Race-Ethnic Differences in the Extent, Prevalence, and Progression of Coronary Calcium

Miwa Kawakubo, MS; Laurie LaBree, MS; Min Xiang, MS; Terence M. Doherty, BA; Nathan D. Wong, PhD; Stanley Azen, PhD; Robert Detrano, MD, PhD

Objective: To compare across four race-ethnic groups the baseline prevalence and extent of coronary calcium and the 7-year rate of progression in the extent of coronary calcium.

Design: The South Bay Heart Watch is a prospective cohort study designed to appraise the value of coronary calcium for predicting cardiovascular outcomes in asymptomatic adults with cardiac risk factors. Statistical analyses were conducted to evaluate ethnic differences in the prevalence, extent, and progression of coronary calcium among Caucasian, African-American, Hispanic, and Asian participants.

Setting: Population-based study.

Patients or Participants: Between December 1990 and December 1992, 1289 participants without coronary heart disease underwent baseline risk factor screening and computed tomography for coronary calcification (Cohort 1). Seven years later, 828 (64%) participants returned for follow-up evaluation and re-scanning (Cohort 2).

Main Outcome Measures: Prevalence, extent, and progression of coronary artery calcium.

Results: In Cohort 2, compared to Whites, African Americans had a lower prevalence of coronary calcium at baseline ($P=.012$) and follow-up ($P=.005$), smaller calcium scores at baseline ($P=.005$) and follow-up ($P=.0004$), and less progression ($P=.001$); Hispanics had a lower prevalence of coronary calcium at follow-up ($P=.04$) with smaller calcium scores ($P=.011$), and less progression ($P=.009$). In contrast, no differences were seen between Whites and Asian/Pacific Islanders. Race-ethnic differences in progression persisted after adjusting for risk factors and participation bias ($P<.05$).

Conclusions: The present results lend further credence to the notion that race-ethnic differences exist in the prevalence and rate of progression of coronary calcification. The relationship between calcification and the incidence of coronary heart disease in these race-ethnic groups needs further exploration. (*Ethn Dis*. 2005;15:198–204)

Key Words: Coronary Calcium, Coronary Heart Disease, Ethnicity

Introduction

Coronary artery calcification, as measured by coronary calcium—a component of coronary atherosclerosis—is lower in African Americans when compared to Whites,[1–7] despite poorer coronary heart disease outcomes in African Americans.[1] One study suggested that the difference in prevalence and extent of coronary calcium is partially explained by differences in vitamin D metabolism.[8] Autopsy and other studies of subclinical cardiovascular disease and mortality and incidence statistics reveal other race-ethnic differences in atherosclerotic disease, but the results are not consistent.[9–15] Past research has not addressed the question as to whether race-ethnic differences in the extent and prevalence of calcification, and indeed of atherosclerosis itself, can be completely explained by later onset of coronary calcification or by race-ethnic differences in the rates of progression of coronary calcium. This study is the first to demonstrate ethnic differences in the progression of coronary calcium.

A strong correlational relationship in coronary calcium and atherosclerosis has been demonstrated.[16] In addition, a recent article from our group demonstrated that coronary calcium significantly contributes to the Framingham Risk Score for predicting coronary events.[17]

The South Bay Heart Watch is a prospective cohort study designed to appraise the value of coronary calcium and both traditional and non-traditional risk factors for predicting cardiovascular outcomes and calcium progression in asymptomatic adults. The objective of this report is to compare across four race-ethnic groups: 1) the prevalence and amount of coronary calcium; and 2) to provide unique data regarding the progression in the extent of coronary calcium over a seven-year follow-up period.

From the Statistical Consultation and Research Center, Department of Preventive Medicine, Keck School of Medicine, University of Southern California (MK, WQ, LL, MX, SA); Atherosclerosis Research Center, Division of Cardiology, Department of Medicine, Cedars-Sinai Medical Center and David Geffen School of Medicine at UCLA (TMD); Division of Cardiology, Department of Medicine, Harbor-UCLA Research and Education Institute (RD); Los Angeles; Heart Disease Prevention Program, Department of Medicine, University of California, Irvine (NW); California.

Address correspondence and reprint requests to Robert C. Detrano, MD, PhD; Division of Cardiology; Bldg. RB-2; Harbor-UCLA Medical Center; 1124 West Carson Street; Torrance, CA 90502; 310-222-5290; 310-533-1616 (fax); rdetrano@rei.edu

Methods

Study Design

The study design of the South Bay Heart Watch has been previously described.[18] In brief, the cohort is composed of respondents to a community-based mailing campaign of letters of invitation to participate in a research project. The cohort consists of 1461 asymptomatic participants ≥45 years old with multiple cardiac risk factors (≥10% eight-year risk of developing coronary heart disease by Framingham risk equation) without evidence of coronary heart disease at the time of enrollment. Participants were initially

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screened and enrolled between December 1990 and December 1992. Participants with electrocardiographic or clinical evidence of infarction, revascularization, or typical angina were excluded. At the time of recruitment, participants were asked to classify their race as White, African-American, Asian/Pacific Islander, or ethnicity as Hispanic or non-Hispanic.

Thirty months after enrollment, 1289 participants who had not suffered an intervening myocardial infarction or undergone revascularization procedures underwent a second medical and risk-factor evaluation including fasting phlebotomy concurrent with baseline computed tomographic (CT) examinations for coronary calcification. Approximately seven years after the baseline examination for coronary calcification, 828 of these 1289 participants underwent a third medical and risk-factor evaluation and follow-up CT examination for coronary calcification. In this paper, we refer to the 1289 participants with a baseline CT scan as Cohort 1 and the 828 participants with both a baseline and follow-up scan as Cohort 2. All participants gave informed consent at the time of recruitment and again at the time of repeat risk factor assessment and CT scanning. The Harbor UCLA Research and Education Institute Human Participants Committee approved this study.

Coronary Calcium Scanning

Computed tomographic (CT) scans were performed within 2 days after risk-factor evaluation with an Imatron C-100 scanner. The acquisition protocol consisted of 6-mm image slices obtained at 80% of the electro-cardiographic RR interval during breath-hold.[19] This protocol has similar predictive value but superior retest reproducibility compared to a 3-mm image acquisition protocol.[19] All participants were scanned over a bone mineral density phantom (Image Analysis, Columbia, Kentucky). During follow-up, an identical scanning protocol was used, but with a C-150 Imatron scanner.

Coronary Calcium Scoring

A single cardiologist blinded to all clinical outcome and serologic data interpreted all scans, both baseline and follow-up. Although the cardiologist did not know the results of the baseline (or follow-up) scan when interpreting the follow-up (or baseline) scan, for technical reasons, the cardiologist could not be blinded to which group of scans (baseline vs follow-up) she was interpreting.

The scoring software used was the same as that used for the Multi-Ethnic Study of Atherosclerosis (MESA).[20] This scoring includes a pixel adjustment which uses the formula: new pixel value=(old pixel value - intercept)/slope, where slope and intercept refer to the results of a least-squares linear fit relating standard radiographic densities to the measured mean CT numbers in the calibration phantom scanned under the participants. The minimal calcific focus size was 4.1 mm^3, chosen to be equivalent to that used in the ongoing MESA study.[20] The coronary calcium score was calculated according to the method of Agatston.[21]

Risk Factor Determinations

Smoking, blood pressure measurements, fasting lipoprotein measurements, and electrocardiograph (ECG) to evaluate left ventricular hypertrophy were obtained within two days of CT scanning both at baseline and follow-up. Analysis for lipoproteins was done as previously described.[22]

Statistical Analysis

Comparison of Race-Ethnic Groups

Baseline demographic and clinical characteristics for Cohort 1 were compared between Whites (reference group) and each of the three race-ethnic groups using two-sample *t* tests or Wilcoxon rank-sum tests for continuous measures and chi-square or Fisher's exact tests for discrete measures. Similar procedures were used to compare the prevalence of coronary calcium and the coronary calcium score at baseline for Cohort 1 and at baseline and follow-up for Cohort 2. Progression in coronary calcium (follow up - baseline coronary calcium score) was computed for Cohort 2. For these analyses, calcium scores and change in calcium were $\log_{10}$ transformed to induce normality. Because of the multiple pairwise comparisons between Whites and each of the three race-ethnic groups, the significance level was conservatively set at .016 by using a Bonferroni correction (two-sided).

In addition, multiple linear regression analyses were used to evaluate the independent effect of race-ethnicity on change in calcium score ($\log_{10}$ transformed), adjusting for covariates defined to be: 1) standard risk factors for cardiac events; and 2) factors found to be related to change in calcium score. Preliminary analyses demonstrated that covariates were: baseline calcium score, age, sex, current smoker, diabetes, hypertension, body mass index, systolic blood pressure, diastolic blood pressure, and HDL cholesterol. No data were available on sociodemographic status. Because multiple pairwise comparisons were not conducted for these analyses, the significance level was set at .05.

Evaluation of Follow-up Bias

In order to evaluate potential bias for those participants who did not return for a follow-up evaluation ("partial participants"=Cohort 1 − Cohort 2) with those that did (Cohort 2), we imputed the follow-up calcium score and magnitude and direction of the change

Table 1. Baseline comparisons between Whites and African Americans, Asian/Pacific Islander and Hispanics (Cohort 1, *N*=1289)

Risk Factor*	White (*N*=1067)	African Americans (*N*=72)	*P* Value†	Asian/Pacific Islander (*N*=76)	*P* Value†	Hispanics (*N*=74)	*P* Value†
Age (yrs)	63.9 (7.6)	59.3 (8.0)	<.0001	62.3 (7.2)	.08	60.5 (7.3)	.0002
Sex: male	936 (88)	62 (86)	.69	71 (93)	.14	66 (89)	.71
Hypertension	329 (31)	31 (43)	.03	23 (30)	.92	30 (41)	.07
Diabetes	194 (18)	16 (22)	.39	23 (30)	.01	28 (39)	.0001
Current smoker	187 (18)	10 (14)	.43	11 (14)	.49	10 (14)	.37
HDL-C (mg/dL)	45.1 (15.7)	47.0 (16.3)	.34	45.0 (15.2)	.94	44.5 (16.5)	.73
LDL-C (mg/dL)	150.1 (36.6)	161.7 (42.5)	.012	146.4 (42.8)	.41	144.2 (31.9)	.19

Cohort 1 is the group of participants who had baseline computed tomographic scans.
* Mean (SD) for continuous variables; frequency (%) for discrete variables.
† Independent Student *t* test or Wilcoxon rank sum test for continuous variables; chi-square test or Fisher's exact test for discrete variables.
Significant level was set to .016 to accommodate multiple pairwise comparisons.

in calcium scores for the "partial participants." To this end, we used a standard imputation procedure for estimating the follow-up coronary calcium score for the "partial participants." Namely, we developed a multiple regression model for Cohort 2 that related the follow-up coronary calcium score (dependent variable) to: 1) the baseline calcium score; and 2) those demographic and clinical factors that were significantly different between Cohort 2 and "partial" participants. From this regression model, we then estimated the follow-up coronary calcium score and the change in coronary calcium (=estimated follow-up − observed baseline calcium scores) for the partial participants. We then compared both the imputed coronary calcium score and the imputed change scores in the partial participants with the actual coronary calcium score and the change score (log transformed) for participants in Cohort 2 using two sample Student *t* tests. Finally, we reran the multiple linear regression analyses for the full cohort (Cohort 2 + imputed values for partial participants) to evaluate the independent effect of race-ethnicity on change in calcium score (log transformed), adjusting for the covariates identified above.

RESULTS

Of the 1289 participants who underwent the baseline evaluation (Cohort 1), 1067 (83%) were White, 72 (6%) were African-American, 76 (6%) were Asian/Pacific Islander, and 74 (6%) were Hispanic. No Native American/Alaska Natives participated in the study. Table 1 presents the distribution of demographic and risk factors for each of the race-ethnic groups. Compared to Whites (the reference group), African Americans and Hispanics were younger ($P<.0002$), African Americans had a higher prevalence of hypertension ($P=.03$) and elevated LDL cholesterol ($P=.012$), and Asian/Pacific Islanders and Hispanics had a higher prevalence of diabetes ($P<.01$). No other differences were found.

Baseline Prevalence and Extent of Coronary Calcium (Cohort 1)

Table 2 presents the baseline prevalence of coronary calcium (calcium score>0) and the distribution of the coronary calcium scores for each race-ethnic group in Cohort 1. Compared to Whites, the prevalence of coronary calcium and the average calcium score were significantly lower in African Americans ($P<.0001$). No differences were found between Whites and the other two groups.

Prevalence, Extent, and Progression of Calcium for Participants Who Returned for CT Scanning (Cohort 2)

Of the 828 participants who underwent a baseline and follow-up evaluation (Cohort 2), 697 (84%) were White, 36 (4%) were African-American, 43 (6%) were Asian/Pacific Islander, and 41 (5%) were Hispanic. The race-ethnic distribution for Cohort 2 was similar to that for Cohort 1 ($P=.27$). In contrast, the retention ratios were significantly lower in African Americans and Hispanics (50% and 55%, respectively) compared to Whites and Asian/Pacific Islanders (65% vs 71%, respectively, $P<.0001$).

Table 2 also presents the baseline and follow-up prevalences of coronary calcium and distribution of coronary calcium scores for each race-ethnic group in Cohort 2. The coronary calcium conversion rates (change from calcium=0 to calcium>0) and the 7-year changes in coronary calcium scores are also shown in this table. Calcium scores increased significantly within each of the four race-ethnic groups over the 7-year period ($P<.0001$, paired *t* test). Compared to Whites, African Americans had: 1) lower baseline and follow-up prevalences of coronary calcium ($P=.012$ and $P=.005$, respectively); 2) lower baseline and follow-up calcium scores ($P=.005$ and $P=.0004$, respectively); and 3) less progression in calcium scores ($P=.001$). Compared to Whites at follow-up, Hispanics had: 1) a lower prevalence of coronary calcium ($P=.04$, marginally significant using the Bonferroni adjustment); 2) lower calcium score ($P=.011$); and 3) less pro-

Table 2. Comparison between White and African Americans, Asian-Pacific Islander and Hispanics in the baseline and follow-up coronary calcium prevalences and scores for Cohort 1 and Cohort 2

Coronary Calcium	White	African Americans		Asian-Pacific Islander		Hispanics	
Cohort 1 (*N*=1289)	(*n*=1067)	(*n*=72)	*P* value†	(*n*=76)	*P* value†	(*n*=74)	*P* value†
Prevalence*							
Baseline	774 (73%)	37 (51%)	<.0001	57 (75%)	.64	49 (66%)	.24
Score*							
Baseline	249 (459)	97 (204)	<.001	248 (617)	.75	238 (524)	.19
Cohort 2 (*N*=828)	(*n*=697)	(*n*=36)	*P* value†	(*n*=54)	*P* value†	(*n*=41)	*P* value†
Prevalence*							
Baseline	487 (70%)	18 (50%)	.012	37 (69%)	.83	24 (59%)	.13
Follow-up	623 (89%)	26 (72%)	.005	48 (89%)	.91	32 (78%)	.04
Converter	140/210 (67%)	8/18 (44%)	.06	11/17 (65%)	.87	8 (47%)	.10
Score*							
Baseline	226 (443)	68 (150)	.005	263 (719)	.99	115 (213)	.08
Follow-up	681 (969)	278 (438)	.0004	787 (1462)	.93	477 (782)	.011
Change	455 (643) (*P*<.0001)†	210 (323) (*P*<.0001)†	.001	524 (817) (*P*<.0001)†	.97	362 (674) (*P*<.0001)†	.009

Cohort 1 is the group of participants who had baseline CT scans only.

Cohort 2 is the group of participants who had both baseline and 7-year follow-up CT scans.

* Prevalence = number participants with calcium scores >0/number of participants; Converter = number of participants with calcium scores greater than 0 at follow-up/number of participants with calcium scores = 0 at baseline; Calcium scores are reported as mean (SD).

† Chi-square test for comparison of prevalences. Two sample or paired Student *t* tests for between and within group comparison of calcium score (log_{10} transformed). Significance level was set to .016 to accommodate multiple pairwise comparisons.

gression in calcium scores (*P*=.009). No differences were found between Whites and Asian/Pacific Islander in prevalence or extent or progression of coronary calcium.

Evaluation of Follow-Up Bias

Compared to participants with follow-up CT scans (Cohort 2), participants who did not return tended to be female (17% vs 9%, *P*<.0001), older (67.0 vs 64.5 years, *P*<.0001), hypertensive (39% vs 28%, *P*<.002), diabetic (27% vs 14%, *P*<.0001), and have higher systolic blood pressure (146.0 vs 139.6 mm Hg, *P*<.0001) and HDL cholesterol (46.4 vs 44.5 mg/dL, *P*<.0001). In addition, partial participants had greater calcium prevalence (68% vs 76%, *P*=.003) and baseline calcium scores (216 ± 451 vs 283 ± 486, *P*=.0002) compared to Cohort 2 participants. Thus, partial participants tended to have a higher risk-factor profile than participants in Cohort 2.

Based on the differences between Cohort 2 participants and partial participants in baseline calcium scores, risk factor, and race-ethnic group retention rates, we developed a multiple regression model for Cohort 2 participants that related the observed follow-up coronary calcium score (dependent variable) to the baseline coronary calcium score and those demographic and clinical factors that were significantly different between the two subgroups (sex, age, race-ethnicity, hypertension, diabetes, systolic blood pressure, HDL cholesterol). The resulting regression model was used to predict follow-up calcium scores for partial participants.

Table 3 presents the results of these analyses. Overall, the average predicted follow-up calcium score and predicted progression rate were greater in the "partial participants" compared to the Cohort 2 participants (*P*<.0001). In addition, the predicted follow-up and progression scores were significantly higher than the observed scores within each of the race-ethnic groups (*P*<.002 for all comparisons) except for Asian/Pacific Islander, whose predicted follow-up and progression scores were lower than the observed scores (*P*<.001 for both comparisons).

Multivariable Analysis of Race-Ethnicity and Risk Factors in Coronary Calcium Progression

Table 4 summarizes the results of the multivariable linear regression analysis evaluating the relationship of race-ethnicity to change in calcium, after adjusting for significant inter-race-ethnicity risk-factor covariates. For Cohort 2, significant covariates were found to be age, diabetes, body mass index, and baseline calcium score (all *P*<.03, data not shown in table). For the full cohort (ie, Cohort 2 + the imputed values for the partial participants), HDL cholesterol was found to be an additional independent covariate (*P*=.01). As seen in Table 4, for both Cohort 2 and the full cohort, African Americans and Hispanics had significantly less calcium score

Table 3. Analysis of coronary calcium extent by race-ethnicity for Cohort 2 and partial participants*

	Cohort 2 (*N*=828) Follow-up Calcium Score	Partial (*N*=461) Follow-up Calcium Score		Cohort 2 (*N*=828) Progression in Coronary Calcium Score	Partial (*N*=461) Progression in Coronary Calcium Score	
	Observed Score*	Predicted Score*	*P*†	Observed Score*	Predicted Score*	*P*†
Overall	660 (987)	797 (930)	<.0001	444 (647)	514 (456)	<.0001
White	681 (969)	814 (924)	<.0001	455 (643)	521 (450)	<.0001
African American	278 (438)	419 (520)	<.002	210 (323)	292 (291)	<.0002
Asian/Pacific Islander	787 (1462)	729 (449)	<.001	524 (817)	516 (238)	.0003
Hispanic	477 (782)	1075 (1391)	<.0001	362 (647)	680 (663)	<.0001

* Cohort 2 is the group of participants with baseline and 7-year follow-up CT scans; partial participants were those with only a baseline CT scan (Cohort 1–Cohort 2).
Observed scores = actual follow-up and progression scores for Cohort 2 participants; predicted follow-up scores for partial participants estimated from the multiple regression equation generated for Cohort 2, based on: a) baseline calcium score; and b) age, gender, race-ethnicity, HDL-C, hypertension, diabetes, systolic blood pressure; predicted progression score for partial participants = predicted follow-up score—observed baseline score.
† Two sample Student *t* tests. Calcium scores and change in calcium were $\log_{10}$ transformed in order to induce normality. Significance level was set at .05.

progression compared to Whites, after risk-factor adjustment ($P<.04$ for Cohort 2, $P=.0003$ for the full cohort).

DISCUSSION

Our study is the first to study race-ethnic differences in the progression of coronary calcium, a component of coronary atherosclerosis. As shown in Table 2, compared to Whites, both African Americans and Hispanics have lower rates of progression of coronary calcium during the 85 ± 4.5 months of follow-up. In contrast, no differences in the progression of coronary calcium were demonstrated between Whites and Asian/Pacific Islanders. These race-ethnic differences observed in the cohort with follow-up CT scans are confirmed after adjustment for nonparticipation bias (Table 4).

Autopsy studies, done mostly in White populations, have shown that coronary calcium and atherosclerosis are strongly correlated.[16] Clinical studies have demonstrated less prevalent and less extensive coronary calcium in African Americans compared to Whites.[1–6] Our study confirms these previous findings in African Americans (Table 2).

Importance of Our Findings

Calcification is only one component of the complex process of atherosclerosis. We and others have found important race-ethnic differences in the amount and prevalence of calcification in different race-ethnic groups.[1–8] Such differences might represent different amounts and prevalence of atherosclerosis or may instead be due to race-ethnic difference in calcium deposition in atherosclerotic plaque, or both. Whichever of these mechanisms are at play, our results suggest that not only does the process (atherosclerosis or calcification or both) begin later in life in some race-ethnic groups, but its rate of progression appears to be slower as well.

Our results agree with and extend those of our previous reports[1,2,8] and lend further credence to the notion that race-ethnic differences exist in the prevalence and rate of progression of coronary calcification. From a pathobiologic perspective, the reasons for our findings are not immediately apparent. Atherosclerosis is a chronic, fibroproliferative arterial inflammation that begins quite

Table 4. Covariate-adjusted multiple regression analyses of calcium score progression in African Americans, Asian/Pacific Islanders, and Hispanics compared to Whites

Race-Ethnicity	Cohort 2 (*N*=828)† Parameter Estimate/*P* Value*	Full Cohort (*N*=1289)† Parameter Estimate/*P* Value*
African American	−0.23/P=.04	−0.23/P=.0003
Asian/Pacific Islander	−0.01/P=.95	−0.02/P=.73
Hispanic	−0.22/P=.03	−0.23/P=.0003

* Dependent variable was $\log_{10}$ of change in a score. Analyses for each covariate used univariate regression analyses. Analyses by race-ethnicity relative to Whites (reference group) used multiple regression analysis, adjusting for covariates: baseline calcium scores, age, diabetes HDL-C, hypertension, current smoking status, systolic BP, diastolic BP, sex (male), and body mass index. Significance level was set at .05.
† Cohort 2 is the group of participants with calcium scores at baseline and at follow-up. Full cohort = Cohort 2 plus imputed calcium scores for Cohort 1 participants who did not return for follow-up (see text).

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early, progresses nonlinearly and sporadically, and may have long dormant periods.[23,24] Although the validity of indirect risk factor correlates to both progression of atherosclerosis and its eventual clinical manifestations is established,[25,26] the direct molecular and genetic mechanisms governing how, where, and at what rate plaque development occurs are not well understood. Furthermore, how structural components of plaque such as calcium deposits are determined, how they are altered, and why these processes might differ among individual plaques and among diverse race-ethnic groups are not clear.[27] Our results appear consistent with the suggestion that race-ethnic differences might exist in one or more of these mechanisms. Of potential relevance, we previously reported that serum levels of 1α,25 dihidroxyvitamin D_3 were independently and inversely related to the prevalence of coronary calcium[8,28] and that African Americans had significantly higher serum levels of this steroid.[8] However, the race-ethnic differences observed could not fully account for the variability in coronary calcium quantity between Whites and African Americans.

Modern technology allows in-vivo assessment of preclinical disease of the cardiovascular system. For example, cardiac ultrasound has allowed us to identify an increased prevalence and severity of cardiac left ventricular hypertrophy in Blacks. Liao et al found left ventricular hypertrophy to be a more powerful predictor of mortality in Blacks symptomatic from heart disease and arterial disease to be a more powerful predictor in a similar group of Whites.[29] This finding raises the possibility that myocardial disease and its major causative mechanism of hypertension may be a more important target for prevention in Blacks, and atherosclerosis and its etiologic factors of hyperlipidemia, smoking, and diabetes may be more important in Whites. Establishing a fundamental race-ethnic-specific mechanism of symptom expression would be an important first step toward developing a race-ethnic-specific strategy for risk reduction.

Relationship to Coronary Events

Although race-ethnic comparisons of the incidence of coronary events was not one of the objectives of this paper because of the lack of power for contrasting incidence rates, we did contrast race-ethnic differences in the incidence of coronary endpoints for Cohort 1 by using Cox regression analysis (adjusted for risk-factor covariates). Two coronary event endpoints were studied: 1) nonfatal myocardial infarction (MI) or coronary death; and 2) any cardiovascular event (nonfatal MI, coronary death, coronary revascularization, or stroke). The incidences for Whites, African Americans, Asians, and Hispanics were: 1) CHD death/MI (8%, 10%, 8%, and 10%, respectively); and 2) any cardiovascular event (28%, 33%, 28%, and 28%, respectively). Although no statistically significant differences were seen in covariate-adjusted event rates between White and other race-ethnic groups, an increase was found in the incidence of any cardiovascular events in African Americans, supporting epidemiologic studies that have shown that African Americans are more likely to suffer CHD events.[1] However, because of small sample sizes, statistical significance was not achieved.

Study Limitations

Our study is limited in that few women participated in our cohort, so that these findings may not apply to the female population. Our study is also limited because of the small sample sizes for race-ethnic minorities. However, despite the small sample sizes for African Americans and Hispanics, we found statistically significant differences compared to Whites. Although the progression of coronary calcium was greater in Asian/Pacific Islanders than in Whites (524 vs 455, Table 2), but did not achieve statistical significance, power calculations indicated that at least 1735 Asian participants are needed to demonstrate significance at the .05 level with 80% power.

CONCLUSIONS

The present results lend further credence to the notion that race-ethnic differences exist in the prevalence and rate of progression of coronary calcification. These differences appear to enable the rate of progression of coronary calcium and are not only due to delayed initiation of the process. Our study is unique in that it is the first to study race-ethnic differences in the progression of coronary calcium, a component of coronary atherosclerosis. Given that we have demonstrated that coronary calcium significantly contributes to the Framingham risk score for predicting coronary events,[17] future research is needed to relate the progression of coronary calcium to coronary events and contrast incidences across race-ethnic groups.

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AUTHOR CONTRIBUTIONS

Design and concept of study: Detrano, Doherty, Wong
Acquisition of data: Detrano, LaBree
Data analysis and interpretation: Kawakubo, Azen, Doherty, LaBree, Wong, Xiang
Manuscript draft: Kawakubo, Azen, Detrano, Doherty, Xiang
Statistical expertise: Kawakubo, Azen, LaBree, Xiang
Acquisition of funding: Detrano
Administrative, technical, or material assistance: Doherty
Supervision: Azen, Detrano