

# Using Coronary Artery Calcium (CAC) scoring in underwriting to reduce hidden CAD risk



Dr David Lu

Chief Medical Officer Asia Pacific  
Swiss Re

Coronary artery calcium (CAC) scoring helps insurers reduce information gaps that are inherent in conventional underwriting.

# Current Risk-Factor Based CAD Risk Assessment Approach

---



# Framingham Risk Score for Hard Coronary Heart Disease



Estimates 10-year risk of heart attack in patients 30-79 years with no history of CHD or diabetes.

## Important

There are several distinct Framingham risk models. MDCalc uses the 'Hard' coronary Framingham outcomes model, which is intended for use in **non-diabetic** patients age 30-79 years with no prior history of coronary heart disease or intermittent claudication. This version was selected because it is the most widely applicable to patients without previous cardiac events.

See the [official Framingham website](#) for additional Framingham risk models.

When to Use

Pearls/Pitfalls

Age  years

Sex  Female  Male

Smoker  No  Yes

Total cholesterol  mmol/L

HDL cholesterol  mmol/L

Systolic BP  mm Hg

Blood pressure being treated with medicines  No  Yes

**26.2 %**  
10-year risk of MI or death for this patient

**13 %**  
Average 10-year risk of MI or death

Copy Results

Next Steps

# Risk-factor based Coronary Heart Disease risk assessment tool

<https://www.mdcalc.com/calc/38/framingham-risk-score-hard-coronary-heart-disease>

# Other risk-factor based CAD risk assessment tools

## Systematic Coronary Risk Evaluation 2 (SCORE2)

Predicts 10-year CVD risk in patients without prior CVD or diabetes.

**INSTRUCTIONS**  
Use in European patients aged 40-69 years without prior CVD or diabetes.

When to Use ▾ Why Use ▾

Sex:  Male  Female

Age:  years

Smoking:  Other  Current

SBP:  Norm: 100 - 120 mm Hg

Total cholesterol:  Norm: 3.9 - 5.2 mmol/L ↔

HDL cholesterol:  Norm: 1.55 - 4.01 mmol/L ↔

Risk region  
See [Evidence](#) for definition of risk regions.

Low  
 Moderate  
 High  
 Very high

## Predicting Risk of Cardiovascular Disease EVENTS (PREVENT)

Predicts 10- and 30-year risk of CVD and CVD subtypes in patients aged 30-79 without known CVD.

Model:  Base  
 [uACR](#)  
 HbA1c  
 SDI  
 Full

Sex:  Female  Male

Age:  years

Total cholesterol:  Norm: 3.9 - 5.2 mmol/L ↔

HDL cholesterol:  Norm: 0.52 - 1.55 mmol/L ↔

SBP:  Norm: 100 - 120 mm Hg

Diabetes:  No  Yes

Current smoker:  No  Yes

[eGFR](#):  Norm: 90 - 120 mL/min/1.73 m<sup>2</sup>

Using anti-hypertensive medication:  No  Yes

Using statins:  No  Yes

[BMI](#):  Norm: 20 - 25 kg/m<sup>2</sup>

- These models **estimate an individual's probability** of experiencing a cardiovascular event or death over a defined time horizon **relative to others with similar risk-factor profiles**.
- However, they **do not directly assess** the presence or burden of coronary atherosclerosis in a specific individual.

© 2025 THE AUTHORS. PUBLISHED BY ELSEVIER ON BEHALF OF THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION. THIS IS AN OPEN ACCESS ARTICLE UNDER THE CC BY-NC-ND LICENSE (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## BRIEF REPORT

---

# Limitations of Risk- and Symptom-Based Screening in Predicting First Myocardial Infarction



Anna S. Mueller, MD,<sup>a</sup> Jonathon Leipsic, M,<sup>b</sup> Matthew Tomey, MD,<sup>c</sup> Edgar Argulian, MD,<sup>c</sup> Jagat Narula, MD,<sup>d</sup> Amir Ahmadi, MD<sup>c</sup>

- Real-world data (Mount Sinai West/Morningside, NY)
- 465 myocardial infarction patients ( $\leq 65$  years), no known CAD at baseline
- CAD risk assessment using risk factor–based models
- Simulated **2 days before the first myocardial infarction**

## Statin Indication as per ACC/AHA 2018 Guideline



### ASCVD Risk Estimator Plus

LDL > 190 mg/dl or  
Diabetes Mellitus

78 patients  
(17%)

ASCVD > 20%

47 patients  
(10%)

ASCVD 7.5 -20%

131 patients  
(28%)

ASCVD 5-7.5%

56 patients  
(12%)

ASCVD < 5%

153 patients  
(33%)



### Prevent Calculator

LDL > 190 mg/dl or  
Diabetes Mellitus

59 patients  
(13%)

ASCVD > 20%

14 patients  
(3%)

ASCVD 7.5 -20%

107 patients  
(23%)

ASCVD 5-7.5%

75 patients  
(16%)

ASCVD < 5%

210 patients  
(45%)



Statin or Imaging **NOT**  
recommended: **45%**



Statin or Imaging **NOT**  
recommended: **61%**

45-61%

low to  
borderline  
risk

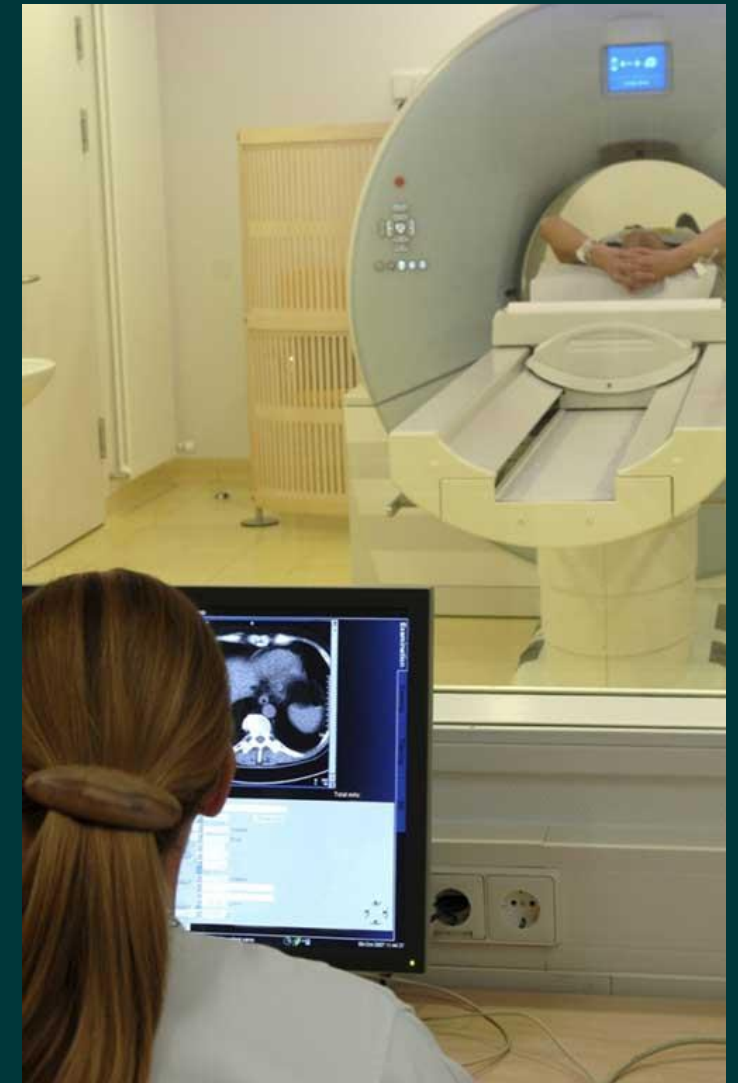
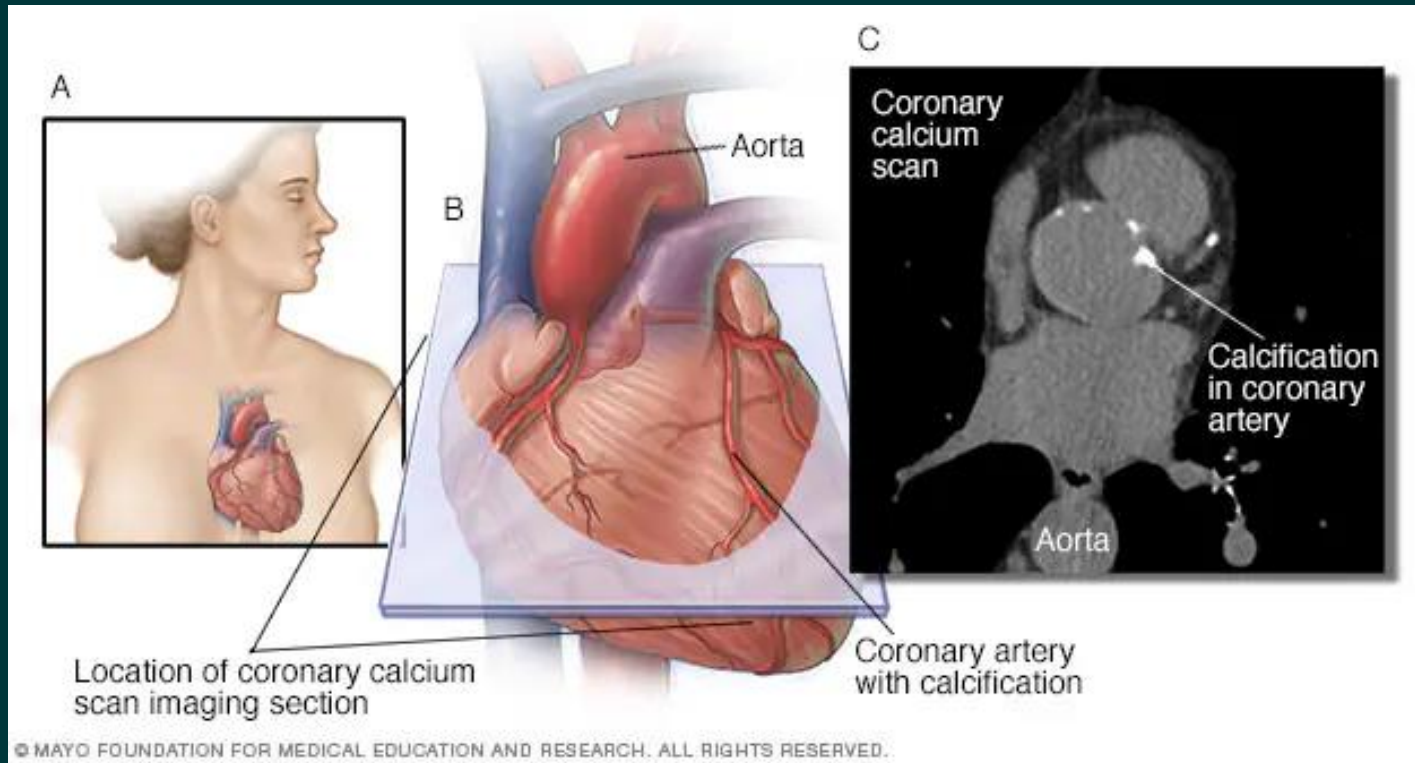
# Coronary Artery Calcium (CAC) Score

---



# Coronary calcium scan

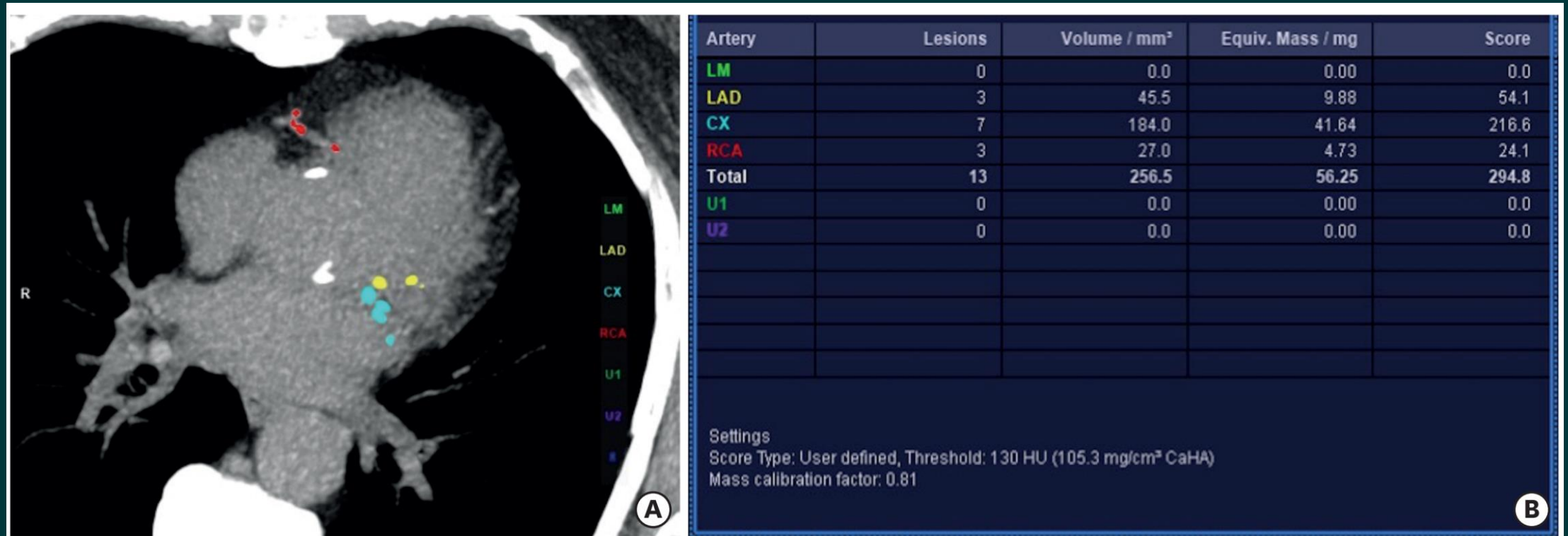
Cost in Asia US\$ 30-550



Source: Mayo Clinic

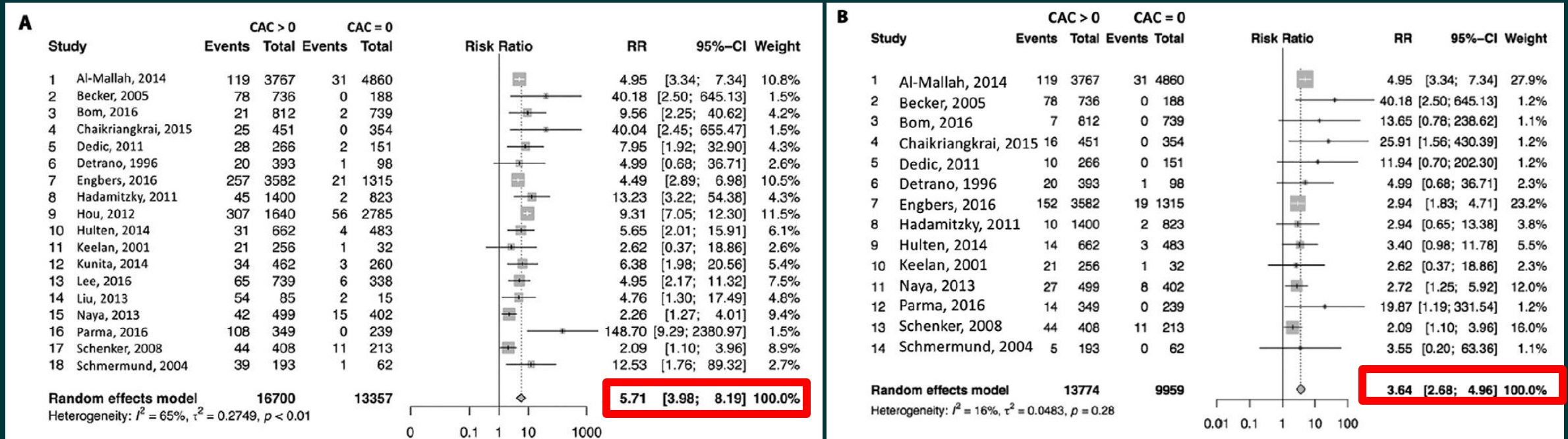
Source: [https://www.radiologyinfo.org/en/info/ct\\_calscoring](https://www.radiologyinfo.org/en/info/ct_calscoring)

# Coronary artery calcium scoring



P Kumar, et al. Coronary Artery Calcium Data and Reporting System (CAC-DRS): A Primer. J Cardiovasc Imaging. 2023 Jan;31(1):1-17

# CAC > 0 vs. CAC = 0

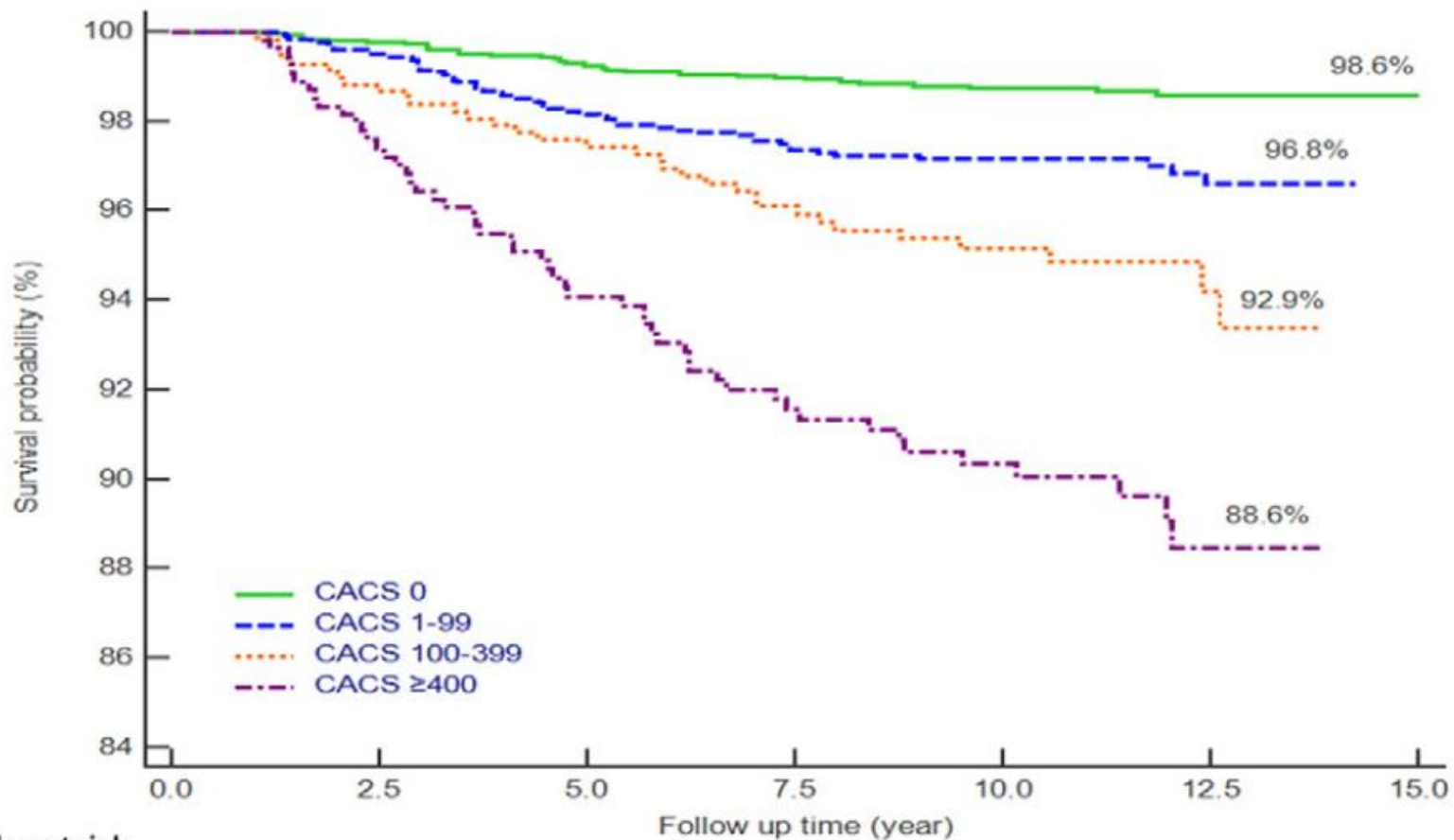


Major adverse cardiac events (MACE)  
Relative risk 5.71

All-cause mortality and nonfatal MI  
Relative risk 3.64

Mallory S. LKS, et al. Prognostic value of coronary artery calcium score in symptomatic individuals: A meta-analysis of 34,000 subjects. International Journal of Cardiology 299 (2020) 56–62.

a



Number at risk

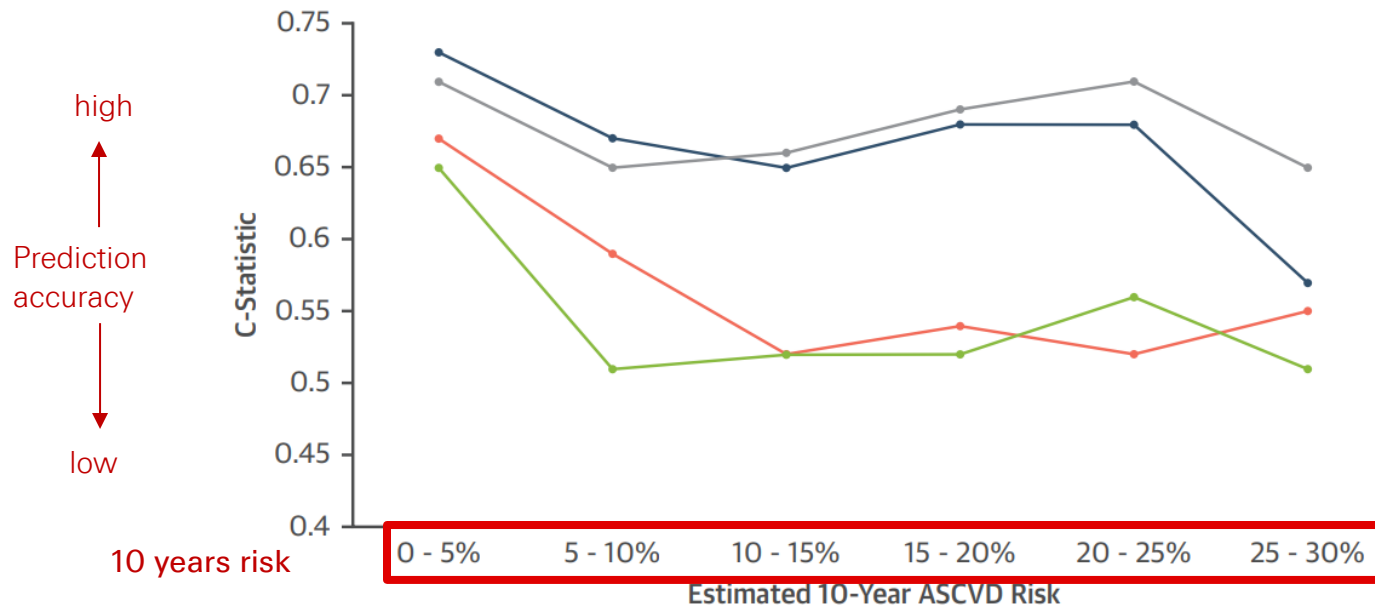
CACS 0	2539	2494	2385	2280	1652	934
CACS 1-99	1812	1762	1650	1534	1131	367
CACS 100-399	687	662	607	551	379	129
CACS ≥400	546	519	464	414	305	106

# Survival by CAC score

Asymptomatic individuals (mean age 56.6) with no known CVD and  $\leq 1$  risk factor

R. Nakanishi et al. The relationship between coronary artery calcium score and the long-term mortality among patients with minimal or absent coronary artery risk factors. *International Journal of Cardiology* 185 (2015) 275–281

**FIGURE 2 Discriminative Ability for the Prediction of CHD Death Events, by 5% ASCVD Risk Strata**



# Combining CAC with traditional risk model improves prediction

Asymptomatic individuals (mean age 57) referred for clinical CAC scoring

Results are presented using the C-statistic. CHD = coronary heart disease; MESA = Multi-Ethnic Study of Atherosclerosis; other abbreviations as in Figure 1. 10-year ASCVD Risk Estimator (the Pooled Cohort Equations [PCE])

Blaha et al. Comparing Risk Scores in the Prediction of Coronary and Cardiovascular Deaths. Coronary Artery Calcium Consortium. JACC: CARDIOVASCULAR IMAGING, VOL. 14, NO. 2, 2021

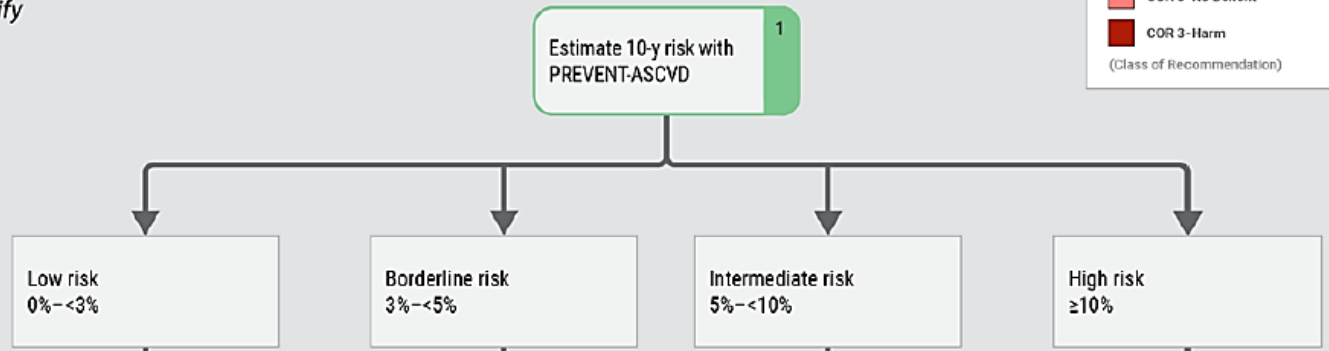
# CPR Framework for Risk Evaluation

**LEGEND**

- COR 1
- COR 2a
- COR 2b
- COR 3-No Benefit
- COR 3-Harm

(Class of Recommendation)

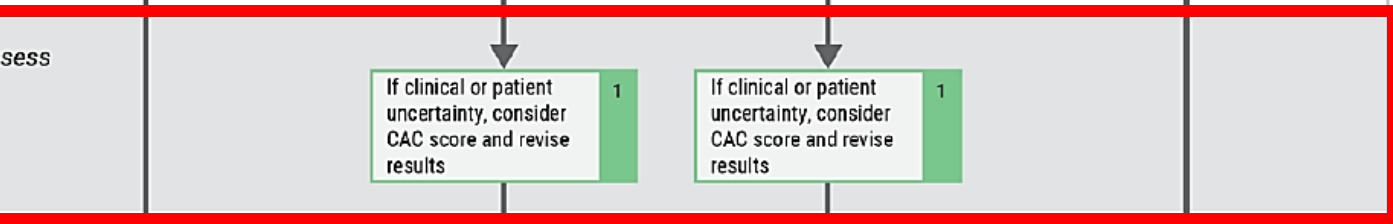
## Calculate and Classify



## Personalize



## Reclassify and Reassess



## Decide and Treat



# 2026 Guidance

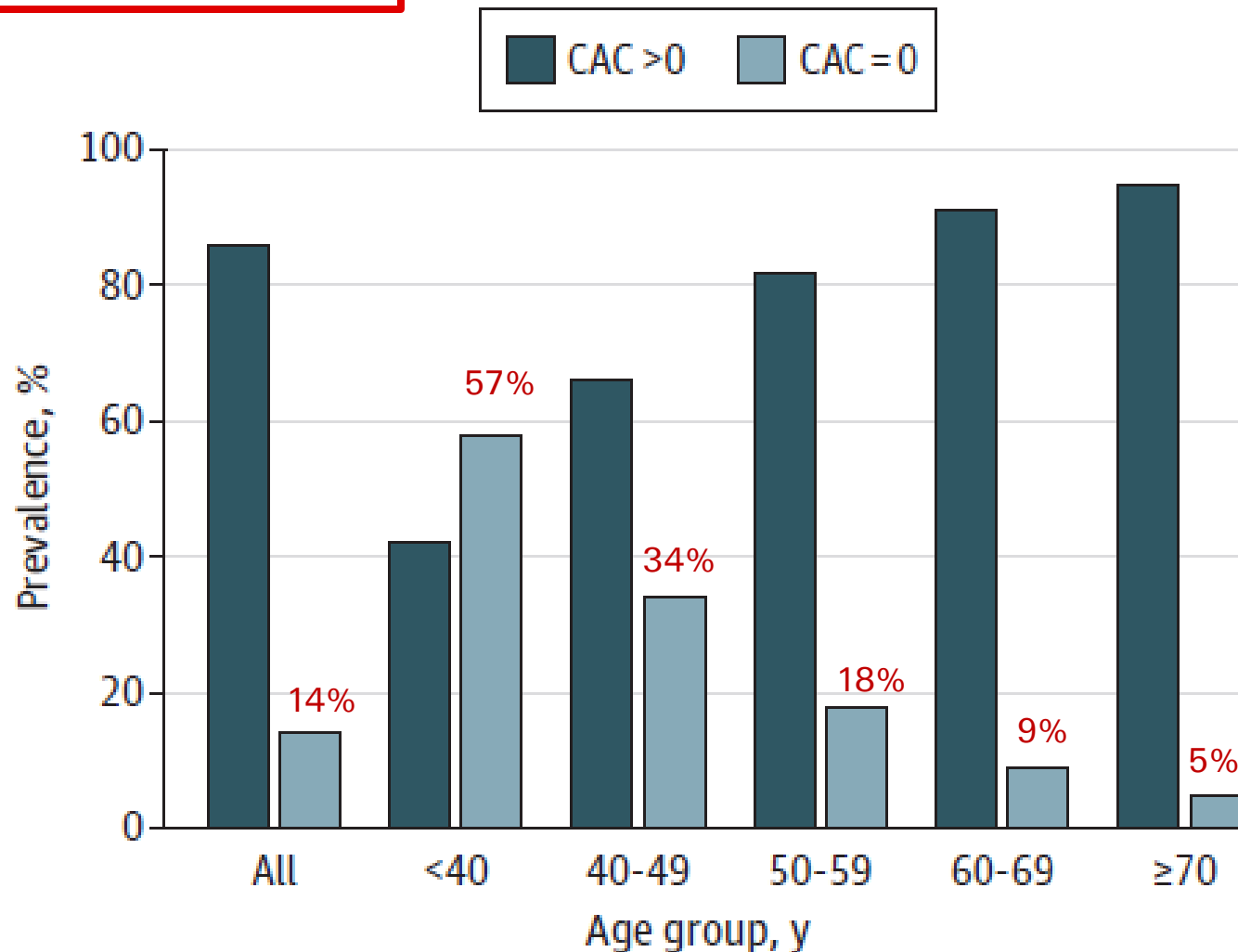
CAC **does not replace** traditional risk factor–based assessment **but enhances it** by resolving uncertainty at the individual level

Blumenthal RS, et al. 2026 ACC/AHA/Multisociety Guideline on the Management of Dyslipidemia. Journal of the American College of Cardiology (JACC). Published online 13 March 2026.

# Limitation

**CAC cannot identify  
non-calcified (soft) plaque**

**B** Patients with obstructive CAD



No. at risk

Obstructive CAD	5043	68	562	1486	1963	964
CAC = 0 + obstructive CAD	725	39	192	268	174	52

**CAC 0 does not exclude high-risk CAD in younger symptomatic patients**

Symptomatic patients, CT angiography (CTA) confirmed obstructive CAD (stenosis  $\geq$  50%)

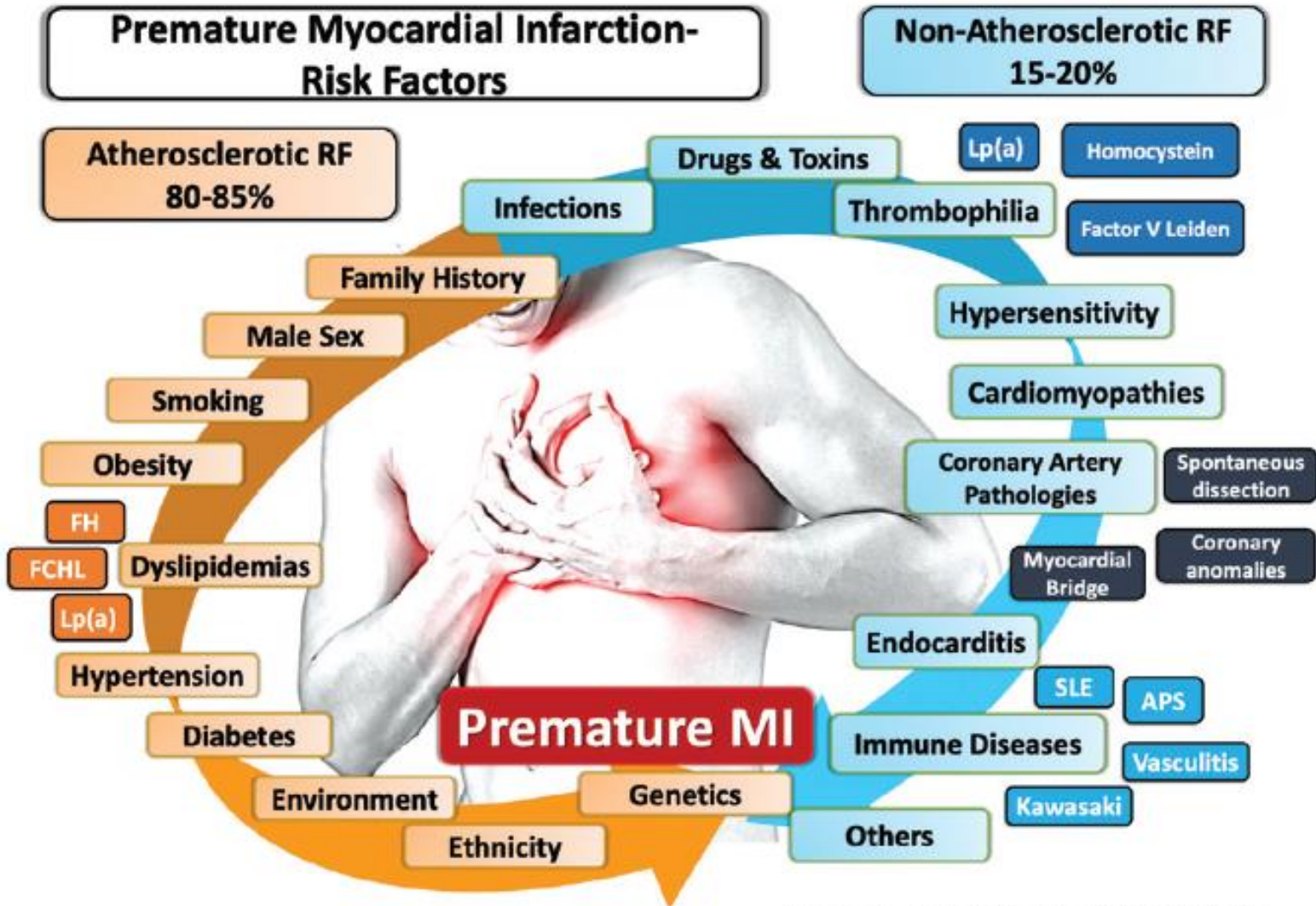
Martin BM, et al. Association of Age With the Diagnostic Value of Coronary Artery Calcium Score for Ruling Out Coronary Stenosis in Symptomatic Patients. JAMA Cardiol. 2022;7(1):36-44.

CAC = 0 does NOT rule out treatment

**Do NOT defer therapy if ANY high-risk features present:**

- Familial hypercholesterolaemia (FH)
- LDL-C >190 mg/dL
- Diabetes (age >40)
- Current smoking
- Strong family history of premature ASCVD

Blumenthal RS, et al. **2026 ACC/AHA/Multi-society Guideline** on the Management of Dyslipidemia. Journal of the American College of Cardiology (JACC). Published online 13 March 2026.



Kayikcioglu et al, Balkan Med J 2022;39:83-95

CAC = 0 does not exclude MI risk: up to 20% are non-atherosclerotic

# Why CAC Matters for Insurance Risk Management?

---



CAD remains a key driver of mortality and morbidity claims

Combining CAC with traditional risk factors may:

- Improves risk stratification
- Reveals hidden coronary risk

CAC is most valuable in high-impact segments, where:

- Claim amounts are high
- Risk concentration is greater (e.g. high sum assured segments)

## Life & Health Insights Coronary artery calcium score in underwriting

Ischaemic heart disease is the leading cause of death worldwide, and myocardial infarction is the major driver of critical illness claims. The majority of myocardial infarctions are caused by atherosclerotic coronary artery disease.<sup>2</sup>

Coronary artery calcium (CAC) scoring complements traditional assessment by providing direct evidence of calcified coronary atherosclerotic burden in asymptomatic individuals above age 40, and adds incremental prognostic value beyond traditional risk factors and supports more refined individual risk differentiation. Because CAC cannot identify non-calcified (soft) plaque, it is not recommended for younger adults, people with diabetes, or those with smoking or inflammatory risk profiles.

### Current risk factor-based coronary artery disease risk assessment approach

The current underwriting approach for coronary artery disease (CAD) primarily relies on risk factors-based CAD risk scoring systems that have been used in clinical settings for over five decades. Initiated in 1948, the Framingham

Heart Study established the foundation for longitudinal cardiovascular risk assessment by identifying key CAD risk factors, including hypertension, cholesterol, smoking, diabetes, and age. The resulting Framingham Risk Score became the first widely adopted tool for CAD risk prediction.<sup>4</sup>

Other CAD risk scoring systems developed later include the European SCORE system, the ACC/AHA Pooled Cohort Equations, and, most recently, the PREVENT equations.<sup>5, 6, 7</sup> These CAD risk scoring systems are all derived from large, long running population cohort studies and have consistently demonstrated strong population level associations between traditional cardiovascular risk factors and clinical outcomes.

These models estimate an individual's probability of experiencing a cardiovascular event over a defined time

horizon relative to others with similar risk-factor profiles. However, they do not directly assess the presence or burden of coronary atherosclerosis and therefore do not rule out underlying coronary artery disease.

In a retrospective study of 465 patients aged  $\leq 65$  years presenting with a first myocardial infarction, 45–61% were classified as low or borderline risk and would not have met guideline thresholds for statin therapy or imaging based on ASCVD or PREVENT scores when assessed two days before the event.<sup>8</sup> Together with prospective evidence that imaging-detected subclinical atherosclerosis adds prognostic value beyond traditional risk factors, this supports the use of CAC as a complementary risk-refinement tool.<sup>9</sup>

### Find out more

Find out more on CAC Score and other testing in underwriting in the upcoming publication, *Evaluating the Predictive Value of Medical Underwriting Tests for Mortality Risk: Evidence from the Multi-Ethnic Study of Atherosclerosis*

### Key message

Accurately predicting the risk of heart attack is essential for underwriting, given its material impact on mortality and morbidity, particularly critical illness claims. Established risk-factor-based cardiovascular risk models, derived from large population datasets, provide a robust and well-validated foundation for risk assessment. However, as population-based tools, they may not fully capture individual variation in atherosclerotic burden or vulnerability, which can lead to differences between estimated and actual risk at the individual level. This highlights the need for complementary tools to refine individual risk stratification.<sup>3</sup>

© 2026 Swiss Re. All rights reserved.



### 3 Swiss Re Life & Health Insights: Coronary artery calcium score in underwriting

when CAC data are available. Collectively, these tools offer a comprehensive and complementary assessment of cardiovascular risk.

### Conclusions/Key takeaways for insurers

- Coronary artery disease remains a major driver of claims, yet early-stage disease is often clinically silent and not fully captured by traditional underwriting approaches.
- Risk factor-based cardiovascular models are essential for population risk estimation but estimate probability rather than detect disease and may lack precision at the individual level.
- Coronary artery calcium (CAC) scoring adds value by providing a direct measure of calcified coronary atherosclerosis, improving individual risk differentiation among applicants with similar apparent risk profiles.
- However, CAC should be used to complement – not replace – traditional assessment, as a zero score does not exclude non-calcified atherosclerotic plaque, particularly in younger adults, individuals with diabetes, smoking exposure, severe hypercholesterolaemia, or strong family history.
- Recent clinical guidelines position CAC as a calibrated decision support tool, emphasising appropriate use and cautioning against over-reliance.
- For insurers, especially in high sum assured or concentrated portfolios, CAC can help reduce hidden coronary risk, mitigate the impact of large claims on portfolios and support more precise, evidence-based underwriting when applied within a robust medical and risk governance framework.

### Author



David Lu  
Chief Medical Officer Asia Pacific  
David\_Lu@swissre.com

### References

- World Health Organization, The top 10 causes of death, Geneva: WHO, 2024.
- Thygesen K, et al. Fourth Universal Definition of Myocardial Infarction. *Circulation*, 2018;138:e618–e651.
- Wahab J, et al. Current approach to atherosclerotic cardiovascular disease risk prediction. *Future Cardiology*, 2026, 21(2), 67–69.
- Framingham Heart Study. <https://www.framinghamheartstudy.org/>
- Conroy SM, et al. Estimation of ten-year risk of fatal cardiovascular disease in Europe: the SCORE project. *European Heart Journal*, 2003, 24:987–1003.
- Goff DC Jr, et al. 2013 ACC/AHA guideline on the assessment of cardiovascular risk. *Circulation*, 2014;129(Suppl 2): S49–S73.
- Khan SS, et al. Development and validation of the American Heart Association Predicting Risk of Cardiovascular Disease (PREVENT) equations. *Circulation*, 2023.
- A Mueller, et al. Limitations of Risk- and Symptom-Based Screening in Predicting First Myocardial Infarction. *JACC: ADVANCES*, Vol 4, No. 12, 2025.
- V Fuster, et al. Influence of Subclinical Atherosclerosis Burden and Progression on Mortality. *JACC* VOL. 84, NO. 16, 2024:1931 – 1409.
- A Chui, et al. Coronary artery calcium in primary prevention. *AJGP* VOL. 49, NO. 8, AUGUST 2020.
- RL McClabund, et al. Distribution of Coronary Artery Calcium by Race, Gender, and Age: Results from the Multi-Ethnic Study of Atherosclerosis (MESA). *Circulation*, Volume 113, Issue 1, 3 January 2006, Pages 30–37.
- KR Kalantari, et al. Updates on CAD risk assessment: using the coronary artery calcium score in combination with traditional risk factors. *The Egyptian Heart Journal* (2025) 77:14.
- Sheppard JP, et al. Age and the power of zero CAC in cardiac risk assessment: overview of the literature and a cautionary case. *Br J Cardiol* 2022;29:89–94.
- Hussain A, et al. Zero Coronary Artery Calcium Score: Desirable, but Enough? *Circulation* 2020 Sep 8;142(10):917–919, Hussain A, et al. Zero Coronary Artery Calcium Score: Desirable, but Enough? *Circulation*, 2020 Sep 8;142(10):917–919.
- Blumenthal RS, et al. 2026 ACC/AHA/Multisociety Guideline on the Management of Dyslipidemia. *Journal of the American College of Cardiology (JACC)*. Published online 13 March 2026.
- Deepak DV, et al. Artificial Intelligence-Driven Advances in Coronary Calcium Scoring. *Expanding Preventive Cardiology*, Current 2024 Nov 28;16(11):e4881.
- Randi F, et al. Opportunistic Detection of Coronary Artery Calcium on Noncardiac Chest Computed Tomography: An Emerging Tool for Cardiovascular Disease Prevention: A Scientific Statement From the American Heart Association. *Circulation*, 2025;152:e381–e401.
- David JM, et al. Coronary Artery Calcium Staging to Guide Preventive Interventions: A Proposal and Call to Action. *JACC: ADVANCES*, Vol. 3, No. 11, 2024.
- Muhammad AK. Retinal Coronary Artery Calcium Scoring – A Scalable Tool for Life Insurers. *J Ineur Med* 2026;3:78–80.

The entire content of this factsheet is subject to copyright with all rights reserved. The information may be used for private or internal purposes, provided that any copyright or other proprietary notices are not removed. Electronic reuse of the data published in this factsheet is prohibited. Reproduction in whole or in part or use for any public purpose is permitted only with the prior written approval of Swiss Re, and if the source reference is indicated. Courtesy copies are appreciated. Although all the information used in this factsheet was taken from reliable sources, Swiss Re does not accept any responsibility for the accuracy or completeness of the information given or forward-looking statements made. The information provided and forward-looking statements made are for informational purposes only and in no way constitute or should be taken to reflect Swiss Re's position, in particular in relation to any ongoing or future dispute. In no event shall Swiss Re be liable for any loss or damage arising in connection with the use of this information and readers are cautioned not to place undue reliance on forward-looking statements. Under no circumstances shall Swiss Re or its Group companies be liable for any financial and/or consequential loss relating to this factsheet. Swiss Re undertakes no obligation to publicly revise or update any forward-looking statements, whether as a result of new information, future events or otherwise. This factsheet does not constitute legal or regulatory advice and Swiss Re gives no advice and makes no investment recommendation to buy, sell or otherwise deal in securities or investments whatsoever. This document does not constitute an invitation to effect any transaction in securities or make investments.

© 2026 Swiss Re. All rights reserved.

# Legal notice

©2026 Swiss Re. All rights reserved. You may use this presentation for private or internal purposes but note that any copyright or other proprietary notices must not be removed. You are not permitted to create any modifications or derivative works of this presentation, or to use it for commercial or other public purposes, without the prior written permission of Swiss Re.

The information and opinions contained in the presentation are provided as at the date of the presentation and may change. Although the information used was taken from reliable sources, Swiss Re does not accept any responsibility for its accuracy or comprehensiveness or its updating. All liability for the accuracy and completeness of the information or for any damage or loss resulting from its use is expressly excluded.

