

What is the Best Cardiovascular Risk Score in Our Daily Practice?

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Preventing cardiovascular disease (CVD) involves lifestyle modifications, risk factor management at the individual level (identifying high-risk patients and setting targets to reduce CVD risk), and public health strategies at the population level (targeting the overall population and aiming to minimize the risk throughout the entire population). The intervention, with a slight reduction in overall CVD risk, is unexceptionally significant but difficult to achieve. Both strategies must be combined to reduce the burden of CVDs.¹ Moreover, it is essential to consider that younger patients are often classified as low risk in most risk-prediction models. However, the future lifetime risk of CVD is much greater in younger patients with multiple risk factors than in older patients.²

Population-level prevention is implemented through broad strategies, such as policy and community interventions, to reduce risk factor prevalence, including tobacco control through bans and taxes, salt/trans fat reduction in foods, the promotion of physical activity via urban planning, and mass media campaigns for healthy eating and alcohol moderation. Community settings, such as faith-based organizations, schools, workplaces, and social services, deliver evidence-based programs (e.g., nutrition education, activity policies), using multilevel strategies, including training implementers, audits, incentives, and partnerships for equity.³

The individual-based approach is practical and feasible, and is usually performed in daily clinical practice, even using clinician experience tools to identify high-risk patients. However, a substantial number of CVD events occur among intermediate- or low-risk patients, which need to be addressed with a risk prediction model to manage this group of patients. Cardiovascular risk is typically estimated by calculating a person's likelihood of developing CVD, such as a heart attack or stroke, within a given timeframe, usually the next 10 years. This estimation is based on several factors, including age, gender, race, cholesterol levels, blood pressure, smoking status, diabetes, and medication use.⁴ The most widely used tools for estimating cardiovascular risk are risk calculators based on extensive population studies, like the ASCVD (Atherosclerotic Cardiovascular Disease) Risk Estimator, developed by the American College of Cardiology, which calculates 10-year

and lifetime risk of ASCVD events, using such factors as age, sex, race, cholesterol levels (total, LDL, HDL), blood pressure levels, diabetes status, smoking status, and the use of blood pressure medications.⁵ Other tools, such as SCORE2⁶ and SCORE-OP,⁷ estimate 10-year total CVD risk, using blood pressure and non-HDL cholesterol, adjusted by age, sex, and smoking status, and are often used in European settings. Additional calculators include QRISK3 risk prediction models, which include additional clinical variables (chronic kidney disease, a measure of systolic blood pressure variability, migraine, corticosteroids, SLE, atypical antipsychotics, severe mental illness, and erectile dysfunction), to identify those at the highest risk of heart disease and stroke.⁸

The best screening tools for individual cardiovascular risk assessment include the American Heart Association's PREVENT calculator,⁹ the European Society of Cardiology's SCORE2/HeartScore,⁶ and the ACC/AHA Pooled Cohort Equations (PCE) for ASCVD risk,¹⁰ selected based on contemporary data, regional applicability, and the inclusion of key factors, like age, sex, blood pressure, cholesterol, diabetes, smoking, and metabolic markers.

The SCORE2 and HeartScore⁶ were designed for use in the European population. ESC's updated SCORE2 (ages 40-69) and SCORE2-OP (ages 70+)⁷ predict 10-year fatal/non-fatal CVD events, calibrated for European risk regions, without prior CVD, considering age, sex, smoking, blood pressure, and non-HDL cholesterol. HeartScore provides an interactive, no-login interface with personalized recommendations, supporting tailored interventions in line with the 2021 ESC guidelines (Figure 1).

PREVENT Calculator, an AHA tool,⁹ estimates 10- and 30-year total CVD risk (including ASCVD and heart failure) for ages 30-79 without prior CVD, using data from over 6.5 million diverse U.S. adults and incorporating kidney/metabolic factors, like Urine Albumin-to-Creatinine Ratio (UACR) and HbA1c, for precision, and eliminating race as a variable to reduce bias. An optional social deprivation index enhances personalization. It is ideal for primary prevention discussions and outperforms prior models across general U.S. populations. PREVENT demonstrates superior calibration across sexes, races, and ethnicities, providing more accurate absolute 10-year ASCVD risk estimates – addressing Pooled Cohort Equations (PCE) overestimation in some cohorts and underestimation in others (e.g., South Asians, low socioeconomic groups) with lower Brier scores and better alignment in calibration plots. It also excels at predicting total CVD (including heart failure) at 10- and 30-year horizons, outperforming PCE in validation studies, with c-statistics up to 0.890 for fatal events. While discrimination (c-statistic ~0.78-0.89) shows modest gains overall – stronger in males and non-Hispanic Black adults – PREVENT reclassifies many PCE high-risk individuals to lower categories, enabling

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targeted interventions like statins for those benefiting the most.¹¹ The PREVENT score was used in the 2025 AHA/ACC hypertension guidelines and adopted by the Brazilian Society of Cardiology in its most recent guidelines (Figure 1).

In addition, to estimate risk score calculators, emerging non-traditional markers (apolipoprotein A, apolipoprotein B, high-sensitivity C-reactive protein, brain natriuretic peptides, troponin I, homocysteine, interleukins 1 and 6, lipoprotein Lp(a), cholesterol remnants, size and number of LDL particles, tissue/tumour necrosis factor- α , and uric acid) should be addressed and used in an individual approach in risk stratification.¹² Despite encouraging findings, challenges remain in integrating these biomarkers into clinical practice, and there is a need for evidence from clinical trials, demonstrating their cost-effectiveness in reducing CV events, as well as investigations to establish clear treatment guidelines and optimize patient outcomes.¹³

Although risk scores can be used for risk stratification in clinical practice, it is essential to note that available risk calculators do not accurately estimate risk in young patients and women. For individuals under 50 years of age, it is crucial to calculate both 10- and 30-year CVD risk. Furthermore, for

females, the measurement of traditional risk factors, using the risk score calculators mentioned above, should be associated with the evaluation of female-specific factors, including age of menarche and menopause, polycystic ovary syndrome, infertility, and the use of assisted reproductive technology, spontaneous pregnancy loss, parity, and adverse pregnancy outcomes, as well as female-predominant conditions, such as autoimmune diseases, migraines, and depression, which enhance women's cardiovascular risk during one's lifespan. These factors must be addressed to identify women at high CVD risk, in which non-pharmacological measures, such as lifestyle changes, and pharmacological measures, such as high-potency statins, need to be implemented.¹⁴

In the near future, clinical, biochemical, and imaging parameters will be used to stratify cardiovascular risk and provide more detailed information regarding the risk management of individual patients. AI will provide a data-driven, individualized risk evaluation and a targeted approach to prevent CVD. Until then, our clinical judgment and risk calculators will help us individualize risk stratification for the Brazilian population, which has not been included in existing scoring systems.

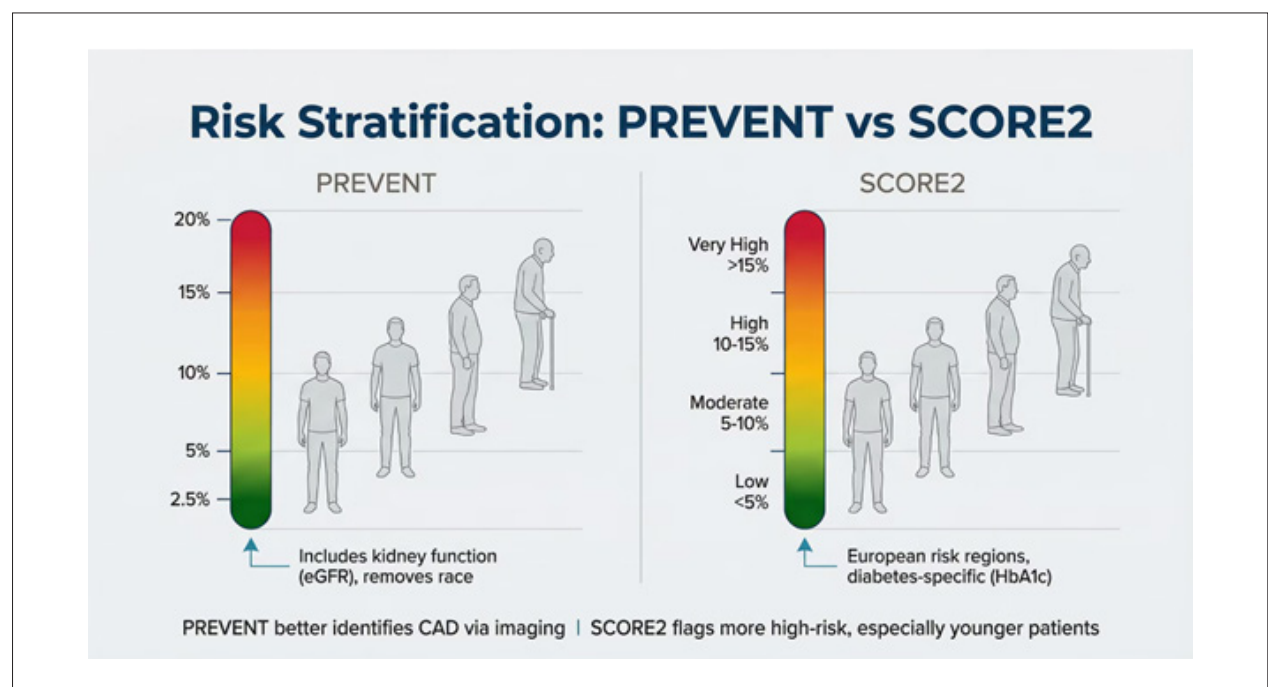


Figure 1 – Differences in cardiovascular risk stratification between the Prevent Score and SCORE2.^{6,9}

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