondary definition of CHD. Model 1 adjusts for age. Model 2 adjusts for age, education, and income levels (and region of residence in REGARDS). Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference, and current smoking. Model 4 adjusts for covariates in Model 3 plus diabetes mellitus, reduced eGFR, stroke, SBP, use of antihypertensive medications, total and HDL cholesterol, and use of lipid-lowering medication. Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 y of age (all participants ≥65 y of age had Medicare). Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation (except in ARIC). ARIC indicates Atherosclerosis Risk in Communities; CHD, coronary heart disease; CHS, Cardiovascular Health Study; CI, confidence interval; eGFR, estimated glomerular filtration rate; HDL, high-density lipoprotein; MI, myocardial infarction; NA, not applicable; REGARDS, Reasons for Geographic and Racial Differences in Stroke; and SBP, systolic blood pressure.

*Using the primary definition of CHD.

†Using the secondary definition of CHD, which includes MI hospitalizations detected through Medicare claims.

This finding suggests that differences in age-adjusted HRs for nonfatal and total CHD between men and women could be attributed to different confounding effects by social determinants of health and cardiovascular risk factors by sex.

Consistent with prior studies, we found a higher case fatality among black versus white men with incident CHD, which was statistically significant in ARIC but not in CHS.^{48,49} We also found a higher case fatality among black versus white men 45 to 64 and ≥65 years of age in REGARDS. We hypothesized that LVH could have been associated with a higher case fatality among blacks versus whites through a higher risk for fatal arrhythmias. However, case-fatality ratios in ARIC and RE-

GARDS remained statistically significant after multivariable adjustment, including LVH and atrial fibrillation (in REGARDS). Case-fatality ratios comparing black versus white women were consistent with results among men. In secondary analyses in REGARDS, blacks had a higher incidence of out-of-hospital fatal CHD compared with whites, which is consistent with the higher risk for sudden cardiac death among the former.⁵⁰ We also found a higher incidence of postadmission fatal CHD among blacks versus whites in REGARDS. Prior studies have shown that blacks are less likely to receive short-term antiplatelet therapies, reperfusion therapy within 24 hours, and diagnostic cardiac catheterization and revascularization after an MI hospitalization compared

Table 5. Case Fatality Among Black Versus White Women With Incident CHD

	45–64 y of Age		≥65 y of Age		
	ARIC	REGARDS	CHS	REGARDS*	REGARDS†
Case fatality (fatal CHD/total CHD)					
Blacks	24.6% (30/122)	34.6% (36/104)	44.1% (30/68)	47.0% (39/83)	32.5% (37/114)
Whites	16.0% (29/181)	27.7% (23/83)	41.4% (115/278)	33.1% (42/127)	27.7% (44/159)
Case-fatality ratio (95% CI)‡					
Model 1	1.57 (1.00–2.46)	1.25 (0.81–1.93)	0.99 (0.73–1.35)	1.48 (1.06–2.08)	1.18 (0.82–1.71)
Model 2	1.27 (0.81–2.00)	1.19 (0.76–1.86)	0.95 (0.69–1.30)	1.46 (1.00–2.12)	1.21 (0.79–1.84)
Model 3	1.27 (0.79–2.04)	1.18 (0.74–1.87)	0.91 (0.66–1.26)	1.41 (0.96–2.06)	1.14 (0.76–1.71)
Model 4	1.09 (0.67–1.76)	1.29 (0.81–2.06)	0.87 (0.63–1.21)	1.44 (0.98–2.13)	1.12 (0.74–1.69)
Model 5	1.12 (0.68–1.84)	1.30 (0.82–2.06)	NA	NA	NA
Model 6	1.09 (0.65–1.82)	1.40 (0.88–2.21)	0.90 (0.64–1.26)	1.43 (0.97–2.12)	1.11 (0.73–1.68)

Analyses were conducted using multiple imputations for missing data. REGARDS study participants ≥65 y of age with incident fatal CHD by the primary definition can have incident nonfatal CHD by the secondary definition if they had a Medicare claim for a MI hospitalization at least 28 days before their death date. Model 1 adjusts for age. Model 2 adjusts for age, education, and income levels (and region of residence in REGARDS). Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference, and current smoking. Model 4 adjusts for covariates in Model 3 plus diabetes mellitus, reduced eGFR, stroke, SBP, use of antihypertensive medications, total and HDL cholesterol, and use of lipid-lowering medication. Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 y of age (all participants ≥65 y of age had Medicare). Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation (except in ARIC). ARIC indicates Atherosclerosis Risk in Communities; CHD, coronary heart disease; CHS, Cardiovascular Health Study; CI, confidence interval; eGFR, estimated glomerular filtration rate; HDL, high-density lipoprotein; MI, myocardial infarction; NA, not applicable; REGARDS, Reasons for Geographic and Racial Differences in Stroke; and SBP, systolic blood pressure.

*Using the primary definition of CHD.

†Using the secondary definition of CHD, which includes MI hospitalizations detected through Medicare claims.

‡Case-fatality ratios were calculated comparing blacks versus whites (reference group).

with whites.^{51,52} Although some hospital-based studies suggest that short-term mortality after an MI admission may be lower for blacks versus whites,^{51–53} this situation seems to have changed over time.^{54,55} In the National Registry of Myocardial Infarction, in-hospital mortality was lower comparing blacks versus whites in 1994 to 1999 but higher in 2003 to 2006.⁵⁴ Future studies are needed to further elucidate the mechanisms leading to the higher case fatality among blacks versus whites with incident CHD, including both out-of-hospital and postadmission mortality, and to identify potential targets for interventions to reduce racial disparities.

The numerically lower HR for fatal CHD associated with black race in CHS versus ARIC and REGARDS needs to be considered in the context of epidemiological changes occurred since the 1960s in the United States. Studies using mortality data from the 1960s and 1970s reported a “black-white mortality age cross-over” for CHD.^{56–58} This phenomenon, which consisted of CHD mortality being higher for blacks versus whites at younger ages but lower in older populations was attributed to a survivor bias.^{56–58} CHD mortality persisted higher for blacks versus whites at younger ages in more contemporary analyses.⁵⁶ However, CHD mortality among older US adults has declined more for whites versus blacks since the 1970s.⁵⁶ This resulted in CHD mortality being similar among older blacks and whites by the 1980s, just before ARIC and CHS started.⁵⁶ In the current study, age-adjusted HRs for fatal CHD among blacks versus whites ≥65 years of age were numerically

higher in REGARDS versus CHS. This finding suggests that black-white disparities in fatal CHD incidence may be becoming wider among older US adults. Continued surveillance of CHD incidence and mortality among US adults by race, age, and sex is warranted. In addition, targeted interventions may need to be integrated into population health management strategies if disparities are to be eliminated or, at a minimum, if an inadvertent widening of disparities is to be prevented.

Our analysis has several strengths, including the use of data from cohorts with a large sample size, adequate representation of blacks and whites, long-term follow-up, and a rigorous CHD event adjudication process. We used a comparable follow-up and CHD definition and the same analytic approach accounting for missing data and competing risks across studies. When possible, we re-created variables in ARIC and CHS to be consistent with the REGARDS definition. Our study also has potential and known limitations. ARIC, CHS, and REGARDS used different methods for data collection, and not all the variables could be reconciled. Also, few nonblack/nonwhite participants in ARIC were included in the analysis because these cannot be differentiated from whites using the publicly available dataset. ARIC and CHS have a limited geographic representation, and results from these studies may not be generalizable to the overall US population. In REGARDS, adjudication of nonfatal CHD events is triggered by participants’ self-report of a CHD-related hospitalization, which may result in underestimation of incidence rates. LVH was

defined using electrocardiography, which may lead to a differential detection by race and sex compared with echocardiography.⁵⁹ Also, LVH and atrial fibrillation were measured at baseline. Some participants may have developed LVH or atrial fibrillation by the time of their incident CHD event. However, data on the presence of LVH and atrial fibrillation at the time of the event was not available in ARIC, CHS, and REGARDS. Last, we were not able to adjust CHD incidence across studies for changes in diagnostic methods, including more sensitive biomarkers.

In the current analysis, black men had a consistently lower incidence of nonfatal CHD compared with white men, although they had a higher burden of unfavorable social determinants of health and cardiovascular risk factors and a higher incidence of fatal CHD. This black paradox on CHD incidence does not seem to be explained by racial differences in undetected MIs among men. Indeed, black men and women had a consistently lower risk for nonfatal and total CHD compared with white men and women, respectively, after adjusting for social determinants of health and cardiovascular risk factors. Results from the current study also suggest that black men and women with incident CHD have higher case fatality compared with white men and women, respectively, which remained largely unexplained by social determinants of health and cardiovascular risk factors. These findings highlight the importance of primary prevention among blacks because they are more likely to die after their incident CHD event compared with whites.

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DISCLOSURES

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FOOTNOTES

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Black-White Differences in Incident Fatal, Nonfatal, and Total Coronary Heart Disease

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SUPPLEMENTAL MATERIAL

Black-White Differences in Incident Fatal, Nonfatal and Total Coronary Heart Disease

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Supplemental table 1. Distribution of missing data among ARIC, CHS and REGARDS study participants included in the analysis stratified by gender.

	Men				Women			
	45-64 years of age		≥65 years of age		45-64 years of age		≥65 years of age	
	ARIC (N=6,479) n (%)	REGARDS (N=5,296) n (%)	CHS (N=1,836) n (%)	REGARDS (N=3,381) n (%)	ARIC (N=8,488) n (%)	REGARDS (N=7,822) n (%)	CHS (N=2,790) n (%)	REGARDS (N=4,112) n (%)
Baseline characteristics								
Age	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Blacks	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Region of residence	NA	0 (0.0)	NA	0 (0.0)	NA	0 (0.0)	NA	0 (0.0)
Less than high school education	14 (0.2)	0 (0.0)	6 (0.3)	3 (0.1)	12 (0.1)	7 (0.1)	7 (0.3)	1 (0.02)
Annual household income <\$25,000	334 (5.2)	211 (4.0)	87 (4.7)	139 (4.1)	534 (6.3)	373 (4.8)	213 (7.6)	307 (7.5)
Alcohol consumption	43 (0.7)	109 (2.1)	9 (0.5)	85 (2.5)	47 (0.6)	128 (1.6)	9 (0.3)	61 (1.5)
Physical activity	15 (0.2)	69 (1.3)	2 (0.1)	58 (1.7)	10 (0.1)	80 (1.0)	1 (0.04)	87 (2.1)
Current smoking	3 (0.05)	21 (0.4)	3 (0.2)	15 (0.4)	13 (0.2)	30 (0.4)	3 (0.1)	11 (0.3)
Diabetes	58 (0.9)	152 (2.9)	0 (0.0)	97 (2.9)	84 (1.0)	317 (4.1)	0 (0.0)	179 (4.4)
Reduced eGFR	47 (0.7)	170 (3.2)	17 (0.9)	99 (2.9)	96 (1.1)	350 (4.5)	40 (1.4)	200 (4.9)
History of stroke	15 (0.2)	8 (0.2)	0 (0.0)	9 (0.3)	26 (0.3)	21 (0.3)	0 (0.0)	19 (0.5)
Waist circumference (cm)	13 (0.2)	13 (0.2)	10 (0.5)	11 (0.3)	13 (0.2)	68 (0.9)	18 (0.6)	33 (0.8)
SBP (mmHg)	8 (0.1)	10 (0.2)	3 (0.2)	9 (0.3)	6 (0.1)	25 (0.3)	6 (0.2)	11 (0.3)
Taking antihypertensive medication	35 (0.5)	251 (4.7)	4 (0.2)	109 (3.2)	41 (0.5)	328 (4.2)	8 (0.3)	146 (3.6)
Total cholesterol (mg/dL)	77 (1.2)	169 (3.2)	10 (0.5)	99 (2.9)	161 (1.9)	349 (4.5)	30 (1.1)	200 (4.9)
HDL cholesterol (mg/dL)	77 (1.2)	183 (3.5)	13 (0.7)	112 (3.3)	159 (1.9)	395 (5.0)	32 (1.1)	233 (5.7)
Taking lipid-lowering medications	66 (1.0)	0 (0.0)	4 (0.2)	0 (0.0)	54 (0.6)	0 (0.0)	8 (0.3)	0 (0.0)
Health insurance	13 (0.2)	6 (0.1)	NA	NA	21 (0.2)	7 (0.1)	NA	NA
Left ventricular hypertrophy	227 (3.5)	97 (1.8)	7 (0.4)	59 (1.7)	266 (3.1)	149 (1.9)	9 (0.3)	74 (1.8)
Atrial fibrillation*	NA	90 (1.7)	0 (0.0)	69 (2.0)	NA	167 (2.1)	1 (0.04)	100 (2.4)
Any missing information	755 (11.7)	918 (17.3)	139 (7.6)	571 (16.9)	1,081 (12.7)	1,497 (19.1)	300 (10.8)	913 (22.2)

ARIC: Atherosclerosis Risk In Communities; CHS: Cardiovascular Health Study; eGFR: estimated glomerular filtration rate; HDL: high-density lipoprotein; NA: not applicable; REGARDS: REasons for Geographic And Racial Differences in Stroke; SBP: systolic blood pressure.

* Data on atrial fibrillation at baseline was not included in the ARIC publicly available dataset.

Supplemental table 2. Baseline characteristics of ARIC, CHS and REGARDS study participants included in the analysis by race and gender (without multiple imputation).

Baseline characteristics	45-64 years of age				≥65 years of age			
	ARIC		REGARDS		CHS		REGARDS	
	Blacks	Whites	Blacks	Whites	Blacks	Whites	Blacks	Whites
MEN, N	1,534	4,945	2,044	3,252	277	1,559	997	2,384
Age in years, mean (SD)	53.7 (5.9)	54.6 (5.7)	57.2 (4.9)	57.6 (4.8)	72.2 (5.8)	72.7 (5.8)	71.9 (5.6)	72.4 (5.8)
Region of residence,* n (%)								
Stroke belt (buckle states)	NA	NA	380 (18.6)	659 (20.3)	NA	NA	144 (14.4)	503 (21.1)
Stroke belt (non-buckle states)	NA	NA	751 (36.7)	1,105 (34.0)	NA	NA	319 (32.0)	879 (36.9)
Other contiguous US states	NA	NA	913 (44.7)	1,488 (45.8)	NA	NA	534 (53.6)	1,002 (42.0)
Less than high school education, n (%)	671 (43.9)	837 (17.0)	221 (10.8)	131 (4.0)	127 (46.2)	429 (27.6)	262 (26.3)	180 (7.6)
Annual household income <\$25,000, n (%)	842 (61.3)	965 (20.2)	522 (27.0)	341 (10.8)	185 (71.2)	751 (50.4)	375 (39.5)	377 (16.4)
Alcohol consumption, n (%)								
None	830 (55.2)	2,248 (45.6)	1,126 (56.6)	1,340 (41.9)	142 (51.3)	613 (39.5)	614 (64.2)	1,214 (51.9)
Moderate	514 (34.2)	2,132 (43.2)	783 (39.3)	1,650 (51.6)	109 (39.4)	744 (48.0)	310 (32.4)	1,006 (43.0)
Heavy	159 (10.6)	553 (11.2)	81 (4.1)	207 (6.5)	26 (9.4)	193 (12.5)	32 (3.3)	120 (5.1)
Low physical activity, n (%)	798 (52.4)	1,449 (29.3)	541 (26.8)	748 (23.3)	161 (58.1)	785 (50.4)	306 (31.4)	605 (25.8)
Current smoking, n (%)	584 (38.1)	1,216 (24.6)	503 (24.8)	489 (15.1)	60 (21.7)	162 (10.4)	124 (12.5)	189 (8.0)
Diabetes, n (%)	246 (16.5)	407 (8.3)	519 (26.3)	412 (13.0)	65 (23.5)	238 (15.3)	304 (31.8)	375 (16.1)
Reduced eGFR, n (%)	44 (2.9)	111 (2.2)	99 (5.1)	84 (2.7)	63 (23.5)	426 (27.5)	143 (15.0)	322 (13.8)
History of stroke, n (%)	52 (3.4)	61 (1.2)	117 (5.7)	90 (2.8)	30 (10.8)	62 (4.0)	108 (10.9)	140 (5.9)
Waist circumference (cm), mean (SD)	96.6 (12.1)	99.5 (10.1)	99.6 (15.3)	100.1 (13.5)	96.6 (10.7)	97.6 (9.6)	98.8 (13.5)	99.8 (12.3)
SBP (mmHg), mean (SD)	130.3 (21.5)	120.2 (16.0)	130.3 (16.4)	124.6 (14.2)	138.6 (21.0)	136.2 (21.4)	133.6 (17.3)	129.4 (15.5)
Taking antihypertensive medication, n (%)	502 (32.9)	897 (18.2)	1,048 (53.4)	1,020 (33.1)	135 (48.9)	559 (35.9)	604 (62.2)	1,052 (45.7)
Total cholesterol (mg/dL), mean (SD)	210.8 (43.8)	210.3 (38.3)	189.6 (39.9)	192.1 (37.7)	192.3 (36.1)	201.6 (35.7)	183.9 (39.4)	181.7 (34.1)
HDL cholesterol (mg/dL), mean (SD)	50.8 (16.9)	43.1 (12.4)	47.8 (14.4)	44.2 (12.9)	52.0 (13.6)	48.0 (12.7)	49.2 (14.9)	45.3 (13.3)
Taking lipid-lowering medications, n (%)	16 (1.1)	144 (2.9)	584 (28.6)	1,029 (31.6)	9 (3.3)	48 (3.1)	357 (35.8)	897 (37.6)
Health insurance, n (%)	1,168 (76.6)	4,714 (95.4)	1,715 (84.1)	3,006 (92.5)	NA	NA	NA	NA
Left ventricular hypertrophy, n (%)	82 (5.5)	46 (1.0)	72 (3.6)	21 (0.7)	16 (5.8)	51 (3.3)	43 (4.4)	52 (2.2)
Atrial fibrillation,† n (%)	NA	NA	91 (4.6)	149 (4.6)	16 (5.8)	94 (6.0)	51 (5.3)	215 (9.2)

Supplemental table 2. Continuation.

Baseline characteristics	45-64 years of age				≥65 years of age			
	ARIC		REGARDS		CHS		REGARDS	
	Blacks	Whites	Blacks	Whites	Blacks	Whites	Blacks	Whites
WOMEN, N	2,551	5,937	3,729	4,093	448	2,342	1,590	2,522
Age in years, mean (SD)	53.3 (5.7)	53.9 (5.7)	56.9 (5.0)	57.0 (5.0)	72.3 (5.8)	71.6 (5.3)	72.1 (5.8)	72.6 (5.8)
Region of residence,* n (%)								
Stroke belt (buckle states)	NA	NA	751 (20.1)	1,061 (25.9)	NA	NA	347 (21.8)	660 (26.2)
Stroke belt (non-buckle states)	NA	NA	1,383 (37.1)	1,475 (36.0)	NA	NA	523 (32.9)	962 (38.1)
Other contiguous US states	NA	NA	1,595 (42.8)	1,557 (38.0)	NA	NA	720 (45.3)	900 (35.7)
Less than high school education, n (%)	1,016 (39.9)	964 (16.3)	481 (12.9)	206 (5.0)	193 (43.3)	567 (24.3)	426 (26.8)	209 (8.3)
Annual household income <\$25,000, n (%)	1,753 (76.1)	1,777 (31.5)	1,446 (40.9)	745 (19.1)	348 (83.7)	1,329 (61.5)	869 (59.5)	861 (36.7)
Alcohol consumption, n (%)								
None	2,134 (84.9)	3,932 (66.4)	2,735 (75.2)	2,341 (57.7)	325 (72.9)	1,192 (51.0)	1,311 (84.0)	1,717 (68.9)
Moderate	312 (12.4)	1,543 (26.0)	833 (22.9)	1,486 (36.6)	108 (24.2)	875 (37.5)	225 (14.4)	670 (26.9)
Heavy	69 (2.7)	451 (7.6)	71 (2.0)	228 (5.6)	13 (2.9)	268 (11.5)	24 (1.5)	104 (4.2)
Low physical activity, n (%)	1,511 (59.4)	1,892 (31.9)	1,381 (37.4)	1,387 (34.3)	297 (66.3)	1,360 (58.1)	709 (45.7)	975 (39.4)
Current smoking, n (%)	625 (24.6)	1,479 (24.9)	711 (19.1)	660 (16.2)	58 (13.0)	299 (12.8)	165 (10.4)	212 (8.4)
Diabetes, n (%)	455 (18.4)	407 (6.9)	945 (26.5)	403 (10.2)	97 (21.7)	247 (10.5)	458 (30.2)	316 (13.1)
Reduced eGFR, n (%)	95 (3.9)	141 (2.4)	178 (5.1)	105 (2.7)	89 (21.0)	469 (20.2)	292 (19.6)	404 (16.7)
History of stroke, n (%)	49 (1.9)	53 (0.9)	181 (4.9)	112 (2.7)	18 (4.0)	55 (2.3)	128 (8.1)	123 (4.9)
Waist circumference (cm), mean (SD)	100.4 (16.0)	93.1 (14.8)	97.8 (16.7)	89.1 (16.2)	98.3 (13.0)	90.5 (12.3)	95.9 (14.5)	88.0 (14.6)
SBP (mmHg), mean (SD)	127.9 (21.3)	117.0 (17.7)	127.8 (16.8)	119.8 (14.9)	143.9 (24.1)	135.5 (21.3)	132.2 (17.8)	127.2 (16.1)
Taking antihypertensive medication, n (%)	1,114 (43.9)	1,123 (19.0)	2,214 (61.9)	1,307 (33.4)	282 (63.2)	908 (38.9)	1,109 (72.3)	1,235 (50.8)
Total cholesterol (mg/dL), mean (SD)	217.2 (45.9)	218.1 (42.2)	199.4 (40.1)	204.2 (38.1)	212.2 (40.6)	224.9 (38.0)	199.0 (41.8)	200.8 (37.9)
HDL cholesterol (mg/dL), mean (SD)	58.0 (17.3)	57.5 (17.1)	56.3 (15.6)	57.6 (16.2)	61.6 (15.5)	59.4 (15.9)	58.8 (16.4)	58.3 (16.9)
Taking lipid-lowering medications, n (%)	37 (1.5)	180 (3.0)	1,034 (27.7)	1,048 (25.6)	31 (7.0)	116 (5.0)	623 (39.2)	930 (36.9)
Health insurance, n (%)	1,938 (76.3)	5,629 (95.0)	3,075 (82.6)	3,720 (91.0)	NA	NA	NA	NA
Left ventricular hypertrophy, n (%)	129 (5.2)	52 (0.9)	289 (7.9)	91 (2.3)	41 (9.3)	109 (4.7)	208 (13.2)	156 (6.3)
Atrial fibrillation,† n (%)	NA	NA	266 (7.3)	219 (5.4)	15 (3.4)	102 (4.4)	85 (5.5)	249 (10.1)

ARIC: Atherosclerosis Risk In Communities; CHS: Cardiovascular Health Study; eGFR: estimated glomerular filtration rate; HDL: high-density lipoprotein; NA: not applicable; REGARDS: REasons for Geographic And Racial Differences in Stroke; SBP: systolic blood pressure; SD: standard deviation; US: United States.

* Stroke belt (buckle states) includes coastal North Carolina, South Carolina and Georgia. Stroke belt (non-buckle states) includes the remaining parts of the stroke buckle states and Tennessee, Mississippi, Alabama, Louisiana and Arkansas.

† Data on atrial fibrillation at baseline was not included in the ARIC publicly available dataset.

Supplemental table 3. Incidence rates for fatal, nonfatal and total CHD, and non-CHD mortality among black and white men in ARIC, CHS and REGARDS.

	45-64 years of age				≥65 years of age					
	ARIC		REGARDS		CHS		REGARDS*		REGARDS†	
	Blacks (N=1,534)	Whites (N=4,945)	Blacks (N=2,044)	Whites (N=3,252)	Blacks (N=277)	Whites (N=1,559)	Blacks (N=997)	Whites (N=2,384)	Blacks (N=997)	Whites (N=2,384)
Fatal CHD										
Events	42	69	39	32	26	119	48	70	48	72
Incidence rate (95% CI)‡	2.8 (1.9-3.6)	1.4 (1.0-1.7)	2.8 (1.9-3.6)	1.3 (0.8-1.7)	11.7 (7.2-16.3)	9.1 (7.5-10.8)	7.0 (5.0-9.0)	4.1 (3.1-5.0)	7.1 (5.1-9.1)	4.2 (3.2-5.2)
Nonfatal CHD										
Events	77	312	61	111	33	216	35	152	54	184
Incidence rate (95% CI)‡	5.1 (3.9-6.2)	6.1 (5.5-6.8)	4.3 (3.2-5.4)	4.5 (3.7-5.3)	14.9 (9.8-20.0)	16.6 (14.4-18.8)	5.1 (3.4-6.8)	8.9 (7.4-10.3)	7.9 (5.8-10.1)	10.8 (9.2-12.3)
Total CHD										
Events	119	381	100	143	59	335	83	222	102	256
Incidence rate (95% CI)‡	7.9 (6.4-9.3)	7.5 (6.7-8.3)	7.1 (5.7-8.5)	5.8 (4.9-6.8)	26.7 (19.9-33.5)	25.7 (23.0-28.5)	12.1 (9.5-14.7)	12.9 (11.2-14.6)	15.0 (12.1-17.9)	15.0 (13.2-16.8)
Non-CHD death										
Deaths	211	344	193	158	107	467	284	544	272	525
Mortality rate (95% CI)‡	13.9 (12.1-15.8)	6.8 (6.1-7.5)	13.7 (11.8-15.6)	6.4 (5.4-7.4)	48.3 (39.2-57.5)	35.9 (32.6-39.1)	41.5 (36.7-46.3)	31.7 (29.0-34.4)	40.0 (35.3-44.8)	30.7 (28.1-33.4)

ARIC: Atherosclerosis Risk In Communities; CHD: coronary heart disease; CHS: Cardiovascular Health Study; CI: confidence interval; REGARDS: REasons for Geographic And Racial Differences in Stroke.

* Using the primary definition of CHD.

† Using the secondary definition of CHD which includes myocardial infarction hospitalizations detected through Medicare claims.

‡ Per 1,000 person-years.

The maximum follow-up for all analyses was 11 years. Mean follow-up was 10.2 years in ARIC, 7.3 years among participants 45-64 years of age in REGARDS, 8.3 years in CHS, and 7.1 years among participants ≥65 years of age in REGARDS when using the primary and secondary definitions of CHD.

Supplemental table 4. Incidence rates for fatal, nonfatal and total CHD, and non-CHD mortality among black and white women in ARIC, CHS and REGARDS.

	45-64 years of age				≥65 years of age					
	ARIC		REGARDS		CHS		REGARDS*		REGARDS†	
	Blacks (N=2,551)	Whites (N=5,937)	Blacks (N=3,729)	Whites (N=4,093)	Blacks (N=448)	Whites (N=2,342)	Blacks (N=1,590)	Whites (N=2,522)	Blacks (N=1,590)	Whites (N=2,522)
Fatal CHD										
Events	30	29	36	23	30	115	39	42	37	44
Incidence rate (95% CI)‡	1.1 (0.7-1.5)	0.5 (0.3-0.6)	1.4 (1.0-1.9)	0.8 (0.5-1.1)	7.2 (4.6-9.7)	5.2 (4.2-6.1)	3.6 (2.5-4.7)	2.3 (1.6-3.0)	3.4 (2.3-4.5)	2.5 (1.7-3.2)
Nonfatal CHD										
Events	92	152	68	60	38	163	44	85	77	115
Incidence rate (95% CI)‡	3.5 (2.8-4.2)	2.4 (2.0-2.8)	2.7 (2.0-3.3)	2.0 (1.5-2.5)	9.1 (6.2-12.0)	7.3 (6.2-8.5)	4.1 (2.9-5.3)	4.7 (3.7-5.7)	7.2 (5.6-8.8)	6.4 (5.3-7.6)
Total CHD										
Events	122	181	104	83	68	278	83	127	114	159
Incidence rate (95% CI)‡	4.6 (3.8-5.5)	2.9 (2.4-3.3)	4.1 (3.3-4.9)	2.8 (2.2-3.4)	16.3 (12.4-20.1)	12.5 (11.0-14.0)	7.7 (6.0-9.3)	7.1 (5.8-8.3)	10.6 (8.7-12.5)	8.9 (7.5-10.3)
Non-CHD death										
Deaths	236	272	225	153	104	537	293	431	271	415
Mortality rate (95% CI)‡	9.0 (7.8-10.1)	4.3 (3.8-4.8)	8.8 (7.7-10.0)	5.2 (4.4-6.0)	24.9 (20.1-29.7)	24.2 (22.1-26.2)	27.1 (24.0-30.2)	24.0 (21.8-26.3)	25.2 (22.2-28.2)	23.2 (21.0-25.4)

ARIC: Atherosclerosis Risk In Communities; CHD: coronary heart disease; CHS: Cardiovascular Health Study; CI: confidence interval; REGARDS: REasons for Geographic And Racial Differences in Stroke.

* Using the primary definition of CHD.

† Using the secondary definition of CHD which includes myocardial infarction hospitalizations detected through Medicare claims.

‡ Per 1,000 person-years.

REGARDS study participants ≥65 years of age with incident fatal CHD by the primary definition can have incident nonfatal CHD by the secondary definition if they had a Medicare claim for a myocardial infarction hospitalization >28 days before their death date.

The maximum follow-up for all analyses was 11 years. Mean follow-up was 10.5 years in ARIC, 7.0 years among participants 45-64 years of age in REGARDS, 9.5 years in CHS, and 7.0 among participants ≥65 years of age in REGARDS when using the primary and secondary definition of CHD.

Supplemental table 5. Hazard ratios for fatal, nonfatal and total CHD among black versus white men in ARIC, CHS and REGARDS. Secondary analysis removing competing risk.

	45-64 years of age			≥65 years of age	
	ARIC	REGARDS	CHS	REGARDS*	REGARDS†
	(N=6,479)	(N=5,296)	(N=1,836)	(N=3,381)	(N=3,381)
Fatal CHD, events	111	71	145	118	120
Hazard ratio (95% CI)					
Model 1	2.19 (1.49-3.22)	2.17 (1.36-3.46)	1.43 (0.93-2.18)	1.81 (1.25-2.61)	1.76 (1.22-2.54)
Model 2	1.94 (1.26-3.00)	1.67 (1.02-2.72)	1.20 (0.78-1.86)	1.41 (0.95-2.12)	1.36 (0.91-2.04)
Model 3	1.91 (1.23-2.96)	1.57 (0.96-2.57)	1.15 (0.74-1.80)	1.38 (0.92-2.05)	1.32 (0.89-1.97)
Model 4	1.33 (0.83-2.12)	1.16 (0.68-1.95)	0.95 (0.60-1.50)	1.16 (0.76-1.75)	1.12 (0.74-1.70)
Model 5	1.24 (0.77-2.01)	1.14 (0.67-1.93)	NA	NA	NA
Model 6	1.20 (0.74-1.95)	1.08 (0.63-1.84)	0.90 (0.56-1.43)	1.19 (0.78-1.82)	1.16 (0.76-1.76)
Nonfatal CHD, events	389	172	249	187	238
Hazard ratio (95% CI)					
Model 1	0.87 (0.67-1.11)	0.97 (0.71-1.33)	0.92 (0.64-1.32)	0.59 (0.41-0.85)	0.76 (0.56-1.03)
Model 2	0.70 (0.54-0.93)	0.86 (0.62-1.19)	0.90 (0.62-1.31)	0.61 (0.42-0.90)	0.71 (0.52-0.99)
Model 3	0.67 (0.51-0.89)	0.82 (0.59-1.13)	0.90 (0.62-1.31)	0.60 (0.41-0.88)	0.71 (0.51-0.97)
Model 4	0.65 (0.49-0.87)	0.70 (0.50-0.99)	0.84 (0.57-1.24)	0.55 (0.37-0.82)	0.65 (0.47-0.91)
Model 5	0.66 (0.49-0.88)	0.70 (0.49-0.99)	NA	NA	NA
Model 6	0.65 (0.48-0.87)	0.68 (0.48-0.96)	0.84 (0.57-1.24)	0.55 (0.37-0.81)	0.64 (0.46-0.89)
Total CHD, events	500	243	394	305	358
Hazard ratio (95% CI)					
Model 1	1.10 (0.90-1.36)	1.24 (0.96-1.60)	1.09 (0.82-1.43)	0.97 (0.75-1.24)	1.04 (0.82-1.31)
Model 2	0.91 (0.73-1.15)	1.05 (0.80-1.37)	1.01 (0.76-1.34)	0.89 (0.68-1.17)	0.91 (0.71-1.16)
Model 3	0.88 (0.70-1.11)	1.00 (0.76-1.30)	1.00 (0.75-1.33)	0.87 (0.66-1.14)	0.89 (0.70-1.14)
Model 4	0.78 (0.61-1.00)	0.82 (0.61-1.08)	0.89 (0.66-1.19)	0.77 (0.59-1.03)	0.80 (0.62-1.04)
Model 5	0.77 (0.61-0.99)	0.81 (0.61-1.08)	NA	NA	NA
Model 6	0.76 (0.59-0.97)	0.79 (0.59-1.05)	0.87 (0.65-1.17)	0.78 (0.59-1.03)	0.80 (0.62-1.04)

ARIC: Atherosclerosis Risk In Communities; CHD: coronary heart disease; CHS: Cardiovascular Health Study; CI: confidence interval; NA: not applicable; REGARDS: REasons for Geographic And Racial Differences in Stroke.

* Using the primary definition of CHD.

† Using the secondary definition of CHD which includes myocardial infarction hospitalizations detected through Medicare claims.

Analyses were conducted using Cox-regression and multiple imputation for missing data. The maximum follow-up for all analyses was 11 years. Mean follow-up was 10.2 years in ARIC, 7.3 years among participants 45-64 years of age in REGARDS, 8.3 years in CHS, and 7.1 years among participants ≥65 years of age in REGARDS when using the primary and secondary definitions of CHD.

Model 1 adjusts for age.

Model 2 adjusts for age, education and income levels (and region of residence in REGARDS).

Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference and current smoking.

Model 4 adjusts for covariates in Model 3 plus diabetes, reduced estimated glomerular filtration rate, stroke, systolic blood pressure, use of antihypertensive medications, total and high-density lipoprotein cholesterol, and use of lipid-lowering medication.

Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 years of age (all participants ≥65 years of age had Medicare).

Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation (except in ARIC).

Supplemental table 6. Hazard ratios for fatal, nonfatal and total CHD among black versus white women in ARIC, CHS and REGARDS. Secondary analysis removing competing risk.

	45-64 years of age			≥65 years of age	
	ARIC	REGARDS	CHS	REGARDS*	REGARDS†
	(N=8,488)	(N=7,822)	(N=2,790)	(N=4,112)	(N=4,112)
Fatal CHD, events	59	59	145	81	81
Hazard ratios (95% CI)					
Model 1	2.77 (1.66-4.61)	1.82 (1.08-3.07)	1.18 (0.79-1.77)	1.59 (1.03-2.46)	1.43 (0.93-2.22)
Model 2	1.40 (0.81-2.42)	1.38 (0.80-2.39)	0.95 (0.62-1.44)	1.39 (0.87-2.22)	1.27 (0.80-2.03)
Model 3	1.30 (0.74-2.28)	1.07 (0.62-1.86)	0.75 (0.49-1.16)	1.18 (0.73-1.89)	1.05 (0.65-1.68)
Model 4	0.77 (0.42-1.42)	0.98 (0.55-1.75)	0.64 (0.40-1.01)	1.04 (0.64-1.71)	0.96 (0.59-1.57)
Model 5	0.71 (0.38-1.33)	0.99 (0.55-1.76)	NA	NA	NA
Model 6	0.69 (0.37-1.28)	0.97 (0.54-1.74)	0.63 (0.40-1.01)	1.06 (0.65-1.75)	0.97 (0.59-1.60)
Nonfatal CHD, events	244	128	201	129	192
Hazard ratios (95% CI)					
Model 1	1.53 (1.18-1.98)	1.31 (0.93-1.86)	1.19 (0.83-1.69)	0.87 (0.61-1.26)	1.15 (0.86-1.54)
Model 2	1.00 (0.75-1.33)	1.04 (0.72-1.51)	1.05 (0.73-1.51)	0.77 (0.53-1.14)	0.99 (0.73-1.35)
Model 3	0.94 (0.70-1.26)	0.95 (0.66-1.38)	0.92 (0.63-1.34)	0.69 (0.46-1.02)	0.91 (0.66-1.24)
Model 4	0.73 (0.53-0.99)	0.74 (0.50-1.09)	0.89 (0.60-1.32)	0.67 (0.44-1.00)	0.84 (0.60-1.16)
Model 5	0.70 (0.51-0.96)	0.74 (0.50-1.09)	NA	NA	NA
Model 6	0.69 (0.50-0.95)	0.69 (0.47-1.03)	0.88 (0.59-1.31)	0.68 (0.45-1.03)	0.86 (0.62-1.20)
Total CHD, events	303	187	346	210	273
Hazard ratios (95% CI)					
Model 1	1.72 (1.37-2.17)	1.45 (1.09-1.94)	1.19 (0.91-1.56)	1.11 (0.84-1.46)	1.23 (0.97-1.57)
Model 2	1.07 (0.83-1.38)	1.14 (0.84-1.54)	1.02 (0.77-1.34)	0.98 (0.73-1.31)	1.07 (0.83-1.38)
Model 3	1.00 (0.77-1.30)	0.98 (0.72-1.34)	0.86 (0.65-1.14)	0.85 (0.63-1.15)	0.95 (0.73-1.23)
Model 4	0.73 (0.56-0.97)	0.81 (0.59-1.12)	0.79 (0.58-1.06)	0.80 (0.59-1.09)	0.88 (0.67-1.15)
Model 5	0.70 (0.53-0.93)	0.81 (0.59-1.12)	NA	NA	NA
Model 6	0.68 (0.51-0.91)	0.77 (0.56-1.07)	0.78 (0.58-1.06)	0.82 (0.60-1.12)	0.89 (0.68-1.18)

ARIC: Atherosclerosis Risk In Communities; CHD: coronary heart disease; CHS: Cardiovascular Health Study; CI: confidence interval; NA: not applicable;

REGARDS: REasons for Geographic And Racial Differences in Stroke.

* Using the primary definition of CHD.

† Using the secondary definition of CHD which includes myocardial infarction hospitalizations detected through Medicare claims.

Analyses were conducted using Cox-regression and multiple imputation for missing data. The maximum follow-up for all analyses was 11 years. Mean follow-up was 10.5 years in ARIC, 7.0 years among participants 45-64 years of age in REGARDS, 9.5 years in CHS, and 7.0 years among participants ≥65 years of age in REGARDS when using the primary and secondary definition of CHD.

Model 1 adjusts for age.

Model 2 adjusts for age, education and income levels (and region of residence in REGARDS).

Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference and current smoking.

Model 4 adjusts for covariates in Model 3 plus diabetes, reduced estimated glomerular filtration rate, stroke, systolic blood pressure, use of antihypertensive medications, total and high-density lipoprotein cholesterol, and use of lipid-lowering medication.

Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 years of age (all participants ≥65 years of age had Medicare).

Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation (except in ARIC).

Supplemental table 7. Hazard ratios for fatal, nonfatal and total CHD among black versus white men in ARIC and CHS. Secondary analysis using all available follow-up.

	45-64 years of age ARIC (N=6,479)	≥65 years of age CHS (N=1,836)
Fatal CHD, events	141	252
Incidence rate, blacks (95% CI)*	3.6 (2.6-4.5)	13.7 (9.3-18.0)
Incidence rate, whites (95% CI)*	1.7 (1.4-2.1)	12.2 (10.6-13.8)
Hazard ratio (95% CI)		
Model 1	2.16 (1.54-3.03)	1.06 (0.75-1.50)
Model 2	1.72 (1.18-2.51)	0.99 (0.69-1.41)
Model 3	1.67 (1.15-2.42)	0.99 (0.69-1.41)
Model 4	1.21 (0.80-1.83)	0.92 (0.64-1.33)
Model 5	1.14 (0.74-1.75)	NA
Model 6	1.12 (0.73-1.73)	0.90 (0.62-1.31)
Nonfatal CHD, events	486	356
Incidence rate, blacks (95% CI)*	6.5 (5.2-7.8)	16.9 (12.1-21.7)
Incidence rate, whites (95% CI)*	7.6 (6.9-8.4)	17.6 (15.6-19.6)
Hazard ratio (95% CI)		
Model 1	0.84 (0.68-1.05)	0.84 (0.62-1.13)
Model 2	0.71 (0.55-0.91)	0.85 (0.62-1.16)
Model 3	0.69 (0.54-0.88)	0.87 (0.64-1.19)
Model 4	0.68 (0.52-0.88)	0.87 (0.63-1.19)
Model 5	0.68 (0.52-0.88)	NA
Model 6	0.67 (0.51-0.87)	0.87 (0.63-1.20)
Total CHD, events	627	608
Incidence rate, blacks (95% CI)*	10.1 (8.5-10.2)	29.8 (27.3-32.4)
Incidence rate, whites (95% CI)*	9.3 (8.5-11.7)	30.6 (24.1-37.1)
Hazard ratio (95% CI)		
Model 1	1.08 (0.90-1.29)	0.93 (0.74-1.17)
Model 2	0.89 (0.73-1.09)	0.90 (0.71-1.15)
Model 3	0.86 (0.70-1.06)	0.91 (0.72-1.16)
Model 4	0.77 (0.62-0.96)	0.88 (0.69-1.12)
Model 5	0.76 (0.61-0.94)	NA
Model 6	0.75 (0.60-0.93)	0.87 (0.68-1.11)

ARIC: Atherosclerosis Risk In Communities; CHD: coronary heart disease; CHS: Cardiovascular Health Study; CI: confidence interval; NA: not applicable.

* Per 1,000 person-years.

Analyses were conducted using competing risk regression and multiple imputation for missing data. Mean (maximum) follow-up was 12.1 (15.1) years in ARIC, and 11.1 (21.5) years in CHS.

Model 1 adjusts for age.

Model 2 adjusts for age, and education and income levels.

Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference and current smoking.

Model 4 adjusts for covariates in Model 3 plus diabetes, reduced estimated glomerular filtration rate, stroke, systolic blood pressure, use of antihypertensive medications, total and high-density lipoprotein cholesterol, and use of lipid-lowering medication.

Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 years of age in ARIC (all participants ≥65 years of age in CHS had Medicare).

Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation (except in ARIC).

Supplemental table 8. Hazard ratios for fatal, nonfatal and total CHD among black versus white women in ARIC and CHS. Secondary analysis using all available follow-up.

	45-64 years of age ARIC (N=8,488)	≥65 years of age CHS (N=2,790)
Fatal CHD, events	81	320
Incidence rate, blacks (95% CI)*	1.4 (0.9-1.8)	10.0 (7.4-12.5)
Incidence rate, whites (95% CI)*	0.7 (0.5-9.2)	8.1 (7.1-9.1)
Hazard ratio (95% CI)		
Model 1	2.03 (1.31-3.13)	1.12 (0.84-1.50)
Model 2	1.19 (0.76-1.85)	1.04 (0.77-1.40)
Model 3	1.12 (0.70-1.79)	0.91 (0.67-1.25)
Model 4	0.66 (0.39-1.12)	0.83 (0.60-1.15)
Model 5	0.63 (0.37-1.06)	NA
Model 6	0.60 (0.35-1.02)	0.83 (0.60-1.15)
Nonfatal CHD, events	317	338
Incidence rate, blacks (95% CI)*	4.3 (3.5-5.1)	9.4 (6.9-11.9)
Incidence rate, whites (95% CI)*	3.2 (2.8-3.7)	8.8 (7.7-9.8)
Hazard ratio (95% CI)		
Model 1	1.37 (1.09-1.73)	1.04 (0.78-1.40)
Model 2	1.00 (0.77-1.31)	0.99 (0.73-1.33)
Model 3	0.94 (0.72-1.24)	0.94 (0.70-1.27)
Model 4	0.76 (0.57-1.01)	0.98 (0.72-1.35)
Model 5	0.74 (0.55-0.99)	NA
Model 6	0.73 (0.55-0.98)	0.97 (0.71-1.33)
Total CHD, events	398	658
Incidence rate, blacks (95% CI)*	5.7 (4.8-6.6)	19.4 (15.8-23.0)
Incidence rate, whites (95% CI)*	3.9 (3.5-4.4)	16.9 (15.4-18.3)
Hazard ratio (95% CI)		
Model 1	1.47 (1.20-1.80)	1.11 (0.90-1.36)
Model 2	1.02 (0.81-1.29)	1.03 (0.83-1.27)
Model 3	0.96 (0.76-1.22)	0.94 (0.75-1.16)
Model 4	0.72 (0.56-0.92)	0.91 (0.72-1.14)
Model 5	0.69 (0.54-0.90)	NA
Model 6	0.68 (0.53-0.88)	0.90 (0.72-1.13)

ARIC: Atherosclerosis Risk In Communities; CHD: coronary heart disease; CHS: Cardiovascular Health Study; CI: confidence interval; NA: not applicable.

* Per 1,000 person-years.

Analyses were conducted using competing risk regression and multiple imputation for missing data. Mean (maximum) follow-up was 12.6 (15.1) years in ARIC, and 13.7 (21.5) years in CHS.

Model 1 adjusts for age.

Model 2 adjusts for age, and education and income levels.

Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference and current smoking.

Model 4 adjusts for covariates in Model 3 plus diabetes, reduced estimated glomerular filtration rate, stroke, systolic blood pressure, use of antihypertensive medications, total and high-density lipoprotein cholesterol, and use of lipid-lowering medication.

Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 years of age in ARIC (all participants ≥65 years of age in CHS had Medicare).

Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation (except in ARIC).

Supplemental table 9. Hazard ratios for fatal, nonfatal and total CHD among black versus white men in ARIC and CHS. Secondary analysis including incident unrecognized myocardial infarctions in the definition of incident nonfatal CHD.

	45-64 years of age ARIC (N=6,479)	≥65 years of age CHS (N=1,836)
Fatal CHD, events	106	139
Incidence rate, blacks (95% CI)*	2.7 (1.8-3.5)	11.8 (7.2-16.3)
Incidence rate, whites (95% CI)*	1.3 (1.0-1.6)	8.8 (7.2-10.4)
Hazard ratio (95% CI)		
Model 1	2.07 (1.39-3.07)	1.39 (0.90-2.14)
Model 2	1.84 (1.21-2.80)	1.26 (0.81-1.96)
Model 3	1.82 (1.20-2.75)	1.27 (0.82-1.97)
Model 4	1.27 (0.79-2.02)	1.10 (0.69-1.75)
Model 5	1.18 (0.72-1.93)	NA
Model 6	1.16 (0.71-1.89)	1.07 (0.68-1.70)
Nonfatal CHD, events	452	284
Incidence rate, blacks (95% CI)*	6.2 (5.0-7.5)	14.9 (9.8-20.0)
Incidence rate, whites (95% CI)*	7.1 (6.3-7.8)	19.5 (17.1-21.9)
Hazard ratio (95% CI)		
Model 1	0.87 (0.69-1.09)	0.72 (0.50-1.04)
Model 2	0.75 (0.58-0.97)	0.71 (0.49-1.03)
Model 3	0.73 (0.56-0.94)	0.70 (0.48-1.02)
Model 4	0.67 (0.51-0.89)	0.66 (0.45-0.96)
Model 5	0.67 (0.51-0.89)	NA
Model 6	0.66 (0.50-0.88)	0.66 (0.45-0.97)
Total CHD, events	558	423
Incidence rate, blacks (95% CI)*	8.9 (7.4-10.4)	26.7 (19.9-33.5)
Incidence rate, whites (95% CI)*	8.4 (7.6-9.2)	28.3 (25.4-31.2)
Hazard ratio (95% CI)		
Model 1	1.06 (0.87-1.29)	0.92 (0.70-1.22)
Model 2	0.92 (0.74-1.14)	0.87 (0.66-1.16)
Model 3	0.89 (0.71-1.10)	0.86 (0.65-1.15)
Model 4	0.77 (0.61-0.97)	0.78 (0.58-1.05)
Model 5	0.75 (0.60-0.96)	NA
Model 6	0.74 (0.58-0.94)	0.77 (0.58-1.04)

ARIC: Atherosclerosis Risk In Communities; CHD: coronary heart disease; CHS: Cardiovascular Health Study; CI: confidence interval; NA: not applicable.

* Per 1,000 person-years.

Analyses were conducted using competing risk regression and multiple imputation for missing data. The maximum follow-up for all analyses was 11 years. Mean follow-up was 10.2 years in ARIC, and 8.3 years in CHS.

Model 1 adjusts for age.

Model 2 adjusts for age, and education and income levels.

Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference and current smoking.

Model 4 adjusts for covariates in Model 3 plus diabetes, reduced estimated glomerular filtration rate, stroke, systolic blood pressure, use of antihypertensive medications, total and high-density lipoprotein cholesterol, and use of lipid-lowering medication.

Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 years of age in ARIC (all participants ≥65 years of age in CHS had Medicare).

Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation (except in ARIC).

Supplemental table 10. Hazard ratios for fatal, nonfatal and total CHD among black versus white women in ARIC and CHS. Secondary analysis including incident unrecognized myocardial infarctions in the definition of incident nonfatal CHD.

	45-64 years of age ARIC (N=8,488)	≥65 years of age CHS (N=2,790)
Fatal CHD, events	57	140
Incidence rate, blacks (95% CI)*	1.1 (0.7-1.5)	7.0 (4.4-9.5)
Incidence rate, whites (95% CI)*	0.5 (0.3-0.6)	5.0 (4.1-6.0)
Hazard ratio (95% CI)		
Model 1	2.44 (1.45-4.09)	1.22 (0.81-1.85)
Model 2	1.30 (0.77-2.18)	1.01 (0.66-1.57)
Model 3	1.21 (0.69-2.11)	0.82 (0.52-1.28)
Model 4	0.74 (0.40-1.37)	0.75 (0.46-1.21)
Model 5	0.69 (0.37-1.27)	NA
Model 6	0.63 (0.33-1.20)	0.75 (0.46-1.22)
Nonfatal CHD, events	280	228
Incidence rate, blacks (95% CI)*	4.0 (3.2-4.7)	10.1 (7.0-13.1)
Incidence rate, whites (95% CI)*	2.8 (2.4-3.2)	8.4 (7.2-9.6)
Hazard ratio (95% CI)		
Model 1	1.44 (1.13-1.83)	1.16 (0.84-1.62)
Model 2	0.99 (0.75-1.30)	1.03 (0.73-1.45)
Model 3	0.93 (0.70-1.24)	0.94 (0.66-1.34)
Model 4	0.74 (0.55-1.00)	0.91 (0.63-1.32)
Model 5	0.72 (0.53-0.97)	NA
Model 6	0.70 (0.52-0.95)	0.90 (0.62-1.30)
Total CHD, events	337	368
Incidence rate, blacks (95% CI)*	5.0 (4.2-5.9)	17.1 (13.1-21.0)
Incidence rate, whites (95% CI)*	3.3 (2.8-3.7)	13.5 (11.9-15.0)
Hazard ratio (95% CI)		
Model 1	1.59 (1.27-1.98)	1.20 (0.93-1.55)
Model 2	1.04 (0.81-1.33)	1.04 (0.79-1.35)
Model 3	0.98 (0.76-1.26)	0.89 (0.68-1.18)
Model 4	0.74 (0.56-0.96)	0.85 (0.63-1.13)
Model 5	0.70 (0.53-0.92)	NA
Model 6	0.68 (0.52-0.90)	0.84 (0.63-1.13)

ARIC: Atherosclerosis Risk In Communities; CHD: coronary heart disease; CHS: Cardiovascular Health Study; CI: confidence interval; NA: not applicable.

* Per 1,000 person-years.

Analyses were conducted using competing risk regression and multiple imputation for missing data. The maximum follow-up for all analyses was 11 years. Mean follow-up was 10.5 years in ARIC, and 9.5 years in CHS.

Model 1 adjusts for age.

Model 2 adjusts for age, and education and income levels.

Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference and current smoking.

Model 4 adjusts for covariates in Model 3 plus diabetes, reduced estimated glomerular filtration rate, stroke, systolic blood pressure, use of antihypertensive medications, total and high-density lipoprotein cholesterol, and use of lipid-lowering medication.

Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 years of age in ARIC (all participants ≥65 years of age in CHS had Medicare).

Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation (except in ARIC).

Supplemental table 11. Hazard ratios for out-of-hospital and post-admission fatal CHD among black versus white men in REGARDS.

	45-64 years of age REGARDS (N=5,296)	≥65 years of age REGARDS* (N=3,381)	REGARDS† (N=3,381)
Out-of-hospital fatal CHD, events	50	66	65
Incidence rate, blacks (95% CI)‡	2.0 (1.3-2.7)	3.8 (2.3-5.3)	3.7 (2.2-5.1)
Incidence rate, whites (95% CI)‡	0.9 (0.5-1.3)	2.3 (1.6-3.1)	2.3 (1.6-3.1)
Hazard ratio (95% CI)			
Model 1	2.21 (1.26-3.87)	1.60 (0.98-2.62)	1.54 (0.93-2.54)
Model 2	1.69 (0.95-3.00)	1.16 (0.70-1.94)	1.09 (0.65-1.82)
Model 3	1.60 (0.89-2.88)	1.16 (0.70-1.92)	1.09 (0.66-1.80)
Model 4	1.20 (0.62-2.29)	0.99 (0.59-1.64)	0.94 (0.56-1.58)
Model 5	1.18 (0.61-2.28)	NA	NA
Model 6	1.15 (0.60-2.22)	1.06 (0.62-1.79)	1.00 (0.58-1.70)
Post-admission fatal CHD, events	21	52	55
Incidence rate, blacks (95% CI)‡	0.8 (0.3-1.2)	3.2 (1.9-4.6)	3.4 (2.0-4.8)
Incidence rate, whites (95% CI)‡	0.4 (0.2-0.7)	1.7 (1.1-2.4)	1.9 (1.2-2.5)
Hazard ratio (95% CI)			
Model 1	1.88 (0.79-4.47)	1.84 (1.06-3.19)	1.80 (1.05-3.07)
Model 2	1.57 (0.63-3.91)	1.69 (0.94-3.01)	1.66 (0.94-2.94)
Model 3	1.46 (0.58-3.70)	1.63 (0.93-2.88)	1.59 (0.91-2.77)
Model 4	1.09 (0.36-3.34)	1.40 (0.77-2.55)	1.42 (0.77-2.60)
Model 5	1.08 (0.36-3.26)	NA	NA
Model 6	1.02 (0.34-3.11)	1.39 (0.76-2.54)	1.40 (0.76-2.57)

CHD: coronary heart disease; CI: confidence interval; NA: not applicable; REGARDS: REasons for Geographic And Racial Differences in Stroke.

* Using the primary definition of CHD.

† Using the secondary definition of CHD which includes myocardial infarction hospitalizations detected through Medicare claims.

‡ Per 1,000 person-years.

Analyses were conducted using competing risk regression and multiple imputation for missing data. Hazard ratios for out-of-hospital fatal CHD account for competing risk due to post-admission fatal CHD, nonfatal CHD and non-CHD death. Hazard ratios for post-admission fatal CHD account for competing risk due to out-of-hospital fatal CHD, nonfatal CHD and non-CHD death. The maximum follow-up for all analyses was 11 years. Mean follow-up was 7.3 years among participants 45-64 years of age in REGARDS, and 7.1 years among participants ≥65 years of age in REGARDS when using the primary and secondary definitions of CHD.

Model 1 adjusts for age.

Model 2 adjusts for age, education and income levels and region of residence.

Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference and current smoking.

Model 4 adjusts for covariates in Model 3 plus diabetes, reduced estimated glomerular filtration rate, stroke, systolic blood pressure, use of antihypertensive medications, total and high-density lipoprotein cholesterol, and use of lipid-lowering medication.

Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 years of age (all participants ≥65 years of age had Medicare).

Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation.

Supplemental table 12. Hazard ratios for out-of-hospital and post-admission fatal CHD among black versus white women in REGARDS.

	45-64 years of age REGARDS (N=5,296)	≥65 years of age REGARDS* (N=3,381)	REGARDS† (N=3,381)
Out-of-hospital fatal CHD, events	38	45	43
Incidence rate, blacks (95% CI)‡	1.0 (0.6-1.4)	1.8 (1.0-2.5)	1.7 (0.9-2.4)
Incidence rate, whites (95% CI)‡	0.4 (0.2-0.7)	1.4 (0.9-2.0)	1.4 (0.9-1.9)
Hazard ratio (95% CI)			
Model 1	2.18 (1.11-4.29)	1.23 (0.68-2.23)	1.21 (0.66-2.23)
Model 2	1.70 (0.82-3.51)	1.15 (0.59-2.22)	1.16 (0.59-2.28)
Model 3	1.30 (0.63-2.66)	1.03 (0.55-1.95)	1.04 (0.54-2.00)
Model 4	1.26 (0.58-2.78)	0.91 (0.47-1.78)	0.94 (0.48-1.85)
Model 5	1.27 (0.58-2.80)	NA	NA
Model 6	1.27 (0.57-2.82)	0.91 (0.46-1.79)	0.95 (0.48-1.89)
Post-admission fatal CHD, events	21	36	38
Incidence rate, blacks (95% CI)‡	0.4 (0.2-0.7)	1.8 (1.0-2.7)	1.8 (1.0-2.5)
Incidence rate, whites (95% CI)‡	0.3 (0.1-0.5)	0.9 (0.5-1.3)	1.1 (0.6-1.5)
Hazard ratio (95% CI)			
Model 1	1.27 (0.54-2.99)	2.10 (1.09-4.07)	1.66 (0.88-3.14)
Model 2	0.97 (0.41-2.33)	1.73 (0.83-3.59)	1.38 (0.67-2.84)
Model 3	0.79 (0.32-1.94)	1.41 (0.69-2.86)	1.08 (0.53-2.20)
Model 4	0.68 (0.27-1.71)	1.27 (0.59-2.74)	1.01 (0.47-2.14)
Model 5	0.68 (0.27-1.72)	NA	NA
Model 6	0.66 (0.26-1.70)	1.32 (0.59-2.95)	0.61 (0.24-1.56)

CHD: coronary heart disease; CI: confidence interval; NA: not applicable; REGARDS: REasons for Geographic And Racial Differences in Stroke.

* Using the primary definition of CHD.

† Using the secondary definition of CHD which includes myocardial infarction hospitalizations detected through Medicare claims.

‡ Per 1,000 person-years.

Analyses were conducted using competing risk regression and multiple imputation for missing data. Hazard ratios for out-of-hospital fatal CHD account for competing risk due to post-admission fatal CHD, nonfatal CHD and non-CHD death. Hazard ratios for post-admission fatal CHD account for competing risk due to out-of-hospital fatal CHD, nonfatal CHD and non-CHD death. The mean (maximum) follow-up for all analyses was 7.0 (11) years.

Model 1 adjusts for age.

Model 2 adjusts for age, education and income levels and region of residence.

Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference and current smoking.

Model 4 adjusts for covariates in Model 3 plus diabetes, reduced estimated glomerular filtration rate, stroke, systolic blood pressure, use of antihypertensive medications, total and high-density lipoprotein cholesterol, and use of lipid-lowering medication.

Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 years of age (all participants ≥65 years of age had Medicare).

Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation.

Supplemental table 13. Case-fatality among black versus white men with incident CHD in ARIC and CHS. Secondary analysis using all available follow-up.

	45-64 years of age ARIC	≥65 years of age CHS
Case-fatality (fatal CHD / total CHD)		
Blacks	35.3% (54 / 153)	44.7% (38 / 85)
Whites	18.4% (87 / 474)	40.1 % (214 / 523)
Case-fatality ratio (95% CI)*		
Model 1	1.97 (1.49-2.62)	1.11 (0.86-1.43)
Model 2	1.88 (1.36-2.61)	1.07 (0.83-1.38)
Model 3	1.89 (1.36-2.63)	1.05 (0.81-1.36)
Model 4	1.52 (1.06-2.19)	1.00 (0.76-1.32)
Model 5	1.48 (1.02-2.16)	NA
Model 6	1.48 (1.01-2.15)	0.99 (0.75-1.30)

ARIC: Atherosclerosis Risk In Communities; CHD: coronary heart disease; CHS:

Cardiovascular Health Study; CI: confidence interval; NA: not applicable.

* Case-fatality ratios were calculated comparing blacks versus whites (reference group).

Analyses were conducted using multiple imputation for missing data.

Model 1 adjusts for age.

Model 2 adjusts for age, and education and income levels.

Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference and current smoking.

Model 4 adjusts for covariates in Model 3 plus diabetes, reduced estimated glomerular filtration rate, stroke, systolic blood pressure, use of antihypertensive medications, total and high-density lipoprotein cholesterol, and use of lipid-lowering medication.

Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 years of age in ARIC (all participants ≥65 years of age in CHS had Medicare).

Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation (except in ARIC).

Supplemental table 14. Case-fatality among black versus white women with incident CHD in ARIC and CHS. Secondary analysis using all available follow-up.

	45-64 years of age ARIC	≥65 years of age CHS
Case-fatality (fatal CHD / total CHD)		
Blacks	24.2% (36 / 149)	51.4 % (57 / 111)
Whites	18.1% (45 / 249)	48.1% (263 / 547)
Case-fatality ratio (95% CI)*		
Model 1	1.35 (0.92-1.99)	1.02 (0.83-1.25)
Model 2	1.12 (0.76-1.65)	1.01 (0.82-1.25)
Model 3	1.16 (0.77-1.73)	0.98 (0.79-1.21)
Model 4	0.90 (0.59-1.36)	0.92 (0.74-1.15)
Model 5	0.90 (0.59-1.39)	NA
Model 6	0.89 (0.57-1.38)	0.92 (0.74-1.16)

ARIC: Atherosclerosis Risk In Communities; CHD: coronary heart disease; CHS:

Cardiovascular Health Study; CI: confidence interval; NA: not applicable.

* Case-fatality ratios were calculated comparing blacks versus whites (reference group).

Analyses were conducted using multiple imputation for missing data.

Model 1 adjusts for age.

Model 2 adjusts for age, and education and income levels.

Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference and current smoking.

Model 4 adjusts for covariates in Model 3 plus diabetes, reduced estimated glomerular filtration rate, stroke, systolic blood pressure, use of antihypertensive medications, total and high-density lipoprotein cholesterol, and use of lipid-lowering medication.

Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 years of age in ARIC (all participants ≥65 years of age in CHS had Medicare).

Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation (except in ARIC).

Supplemental table 15. Case-fatality among black versus white men with incident CHD in ARIC and CHS. Secondary analysis including incident unrecognized myocardial infarctions in the definition of incident nonfatal CHD.

	45-64 years of age ARIC	≥65 years of age CHS
Case-fatality (fatal CHD / total CHD)		
Blacks	29.9% (40 / 134)	44.1% (26 / 59)*
Whites	15.6% (66 / 424)	31.0% (113 / 364)
Case-fatality ratio (95% CI)†		
Model 1	1.92 (1.37-2.70)	1.45 (1.06-2.00)
Model 2	1.96 (1.35-2.85)	1.41 (1.01-1.95)
Model 3	2.02 (1.38-2.96)	1.41 (1.02-1.97)
Model 4	1.67 (1.09-2.55)	1.32 (0.93-1.88)
Model 5	1.58 (1.02-2.46)	NA
Model 6	1.59 (1.03-2.46)	1.28 (0.90-1.83)

ARIC: Atherosclerosis Risk In Communities; CHD: coronary heart disease; CHS:

Cardiovascular Health Study; CI: confidence interval; NA: not applicable.

* Only 1 incident unrecognized myocardial infarction was included in the analysis among black men in CHS. This unrecognized myocardial infarction was detected in a participant who was already classified as having an incident nonfatal CHD event in the main analysis.

† Case-fatality ratios were calculated comparing blacks versus whites (reference group).

Analyses were conducted using competing risk regression and multiple imputation for missing data.

Model 1 adjusts for age.

Model 2 adjusts for age, and education and income levels.

Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference and current smoking.

Model 4 adjusts for covariates in Model 3 plus diabetes, reduced estimated glomerular filtration rate, stroke, systolic blood pressure, use of antihypertensive medications, total and high-density lipoprotein cholesterol, and use of lipid-lowering medication.

Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 years of age in ARIC (all participants ≥65 years of age in CHS had Medicare).

Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation (except in ARIC).

Supplemental table 16. Case-fatality among black versus white women with incident CHD in ARIC and CHS. Secondary analysis including incident unrecognized myocardial infarctions in the definition of incident nonfatal CHD.

	45-64 years of age ARIC	≥65 years of age CHS
Case-fatality (fatal CHD / total CHD)		
Blacks	21.2% (28 / 132)	40.8% (29 / 71)
Whites	14.1% (29 / 205)	37.4% (111 / 297)
Case-fatality ratio (95% CI)*		
Model 1	1.55 (0.97-2.46)	1.01 (0.72-1.40)
Model 2	1.25 (0.78-1.99)	0.98 (0.70-1.36)
Model 3	1.25 (0.76-2.04)	0.92 (0.65-1.30)
Model 4	1.07 (0.65-1.76)	0.89 (0.63-1.26)
Model 5	1.11 (0.66-1.85)	NA
Model 6	1.05 (0.61-1.80)	0.92 (0.64-1.31)

ARIC: Atherosclerosis Risk In Communities; CHD: coronary heart disease; CHS:

Cardiovascular Health Study; CI: confidence interval; NA: not applicable.

* Case-fatality ratios were calculated comparing blacks versus whites (reference group).

Analyses were conducted using multiple imputation for missing data.

Model 1 adjusts for age.

Model 2 adjusts for age, and education and income levels.

Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference and current smoking.

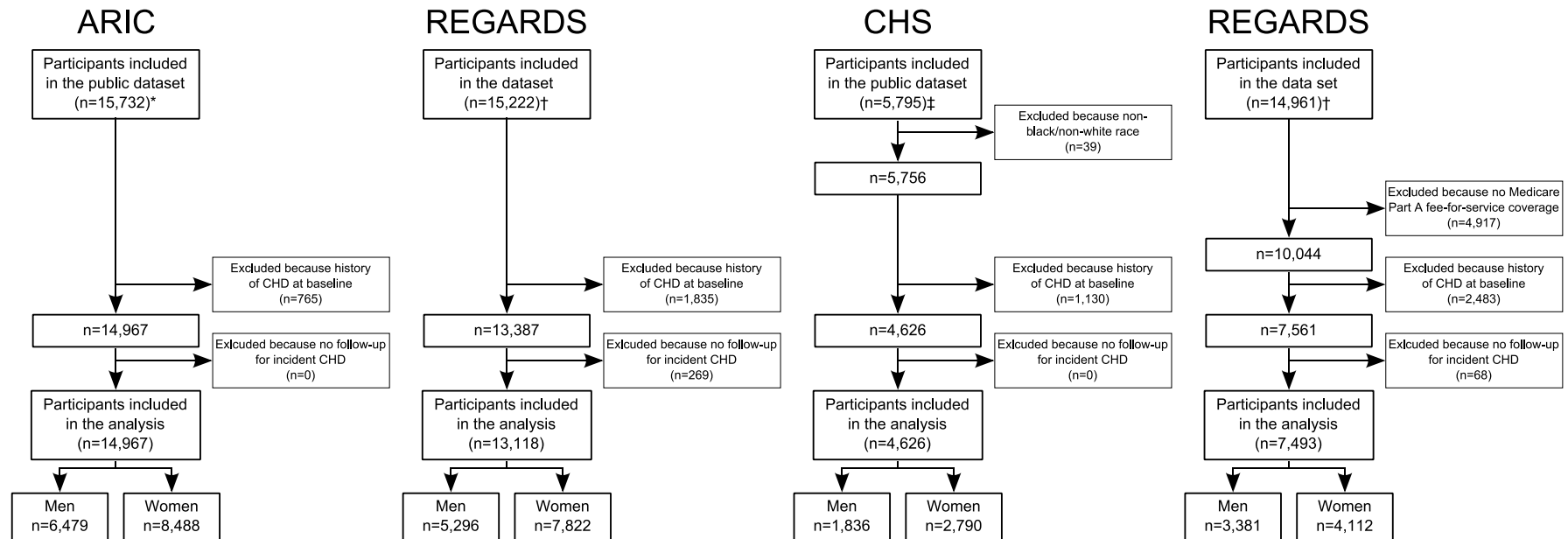
Model 4 adjusts for covariates in Model 3 plus diabetes, reduced estimated glomerular filtration rate, stroke, systolic blood pressure, use of antihypertensive medications, total and high-density lipoprotein cholesterol, and use of lipid-lowering medication.

Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 years of age in ARIC (all participants ≥65 years of age in CHS had Medicare).

Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation (except in ARIC).

Supplemental figure 1. Flow-chart of ARIC, CHS and REGARDS study participants included in the analysis.

45-64 years of age ≥65 years of age

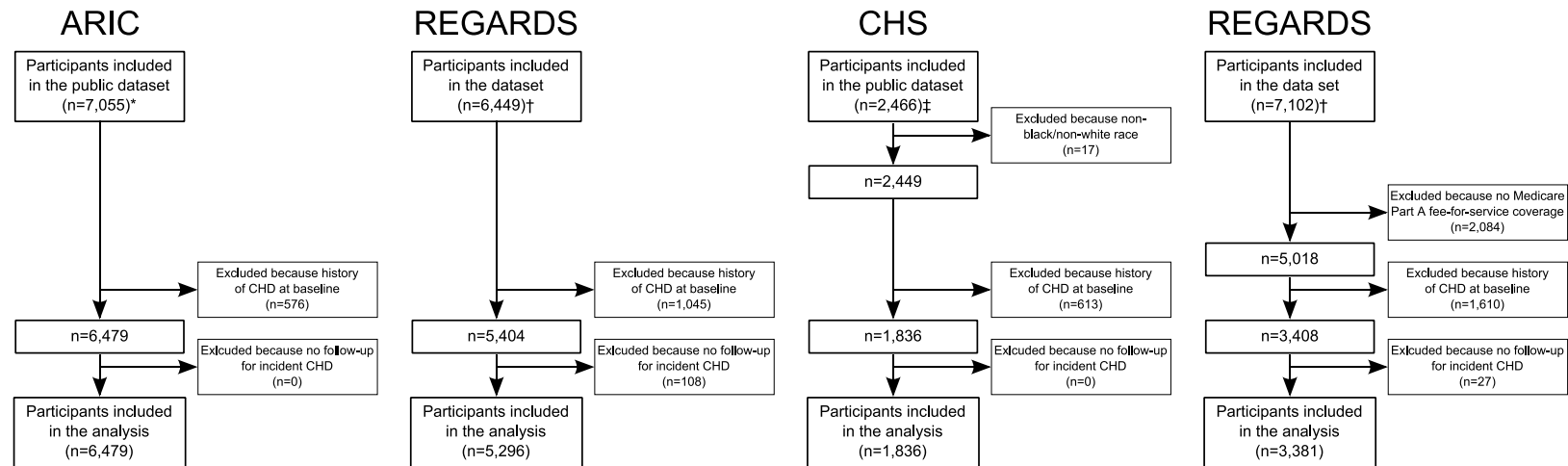


ARIC: Atherosclerosis Risk In Communities; CHD: coronary heart disease; CHS: Cardiovascular Health Study; REGARDS: REasons for Geographic And Racial Differences in Stroke. * After excluding 60 ARIC study participants who did not allow their data to be released in the publicly available dataset. † After excluding 56 REGARDS study participants with anomalies in their informed consent. ‡ After excluding 93 CHS participants who did not allow their data to be released in the publicly available dataset.

Supplemental figure 2. Flow-chart of ARIC, CHS and REGARDS study participants included in the analysis by gender.**MEN**

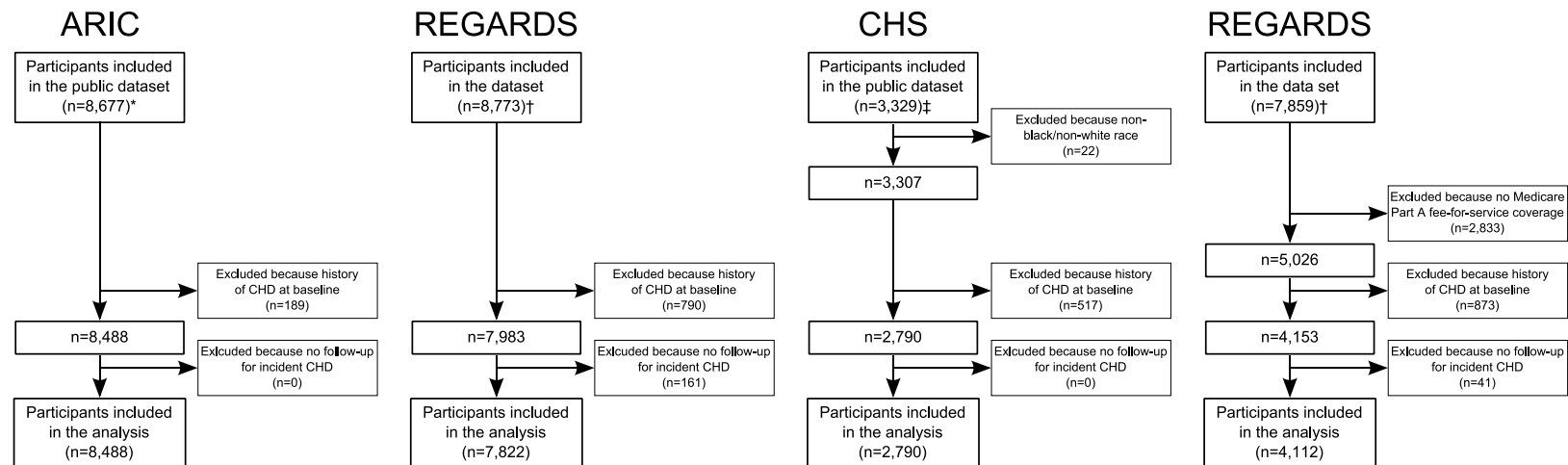
45-64 years of age

≥65 years of age

**WOMEN**

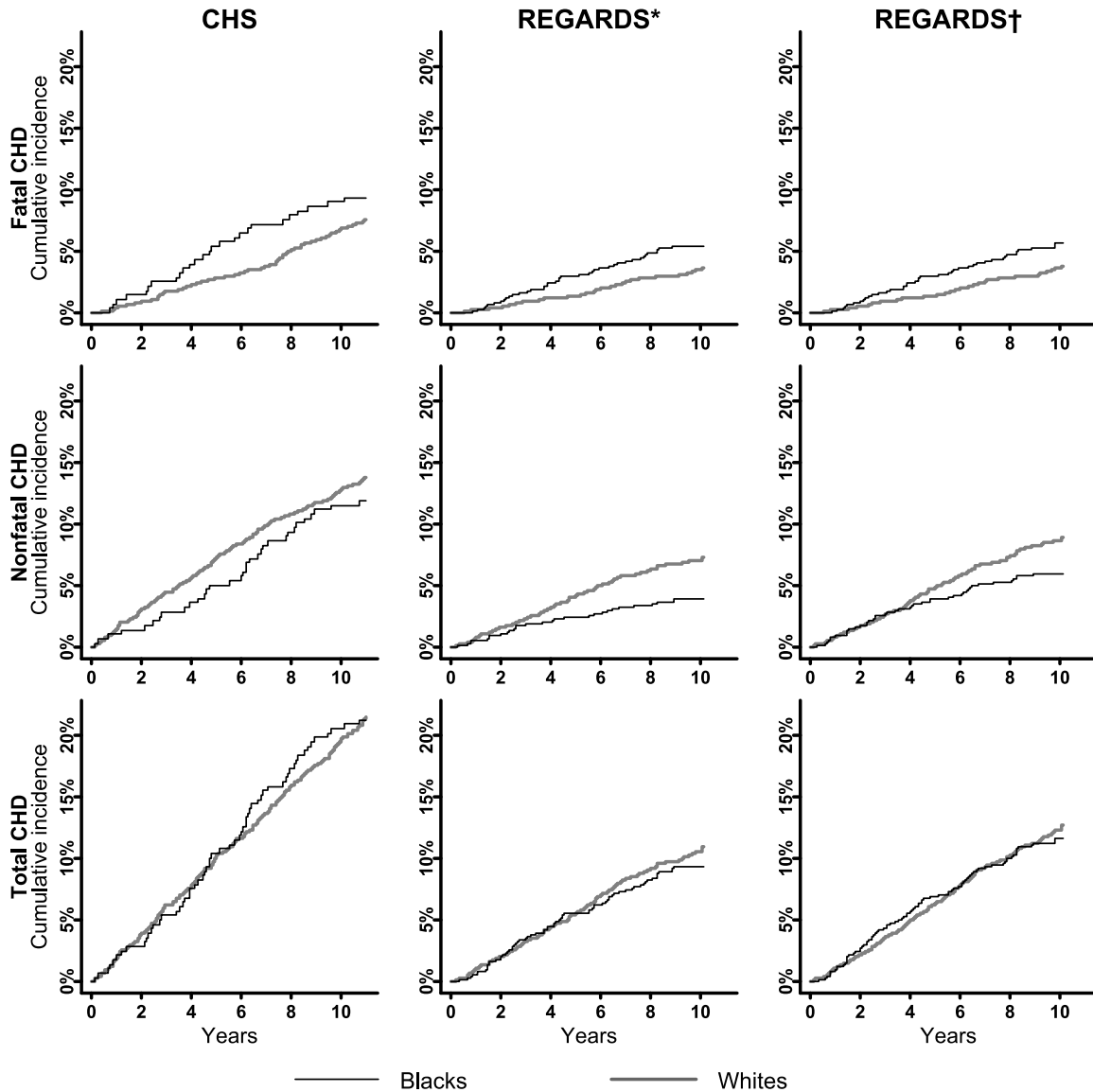
45-64 years of age

≥65 years of age



ARIC: Atherosclerosis Risk In Communities; CHD: coronary heart disease; CHS: Cardiovascular Health Study; REGARDS: REasons for Geographic And Racial Differences in Stroke. * After excluding 60 ARIC study participants who did not allow their data to be released in the publicly available dataset. † After excluding 56 REGARDS study participants with anomalies in their informed consent. ‡ After excluding 93 CHS participants who did not allow their data to be released in the publicly available dataset.

Supplemental figure 3. Cumulative incidence of fatal, nonfatal and total CHD among black and white men ≥ 65 years of age in CHS and REGARDS.



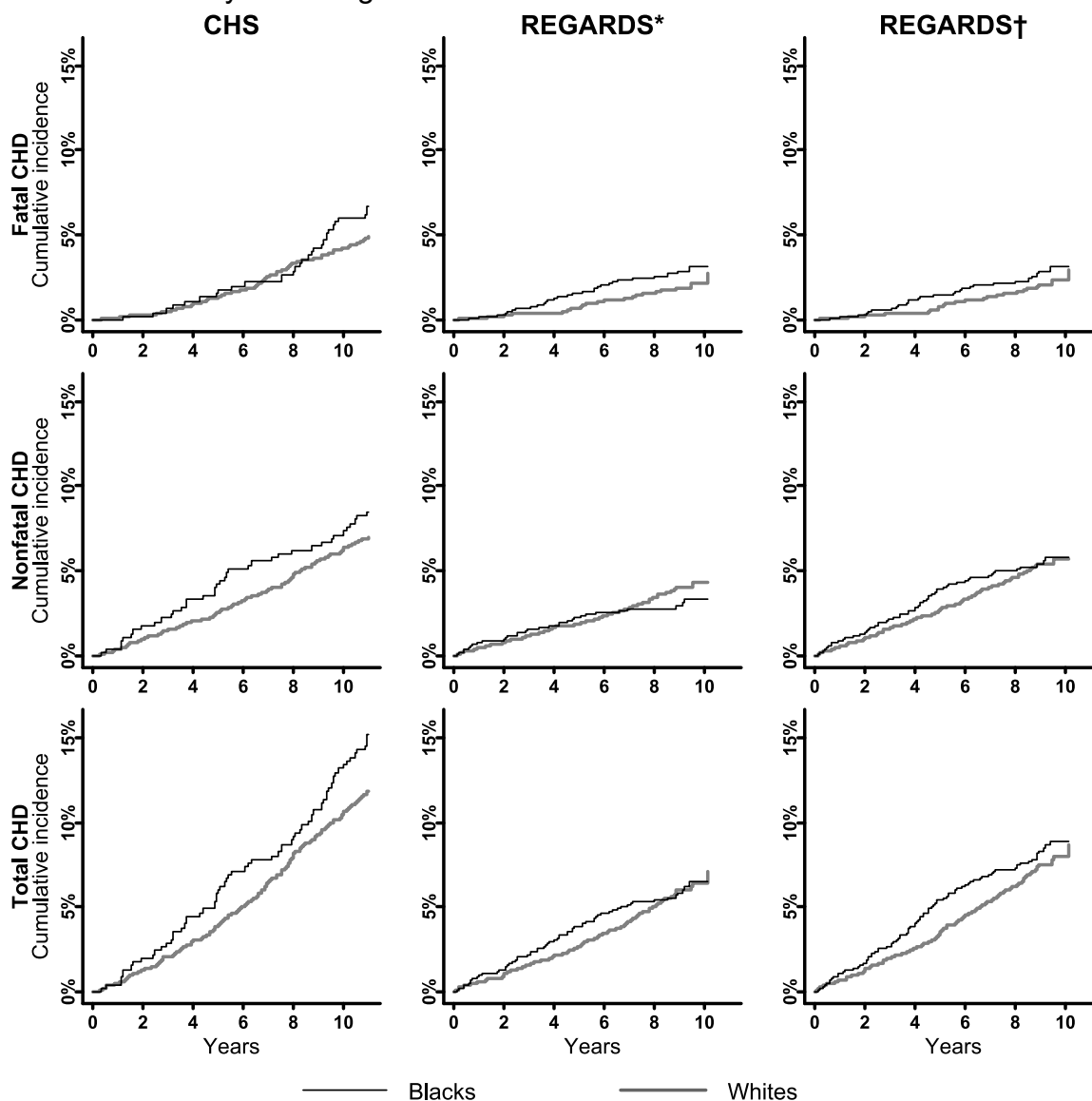
CHD: coronary heart disease; CHS: Cardiovascular Health Study; REGARDS: REasons for Geographic And Racial Differences in Stroke.

* Using the primary definition of CHD.

† Using the secondary definition of CHD which includes myocardial infarction hospitalizations detected through Medicare claims.

The maximum follow-up for all analyses was 11 years. Mean follow-up was 8.3 years in CHS, and 7.1 years among participants in REGARDS when using the primary and secondary definitions of CHD.

Supplemental figure 4. Cumulative incidence of fatal, nonfatal and total CHD among black and white women ≥ 65 years of age in CHS and REGARDS.



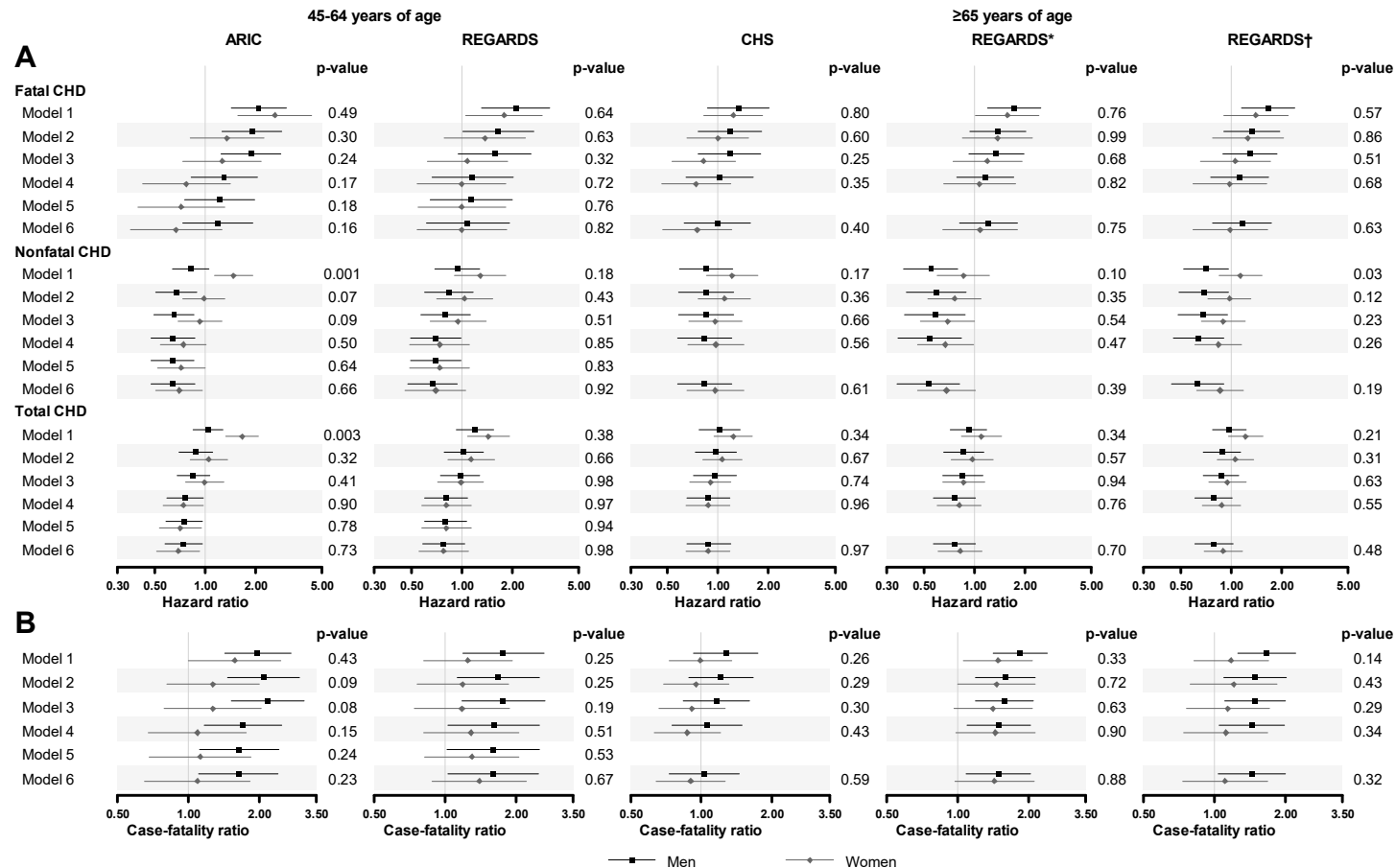
CHD: coronary heart disease; CHS: Cardiovascular Health Study; REGARDS: REasons for Geographic And Racial Differences in Stroke.

* Using the primary definition of CHD.

† Using the secondary definition of CHD which includes myocardial infarction hospitalizations detected through Medicare claims.

The maximum follow-up for all analyses was 11 years. Mean follow-up was 9.5 years in CHS, and 7.0 years in REGARDS when using the primary and secondary definition of CHD.

Supplemental figure 5. P-values for gender differences on hazard ratios for incident CHD (Panel A) and case-fatality (Panel B) comparing blacks versus whites.



ARIC: Atherosclerosis Risk In Communities; CHD: coronary heart disease; CHS: Cardiovascular Health Study; REGARDS: REasons for Geographic And Racial Differences in Stroke.

* Using the primary definition of CHD.

† Using the secondary definition of CHD which includes myocardial infarction hospitalizations detected through Medicare claims.

Hazard ratios were estimated using competing risk regression. All analyses were conducted using multiple imputation. Model 1 adjusts for age. Model 2 adjusts for age, education and income levels (and region of residence in REGARDS). Model 3 adjusts for covariates in Model 2 plus alcohol consumption, physical activity, waist circumference and current smoking. Model 4 adjusts for covariates in Model 3 plus diabetes, reduced estimated glomerular filtration rate, stroke, systolic blood pressure, use of antihypertensive medications, total and high-density lipoprotein cholesterol, and use of lipid-lowering medication. Model 5 adjusts for covariates in Model 4 plus health insurance among participants <65 years of age (all participants ≥65 years of age had Medicare). Model 6 adjusts for covariates in Model 5 plus left ventricular hypertrophy and atrial fibrillation (except in ARIC).