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Comparing Coronary Artery Calcium among U.S. South Asians with Four Racial/Ethnic Groups: The MASALA and MESA studies

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Abstract

Objectives—South Asians (individuals from India, Pakistan, Bangladesh, Nepal, and Sri Lanka) have high rates of cardiovascular disease which cannot be explained by traditional risk factors. Few studies have examined coronary artery calcium (CAC) in South Asians.

Methods—We created a community-based cohort of South Asians in the United States and compared the prevalence and distribution of CAC to four racial/ethnic groups in the Multi-Ethnic Study of Atherosclerosis (MESA). We compared 803 asymptomatic South Asians free of cardiovascular disease to the four MESA racial/ethnic groups (2,622 Whites, 1,893 African Americans, 1,496 Latinos and 803 Chinese Americans).

Results—The age-adjusted prevalence of any CAC was similar between White and South Asian men, but was lower in South Asian women compared to White women. After adjusting for all covariates associated with CAC, South Asian men were similar to White men and had higher CAC scores compared to African Americans, Latinos and Chinese Americans. In fully adjusted models, CAC scores were similar for South Asian women compared to all women enrolled in MESA. However, South Asian women ≥70 years had a higher prevalence of any CAC than most other racial/ethnic groups.

Conclusions—South Asian men have similarly high CAC burden as White men, but higher CAC than other racial/ethnic groups. South Asian women appear to have similar CAC burden

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compared to other women, but have somewhat higher CAC burden in older age. The high burden of subclinical coronary atherosclerosis in South Asians may partly explain higher rates of cardiovascular disease in South Asians.

Keywords

South Asians; ethnic differences; subclinical atherosclerosis; coronary artery calcium

Introduction

Individuals of South Asian ancestry (from India, Pakistan, Bangladesh, Nepal, and Sri Lanka) represent a quarter of the world's population and are second fastest growing ethnic minority group in the United States.[1] South Asians have a high rate of coronary heart disease which cannot be fully explained by traditional cardiovascular risk factors.[2–4] In California, South Asians have the highest incidence of coronary heart disease[5] and highest heart disease mortality of any racial/ethnic group.[6]

Coronary artery calcium (CAC) measurement is a non-invasive method for determining atherosclerosis burden[7] and has been recommended for further cardiovascular risk assessment amongst intermediate risk individuals.[8–10] While CAC scores differ by race/ethnicity,[11,12] a significant association between CAC score and incident coronary heart disease events has been reported in each of the race/ethnic groups studied in the Multi-Ethnic Study of Atherosclerosis (MESA).[13] Few studies have examined the distribution of CAC score in asymptomatic South Asians,[14–16] and no studies have determined whether CAC scores help explain the high incidence of heart disease in South Asians.

We sought to determine the prevalence, burden, and associations of CAC among a community-based sample of asymptomatic South Asians in the U.S. compared to the four other racial/ethnic groups in MESA. We used data from the Mediators of Atherosclerosis in South Asians Living in America (MASALA) study which was modeled on MESA with similar protocols to allow for efficient cross-ethnic comparisons. We hypothesized that South Asian men and women would have higher overall CAC burden than other racial/ethnic groups.

Methods

The MASALA study is a community-based cohort of South Asian men and women from two clinical sites (San Francisco Bay Area at the University of California, San Francisco (UCSF) and the greater Chicago area at Northwestern University (NWU)). The baseline examination was conducted from October 2010 through March 2013. The institutional review boards of UCSF and NWU approved the MASALA study protocol.

The MASALA study methods and recruitment have been previously reported.[17] Briefly, to be eligible for the MASALA study participants had to have (1) South Asian ancestry defined by having at least 3 grandparents born in one of the following countries: India, Pakistan, Bangladesh, Nepal, or Sri Lanka; and (2) age between 40 and 84 years; (3) ability to speak and/or read English, Hindi or Urdu. We used identical exclusion criteria to MESA[18] which

included having a physician diagnosed heart attack, stroke or transient ischemic attack, heart failure, angina, use of nitroglycerin, or those with a history of cardiovascular procedures or any surgery on the heart or arteries.

All visits were conducted by trained bilingual study staff. We gathered information on participant's demographic data, tobacco use, alcohol consumption, and medication use. Physical activity was assessed using the Typical Week's Physical Activity Questionnaire.[19]

Seated resting blood pressure was measured three times using an automated blood pressure monitor (V100 Vital sign monitor, GE Medical Systems, Fairfield, CT) and the average of the last two readings used for analysis. Participant weight was measured on a standard balance beam scale or digital weighing scale and height using a stadiometer. Waist circumference was measured using a flexible tape measure tape at the site of maximum circumference midway between the lower ribs and the anterior superior iliac spine. Fasting plasma glucose was measured by the glucose oxidase method; total cholesterol, triglycerides, high-density lipoprotein (HDL) cholesterol and creatinine were measured by enzymatic methods (Quest, San Jose, CA) and low-density lipoprotein (LDL) cholesterol was calculated.[20] Fasting serum samples were batched for insulin measured by the sandwich immunoassay method (Roche Elecsys 2010, Roche Diagnostics, Indianapolis, IN).

Hypertension was defined as medication use for hypertension or a systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg. Diabetes was classified if a participant was using a hypoglycemic medication or had a fasting plasma glucose ≥6.99 mmol/L. Use of a HMG-coA reductase inhibitor, fibrate, or niacin was categorized as cholesterol medication use.

Non-contrast cardiac CT scans were performed using a cardiac-gated electron-beam computed tomography scanner (UCSF: Phillips 16D scanner or a Toshiba MSD Aquilion 64; and at NWU: Siemens Sensation Cardiac 64 Scanner (Siemens Medical Solutions, Malvern, PA). Participants were examined in the supine position with both arms stretched above the head. A four-sample calibration phantom was placed under the thorax. A scout image was done to determine the level of the carina and the first scan was set at exactly 1 cm below the carina. A total of 46 images were obtained with 3.0 mm slice thickness. Exposures were set at kV 140 and mAs 50 for participants weighing ≤100 kg and at mAs of 63 for those weighing >100 kg. Reconstruction was done in the 35 cm field of view. All scans were sent in batches to the CT reading center at Harbor-UCLA where they were read with the Rephot Imaging Software. Phantom-adjusted coronary artery calcium Agatston scores were reported for each of the four major coronary arteries and the summed score was used.

MESA study methods

The study design, eligibility and methods for MESA have been previously published[18]. MESA includes individuals from four racial/ethnic groups (Whites, African Americans, Latinos and Chinese Americans). We used data from the baseline MESA examination (2000–2002). Identical questionnaires for socio-demographic characteristics and physical

activity and protocols for seated blood pressure, anthropometry and cardiac CT scanning were used as described above.

To have similar age range of participants from both studies, individuals in the MASALA study <44 years of age were excluded from this analysis, leaving 803 South Asians who were compared to each of the four MESA racial/ethnic groups (2,622 Whites, 1,893 African Americans, 1,496 Latinos and 803 Chinese Americans).

Statistical Analyses

Baseline characteristics of the MASALA participants were compared to each of the MESA racial/ethnic groups using ANOVA for continuous variables and chi-squared tests of homogeneity for categorical variables. CAC scores were analyzed as a dichotomous outcome for any prevalent CAC, as a continuous outcome using ln(CAC+1), and as a categorical outcome (CAC = 0, 1–400, and >400). We compared the prevalence, mean, and distribution of CAC score categories between South Asians and the four MESA racial/ethnic groups using ANOVA and chi-squared tests of homogeneity.

We created multivariate log-binomial (or Poisson), linear, and partial proportional odds models to examine the correlates associated with the three CAC outcomes among South Asians after adjusting for clinical site, sex, age, education, smoking history, BMI, diabetes, hypertension, HDL-cholesterol, LDL-cholesterol, and cholesterol lowering medication use. Log-binomial regression was used to model the association between the correlates and risk of any CAC, with results presented as relative risks (RR) and 95% CI.[21] For those instances in which the log-binomial model did not converge, log-Poisson models, which provide consistent estimates of the RR and its CIs, were used.[22]

Using the pooled data, we compared the relative associations between each racial/ethnic group and the CAC score results. We tested whether the effect of race/ethnicity on CAC varied by sex or by age. We compared the CAC associations for each race/ethnicity vs. the South Asians separately for each sex and by age (dichotomized at age 70). For each sex and race/ethnic group, we regressed log-transformed CAC score on a 3-knot restricted cubic spline by age, and then back-transformed the fitted CAC values to the observed scale, and plotted the fitted values by 5-year increments in age for each race/ethnic subgroup. We determined whether the curves differed by race/ethnicity by testing the interaction between quadratic age and race/ethnicity.

All analyses were conducted in SAS version 9.3 (SAS Institute, Cary, NC) and Stata version 12.1 (Stata Corporation, College Station, TX).

Results

The 803 South Asians between ages 44–84 enrolled in the MASALA study were on average five years younger than the MESA study participants. Table 1 shows the baseline characteristics by sex for each of the five racial/ethnic groups. Most South Asians (99%), Chinese (96%) and Latinos (69%) were born outside the U.S. South Asians had significantly higher socioeconomic attainment and lower current smoking rates than each of the MESA

groups. South Asians had relatively lower BMI and waist circumference compared to Whites, African Americans and Latinos but somewhat higher than Chinese Americans. South Asian men had the second highest prevalence of hypertension after African American men, but South Asian women had relatively low rates of hypertension compared to all other women. South Asian men had the highest prevalence of diabetes (27%) while South Asian women were similar to African American and Latino women. LDL-cholesterol was lower for South Asians and HDL-cholesterol was similar for all racial/ethnic groups reflecting the significantly higher use of cholesterol medications among South Asians compared to the MESA groups.

Table 2 displays the distribution of CAC scores by sex and race/ethnicity. After adjusting for age, the prevalence of any detectable CAC was similar between South Asian and White men (68%) but was significantly lower for South Asian women compared to White women (37% vs. 43%). The age-adjusted prevalence of CAC>400 was 19% in White men, 16% in South Asian, 13% in Latino men, 11% in African American men, and 7% in Chinese American men. The figure shows the CAC scores among each of the five racial/ethnic groups by 5-year increments in age. (see supplemental tables for median CAC values by age, sex, and ethnic group) Among men, CAC scores were similar for Whites and South Asians for all ages evaluated and were highest in these two racial/ethnic groups after age 60 onwards. The CAC scores were lowest among African American men between ages 50–60 and among Chinese American men after 65 years of age. In women, CAC patterns were similar among all five racial/ethnic groups until about age 70. After 70 years of age, South Asian women had relatively higher CAC scores than other ethnic minority women in MESA and similar scores compared to White women. However, since there were only 22 South Asian women in the age category ≥70 years the median CAC scores estimates are more imprecise than in other ethnic groups (median CAC 29, 95% CI 14–61).

Table 3 shows the multivariable models for CAC among South Asians using the same covariate adjustments as reported for MESA racial/ethnic groups with the addition of fasting glucose, insulin and triglycerides.[11] The strongest correlates of CAC in South Asians include male sex, age, diabetes, cholesterol medication use, and hypertension. BMI and LDL-cholesterol were of borderline significance while smoking status, educational attainment, and HDL-cholesterol were not significantly associated with CAC.

Table 4 shows the pooled multivariable model results for all five racial/ethnic groups comparing South Asians to each of the four MESA groups for CAC outcomes. After adjusting for all covariates associated with CAC score, South Asians had significantly higher CAC than African Americans and Latinos but similar CAC to Whites and Chinese Americans. However, this association between race/ethnicity and CAC varied significantly by sex (p-for-interaction= 0.005). Among men, South Asians and Whites had similar prevalence risk ratio of any CAC after full covariate adjustment, while the other three MESA racial/ethnic groups had significantly lower risk than South Asians. Among women, the risk of any CAC did not differ among any of the MESA racial/ethnic groups compared to South Asian women.

Lastly, we checked to see whether age modified the association between race/ethnicity and CAC. Among men, while the overall interaction between race/ethnicity and age was significant among men (p-for-interaction = 0.005), the individual associations between each MESA race/ethnicity and South Asian men were not significant. However, the association between race/ethnicity and any CAC did vary significantly with age among women (p-for-interaction= 0.02). Moreover, in fully adjusted models, South Asian women ≥70 years of age had a significantly higher prevalence of any CAC than African American and Latino women and a trend towards higher CAC prevalence than in White and Chinese American women, consistent with the unadjusted rates shown in the figure.

Discussion

In this cross-sectional comparison between U.S. South Asians and four other U.S. racial/ethnic groups without known cardiovascular disease, we found that South Asian men had similarly elevated prevalence of CAC compared to White men, while South Asian women had lower CAC prevalence than White women but similar to other race/ethnic minority groups in MESA. Mean CAC was similar between South Asian and White men over the age span and after full adjustment for covariates, and South Asian men had significantly higher CAC burden than African American, Latinos, and Chinese American men. In fully adjusted multivariable models, CAC scores did not differ for South Asian women compared to women in the four MESA racial/ethnic groups, but South Asian women had somewhat higher prevalence of CAC compared to other groups after age 70.

The present study adds to the current body of literature by determining the burden and distribution of CAC by sex among South Asians compared to the four most populous racial/ethnic groups in the U.S. The prevalence of CAC in asymptomatic South Asians has been reported by three prior studies, one from southern California,[14] one from India,[15] and a more recent report from London, England.[16] None of these prior studies have reported results separately by sex. In the first California study, asymptomatic individuals who were considered high risk were referred for cardiac CT imaging by their primary care physicians and 156 Asian Indians were compared to whites, Hispanic, African American and other Asians.[14] The Asian Indians were younger and had significantly less hypertension but higher CAC scores (62% CAC prevalence) than the other racial/ethnic minority groups. Consistent with the present study, the prevalence and severity of CAC was similar between Asian Indians and Whites although Asian Indians had higher CAC prevalence after age 60 than Whites.[14] In the Indian study, 500 asymptomatic volunteers between age 30–75 years underwent a standard multi-detector CT protocol.[15] The smoking prevalence was much higher (15%) while hypertension (12%) and diabetes (7%) prevalence was much lower than in the MASALA study population. The prevalence of any detectable CAC was 40% among the 352 participants between ages 41–75 with only two individuals with CAC>400,[15] much lower than in the current study. In the London Life Sciences Population (LOLIPOP) study, a total of 2,369 Indian Asians and European Whites between ages 35 and 75 years had similar CAC scores after adjusting for conventional risk factors,[16] also consistent with the current study.

Other studies have investigated patterns of coronary calcification among South Asian patients with angina[23] and heart disease,[24] with somewhat disparate results. In a study of angina patients, South Asians had similar conventional risk factors but more aggressive and diffuse arterial calcification with higher CAC scores and diffuse plaque burden compared to Europeans.[23] In a case control study of heart disease patients, South Asian men had similar CAC scores compared to European men, but a greater coronary artery stenosis overall.[24] In addition, some angiography studies have found that South Asians have more proximal distribution and longer lesions of coronary artery disease[25] and smaller coronary artery diameter than Europeans.[26–28]

In the present study, South Asians had high prevalence of diabetes and hypertension, but also had high socioeconomic attainment and more utilization of cholesterol lowering medication likely resulting in lower LDL and higher HDL levels than has been reported from other Diaspora countries.[4,16,29] The pattern of covariates associated with any CAC prevalence was generally similar in the South Asians compared to what has been reported in the MESA ethnic groups[11] with the exception of smoking. The low prevalence of smoking in South Asians can make it difficult to find an association. Similarly, LDL-cholesterol had a trend towards association with any CAC which may have been partially attenuated by the addition of triglycerides to the model.

Since South Asians had similar CAC burden compared to Whites after adjusting for conventional risk factors, it is likely that CAC will only partly explain the higher coronary heart disease rates experienced in South Asians. While these findings demonstrate an association between South Asian ethnicity with CAC, we cannot determine whether CAC has a causal role in the development of clinical coronary artery disease among South Asians. Additional factors such of the atherosclerotic plaque such as plaque composition, morphology, distribution, localization, calcium density, and vulnerability may prove to be better predictors of CHD events. Other non-plaque factors which may also be implicated in greater CHD risk among South Asians include systemic inflammation, thrombosis, and metabolic profiles determined by lifestyle and cultural factors.

While MASALA was modeled on MESA with similar methods and measures to allow for consistency of data to make inter-ethnic comparisons, there were some differences in the equipment used to measure blood pressure between the two studies and in the core labs used to measure lipoproteins and glucose, though the assay methods were similar. We do not believe these differences would meaningfully affect the results. The MASALA sample was also limited to the South Asian sample from two specific geographic regions, the San Francisco Bay Area and greater Chicago area, which may not represent all South Asians in the U.S. or globally. However, we have reported the similarity of the MASALA population to the Census 2010 South Asian data.[17] We also excluded all persons with known cardiovascular disease or any cardiovascular symptoms from the study population so the estimates reported represent a relatively healthier population of South Asians.

In conclusion, South Asian men have similarly high burden and distribution of coronary artery calcium compared to White men and higher than other racial/ethnic minority groups in the U.S. while South Asian women have similar CAC burden compared to other major

U.S. racial/ethnic groups except higher CAC burden in older age. Follow-up data from the MASALA study will determine whether CAC is associated with incident cardiovascular disease among South Asians and if this association differs from that observed in other racial/ethnic groups.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- Coronary artery calcium (CAC) prevalence was similar among South Asian & White men.
- CAC was higher in South Asian men than African American, Latino and Chinese men.
- South Asian women had similar CAC prevalence compared to all MESA women.
- South Asian women ≥70 years had higher CAC prevalence than all other women.

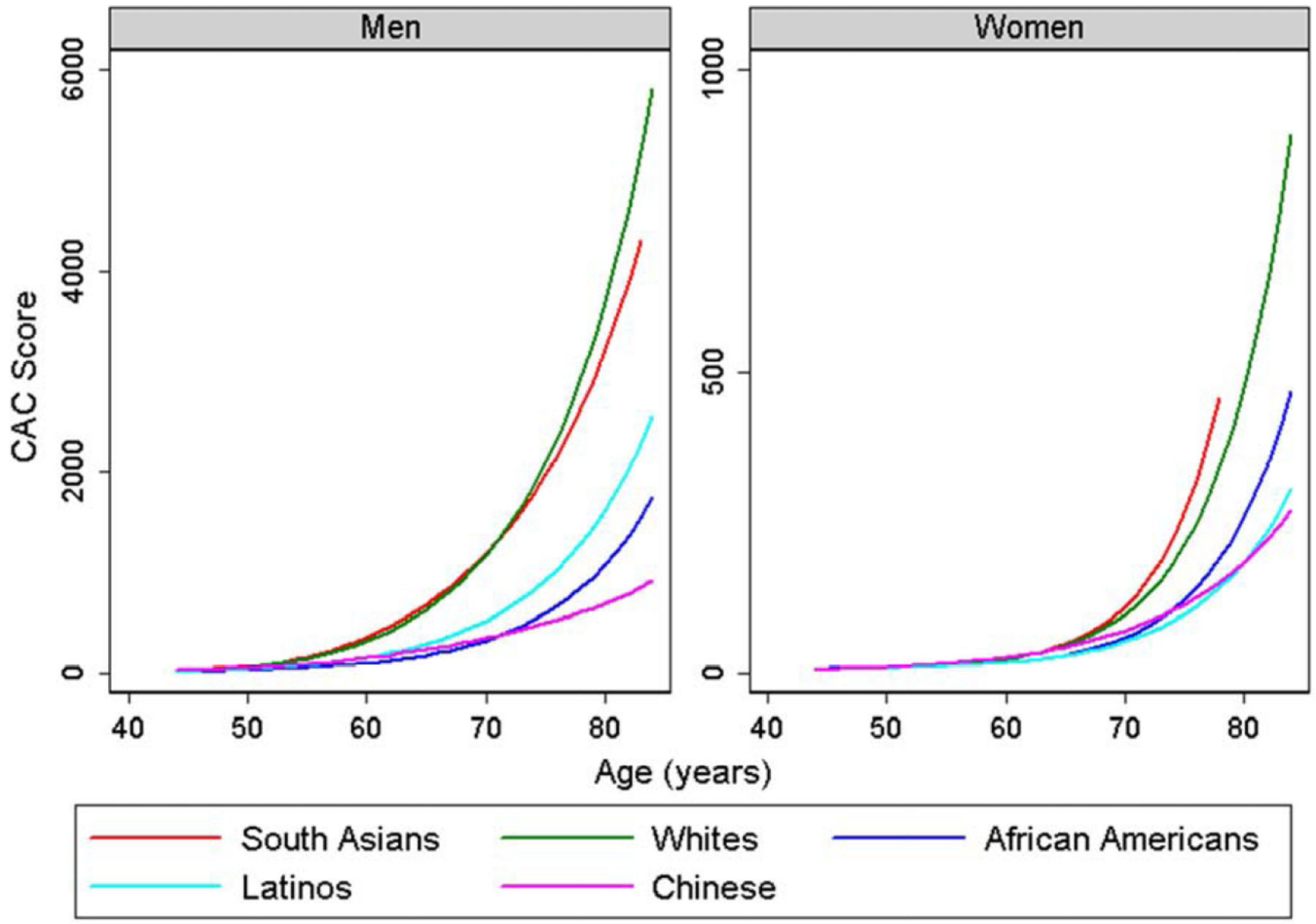

Figure.

Mean coronary artery calcium score by age for five ethnic groups by sex, the MASALA and MESA studies

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Table 1

Baseline characteristics of MASALA and MESA participants by sex and ethnicity

	Men					Women				
	South Asian n=424	**White n=1,259**	**African American n=843**	**Latino n=721**	**Chinese American n=390**	**South Asian n=379**	**White n=1,363**	**African American n=1,050**	**Latino n=775**	**Chinese American n=413**
Age, years	58 ± 9	63 ± 10	62 ± 10	61 ± 10	62 ± 10	56 ± 8	62 ± 10	62 ± 10	61 ± 10	62 ± 10
Immigrants to U.S., %	99	6	9	66	96	98	7	9	72	97
Education ≥ Bachelor, %	90	59	34	13	52	84	41	34	7	27
Family income ≥$75,000, %	71	42	22	10	21	72	29	12	4	13
Current smoker, %	5	11	20	16	10	1	12	16	11	2
Alcohol use ≥1 drink/week, %	45	77	68	72	36	18	53	38	23	8
Exercise, MET-min/week*	1,027 (367–1867)	1,972 (945–3570)	1680 (690–3727)	1357 (585–3255)	1264 (630–2587)	840 (315–1792)	1747 (810–3150)	1620 (630–3330)	1072 (322–2407)	1147 (525–2257)
BMI, kg/m^2	25.8 ± 4.3	27.9 ± 4.1	28.7 ± 4.7	28.8 ± 4.3	24.1 ± 3.1	26.1 ± 4.2	27.5 ± 5.8	31.3 ± 6.4	30.0 ± 5.7	23.9 ± 3.4
Waist circumference, cm	95.6 ± 9.2	101.0 ± 11.4	100.7 ± 12.7	100.8 ± 11.3	87.8 ± 9.1	89.4 ± 9.9	95.1 ± 16.2	101.6 ± 16.1	100.4 ± 14.6	86.4 ± 10.6
Systolic blood pressure, mmHg	127 ± 15	124 ± 18	130 ± 19	126 ± 20	124 ± 19	124 ± 17	123 ± 22	133 ± 23	127 ± 23	125 ± 24
Diastolic blood pressure, mmHg	76 ± 9	74 ± 9	77 ± 9	75 ± 9	75 ± 9	70 ± 10	67 ± 10	72 ± 10	68 ± 10	69 ± 10
Hypertension**, %	48	39	57	38	35	37	38	62	45	40
Diabetes†, %	27	8	19	19	14	15	5	16	16	12
LDL-cholesterol, mmol/L	2.8 ± 0.8	3.0 ± 0.8	2.9 ± 0.8	3.1 ± 0.8	3.0 ± 0.7	2.9 ± 0.8	3.0 ± 0.8	3.1 ± 0.8	3.1 ± 0.8	2.9 ± 0.7
HDL-cholesterol, mmol/L*	1.4 (1.0–1.3)	1.1 (1.0–1.3)	1.1 (1.0–1.4)	1.1 (1.0–1.2)	1.1 (1.0–1.3)	1.4 (1.2–1.7)	1.5 (1.2–1.7)	1.4 (1.2–1.7)	1.3 (1.1–1.5)	1.3 (1.1–1.6)
Triglycerides, mmol/L*	1.4 (1.0–1.9)	1.3 (0.9–1.9)	1.0 (0.7–1.5)	1.6 (1.1–2.3)	1.4 (0.9–2.0)	1.3 (1.0–1.6)	1.3 (0.9–1.8)	1.0 (0.7–1.3)	1.5 (1.1–2.1)	1.4 (1.0–1.9)
Fasting glucose, mmol/L	6.0 ± 1.4	5.3 ± 1.4	5.7 ± 1.8	5.9 ± 2.3	5.7 ± 1.8	5.6 ± 1.3	4.9 ± 0.9	5.4 ± 1.7	5.6 ± 2.0	5.3 ± 1.3
Fasting insulin, pmol/L*	60 (44–94)	45 (35–70)	53 (35–74)	57 (38–84)	46 (36–65)	56 (40–78)	42 (32–62)	56 (39–80)	58 (41–82)	45 (37–64)
Creatinine, μmol/L	83.1 ± 17.7	93.7 ± 17.7	102.5 ± 35.4	90.2 ± 35.4	90.2 ± 17.7	62.8 ± 8.8	76.0 ± 17.7	79.6 ± 17.7	70.7 ± 26.5	69.0 ± 8.8
Cholesterol medication use, %	35	19	15	13	14	24	17	18	15	16

*median (interquartile range) shown for skewed variables

**hypertension defined by SBP≥140 or DBP ≥90mmHg or use of an anti-hypertensive medication

†diabetes defined by fasting plasma glucose ≥126 mg/dl and/or use of a diabetes medication

Table 2

Distribution of coronary artery calcium scores by sex and ethnicity, the MASALA and MESA studies

	Men					Women				
	South Asian n=424	**White n=1259**	**African American n=843**	**Latino n=721**	**Chinese American n=390**	**South Asian n=379**	**White n=1363**	**African American n=1050**	**Latino n=775**	**Chinese American n=413**
Crude CAC prevalence, %	62.5	70.4*	52.1†	56.6*	59.2	25.9	44.7†	36.4†	34.8*	41.9†
Age-adjusted CAC prevalence, %	67.9	68.8	51.2†	57.9†	57.8*	36.8	42.6*	35.6	35.0	40.3
Age-adjusted CAC categories, %										
0	31.9	31.3	48.7†	42.1*	42.1*	62.7	57.5	64.4	65.0	59.6
1–10	6.1	8.2	7.5	7.3	8.5	4.8	8.0	6.4	6.6	7.2
11–100	24.8	20.8	20.5	22.2	22.7	15.9	16.1	14.7	17.0	19.5
101–400	21.3	20.8	12.0	15.0	19.1	10.7	11.9	9.5	7.5	8.9
401–1,000	9.4	10.8	6.2	7.1	5.1	5.3	4.8	3.6	3.2	3.8
>1,000	6.5	8.2	5.0	6.3	2.4	0.6	1.6	1.4	0.6	0.9
CAC distribution:										
Mean±SD	195 ± 495	295 ± 598†	177 ± 509†	207 ± 550	127 ± 322	41 ± 139	94 ± 249†	78 ± 287†	51 ± 169*	65 ± 199†
50th percentile	21	47	3	8	11	0	0	0	0	0
75th percentile	161	297	88	125	116	3	53	23	17	37
90th percentile	511	877	486	563	340	90	282	171	122	155
Maximum value	4794	6316	6047	5148	3773	1317	2528	4013	1830	2440

*p<0.05 for comparison to South Asians

†p<0.001 for comparison to South Asians

Table 3

Multivariable model* for CAC among South Asians, the MASALA study 2010–2013

	Poisson model, any CAC outcome	
	RR (95% CI)	**p-value**
Male sex	1.98 (1.62 – 2.41)	<0.001
Age, per 10 years	1.47 (1.36 – 1.59)	<0.001
Education < HS	0.98 (0.63 – 1.54)	0.95
Current smoker	1.28 (0.95 – 1.72)	0.10
Past smoker	1.09 (0.92 – 1.28)	0.32
BMI, per 5 kg/m^2	1.10 (1.00 – 1.21)	0.04
Diabetes	1.33 (1.12 – 1.59)	0.001
Hypertension	1.27 (1.07 – 1.50)	0.006
HDL, per 10 mg/dl	1.04 (0.98 – 1.11)	0.22
LDL, per 30 mg/dl	1.06 (0.99 – 1.14)	0.11
Triglycerides, per 100 mg/dl	1.06 (0.92–1.23)	0.40
Fasting glucose, per SD	0.99 (0.92–1.06)	0.74
Fasting insulin, per SD	1.01 (0.97–1.04)	0.74
Cholesterol medication use	1.32 (1.13 – 1.55)	<0.001

* also adjusted for clinical site

Table 4

Pooled model comparing each race/ethnic group to South Asians overall and by sex, the MASALA and MESA studies

	Poisson model, any CAC outcome	
	RR (95% CI)	**p-value**
Overall population:		
South Asian (ref.)	1.0	-
White	0.99 (0.87 – 1.12)	0.83
African American	0.73 (0.65 – 0.83)	**<0.001**
Latino	0.81 (0.71 – 0.92)	**0.001**
Chinese American	0.95 (0.83 – 1.10-)	0.52
Men:		
South Asian (ref.)	1.0	-
White	0.92 (0.80 – 1.05)	0.21
African American	0.66 (0.58 – 0.76)	**<0.001**
Latino	0.77 (0.67 – 0.89)	**<0.001**
Chinese American	0.83 (0.71 – 0.97)	**0.02**
Women:		
South Asian (ref.)	1.0	-
White	1.09 (0.83 – 1.44)	0.53
African American	0.83 (0.62 – 1.09)	0.18
Latino	0.89 (0.68 – 1.18)	0.42
Chinese American	1.25 (0.93 – 1.68)	0.14

*adjusted for clinical site, sex, age, education, smoking history, BMI, diabetes, hypertension, HDL-cholesterol, LDL-cholesterol, triglycerides, fasting glucose, fasting insulin, and cholesterol lowering medication use