

Coronary artery calcification distribution and progression in over 70 000 asymptomatic individuals: implications for assessment intervals and optimal testing age

Da-Eun Sung¹, Mi-Yeon Lee², Jong-Young Lee³, Eun-Jung Rhee⁴, and Ki-Chul Sung^{3*}

¹Department of Internal Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea; ²Division of Biostatistics, Department of Academic Research, Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Seoul, Republic of Korea; ³Division of Cardiology, Department of Internal Medicine, Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, 29 Saemunan-ro, Jongno-gu, Seoul 03181, Republic of Korea; and ⁴Division Endocrinology and Metabolism, Department of Internal Medicine, Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Seoul 06351, Republic of Korea

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Aims

To assess the prevalence and progression of CAC in asymptomatic individuals and evaluate the duration for which a CAC score of 0 persists over time.

Methods and results

This retrospective cohort study included 70 389 asymptomatic individuals aged over 30 years from Korea, with at least two CAC score assessments (2010–22). Subgroups were defined based on follow-up intervals: the entire cohort, those with at least four assessments within 10 years, and those with follow-up after five years. Analyses focused on age- and sex-specific CAC distributions, incidence and timing of new CAC, and changes in CAC scores among those with an initial score of 0 over 6–12 years. Among participants (mean age 40.5 ± 6.6 years; 87% men), 84% had a baseline CAC score of 0, and 3% had scores > 100. Notably, 93% of women had a CAC score of 0, with the highest percentages observed in younger women. Incident CAC developed in 16% of participants with an initial score of 0 within five to six years, with just 1% exceeding score of 100. Extended follow-up data showed a consistently low prevalence of significant CAC scores, with only 4% exceeding scores > 100 after 10 years.

Conclusion

In a large Korean cohort of over 70 000 asymptomatic adults, most had baseline CAC = 0, indicating low subclinical atherosclerosis. Significant calcification (CAC > 100) was rare within 5–6 years, with only 4% exceeding 100 by 10 years, even among older subgroups.

* Corresponding author. E-mail: kcmd.sung@samsung.com

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individuals were excluded due to missing data on key variables, including alcohol consumption ($n = 4431$), body mass index (BMI) ($n = 82$), systolic blood pressure ($n = 79$), and glucose level ($n = 41$). Additionally, 494 individuals with a history of CAD were excluded. Since 49 individuals had both missing data and a history of CAD, their exclusion was accounted for only once. After these exclusions, the final analytic cohort comprised 70 389 participants.

This study was approved by the Institutional Review Board at Kangbuk Samsung Hospital (IRB No. 2024-07-005), with informed consent waived due to the retrospective design and use of de-identified data.

Data collection and assessment

Baseline demographic and clinical characteristics—including age, sex, lipid profiles (LDL-C, HDL-C, triglycerides, and total cholesterol), glucose level, BMI, smoking status, high alcohol intake, education level, and the presence of HTN or DM—were collected using standardized questionnaires and clinical examinations. These variables were reassessed at each follow-up. Participants' characteristics were stratified by both baseline and follow-up CAC scores.

CAC assessment

CAC measurements were performed using a multidetector computed tomography (MDCT) scanner (Lightspeed VCT XTe 64-slice, GE Healthcare) according to a standardized scanning protocol (40 × 2.5 mm section collimation, 400 ms rotation time, 120 kV tube voltage, 124 mAs with ECG-gated dose modulation). In 2018, a Siemens MDCT system was introduced, followed by replacement of the GE scanner in 2022. Throughout these transitions, a uniform 5 mm slice thickness and standardized protocol were maintained. The Agatston method was used to calculate CAC scores in all scans.

Study outcomes

The primary outcome was defined as incident CAC, identified by a CAC score > 0 at follow-up among individuals with a baseline CAC score of 0. The secondary outcome was annual CAC progression in participants with a baseline CAC score > 0 .

Statistical analysis

Baseline characteristics were summarized using means and standard deviations for continuous variables and frequencies or percentages for categorical variables. Differences between groups were assessed using one-way analysis of variance for continuous variables and χ^2 tests for categorical variables. For comparisons between those with a CAC score of 0 and those with a CAC score > 0 at follow-up within the groups with baseline CAC score of 0 or > 0 , t -tests were used for continuous variables and χ^2 tests were used for categorical variables. A significance level adjusted for multiple comparisons was applied (Bonferroni's correction).

Since patients did not undergo annual testing, they were categorized into three groups: the entire cohort (Dataset 1), those who underwent CAC testing at least four times within 10 years (Dataset 2), and those who had a follow-up CAC measurement five years after the initial scan (Dataset 3). Statistical significance was set at a two-tailed P -value of < 0.05 . All analyses were conducted using STATA version 18.0 (StataCorp LLC, College Station, TX, USA).

Results

Baseline characteristics and follow-up CAC

Participants were categorized according to their baseline and follow-up CAC scores into four groups: (i) baseline CAC score of 0, remaining 0 at follow-up ($n = 49\,967$); (ii) baseline CAC score of 0, developing CAC at follow-up ($n = 9065$); (iii) baseline CAC score > 0 , reverting to 0 at follow-up ($n = 395$); and (iv) baseline CAC score > 0 , remaining elevated

at follow-up ($n = 10\,962$) (Table 1). The mean follow-up period was 5.77 ± 2.77 years, with a median of 5.71 years. Overall, 70 389 participants (mean age, 40.5 ± 6.6 years) were included, of whom 87% ($n = 61\,261$) were men. Among individuals with a baseline CAC score of 0, 85% remained CAC-free (group 1), whereas 15% developed new CAC (group 2). Participants in group 2 were slightly older (mean age, 41.0 ± 5.9 years) and predominantly male (96%), with higher rates of hypertension (24% vs. 12%) and diabetes (8% vs. 4%) compared with group 1.

Of the 194 091 participants initially identified, 123 702 underwent only one CAC examination, while 70 389 had two or more (see [Supplementary data online, Table S1](#)). Differences in risk factors between single-test and multiple-test participants were modest and not clinically substantial.

Age- and sex-specific distribution of CAC

Among the 70 389 participants, 84% had a baseline CAC score of 0, while only 3% had a score exceeding 100 (Table 2). For men, 83% had a CAC score of 0, and 3% had a score over 100. Specifically, 92% of men aged 30–39 had a CAC score of 0, with $< 1\%$ having scores over 100. Among women, 93% had a CAC score of 0, and 1% had scores exceeding 100. Notably, 98% of women aged 30–39 had a CAC score of 0, and $< 1\%$ had scores over 100. In the 40–49 age group, 95% of women had a CAC score of 0, and $< 1\%$ had scores over 100.

After excluding 4074 individuals with DM and 12 122 with HTN, of whom 1651 had both DM and HTN, the proportion of participants with a baseline CAC score of 0 who developed CAC during follow-up decreased from 15% to 13% (see [Supplementary data online, Tables S2 and S3](#)). Additional details are provided in the [supplementary tables](#).

Among men aged 40–84, 74% had a baseline CAC = 0 and 5% had scores ≥ 100 . In women aged 50–84, 67% had CAC = 0, whereas 7% had scores ≥ 100 (see [Supplementary data online, Table S4](#)).

Incidence and progression across follow-up intervals

The incidence of new CAC from an initial score of 0 and the progression of existing CAC were analysed, stratified by follow-up intervals (Table 3). The study included three groups: the overall population ($N = 70\,389$), individuals with at least four CAC exams within 10 years ($N = 8511$), and individuals with a 5-year follow-up ($N = 13\,423$). In the overall population, 15% of participants with an initial CAC score of 0 developed new CAC over an average follow-up period of 5.7 years. The mean time to incident CAC was 6.1 years. For participants with baseline CAC > 0 , the mean annual progression was 20.0. For individuals who underwent at least four CAC exams within 10 years, 43% developed new CAC, with a mean time to incident CAC of 5.6 years. The mean annual progression for those with baseline CAC > 0 was 23.1.

Among men aged ≥ 40 ($N = 61\,261$), 21% of those with a baseline CAC score of 0 developed new CAC over a mean follow-up of 5.8 years, while progression in those with baseline CAC > 0 averaged 21.6 units annually (see [Supplementary data online, Table S5](#)). In women aged ≥ 50 ($N = 9128$), 12% of those with a baseline CAC = 0 developed new CAC after a mean of 5.3 years, and those with a baseline CAC > 0 progressed at 18.9 units annually. Comparable findings were observed in participants who underwent multiple CAC evaluations within 10 years and in those who followed for 5 years.

Five-year incidence and progression of CAC

For participants with a 5-year follow-up, 16% developed new CAC. The mean time to incident CAC was 5.5 years, and the mean annual progression for those with baseline CAC > 0 was 22.4.

Table 1 Baseline characteristics of participants stratified by CAC score at baseline and follow-up

	Total	CAC = 0 at baseline			CAC > 0 at baseline			CAC = 0 at f/up			CAC > 0 at f/up			P-value**
		CAC = 0 at f/up	CAC > 0 at f/up	P-value*	CAC = 0 at f/up	CAC > 0 at f/up	P-value*	CAC = 0 at f/up	CAC > 0 at f/up	P-value*	CAC = 0 at f/up	CAC > 0 at f/up	P-value*	
Number	70 389	49 967	9065		395	10 962		395	10 962		395	10 962		
Age (years)	40.5 ± 6.6	39.3 ± 5.7	41.0 ± 5.9	<0.001	42.7 ± 8.4	45.8 ± 8.1	<0.001	42.7 ± 8.4	45.8 ± 8.1	<0.001	42.7 ± 8.4	45.8 ± 8.1	<0.001	<0.001
Men (%)	61 261 (87.0)	41 932 (83.9)	8657 (95.5)		368 (93.2)	10 304 (94)		368 (93.2)	10 304 (94)		368 (93.2)	10 304 (94)		<0.001
Vigorous exercise frequency (%)				0.036										<0.001
<3 time/week	60 556 (86.0)	43 348 (86.8)	7767 (85.7)		348 (88.1)	9093 (83.0)		348 (88.1)	9093 (83.0)		348 (88.1)	9093 (83.0)		<0.001
≥3 time/week	9212 (13.1)	6241 (12.5)	1218 (13.4)		42 (10.6)	1711 (15.6)		42 (10.6)	1711 (15.6)		42 (10.6)	1711 (15.6)		0.989
Unknown	621 (0.9)	378 (0.8)	80 (0.9)		5 (1.3)	158 (1.4)		5 (1.3)	158 (1.4)		5 (1.3)	158 (1.4)		0.049
LDL-C, mg/dL	131.0 ± 32.3	128.5 ± 31.2	137.1 ± 32.4	<0.001	139.1 ± 32.5	136.6 ± 35.2	<0.001	139.1 ± 32.5	136.6 ± 35.2	<0.001	139.1 ± 32.5	136.6 ± 35.2	<0.001	<0.001
HDL-C, mg/dL	53.5 ± 13.6	54.4 ± 13.9	50.7 ± 12.2	<0.001	51.8 ± 13.2	51.5 ± 13.1	<0.001	51.8 ± 13.2	51.5 ± 13.1	<0.001	51.8 ± 13.2	51.5 ± 13.1	<0.001	<0.001
TG, mg/dL	142.5 ± 95.6	135.0 ± 88.8	162.0 ± 105.7	<0.001	152.7 ± 104.2	160.5 ± 110.2	<0.001	152.7 ± 104.2	160.5 ± 110.2	<0.001	152.7 ± 104.2	160.5 ± 110.2	<0.001	<0.001
TC, mg/dL	201.5 ± 35.0	199.0 ± 33.7	209.5 ± 35.3	<0.001	205.2 ± 34.6	206.4 ± 38.8	<0.001	205.2 ± 34.6	206.4 ± 38.8	<0.001	205.2 ± 34.6	206.4 ± 38.8	<0.001	<0.001
Glucose, mg/dL	98.3 ± 16.4	96.7 ± 13.4	100.6 ± 19.3	<0.001	101.4 ± 26.1	104.0 ± 23.0	<0.001	101.4 ± 26.1	104.0 ± 23.0	<0.001	101.4 ± 26.1	104.0 ± 23.0	<0.001	<0.001
Smoking (%)	18 508 (26.3)	11 950 (23.9)	2987 (33.0)	<0.001	91 (23.0)	3480 (31.8)	<0.001	91 (23.0)	3480 (31.8)	<0.001	91 (23.0)	3480 (31.8)	<0.001	<0.001
High alcohol intake (%)	8799 (12.5)	5501 (11.0)	1437 (15.9)	<0.001	44 (11.1)	1817 (16.6)	<0.001	44 (11.1)	1817 (16.6)	<0.001	44 (11.1)	1817 (16.6)	<0.001	<0.001
Higher education (%)	59 028 (83.9)	42 198 (84.5)	7594 (83.8)	0.009	341 (86.3)	8895 (81.1)	0.009	341 (86.3)	8895 (81.1)	0.009	341 (86.3)	8895 (81.1)	0.009	<0.001
BMI	24.7 ± 3.2	24.4 ± 3.2	25.4 ± 3.1	<0.001	26.0 ± 3.4	25.4 ± 3.1	<0.001	26.0 ± 3.4	25.4 ± 3.1	<0.001	26.0 ± 3.4	25.4 ± 3.1	<0.001	<0.001
HTN (%)	12 122 (17.2)	6086 (12.2)	2198 (24.3)	<0.001	100 (25.3)	3738 (34.1)	<0.001	100 (25.3)	3738 (34.1)	<0.001	100 (25.3)	3738 (34.1)	<0.001	<0.001
DM (%)	4074 (5.8)	1755 (3.5)	747 (8.2)	<0.001	30 (7.6)	1542 (14.1)	<0.001	30 (7.6)	1542 (14.1)	<0.001	30 (7.6)	1542 (14.1)	<0.001	<0.001
HTN medication (%)	5154 (7.3)	2033 (4.1)	919 (10.1)	<0.001	53 (13.4)	2149 (19.6)	<0.001	53 (13.4)	2149 (19.6)	<0.001	53 (13.4)	2149 (19.6)	<0.001	<0.001
DM medication (%)	1819 (2.6)	645 (1.3)	312 (3.4)	<0.001	11 (2.8)	851 (7.8)	<0.001	11 (2.8)	851 (7.8)	<0.001	11 (2.8)	851 (7.8)	<0.001	<0.001
LIPID medication (%)	3040 (4.3)	1279 (2.6)	466 (5.1)	<0.001	28 (7.1)	1267 (11.6)	<0.001	28 (7.1)	1267 (11.6)	<0.001	28 (7.1)	1267 (11.6)	<0.001	<0.001

Follow-up period: mean of 5.77 ± 2.77 years, median of 5.71 years. Values are expressed as means ± standard deviation, medians (interquartile range), or percentages. High alcohol intake was defined as >20 g/day for women, >30 g/day for men. Higher education was defined as education higher than college or university graduate.

CAC, coronary artery calcification; LDL-C, low density lipoprotein cholesterol; HDL-C, high density lipoprotein cholesterol; TG, triglycerides; TC, total cholesterol; BMI, body mass index; HTN, hypertension; DM, diabetes mellitus. *Indicates statistical significance for comparisons between participants with a baseline CAC score of 0 who had CAC = 0 at follow-up and those who developed CAC (CAC > 0) at follow-up. This P-value also reflects comparisons between participants with a baseline CAC score > 0 who reverted to 0 at follow-up and those who remained > 0 at follow-up.

**Indicates statistical significance for comparisons between participants with a baseline CAC score of 0 and those with a baseline CAC score > 0.

Table 2 Distribution of CAC scores by age and sex at baseline

Group	CAC = 0	1–4	5–9	10–19	20–29	30–39	40–49	50–99	100–199	200–299	300–399	400–499	500–999	1000+
Overall	59 032 (83.9%)	2608 (3.7%)	1274 (1.8%)	1837 (2.6%)	1110 (1.6%)	1075 (1.5%)	530 (0.8%)	1374 (2.0%)	959 (1.4%)	391 (0.6%)	184 (0.3%)	102 (0.1%)	162 (0.2%)	69 (0.1%)
Men	50 589 (82.6%)	2463 (4.0%)	1212 (2.0%)	1716 (2.8%)	1026 (1.7%)	704 (1.1%)	498 (0.8%)	1285 (2.1%)	908 (1.5%)	367 (0.6%)	176 (0.3%)	99 (0.2%)	151 (0.2%)	67 (0.1%)
Women	8443 (92.5%)	145 (1.6%)	62 (0.7%)	121 (1.3%)	84 (0.9%)	53 (0.6%)	32 (0.4%)	89 (1.0%)	51 (0.6%)	24 (0.3%)	8 (0.1%)	3 (0.0%)	11 (0.1%)	2 (0.0%)
Men 30–39	25 961 (92.3%)	668 (2.4%)	310 (1.1%)	382 (1.4%)	219 (0.8%)	140 (0.5%)	90 (0.3%)	200 (0.7%)	99 (0.4%)	25 (0.1%)	15 (0.1%)	7 (0.0%)	9 (0.0%)	2 (0.0%)
Men 40–49	22 517 (79.2%)	1439 (5.1%)	733 (2.6%)	1009 (3.5%)	580 (2.0%)	394 (1.4%)	268 (0.9%)	696 (2.4%)	467 (1.6%)	173 (0.6%)	62 (0.2%)	36 (0.1%)	47 (0.2%)	16 (0.1%)
Men 50–59	1934 (49.1%)	307 (7.8%)	144 (3.7%)	278 (7.1%)	185 (4.7%)	125 (3.2%)	112 (2.8%)	311 (7.9%)	261 (6.6%)	114 (02.9%)	56 (1.4%)	30 (0.8%)	55 (1.4%)	24 (0.6%)
Men 60–69	168 (25.3%)	44 (6.6%)	25 (3.8%)	41 (6.2%)	36 (5.4%)	41 (6.2%)	26 (3.9%)	66 (9.9%)	66 (9.9%)	45 (6.8%)	36 (5.4%)	15 (2.3%)	35 (5.3%)	20 (3.0%)
Men 70+	9 (9.3%)	5 (5.2%)	0 (0.0%)	6 (6.2%)	6 (6.2%)	4 (4.1%)	2 (2.1%)	12 (12.4%)	15 (15.5%)	10 (10.3%)	7 (7.2%)	11 (11.3%)	5 (5.2%)	5 (5.2%)
Women 30–39	3178 (97.6%)	24 (0.7%)	12 (0.4%)	16 (0.5%)	9 (0.3%)	6 (0.2%)	3 (0.1%)	4 (0.1%)	3 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Women 40–49	4514 (94.9%)	70 (1.5%)	33 (0.7%)	43 (0.9%)	35(0.7%)	11 (0.2%)	10 (0.2%)	25 (0.5%)	12 (0.3%)	2 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.0%)	0 (0.0%)
Women 50–59	616 (79.2%)	31 (4.0%)	10 (1.3%)	31 (4.0%)	15 (1.9%)	14 (1.8%)	10 (1.3%)	23 (3.0%)	13 (1.7%)	10 (1.3%)	3 (0.4%)	1 (0.1%)	1 (0.1%)	0 (0.0%)
Women 60–69	122 (43.9%)	15 (5.4%)	6 (2.2%)	26 (9.4%)	21 (7.6%)	16 (5.8%)	8 (2.9%)	25 (9.0%)	19 (6.8%)	9 (3.2%)	3(1.1%)	2 (0.7%)	5 (1.8%)	1 (0.4%)
Women 70+	13 (21.3%)	5 (8.2%)	1 (1.6%)	5 (8.2%)	4 (6.6%)	6 (9.8%)	1 (1.6%)	12 (19.7%)	4 (6.6%)	3 (4.9%)	2 (3.3%)	0(0.0%)	4 (6.6%)	1 (1.6%)

The percentages are calculated based on the total count within each age group and gender.

Table 3 Incidence of new CAC from an initial score of zero and progression of existing CAC stratified by follow-up intervals

Dataset	Total N	Initial CAC = 0 N	Initial CAC = 0 and developing incident CAC. N (%)	Mean (SD) and median (IQR) time for incident CAC (years)	Annual progression of CAC for baseline CAC > 0 N	Mean (SD) and median (IQR) annual progression of CAC for baseline CAC > 0
Dataset 1	70 389	59 032	9065 (15.4%)	6.1 (2.6) 6.0 (4.1, 8.0)	10 962	20.0 (48.9) 9.0 (3.0, 9)
Dataset 2	8511	5161	2191 (42.5%)	5.6 (2.5) 5.3 (3.8, 7.6)	3341	23.1 (31.5) 13.0 (5.2, 13.0)
Dataset 3	13 423	10 801	1688 (15.6%)	5.5 (2.2) 5.0 (4.6, 5.5)	2561	22.4 (52.9) 10.8 (4.3, 10.8)

Dataset 1: overall population (N = 70 389). Dataset 2: individuals with at least four CAC exams within 10 years (N = 8511). Dataset 3: individuals with a 5-year follow-up (N = 13 423). CAC, coronary artery calcification; SD, standard deviation; IQR, interquartile range.

Of the 1688 individuals who had a baseline CAC = 0 and later developed incident CAC by 5 years, the mean CAC score was 17.5, and the median (IQR) was 8.0 (3.0–21.0) (see [Supplementary data online, Table S6](#)). Only 2% (26 participants) exceeded a CAC score of 100, indicating minimal progression in most cases.

In men aged ≥40 with baseline CAC = 0, 18% advanced to CAC > 0 over 5 years (mean CAC = 17.6) (see [Supplementary data online, Table S7](#)), and women ≥ 50 had an 8% rate of new CAC (mean CAC = 17.7) (see [Supplementary data online, Table S8](#)). These findings imply that older adults who begin with CAC = 0 still exhibit minimal progression in most cases.

Among men 40 years of age or older, 46.2% had no baseline risk factors (hypertension, diabetes, current smoking, or LDL ≥ 160 mg/dL), 38.8% had one, 12.9% had two, 2.0% had three, and 0.1% had four (see [Supplementary data online, Table S9](#)). Among those with a baseline CAC score of 0, the proportion who maintained a CAC score of 0 at five years was 81.1% in those with one risk factor, 73.6% in those with two, 65.1% in those with three, and 25.0% in those with four. Mean and median follow-up CAC scores were higher among participants who had more baseline risk factors.

Long-term stability of zero CAC

Longitudinal changes in CAC scores were tracked in participants with a baseline CAC score of 0 over follow-up intervals ranging from 6 to 12 years ([Table 4](#)). Most participants consistently maintained a CAC score of 0 throughout the study period. Clinically significant progression, defined as a CAC score exceeding 100, was rare. At the 6-year follow-up, 83% of participants retained a CAC score of 0, with <1% progressing to a score above 100. This low rate of clinically significant progression remained stable across follow-up intervals: by the 10-year mark, 67% of participants still had a CAC score of 0, while 4% had scores over 100. At 12 years, 56% retained a CAC score of 0, and 7% had progressed to scores above 100.

For men aged ≥40 with CAC = 0, 79% remained at 0 after 6 years, 65% after 10 years, and 54% after 12 years, with 0.6%, 4%, and 7% exceeding CAC = 100, respectively (see [Supplementary data online, Table S10](#)). In women ≥ 50 with CAC = 0, 89% maintained a score of 0 at 6 years, 84% at 10 years, and 81% at 12 years, with ~1% exceeding 100. Although some calcification occurred over time, these data suggest that a baseline CAC = 0 is associated with low rates of significant progression in older adults, over intervals up to 12 years.

Discussion

This study provides a comprehensive analysis of the distribution and progression of CAC in a substantial cohort of over 70 000

asymptomatic individuals. By analysing data in 10-year age intervals and stratifying results by sex, it offers valuable insights for targeting specific populations and optimizing CAC testing intervals.

In this Korean cohort of relatively young, asymptomatic adults, the majority exhibited a CAC score of 0. For instance, 92% of men and 98% of women aged 30–39, as well as 95% of women aged 40–49, had no detectable CAC. The low prevalence of significant CAC in this population suggests a minimal likelihood of detecting clinically relevant calcification, especially among younger women.²⁶

Follow-up data indicated that incident CAC typically develops in about five to six years for individuals with an initial CAC score of 0, irrespective of the follow-up intervals. Even in cases where CAC was detected during this period, the degree of calcification was minimal; only 1% (26 out of 1700) had scores > 100, indicating a negligible overall calcification burden. This finding suggests that even a five-year interval for reassessment might be more frequent than necessary. The stable and predictable nature of CAC progression in this population supports extending testing intervals without compromising the ability to detect clinically meaningful changes.

Extended follow-up data revealed that among participants with a baseline CAC score of 0, the prevalence of clinically significant CAC scores remained consistently low over time. At the 6-year follow-up, only 1% had a CAC score > 100. This proportion remained low at 4% after 10 years. This low incidence indicated that significant CAC progressed minimally for these individuals over extended periods. Therefore, for individuals with an initial CAC score of 0, extended testing intervals might be appropriate.

Separately, among the 11 357 participants with a baseline CAC > 0, 395 (3.5%) were observed to have CAC = 0 at follow-up. Their initial calcification burden was minimal (median [IQR], 1 [1–3]), suggesting that this ‘reversion’ likely reflects minor technical variations (e.g. slice misalignment and motion artefacts) rather than true plaque regression.

Our findings hold several important clinical implications. First, this study provides comprehensive data on CAC distribution in a large Korean population, specifically stratified by age and sex. This is particularly valuable because prior studies have reported that East Asians generally exhibit lower average CAC scores compared with White populations, as observed in the Multi-Ethnic Study of Atherosclerosis (MESA). Thus, our findings may not be directly applicable to populations with a higher burden of atherosclerotic cardiovascular disease, such as those in Northern and Eastern Europe, the United States, or South Asia.²⁷ Nevertheless, by presenting CAC proportions across age and sex groups, our study offers a useful reference for cardiovascular risk assessment and developing culturally specific health interventions.

Secondly, CAC assessment should be applied more selectively within asymptomatic populations, especially among younger and female

Table 4 Changes in CAC scores over time for individuals with baseline CAC of zero

CAC category	12 years later		11 years later		10 years later		9 years later		8 years later		7 years later		6 years later	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
0	571	56.4	1465	61.9	2613	67.3	3749	69.6	5484	74.1	6229	77.8	9730	82.8
1-4	59	5.8	171	7.2	279	7.2	396	7.4	499	6.7	490	6.1	662	5.6
5-9	47	4.6	101	4.3	149	3.8	202	3.8	246	3.3	272	3.4	312	2.7
10-19	75	7.4	142	6	231	6.0	314	5.8	378	5.1	343	4.3	408	3.5
20-29	53	5.2	110	4.7	140	3.6	181	3.4	206	2.8	203	2.5	220	1.9
30-39	46	4.6	83	3.5	83	2.1	119	2.2	136	1.8	128	1.6	122	1.0
40-49	28	2.8	52	2.2	79	2.0	89	1.7	110	1.5	110	1.4	89	0.8
50-99	65	6.4	125	5.3	173	4.5	202	3.8	198	2.7	160	2	149	1.3
100-199	38	3.8	68	2.9	101	2.6	92	1.7	121	1.6	53	0.7	40	0.3
200-299	15	1.5	27	1.1	21	0.5	24	0.5	13	0.2	12	0.2	13	0.1
300-399	9	0.9	7	0.3	7	0.2	6	0.1	7	0.1	3	0.0		
400-499			5	0.2	2	0.1	5	0.1	4	0.1				
500-999	5	0.5	8	0.3	4	0.1	5	0.1			2	0.0	3	0.0
1000~	1	0.1	2	0.1	2	0.1								
Total	1012	100	2366	100	3884	100	5384	100	7402	100	8005	100	11748	100
CAC 0 maintained	571	56.4%	1465	61.9%	2613	67.3%	3749	69.6%	5484	74.1%	6229	77.8%	9730	82.8%
CAC > 0	441	43.6%	901	38.1%	1271	32.7%	1635	30.4%	1918	25.9%	1776	22.2%	2018	17.2%

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