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Atherosclerotic cardiovascular disease risk assessment for primary prevention in adults: Our approach

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INTRODUCTION

Atherosclerotic cardiovascular disease (ASCVD) is common in the general population, affecting the majority of adults past the age of 60 years. As a diagnostic category, ASCVD includes four major areas:

- Coronary heart disease manifested by fatal or nonfatal myocardial infarction and angina pectoris
- Cerebrovascular disease manifested by fatal or nonfatal stroke and transient ischemic attack
- Peripheral artery disease manifested by intermittent claudication and critical limb ischemia
- Aortic atherosclerosis and thoracic or abdominal aortic aneurysm

While a general estimate of the relative risk for ASCVD can be approximated by counting the number of traditional risk factors (ie, hypertension, diabetes, cigarette smoking, premature family history of ASCVD, chronic kidney disease, obesity) present in a patient, a more precise estimation of the absolute risk for a first ASCVD event is desirable when making treatment recommendations for a specific individual. This topic will review which patients should undergo ASCVD risk assessment, the approach to assessing risk, and the implications of the estimate risk

on preventive therapies. The various ASCVD risk models are presented separately, as are discussions of the specific approach to the primary prevention treatment of various risk factors:

- (See "Cardiovascular disease risk assessment for primary prevention: Risk calculators".)
- (See "Overview of primary prevention of cardiovascular disease".)
- (See "Low-density lipoprotein cholesterol-lowering therapy in the primary prevention of cardiovascular disease", section on 'Indications for statin therapy'.)
- (See "Aspirin in the primary prevention of cardiovascular disease and cancer".)

OUR APPROACH TO ASCVD RISK ASSESSMENT

Our approach to ASCVD risk assessment in adults is generally consistent with the 2019 American College of Cardiology/American Heart Association primary prevention guidelines [1] and is as follows (algorithm 1):

Who needs ASCVD risk discussions and potentially formal ASCVD risk assessment

- We proceed with ASCVD risk discussions for all patients between 20 and 75 years of age without known ASCVD.

  Periodic risk assessment offers the opportunity to identify ASCVD risk factors and offer guidance on the appropriate management of specific risk factors (eg, dietary modifications for hypertension or dyslipidemia, etc) and overall ASCVD risk (eg, maintaining a healthy diet, regular exercise, etc) [2]. (See 'How often should ASCVD risk be reassessed?' below.)

- For patients older than 75 years of age without known ASCVD, for whom there are no data on risk assessment, we engage the patient in a discussion of the risks and benefits of primary preventive therapies and pursue shared decision-making. (See 'Patients over 75 years of age' below.)

When to perform ASCVD risk assessment

- We begin ASCVD risk evaluations and discussions at 20 years of age or at first encounter with the health care system beyond 20 years of age. (See 'Identify risk factors' below.)
- We reassess ASCVD risk every four to six years in patients whose identified 10-year ASCVD risk is low (<5 percent) or borderline (5 to 7.4 percent). (See 'How often should ASCVD risk

be reassessed?' below.)

- We reassess ASCVD risk more frequently for patients whose identified 10-year ASCVD risk is intermediate (7.5 to 19.9 percent) or following the identification of a new risk factor. The optimal time interval for reassessing risk in patients with intermediate 10-year ASCVD risk is uncertain. However, once a person reaches a threshold for lifestyle or pharmacologic intervention, the emphasis going forward should be placed on optimization of risk factors for that individual. (See 'How often should ASCVD risk be reassessed?' below.)

- We cease screening ASCVD risk assessment beyond 75 years of age (unless the patient wishes to continue) or once ASCVD or an ASCVD risk equivalent (eg, cerebrovascular atherosclerotic disease, peripheral arterial disease, etc) has been identified. (See 'Patients over 75 years of age' below.)

How to perform ASCVD risk assessments

- We first identify traditional ASCVD risk factors, based on the history and physical examination; decide whether and how to perform a formal risk assessment; and then perform any indicated laboratory tests such as serum lipid measurements, as discussed separately. (See 'Identify risk factors' below and "Overview of primary prevention of cardiovascular disease" and "Screening for lipid disorders in adults", section on 'Who should be screened'.)

- Following ASCVD risk factor identification and laboratory testing, we assess the patient's risk of ASCVD. For most patients, we use a calculator to perform quantitative estimates of either 10-year or 30-year risk, or both. (See 'Estimate ASCVD risk using a risk calculator' below and "Cardiovascular disease risk assessment for primary prevention: Risk calculators".)

  - For individuals ages 40 to 75, we use a risk calculator to estimate the 10-year risk of ASCVD. For the subset of these patients with a low or very low 10-year ASCVD risk with ages 40 to 59, we also calculate 30-year (or lifetime) ASCVD risk. (See '10-year risk versus 30-year (lifetime) risk' below.)

  - For persons 20 to 39 years of age who are asymptomatic and have no ASCVD risk factors, we generally do not perform formal ASCVD risk assessment. Ten-year risk is generally low in these patients, and data are scarce regarding the impact of interventions to reduce the future risk of clinical outcomes in young, low-risk populations. Risk calculation in this age group is discussed below. (See 'Patients under 40 years of age' below.)

Why assess ASCVD risk?

- Patients with low or very low 10-year ASCVD risk can be reassured and encouraged to maintain healthy lifestyles (eg, regular exercise, healthy diet, etc).
- Patients with high 10-year ASCVD risk (≥20 percent) can be started on appropriate primary preventive therapies. (See 'Who needs primary prevention therapy?' below and "Low-density lipoprotein cholesterol-lowering therapy in the primary prevention of cardiovascular disease" and "Aspirin in the primary prevention of cardiovascular disease and cancer".)
- Patients with intermediate 10-year ASCVD risk can be engaged in discussions about possible lifestyle changes and/or primary preventive therapies and may also be considered for additional screening (eg, coronary artery calcium scoring). Patients with an identified "negative risk factor" may have their risk adjusted downward and potentially no longer need preventive therapies. (See 'Patients with a negative risk factor' below.)
- First-degree relatives of patients with high ASCVD risk may be counseled regarding undergoing ASCVD risk assessment. (See 'Do first-degree relatives of high-risk patients require screening?' below.)

Risk assessment in children and adolescents — The approach to prevention of ASCVD and screening for risk factors in children and adolescents is discussed in detail separately. (See "Overview of risk factors for development of atherosclerosis and early cardiovascular disease in childhood" and "Pediatric prevention of adult cardiovascular disease: Promoting a healthy lifestyle and identifying at-risk children" and "Dyslipidemia in children and adolescents: Definition, screening, and diagnosis".)

HOW TO ASSESS ASCVD RISK

Identify risk factors — For all individuals, the first step in assessing ASCVD risk is to determine whether one or more of the traditional risk factors for ASCVD is present (algorithm 1) (see "Overview of primary prevention of cardiovascular disease"):

- Hypertension. (See "Overview of hypertension in adults", section on 'Definitions'.)
- Cigarette smoking. (See "Cardiovascular risk of smoking and benefits of smoking cessation".)

- Diabetes mellitus (DM). (See "Clinical presentation, diagnosis, and initial evaluation of diabetes mellitus in adults", section on 'Diagnostic criteria'.)

- Hyperlipidemia, including known familial hyperlipidemia or an individual history of elevated total cholesterol or low-density lipoprotein (LDL) cholesterol. (See "Low-density lipoprotein cholesterol-lowering therapy in the primary prevention of cardiovascular disease".)

- Premature family history of ASCVD. (See "Overview of established risk factors for cardiovascular disease", section on 'Family history'.)

- Obesity. (See "Obesity in adults: Prevalence, screening, and evaluation".)

- Chronic kidney disease. (See "Chronic kidney disease and coronary heart disease", section on 'Chronic kidney disease as an independent risk factor for CHD'.)

For individuals ≥20 years of age, a baseline lipid profile is generally obtained that includes measurements of total, high-density lipoprotein (HDL), and LDL cholesterol. If severely elevated LDL cholesterol ≥190 mg/dL (≥4.9 mmol/L) is present, then the patient will be treated aggressively with recommended lifestyle modifications and lipid-lowering medications. (See "Low-density lipoprotein cholesterol-lowering therapy in the primary prevention of cardiovascular disease", section on 'Indications for statin therapy'.)

Based on the lipid panel results, other risk factors, and the patient's age, we determine whether to estimate ASCVD risk with a risk calculator:

- For patients >40 years without established ASCVD in whom a lipid profile has been obtained, we estimate ASCVD risk using a risk calculator. The results of the calculator are used to determine if specific preventive therapies such as aspirin or statin are indicated. (See 'Estimate ASCVD risk using a risk calculator' below and "Low-density lipoprotein cholesterol-lowering therapy in the primary prevention of cardiovascular disease" and "Aspirin in the primary prevention of cardiovascular disease and cancer".)

- For patients who are 20 to 39 years of age who do not have hypercholesterolemia, but who have other risk factors or diagnoses such as those listed, most guidelines do not provide explicit guidance on ASCVD risk assessment. Patients <40 years of age are further discussed below. (See 'Patients under 40 years of age' below.)

Estimate ASCVD risk using a risk calculator — Once all of the relevant risk factors have been identified and data acquired (ie, blood pressure and lipid profile), all patients from 40 to 75 years of age should have ASCVD risk estimated using a validated ASCVD risk calculator

(algorithm 1). A number of multivariate risk models have been developed for estimating the risk of initial ASCVD events in apparently healthy, asymptomatic individuals based upon assessment of multiple variables. The choice of a specific risk model for ASCVD risk assessment should be individualized based on patient-specific characteristics (eg, age, sex, geographic location). We typically use risk models that predict clinical events (ie, death, myocardial infarction, stroke) over those that include other endpoints (ie, revascularization).

Choosing a risk calculator — We encourage clinicians to become familiar with and use an ASCVD risk calculator that has been validated for their locale and patient population. Several ASCVD risk calculators are in widespread use that capture population-specific risk profiles. In selecting a risk calculator for an individual patient, we consider the generalizability of the calculator's data to the patient, the inclusion of specific risk factors, and the outcomes being predicted. No single risk model will be appropriate for all patients [3,4].

Several calculators currently in use in the United States and the United Kingdom are listed below. A comprehensive discussion of cardiovascular risk calculators appears elsewhere. (See "Cardiovascular disease risk assessment for primary prevention: Risk calculators".)

- United States – In the United States, we use the 2023 American Heart Association (AHA) Predicting Risk of cardiovascular disease EVENTs (PREVENT) calculator or the 2018 ASCVD Risk Estimator Plus.

  - 2023 AHA PREVENT calculator estimates 10-year risks of total cardiovascular disease and its subtypes, heart failure, and ASCVD for individuals aged 30 to 79 and 30-year risks in adults aged 30 to 59 [5,6]. The PREVENT calculator is available online. It was developed, in part, because the pooled cohort equations (PCE), developed by the American College of Cardiology (ACC)/AHA in 2013, can overestimate the risk of incident ASCVD in contemporary populations [7,8]. The PREVENT calculator was derived and validated with more modern clinical data obtained between 1992 to 2017 from cohort studies and electronic health records that included more than 6.6 million patients [6].

    The PREVENT calculator includes the traditional risk factors (age, sex, total and HDL cholesterol, systolic pressure level, DM, current smoking, blood pressure medication) as well as additional factors (estimated glomerular filtration rate [eGFR], body mass index, and lipid-lowering medication) and optional factors (urinary albumin-creatinine ratio, HbA1c, and zip code for estimating social deprivation index). The online calculator provides both 10-year and 30-year risks for cardiovascular disease and heart failure.

The PREVENT algorithm requires that the users enter information for more factors than in the past to estimate risk, and some of the optional factors such as zip code are only applicable to United States residents. Familiarity will grow with greater use by clinicians and as smart phone applications become available. When extended clinical information is not available, it may be expedient to employ the 2018 ASCVD Risk Estimator Plus.

- The 2018 ASCVD Risk Estimator Plus incorporates the 2013 PCE (calculator 1) and the Million Heart Model, which updates risk predictions based on initiation of and response to therapies (aspirin, statins, and antihypertensive therapy) and smoking cessation [7,9,10]. It estimates 10-year risk of ASCVD for individuals aged 40 to 79 and estimates 30-year, or lifetime, risk for individuals aged 20 to 59. This calculator uses data primarily from cohorts of non-Hispanic White and Black Americans.

The PREVENT calculator and the ASCVD Risk Estimator Plus may underestimate risk in certain individuals with risk-enhancing factors. (See 'Consider risk-enhancing factors' below.)

- United Kingdom – Commonly used calculators in the United Kingdom include the NICE (National Institute for Health and Care Excellence) QRISK3 calculator [11,12] and the Joint British Societies risk estimator (JBS3) [13]. These calculators are discussed in detail separately. (See "Cardiovascular disease risk assessment for primary prevention: Risk calculators", section on 'JBS3 risk score (2014)'.)

- Western Europe other than United Kingdom – The European Society of Cardiology SCORE2 (**S**ystematic **CO**ronary **R**isk **E**valuation 2) or JBS3 risk estimator [13-15].

- China – China-PAR (**P**rediction for **A**CSVD **R**isk in China) calculator [16].

- Users in other regions should refer to local recommendations and/or choose the most relevant ASCVD risk calculator.

Lifetime risk — One's lifetime risk of ASCVD is known to progressively increase as the number and severity of risk factors increases. The lifetime risk of developing ASCVD has been assessed in a variety of cohorts as well as a meta-analysis of 18 cohorts involving over 257,000 males and females [17,18]. Data from the Framingham Heart Study were used to assess long-term outcomes according to risk status in individuals at age 50 without known ASCVD, and the authors of the meta-analysis assessed long-term outcomes for participants at ages 45, 55, 65, and 75 years [17,18]. Risk factors within the participants were defined as follows:

Optimal risk factors:

- Total cholesterol <180 mg/dL (4.7 mmol/L)
- Untreated blood pressure <120/<80 mmHg
- Nonsmoker
- No diabetes

Not optimal risk factors (among nonsmokers without diabetes):

- Total cholesterol 180 to 199 mg/dL (4.8 to 5.1 mmol/L)
- Untreated systolic blood pressure 120 to 139 mmHg or diastolic blood pressure 80 to 89 mmHg

Elevated risk factors (among nonsmokers without diabetes):

- Total cholesterol 200 to 239 mg/dL (5.2 to 6.1 mmol/L)
- Untreated systolic blood pressure 140 to 159 mmHg or diastolic blood pressure 90 to 99 mmHg

Major risk factors:

- Treated hyperlipidemia or total cholesterol ≥240 mg/dL (6.2 mmol/L)
- Treated hypertension or untreated systolic pressure ≥160 mmHg or diastolic pressure ≥100 mmHg
- Current smoker
- Diabetes

The following findings were noted in the Framingham study and confirmed in the meta-analysis:

- The lifetime risk of ASCVD increased progressively with the number and intensity of risk factors.

- When compared with those with ≥2 major risk factors, participants with optimal risk factors had markedly lower lifetime risks of ASCVD at all age levels. As an example, among persons 45 years of age, those with all optimal risk factors had a lifetime risk of developing ASCVD of 4.1 percent compared with a 30.7 percent lifetime risk for those with two or more major risk factors.

- Although the difference was less pronounced, the lifetime ASCVD risk was significantly lower in participants with optimal risk factors compared with those with ≥1 not optimal risk factor. As an example, among persons 65 years of age, those with all optimal risk

factors had a lifetime risk of developing ASCVD of 12.4 percent compared with a 25 percent lifetime risk for those with one or more not optimal risk factors.

Many individuals with a low calculated 10-year ASCVD risk will still have a high lifetime risk, as the strongest determinant of risk in most risk calculators is age [5]. This was modeled in a study of nearly 4000 individuals less than 50 years of age in the Multi-Ethnic Study of Atherosclerosis (MESA) and the Coronary Artery Risk Development in Young Adults (CARDIA) study in whom the burden of atherosclerosis was evaluated [19]. Ten-year and lifetime risks were assigned to each individual, and patients were then divided into three groups:

- Low 10-year (<10 percent) and low lifetime (<39 percent) risks
- Low 10-year (<10 percent) and high lifetime (≥39 percent) risks
- High 10-year (≥10 percent) risk or DM

The groups were then compared with regard to both their baseline levels of subclinical atherosclerosis (carotid intima-media thickness or coronary artery calcium [CAC] score) and its progression. The group with low 10-year and high lifetime risks had both a significantly greater burden of baseline subclinical atherosclerosis as well as a significantly higher rate of CAC progression than the group with low 10-year and low lifetime risks. As expected, outcomes in these two groups were significantly better than those in the high 10-year risk group.

10-year risk versus 30-year (lifetime) risk — For patients with low or very low 10-year risk, particularly those ≤59 years of age, we calculate 30-year (or lifetime) ASCVD risk [7]. The ACC/AHA guidelines and the JBS3 guidelines both discuss consideration of lifetime risk as well as 10-year risk for cardiovascular events [1,7,20], and JBS3 recommends use of the QRISK lifetime CV risk calculator in patients at low 10-year risk [13]. Informal or formal calculation of lifetime risk of ASCVD can help to tailor risk discussions and prioritize lifestyle interventions, particularly for those with low 10-year risks. (See "Cardiovascular disease risk assessment for primary prevention: Risk calculators".)

A potential problem with using lifetime risk calculations in making decisions about primary preventive therapies is the lack of long-term evidence regarding benefits or harms with longer-term compared with shorter-term statin therapy, as most clinical experience of the medication has been less than 10 years. (See "Cardiovascular disease risk assessment for primary prevention: Risk calculators".)

Consider risk-enhancing factors — Beyond the traditional risk factors that have been incorporated into the standard risk calculators, additional risk factors (such as family history of premature ASCVD and metabolic syndrome) may significantly alter risk for affected patients. Dubbed "risk-enhancing" factors in the 2018 AHA/ACC guideline on cholesterol management,

the presence of one or more of these factors can be very important in informing and shaping the clinician-patient discussion of ASCVD risk and prioritizing primary prevention interventions (table 1) [1,9,10].

For patients with DM, several diabetes-specific independent risk enhancers have been identified, including long duration (≥10 years for type 2 DM or ≥20 years for type 1 DM), albuminuria ≥30 mcg albumin/mg creatinine, eGFR <60 mL/min/1.73, retinopathy, neuropathy, and ankle-brachial index <0.9. These risk factors are considered if they were not included in the selected risk calculator.

Special populations

Patients with a negative risk factor — While the identification of risk factors has traditionally been used to assess a heightened risk of a particular condition or disease process, the presence of a negative risk factor may allow for the downgrading of risk. Initially thought to be helpful in patients with "borderline" risk or in those who narrowly achieve the threshold for a preventive therapy, negative risk factors can be helpful at any level of risk if their identification results in a meaningful downgrading of risk that alters the approach to therapy.

While a variety of different markers (eg, family history, imaging markers, serum biomarkers, etc) have been assessed for their potential as negative risk markers for the development of ASCVD, the most promising negative risk factor in this area appears to be extremely low amounts of CAC or absence of CAC:

- In the prospective BioImage cohort study, which included 5805 participants (44 percent males ages 55 to 80 years, 56 percent females ages 60 to 80 years) without known ASCVD at baseline, 13 candidate negative risk markers were assessed, with median follow-up of 2.7 years [21]. Absent and extremely low CAC scores were the strongest negative risk factors; patients with CAC = 0 and CAC ≤10 had an 80 percent downward adjustment of their risk (diagnostic likelihood ratios [DLR] 0.20 and 0.20, respectively) compared with the predicted risk from the 2018 PCE.

- Among 6814 participants in the MESA without ASCVD at baseline, CAC = 0 was associated with a significant lowering of predicted risk for coronary heart disease and ASCVD (DLRs of 0.41 and 0.54, respectively) [22].

Use of a low CAC score as a negative cardiac risk factor may have significant potential treatment implications, in particular for older patients with relatively few traditional risk factors in whom age alone is a large driver of the calculated ASCVD risk.

Patients under 40 years of age — There are no firm data for ASCVD risk in persons less than 40 years of age, although generally the incidence is low in this population. However, young persons may seek advice on their long-term risk in a variety of situations, including:

- Family history of premature ASCVD in a first-degree relative (sibling or parent)
- Documented familial hypercholesterolemia (FH)
- Patients with juvenile onset of type 1 DM or early onset of type 2 DM
- Patients with multiple risk factors at an early age
- Patients who have had imaging studies done (such as CAC scoring) yielding abnormalities suggesting atherosclerosis.

Expert opinion and observational database reports have generally directed the approach to management for such persons. In discussions with younger patients, particularly those with risk factors that are not usually well accounted for using standard risk calculators (ie, FH, family history of ASCVD, etc), our approach is to emphasize discussion of a patient's "lifetime risk" (or "30-year risk" in some risk estimators) rather than simply the 10-year risk, as the 10-year risk will almost universally be calculated as low or very low due to age alone. For individuals ages 30 to 39, the PREVENT calculator provides quantitative risk estimates for 10- and 30-year risk, and the ASCVD Risk Estimator Plus provides quantitative risk estimates of 30-year risk. (See 'Choosing a risk calculator' above.)

For specific subsets of younger patients, our approach is as follows:

- **Patients with heterozygous FH** – We do not use 10-year or lifetime risk estimates in patients with FH, as that approach may seriously underestimate ASCVD risk. For primary prevention, these patients are typically treated with maximally tolerated statin doses, and other LDL cholesterol-lowering agents are also often included, depending on the LDL cholesterol level achieved in therapy. (See "Familial hypercholesterolemia in adults: Treatment".)

- **Patients with type 1 DM** – We do not use risk estimators in young patients with type 1 diabetes mellitus (DM), as there are no firm data to guide ASCVD risk assessment in this population. At age 30 years, such patients may have had DM for 20 years or more, placing them at very high risk of ASCVD events. As such, the risk factors should be managed aggressively. (See "Overview of general medical care in nonpregnant adults with diabetes mellitus", section on 'Reducing the risk of macrovascular disease'.)

- **Patients with type 2 DM** – We use risk estimators with caution in patients under 40 years of age with type 2 DM. Similar to patients with type 1 DM, patients with type 2 DM are at very high risk of ASCVD events, and their risk should be managed aggressively.

Additionally, clinicians should also mention risks for microvascular disease (retinopathy, kidney disease with albuminuria, or adverse changes in eGFR) that are common in these patients. (See "Overview of general medical care in nonpregnant adults with diabetes mellitus", section on 'Reducing the risk of macrovascular disease'.)

Patients over 75 years of age — For patients older than 75 years of age without known ASCVD, we engage the patient in a discussion of the risks and benefits of primary preventive therapies and pursue shared decision making. It is unknown at what age periodic risk assessment should no longer be performed. Available risk models have an upper age limit for ASCVD risk estimation. As an example, the PREVENT and ASCVD Risk Estimator Plus estimate risk for adults up to age 79. If a patient older than 79 years of age without known ASCVD is interested in a more precise estimate of risk, the clinician can use one of these calculators and enter an age of 79 to provide a rough estimate of 10-year ASCVD risk and thereby inform risk discussions.

Decisions regarding the discontinuation of periodic risk assessment should be made in collaboration with each individual patient based on the patient's overall functional status, life expectancy, and values and preferences for risk factor modification. A general precept in patients of all ages, including those >75 years of age, is to continue the ASCVD preventive strategies that are in place and not to discontinue them, especially if they are well tolerated.

HOW OFTEN SHOULD ASCVD RISK BE REASSESSED?

As with any clinical scenario, an individual patient's ASCVD risk is not static but can vary significantly over time. A person's ASCVD risk can be positively or negatively influenced depending on the development or treatment of concurrent medical conditions as well as lifestyle choices. As such, risk factors and an estimation of ASCVD risk should be regularly reassessed over time.

- For patients whose identified 10-year ASCVD risk is low (<5 percent) or borderline (5 to 7.4 percent) and with no change in clinical status, we reassess ASCVD risk every four to six years.

- For patients at intermediate (7.5 to 19.9 percent) ASCVD risk, we typically reassess ASCVD risk more frequently than every four to six years, although the optimal time interval for reassessing risk in patients with intermediate 10-year ASCVD risk is uncertain. Patients with ASCVD risk factors are typically treated, and the health care provider should endeavor to optimize the ASCVD risk factors with lifestyle and pharmacologic interventions. Periodic

reassessment of ASCVD risk is of some interest, but the focus should be on the preventive care of the patient with control of risk factors.

IMPLICATIONS OF ESTIMATED ASCVD RISK

Following the estimation of an individual's ASCVD risk, there can be implications for the patient (ie, need for lifestyle changes and/or preventive medications) as well as for family members (ie, need for ASCVD risk screening).

Who needs primary prevention therapy? — We recommend statin therapy to most patients with a 10-year ASCVD risk of 10 percent or greater or a lifetime ASCVD risk >39 percent. This range is consistent with many guideline recommendations [7]. We also engage patients in a discussion about the role of aspirin. In some adults, the benefits of aspirin for primary prevention may exceed the harms (principally bleeding), while in others the harms may exceed the benefits. For most patients, the benefits and harms are likely to be closely balanced, and the clinician should engage the patient in shared decision-making regarding aspirin. Extensive discussions of the role of aspirin and statins in the primary prevention of ASCVD are presented separately. (See "Aspirin in the primary prevention of cardiovascular disease and cancer" and "Low-density lipoprotein cholesterol-lowering therapy in the primary prevention of cardiovascular disease".)

Do first-degree relatives of high-risk patients require screening? — In general, among patients with ASCVD, or those who are identified as being at high ASCVD risk, most first-degree relatives will be ≥20 years of age and should be undergoing regular ASCVD risk factor assessment with their own primary care providers. If the clinician believes the patient is at increased ASCVD risk, the patient should be encouraged to discuss the implications with first-degree family members, who may then choose to discuss ASCVD risk with their own primary care providers.

Can primary prevention therapy be discontinued? — A general precept in nearly all patients is to continue the primary prevention strategies that are in place and not to discontinue them, especially if they are well tolerated. As with any therapy, however, it is prudent to periodically reassess the risks and benefits, along with an assessment of the patient's quality of life and overall prognosis. (See 'Patients over 75 years of age' above and "Deprescribing".)

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Assessment of cardiovascular risk".)

SUMMARY AND RECOMMENDATIONS

- **Background** – Atherosclerotic cardiovascular disease (ASCVD) affects the majority of adults past the age of 60 years. While a general estimate of the relative risk for ASCVD can be approximated by counting the number of traditional risk factors present in a patient, a more precise estimation of the absolute risk for a first ASCVD event is desirable when making treatment recommendations. (See 'Introduction' above.)

- **ASCVD risk assessment approach** – Our comprehensive approach to ASCVD risk assessment (algorithm 1) is summarized as follows (see 'Our approach to ASCVD risk assessment' above):

  - **Timing of assessments** – ASCVD risk evaluations and discussions should begin at 20 years of age or at first encounter with the health care system beyond 20 years of age. ASCVD risk should be reassessed every four to six years in patients whose identified 10-year ASCVD risk is low (<5 percent) or borderline (5 to 7.4 percent) and more frequently for patients whose identified 10-year ASCVD risk is intermediate (7.5 to 19.9 percent) or following the identification of a new risk factor. The optimal time interval for reassessing risk in patients with intermediate 10-year ASCVD risk is uncertain. However, once a person reaches a threshold for lifestyle or pharmacologic intervention, the emphasis going forward should be placed on optimization of risk factors for that individual. (See 'Our approach to ASCVD risk assessment' above and 'How often should ASCVD risk be reassessed?' above.)

    We cease screening ASCVD risk assessment beyond 75 years of age (unless the patient wishes to continue) or once ASCVD or an ASCVD risk equivalent (eg, cerebrovascular atherosclerotic disease, peripheral arterial disease, etc) has been identified.

    Individuals of any age with established ASCVD or ASCVD risk equivalents (eg, diabetes) no longer require the same type of risk assessment as patients without known ASCVD. Such patients are known to be at high risk of recurrent cardiovascular events and should be treated with appropriate secondary prevention measures. (See 'Patients over 75 years of age' above and "Prevention of cardiovascular disease events in those with established disease (secondary prevention) or at very high risk".)

- **Risk factors** – For all individuals, the first step in assessing ASCVD risk is to determine whether one or more of the traditional risk factors (hypertension, cigarette smoking, diabetes mellitus, premature family history of ASCVD, chronic kidney disease, obesity) for ASCVD is present. Then, for individuals ≥20 years of age, we obtain a baseline lipid profile. (See 'Identify risk factors' above and "Overview of primary prevention of cardiovascular disease".)

- **Using a risk calculator** – Once all of the relevant risk factors have been identified, all patients from 40 to 75 years of age should have ASCVD risk estimated using a validated ASCVD risk calculator. (See 'Estimate ASCVD risk using a risk calculator' above and "Cardiovascular disease risk assessment for primary prevention: Risk calculators".)

- **Risk-enhancing factors** – Beyond the traditional risk factors that have been incorporated into the standard risk calculators, there are additional risk factors that may significantly alter risk in subsets of patients. Dubbed "risk-enhancing" factors, the presence of one or more of the following factors can be very important in informing and shaping the clinician-patient discussion of ASCVD risk and primary prevention therapies (table 1). (See 'Consider risk-enhancing factors' above.)

- **Lifetime ASCVD risk** – Many individuals with a low calculated 10-year ASCVD risk will still have a high lifetime risk, as the strongest determinant of risk in most risk calculators is age. For patients with low or very low 10-year risk, particularly those ≤59 years of age, we calculate 30-year (or lifetime) ASCVD risk. (See 'Lifetime risk' above and '10-year risk versus 30-year (lifetime) risk' above.)

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REFERENCES

1. Arnett DK, Blumenthal RS, Albert MA, et al. 2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Circulation 2019; 140:e596.
2. Kavousi M, Leening MJ, Nanchen D, et al. Comparison of application of the ACC/AHA guidelines, Adult Treatment Panel III guidelines, and European Society of Cardiology guidelines for cardiovascular disease prevention in a European cohort. JAMA 2014; 311:1416.

3. DeFilippis AP, Young R, Carrubba CJ, et al. An analysis of calibration and discrimination among multiple cardiovascular risk scores in a modern multiethnic cohort. Ann Intern Med 2015; 162:266.
4. Bazo-Alvarez JC, Quispe R, Peralta F, et al. Agreement Between Cardiovascular Disease Risk Scores in Resource-Limited Settings: Evidence from 5 Peruvian Sites. Crit Pathw Cardiol 2015; 14:74.
5. Khan SS, Coresh J, Pencina MJ, 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. Circulation 2023; 148:1982.
6. Khan SS, Matsushita K, Sang Y, et al. Development and Validation of the American Heart Association's PREVENT Equations. Circulation 2024; 149:430.
7. Goff DC Jr, Lloyd-Jones DM, Bennett G, et al. 2013 ACC/AHA guideline on the assessment of cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation 2014; 129:S49.
8. Yadlowsky S, Hayward RA, Sussman JB, et al. Clinical Implications of Revised Pooled Cohort Equations for Estimating Atherosclerotic Cardiovascular Disease Risk. Ann Intern Med 2018; 169:20.
9. Grundy SM, Stone NJ, Bailey AL, et al. 2018 AHA/ACC/AACVPR/AAPA/ABC/ACPM/ADA/AGS/APhA/ASPC/NLA/PCNA Guideline on the Management of Blood Cholesterol: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Circulation 2019; 139:e1082.
10. Lloyd-Jones DM, Braun LT, Ndumele CE, et al. Use of Risk Assessment Tools to Guide Decision-Making in the Primary Prevention of Atherosclerotic Cardiovascular Disease: A Special Report From the American Heart Association and American College of Cardiology. J Am Coll Cardiol 2019; 73:3153.
11. Samarasekera EJ, Clark CE, Kaur S, et al. Cardiovascular disease risk assessment and reduction: summary of updated NICE guidance. BMJ 2023; 381:1028.
12. Hippisley-Cox J, Coupland C, Brindle P. Development and validation of QRISK3 risk prediction algorithms to estimate future risk of cardiovascular disease: prospective cohort study. BMJ 2017; 357:j2099.
13. JBS3 Board. Joint British Societies' consensus recommendations for the prevention of cardiovascular disease (JBS3). Heart 2014; 100 Suppl 2:ii1.

14. Graham I, Atar D, Borch-Johnsen K, et al. European guidelines on cardiovascular disease prevention in clinical practice: executive summary: Fourth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (Constituted by representatives of nine societies and by invited experts). Eur Heart J 2007; 28:2375.
15. Conroy RM, Pyörälä K, Fitzgerald AP, et al. Estimation of ten-year risk of fatal cardiovascular disease in Europe: the SCORE project. Eur Heart J 2003; 24:987.
16. Yang X, Li J, Hu D, et al. Predicting the 10-Year Risks of Atherosclerotic Cardiovascular Disease in Chinese Population: The China-PAR Project (Prediction for ASCVD Risk in China). Circulation 2016; 134:1430.
17. Lloyd-Jones DM, Leip EP, Larson MG, et al. Prediction of lifetime risk for cardiovascular disease by risk factor burden at 50 years of age. Circulation 2006; 113:791.
18. Berry JD, Dyer A, Cai X, et al. Lifetime risks of cardiovascular disease. N Engl J Med 2012; 366:321.
19. Berry JD, Liu K, Folsom AR, et al. Prevalence and progression of subclinical atherosclerosis in younger adults with low short-term but high lifetime estimated risk for cardiovascular disease: the coronary artery risk development in young adults study and multi-ethnic study of atherosclerosis. Circulation 2009; 119:382.
20. Greenland P. British and American prevention guidelines: different committees, same science, considerable agreement. Heart 2014; 100:678.
21. Mortensen MB, Fuster V, Muntendam P, et al. Negative Risk Markers for Cardiovascular Events in the Elderly. J Am Coll Cardiol 2019; 74:1.
22. Blaha MJ, Cainzos-Achirica M, Greenland P, et al. Role of Coronary Artery Calcium Score of Zero and Other Negative Risk Markers for Cardiovascular Disease: The Multi-Ethnic Study of Atherosclerosis (MESA). Circulation 2016; 133:849.

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GRAPHICS

Cardiovascular disease risk assessment in adults without a history of atherosclerotic cardiovascular disease*¶



CVD: cardiovascular disease; DM: diabetes mellitus; LDL: low-density lipoprotein.

* Patients with known CVD should receive appropriate treatment for secondary prevention; refer to UpToDate topics on secondary prevention of CVD.

¶ Patients >75 years of age may wish to undergo CVD risk assessment following a discussion of the risks and benefits of treatment and shared decision making.

Δ Refer to UpToDate topics on familial hyperlipidemia and secondary prevention of CVD.

◇ Validated risk calculators have not included patients <40 years of age. If desired, a more formal risk estimate can be calculated using an imputed age of 40 years in this population.

§ Refer to UpToDate table on risk-enhancing factors for clinician-patient risk discussion.

¥ Patients under 40 years of age with either type 1 or type 2 DM are at very high risk of CVD events, and their risk should be managed aggressively.

‡ Refer to UpToDate content on CVD risk assessment in primary prevention for available risk calculators to estimate 10-year and lifetime CVD risks.

† Patients may reasonably consider stopping cholesterol screening beyond age 65 years if they have had multiple prior normal lipid profiles. Refer to UpToDate content on screening for lipid disorders in adults for additional information.

Graphic 114544 Version 7.0

Risk-enhancing factors for clinician-patient risk discussion

Risk-enhancing factors

- Family history of premature ASCVD (males, age <55 years; females, age <65 years)
- Primary hypercholesterolemia (LDL cholesterol, 160 to 189 mg/dL [4.1 to 4.8 mmol/L]; non-HDL cholesterol 190 to 219 mg/dL [4.9 to 5.6 mmol/L])*
- Metabolic syndrome (increased waist circumference [by ethnically appropriate cutpoints], elevated triglycerides [>150 mg/dL, nonfasting], elevated blood pressure, elevated glucose, and low HDL cholesterol [<40 mg/dL in males; <50 mg/dL in females] are factors; a tally of 3 makes the diagnosis)
- Chronic kidney disease (eGFR 15 to 59 mL/min/1.73 m^2 with or without albuminuria; not treated wit dialysis or kidney transplantation)
- Chronic inflammatory conditions, such as psoriasis, RA, lupus, or HIV/AIDS
- History of premature menopause (before age 40 years) and history of pregnancy-associated conditions that increase later ASCVD risk, such as preeclampsia
- High-risk race/ethnicity (eg, South Asian ancestry)
- Lipids/biomarkers associated with increased ASCVD risk
  - Persistently elevated* primary hypertriglyceridemia (≥175 mg/dL, nonfasting)
  - If measured:
    - Elevated high-sensitivity C-reactive protein (≥2 mg/L).
    - Elevated Lp(a): A relative indication for its measurement is family history of premature ASCVD An Lp(a) ≥50 mg/dL or ≥125 nmol/L constitutes a risk-enhancing factor, especially at higher levels of Lp(a).
    - Elevated apoB (≥130 mg/dL): A relative indication for its measurement would be triglyceride ≥200 mg/dL. A level ≥130 mg/dL corresponds to an LDL cholesterol >160 mg/dL and constitutes a risk-enhancing factor.
    - ABI (<0.9).

ABI: ankle-brachial index; AIDS: acquired immunodeficiency syndrome; apoB: apolipoprotein B; ASCVD: atherosclerotic cardiovascular disease; eGFR: estimated glomerular filtration rate; HDL cholesterol: high-density lipoprotein cholesterol; HIV: human immunodeficiency virus; LDL cholesterol: low-density lipoprotein cholesterol; Lp(a): lipoprotein (a); RA: rheumatoid arthritis.

* Optimally, 3 determinations.

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Conflict of interest policy

