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American Heart Association PREVENT™ Science

- [Novel Prediction Equations for Absolute Risk Assessment of Total Cardiovascular Disease Incorporating Cardiovascular-Kidney-Metabolic Health: A Scientific Statement From the American Heart Association | Circulation](#)

- [Development and Validation of the American Heart Association's PREVENT™ Equations | Circulation](#)

- [PREVENT Risk Age Equations and Population Distribution in US Adults](#)

- [Age and Sex-Specific Percentiles of 30-Year Cardiovascular Disease Risk Based on the PREVENT Equations](#)

American Heart Association PREVENT™ Resources

- [PREVENT Landing Page](#)

- [PREVENT Clinical Slide Deck](#)

- [PREVENT Calculator FAQ](#)

- [Understanding Risk Assessment: Introducing the PREVENT™ Risk Calculator](#)

What are the PREVENT equations?

Developed in 2023, the American Heart Association Predicting Risk of cardiovascular disease EVENTs (PREVENT™) equations estimate 10-year and 30-year risk for total cardiovascular disease (CVD), including atherosclerotic CVD (ASCVD) and heart failure (HF) with outcome-specific equations. It is the first risk tool that combines cardiovascular, kidney, and metabolic health measurements to support primary prevention-focused treatment decisions.

The PREVENT equations were derived and validated using data from over 6.5 million adults across multiple datasets from all over the U.S. The derivation samples included patients receiving care at multiple health systems (Optum, Geisinger) and population-based cohorts or research studies (Atherosclerosis Risk in Communities, Cardiovascular Health Study, Coronary Artery Risk Development in Young Adults, Jackson Heart Study, Framingham Heart Study, Multi-Ethnic Study of Atherosclerosis). It is validated for adults ages 30–79 years who do not have a history of CVD.

The PREVENT calculator, based on the PREVENT equations, uses required clinical information to estimate risk of CVD. The following three predictors, urine albumin-creatinine ratio (UACR), hemoglobin A1c (HbA1c), and social deprivation index (SDI), are optional and can further personalize the risk estimate. If these values are not available, the calculator will still provide a risk estimate using the required inputs only.

What risk estimates do the PREVENT equations provide?

The PREVENT equations provide separate outcome-specific 10-year and 30-year risk estimates for total cardiovascular disease (PREVENT-CVD), atherosclerotic cardiovascular disease (PREVENT-ASCVD), and heart failure (PREVENT-HF) to support shared decision-making about preventive care. The default setting is to display the PREVENT-CVD results. Each outcome may be displayed separately by selecting that outcome. Because ASCVD and HF are modeled independently, their combined risk may be higher than the total CVD estimate.

How do the PREVENT equations differ from the Pooled Cohort Equations?

The PREVENT equations were developed as an update to the Pooled Cohort Equations (PCEs; sometimes referred to as the ASCVD calculator) because risk for CVD has evolved considerably since the PCEs were developed. The PREVENT equations use a larger, more contemporary, and diverse U.S. dataset than the Pooled Cohort Equations (PCEs). They incorporate additional predictors, including measures of kidney function (UACR [if indicated] and estimated glomerular filtration rate (eGFR)), metabolic health (HbA1c [if indicated]), social drivers of health (Social Deprivation Index (SDI), which is zip code based), and Body Mass Index (BMI) for predicting risk of HF and have sex-specific equations validated across diverse racial and ethnic groups.

Unlike the PCEs, PREVENT provides both 10-year and 30-year risk estimates for total CVD, ASCVD, and HF. It is validated for adults ages 30–79 years without known CVD, enabling earlier and more personalized prevention strategies.

	American Heart Association PREVENT™ Equations	PCEs
Demographic factors		
Age	√	√
Sex	Sex-specific equations	Sex-specific equations
Race	Do not include race or ethnicity	Race-specific (Black race or White race only) coefficients
Clinical predictors		
Systolic blood pressure	√	√
Total cholesterol		√
HDL cholesterol	√	√
Non-HDL cholesterol	√	
BMI	√	
Diabetes	√	√
Tobacco use	√	√
Lipid-lowering drug treatment	√	
Antihypertensive drug treatment	√	√
eGFR	√	
UACR*	√	
HbA1c*	√	
Social drivers of health		
SDI*	√	
Outcomes†		
Total CVD (ASCVD and HF)	√	
ASCVD	√	√
CHD	√	
Stroke	√	
HF	√	

Adapted with permission. Supplemental Table. Comparison of Demographic Factors, Predictors, and Outcomes in the newly developed 2023 PREVENT equations and the ACC/AHA 2013 Pooled Cohort Equations.

*HbA1C, UACR, and SDI were included in separate optional add-on equations because these variables are not clinically indicated in all individuals and may not be routinely available. When these variables are clinically indicated and available, additional equations can be utilized.

†Outcomes represent incident fatal or non-fatal myocardial infarction, stroke, and heart failure.

Source: Khan et al. Novel Prediction Equations for Absolute Risk Assessment of Total Cardiovascular Disease Incorporating Cardiovascular-Kidney-Metabolic Health: A Scientific Statement from the American Heart Association; doi 10.1161/CIRCULATIONAHA.123.067626

Which guidelines currently include the PREVENT equations?

The [2026 Dyslipidemia Guideline](#) now recommends using the PREVENT-ASCVD outcome-specific equations to estimate ASCVD risk to inform management decisions for lipid-lowering therapy (LLT) among adults without known ASCVD or subclinical atherosclerosis with an LDL-C between 70–189 mg/dL (1.8–4.9 mmol/L).

The PREVENT-CVD equations are recommended by the [2025 AHA/ACC High Blood Pressure Guideline](#) to guide management for Stage 1 hypertension among adults to assess risk in those who are not already known to be at high risk (e.g., known CVD, diabetes or chronic kidney disease [CKD]).

For management decisions about HF prevention therapies, the PREVENT-HF equations may help inform clinician-patient discussions. Until updated guidance becomes available with specific risk thresholds, clinicians should continue to follow current recommendations for HF prevention from the latest [HF guideline](#).

How should the PREVENT equations be used to guide Stage 1 hypertension treatment decisions?

The [2025 AHA/ACC High Blood Pressure Guideline](#) recommends using the PREVENT-CVD outcome specific equation to estimate 10-year risk of total CVD to inform management decisions for Stage 1 hypertension (systolic blood pressure (SBP) 130–139 mm Hg or diastolic blood pressure (DBP) 80–89 mm Hg) among adults without known CVD, diabetes, or CKD. For adults with Stage 1 hypertension at increased CVD risk with the PREVENT-CVD equations, which is defined as a 10-year risk of total CVD ≥7.5%, initiating antihypertensive therapy is recommended. For adults with Stage 2 hypertension (systolic blood pressure ≥140 mm Hg or diastolic blood pressure ≥90 mm Hg) antihypertensive therapy is recommended regardless of estimated PREVENT-CVD risk.

Among adults with a 10-year risk of total CVD <7.5%, initiation of antihypertensive therapy is recommended if average SBP remains ≥130 mm Hg or average DBP remains ≥80 mm Hg after a 3-6-month trial of lifestyle intervention.

How should the PREVENT equations be used to guide lipid-lowering therapy treatment decisions?

The guideline recommends new risk thresholds to guide lipid-lowering therapy (LLT) decisions according to 10-year or 30-year risk with the PREVENT-ASCVD equations. With more accurate risk estimates, LLT is recommended for adults with a 10-year ASCVD risk ≥5% (intermediate and high risk) and is reasonable for those with a 10-year ASCVD risk of 3% to <5% (borderline risk) after clinician–patient discussion. In selected adults aged 30–59 years at low 10-year ASCVD risk (<3%) but with LDL-C 160–189 mg/dL or 30-year ASCVD risk ≥10%, statin therapy is reasonable.

In adults aged 30–79 years with LDL-C 70–189 mg/dL and no history of ASCVD, statin intensity should align with PREVENT-ASCVD risk. A moderate-intensity statin is reasonable for those at borderline (3% to <5%) ASCVD risk and in selected younger adults at low (<3%) 10-year ASCVD risk with LDL-C 160–189 mg/dL or high 30-year ASCVD risk. At least a moderate-intensity statin is recommended for intermediate 10-year ASCVD risk, and a high-intensity statin is recommended for high 10-year ASCVD risk (≥10%). For LDL-C ≥190 mg/dL, maximally tolerated statin therapy is recommended regardless of estimated risk.

Intensification of LLT should be guided by ASCVD risk and the degree of LDL-C lowering achieved. Adults at borderline or intermediate risk should achieve a 30% to 49% LDL-C reduction, with consideration of greater LDL-C lowering at the higher end of risk. Adults at high risk should achieve at least a 50% LDL-C reduction, with additional LDL-C lowering as needed to reach guideline-recommended goals. If LDL-C goals are not achieved on maximally tolerated statin therapy in adults who are at high risk, adding ezetimibe and, when appropriate, a PCSK9 inhibitor or bempedoic acid is reasonable.

Is there a cutoff for high 30-year risk or guideline-based recommendations for management according to 30-year risk estimates?

For total CVD risk estimated using the PREVENT-CVD equations, no formal cutoffs or thresholds have been established to define high 30-year risk in current guidelines. The PREVENT equations can be used to estimate long-term CVD risk and support clinician–patient discussions about prevention strategies and current guideline-directed prevention recommendations.

For ASCVD risk estimated using the PREVENT-ASCVD equations, the 2026 Dyslipidemia Guideline recommends using 30-year risk estimates to help refine prevention strategies, particularly in adults aged 30–59 years with low (<3%) 10-year ASCVD risk. In these individuals, the 30-year risk estimate can help guide management decisions.

If LDL-C is <160 mg/dL and the 30-year ASCVD risk is <10%, counseling on healthy lifestyle behaviors is recommended to reduce LDL-C and long-term ASCVD risk. If LDL-C is 160–189 mg/dL or the 30-year ASCVD risk is ≥10%, initiating a moderate-intensity statin is reasonable to reduce cumulative exposure to atherogenic lipoproteins and lower long-term ASCVD risk. These estimates help identify younger adults who may benefit from earlier prevention strategies even when their short-term (10-year) risk appears low.

Why do the PREVENT equations not include race or ethnicity as a predictor?

The PREVENT equations were developed using a large, diverse dataset and incorporate measurable health factors, such as BMI, blood pressure, diabetes, and social drivers of health (including a zip code–based social deprivation index), that accurately reflect an individual's cardiovascular risk.

The PREVENT equations provide risk estimates based on clinical and social variables that holistically capture risk of cardiovascular outcomes even without including race as a predictor. It demonstrates high accuracy across all racial and ethnic groups, with predicted risk closely matching observed risk, eliminating the need for race-specific equations.

How are the PREVENT equations related to Cardiovascular-Kidney-Metabolic (CKM) health?

The PREVENT equations combine cardiovascular, kidney, and metabolic health measurements to support primary prevention-focused treatment decisions. This integrated approach ties into the CKM health framework, which emphasizes how these systems are interconnected and

collectively influence cardiovascular disease risk. CKM stages span from 0 to 4 and reflect the progressive nature of higher CVD risk with greater CKM stages.

What is PREVENT-Age and how should it be interpreted?

The PREVENT calculator now provides an estimated PREVENT-Age, which translates an individual's predicted cardiovascular risk into an equivalent "risk age" or "heart age" based on the PREVENT-CVD equations. When PREVENT-Age exceeds chronological age, this suggests a higher-than-expected predicted cardiovascular risk relative to peers of the same age; when PREVENT-Age is lower, this suggests a more favorable risk profile. PREVENT-Age is intended to complement absolute risk estimates, is only valid for the base equations, and may help facilitate clinician–patient discussions about cardiovascular risk and preventive strategies.

What are 30-year PREVENT-CVD Percentiles and how should they be interpreted?

The PREVENT calculator also reports age- and sex-specific percentiles for 30-year PREVENT-CVD risk to provide population-based context for absolute risk estimates. Percentiles compare an individual's predicted long-term CVD risk with others of the same age and sex in a nationally representative population. For example, a 45-year-old female with a predicted 30-year PREVENT-CVD risk of 14.7% would place her at the 75th percentile, indicating that the estimated long-term CVD risk is higher than approximately 75 of 100 age- and sex-matched peers. Percentiles are intended to complement absolute risk estimates, are only valid for the base equations, and may help facilitate clinician–patient discussions about cardiovascular risk and preventive strategies.

How should the PREVENT equations be used in patients with incomplete data (e.g. missing eGFR) or those outside validated ranges (BMI >39.9 kg/m^2, under age 30, or over 79)?

PREVENT is validated for adults ages 30–79 years who do not have a history of CVD. The PREVENT calculator, based on the PREVENT equations, uses required clinical information to estimate risk of CVD. When any of the required variables (including sex, age, total cholesterol, HDL cholesterol, systolic blood pressure, BMI, eGFR, diabetes, current smoking status, antihypertensive use, and lipid-lowering therapy use) are missing or out-of-range, the calculator will not generate a risk estimate.

The following three predictors, urine UACR, HbA1c, and SDI, are optional and can further personalize the risk estimate. If these values are not available, the calculator will still provide a risk estimate using the required inputs only.

Out-of-range values should be managed as clinically indicated. Risk could still be estimated with the closest in-range value but may represent an over- or under-estimate.

How should the PREVENT risk estimates be communicated to patients?

The risk estimate provided by the PREVENT calculator reflects the likelihood that a person with similar risk factors will develop the specified cardiovascular outcome over the next 10 or 30 years. To aid in understanding, risk may be framed as "X out of 100 people like you may develop CVD over the next 10 or 30 years" and should be paired with an explanation that cardiovascular risk is modifiable. Whenever possible or available, these discussions should include specific, guideline-based prevention strategies.

Can the risk factor values be changed on the PREVENT calculator to interpret the impact treatment would have on my risk level?

The PREVENT equations estimate CVD risk using required clinical information at the current encounter. When input predictors are changed with treatment (e.g., initiation of blood pressure

medication or statin therapy), the PREVENT equations are not intended to calculate change in risk.

This tool is designed for use by clinicians. For accurate results and appropriate interpretation, risk should be calculated using your actual, up-to-date clinical information from recent laboratory tests and evaluations performed by a clinician. The PREVENT equations are intended to inform clinician–patient discussions and guide primary prevention-focused treatment decisions in alignment with the latest relevant clinical guidelines.

Can the PREVENT calculator be used with SI units?
The PREVENT calculator uses U.S. standard units to predict risk (e.g., mg/dL for cholesterol). Please convert SI units into U.S. standard units prior to use. For more guidance on use of the calculator for international populations, please stay tuned for updates.

Can the PREVENT calculator be used outside the U.S.?
While the PREVENT calculator can be used outside the U.S., the PREVENT equations were developed and validated with data from U.S. adults. Therefore, they should be used with caution outside the U.S. for clinical care. Country-specific evaluation should be considered before implementation as variation in risk factor profiles, clinical practice patterns, and competing mortality risks across different countries may lead to differences in CVD risk. Multinational and global evaluation of the PREVENT equations are underway and updates will be posted at heart.org/prevent when available.

The PREVENT equations with the optional SDI predictor are only applicable to adults living in the U.S.

Is the PREVENT calculator available for use in the electronic health record (by individual health systems)?
Yes, health systems can incorporate PREVENT into their own electronic health records by using the source code. To access the PREVENT calculator code, please review and accept our terms and conditions. A GitHub account name is required for access (If you do not have a GitHub account, you will need to create one). Once the agreement is executed, an email will be sent to the registered party within 24 hours that contains the access link to PREVENT on the GitHub site (https://github.com/AHA-DS-Analytics/PREVENT).

The GitHub site contains:
· The source code calculation documentation for PREVENT.
· The AHA PREVENT library for R and STATA.
· Additional information from AHA Science on PREVENT.

For additional information, please contact: prevent@heart.org.

Where can I find additional resources on the PREVENT equations?
PREVENT resources are currently under development. New resources will be featured at heart.org/prevent as they are available. If your organization has created PREVENT resources that you would like to share, please email them to: prevent@heart.org.