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CLINICAL PRACTICE GUIDELINE: EXECUTIVE SUMMARY

2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease: Executive Summary

A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines

Endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation, the American Geriatrics Society, the American Society of Preventive Cardiology, and the Preventive Cardiovascular Nurses Association

Writing Committee Members

Donna K. Arnett, PhD, MSPH, FAHA, *Co-Chair*
Roger S. Blumenthal, MD, FACC, FAHA, *Co-Chair*

Michelle A. Albert, MD, MPH, FAHA*
Andrew B. Buroker, Esq†
Zachary D. Goldberger, MD, MS, FACC, FAHA‡
Ellen J. Hahn, PhD, RN*
Cheryl Dennison Himmelfarb, PhD, RN, ANP, FAHA*
Amit Khera, MD, MSc, FACC, FAHA*
Donald Lloyd-Jones, MD, SCM, FACC, FAHA*
J. William McEvoy, MBBCh, MEd, MHS*
Erin D. Michos, MD, MHS, FACC, FAHA*
Michael D. Miedema, MD, MPH*
Daniel Muñoz, MD, MPA, FACC*
Sidney C. Smith, Jr, MD, MACC, FAHA*
Salim S. Virani, MD, PhD, FACC, FAHA*
Kim A. Williams, Sr, MD, MACC, FAHA*
Joseph Yeboah, MD, MS, FACC, FAHA*
Boback Ziaeian, MD, PhD, FACC, FAHA§

*ACC/AHA Representative. †Lay Representative. ‡ACC/AHA Task Force on Clinical Practice Guidelines Liaison. §Task Force Performance Measures Representative.

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ACC/AHA Task Force Members

Patrick T. O'Gara, MD, MACC, FAHA, *Chair*
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Laura Mauri, MD, MSc, FAHA‖
Mariann R. Piano, RN, PhD, FAHA
Barbara Riegel, PhD, RN, FAHA‖
Duminda N. Wijeysundera, MD, PhD

‖Former Task Force member; current member during the writing effort.

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TOP 10 TAKE-HOME MESSAGES FOR THE PRIMARY PREVENTION OF CARDIOVASCULAR DISEASE

1. The most important way to prevent atherosclerotic vascular disease, heart failure, and atrial fibrillation is to promote a healthy lifestyle throughout life.
2. A team-based care approach is an effective strategy for the prevention of cardiovascular disease. Clinicians should evaluate the social determinants of health that affect individuals to inform treatment decisions.
3. Adults who are 40 to 75 years of age and are being evaluated for cardiovascular disease prevention should undergo 10-year atherosclerotic cardiovascular disease (ASCVD) risk estimation and have a

clinician-patient risk discussion before starting on pharmacological therapy, such as antihypertensive therapy, a statin, or aspirin. The presence or absence of additional risk-enhancing factors can help guide decisions about preventive interventions in select individuals, as can coronary artery calcium scanning.

4. All adults should consume a healthy diet that emphasizes the intake of vegetables, fruits, nuts, whole grains, lean vegetable or animal protein, and fish and minimizes the intake of *trans* fats, red meat and processed red meats, refined carbohydrates, and sweetened beverages. For adults with overweight and obesity, counseling and caloric restriction are recommended for achieving and maintaining weight loss.
5. Adults should engage in at least 150 minutes per week of accumulated moderate-intensity physical activity or 75 minutes per week of vigorous-intensity physical activity.
6. For adults with type 2 diabetes mellitus, lifestyle changes, such as improving dietary habits and achieving exercise recommendations are crucial. If medication is indicated, metformin is first-line therapy, followed by consideration of a sodium-glucose cotransporter 2 inhibitor or a glucagon-like peptide-1 receptor agonist.
7. All adults should be assessed at every healthcare visit for tobacco use, and those who use tobacco should be assisted and strongly advised to quit.
8. Aspirin should be used infrequently in the routine primary prevention of ASCVD because of lack of net benefit.
9. Statin therapy is first-line treatment for primary prevention of ASCVD in patients with elevated low-density lipoprotein cholesterol levels (≥190 mg/dL), those with diabetes mellitus, who are 40 to 75 years of age, and those determined to be at sufficient ASCVD risk after a clinician-patient risk discussion.
10. Nonpharmacological interventions are recommended for all adults with elevated blood pressure or hypertension. For those requiring pharmacological therapy, the target blood pressure should generally be <130/80 mm Hg.

PREAMBLE

Since 1980, the American College of Cardiology (ACC) and American Heart Association (AHA) have translated scientific evidence into clinical practice guidelines with recommendations to improve cardiovascular health. These guidelines, which are based on systematic methods to evaluate and classify evidence, provide a foundation for the delivery of quality cardiovascular care. The ACC and AHA sponsor the development and publication of clinical practice guidelines without commercial support, and members volunteer their time to the writing and review efforts.

Clinical practice guidelines provide recommendations applicable to patients with or at risk of developing cardiovascular disease (CVD). The focus is on medical practice in the United States, but these guidelines are relevant to patients throughout the world. Although guidelines may be used to inform regulatory or payer decisions, the goals are to improve quality of care and align with patients' interests. Guidelines are intended to define practices meeting the needs of patients in most but not all circumstances and should not replace clinical judgment.

Recommendations for guideline-directed management and therapy, which encompasses clinical evaluation, diagnostic testing, and both pharmacological and procedural treatments, are effective only when adopted by both practitioners and patients. Adherence to recommendations can be enhanced by shared decision-making between clinicians and patients, with patient engagement in selecting interventions on the basis of individual values, preferences, and associated conditions and comorbidities.

The ACC/AHA Task Force on Clinical Practice Guidelines strives to ensure that the guideline writing committee includes requisite expertise and is representative of the broader medical community by selecting experts from a broad array of backgrounds, representing different geographic regions, sexes, races, ethnicities, intellectual perspectives/biases, and scopes of clinical practice. The ACC and AHA have rigorous policies and methods to ensure that documents are developed without bias or improper influence. The complete policy on relationships with industry and other entities (RWI) can be found online.

Beginning in 2017, numerous modifications to the guidelines have been and continue to be implemented to make guidelines shorter and enhance "user friendliness." Guidelines are written and presented in a modular knowledge chunk format, in which each chunk includes a table of recommendations, a brief synopsis, recommendation-specific supportive text and, when appropriate, flow diagrams or additional tables. Hyperlinked references are provided for each modular knowledge chunk to facilitate quick access and review. More structured guidelines—including word limits ("targets") and a web guideline supplement for useful but noncritical tables and figures—are 2 such changes. This Preamble is an abbreviated version, with the detailed version available online.

Patrick T. O'Gara, MD, MACC, FAHA
Chair, ACC/AHA Task Force on Clinical Practice Guidelines

1. INTRODUCTION

Although there has been substantial improvement in atherosclerotic cardiovascular disease (ASCVD) outcomes in recent decades, ASCVD remains the leading cause of morbidity and mortality globally (S1-1–S1-3). In the United States, it is also the leading cause of death for people of most racial/ethnic groups, with an estimated cost of >$200 billion annually in healthcare services, medications, and lost productivity. Much of this is attributable to suboptimal implementation of prevention strategies and uncontrolled ASCVD risk factors in many adults (S1-2).

Most Americans who have had a myocardial infarction (MI) had unfavorable levels of at least 1 cardiovascular risk factor before their ASCVD event (S1-4). In 2010, the AHA defined a new model of "ideal cardiovascular health," referred to as Life's Simple 7 (S1-5). Clinicians will find the 2018 Journal of American College of Cardiology (JACC) Cardiovascular Health Promotion Series very helpful in approaching the various aspects of prevention with patients (S1-6). An increasing number of ideal cardiovascular health factors have been associated with a lower prevalence and incidence of ASCVD events, heart failure, atrial fibrillation, cancer, depression, and cognitive impairment (S1-7). Therefore, moving individuals toward ideal cardiovascular health is critically important for prevention of many important health conditions.

The ACC/AHA Task Force on Clinical Practice Guidelines has commissioned this guideline to consolidate existing recommendations and various recent scientific statements, expert consensus documents, and clinical practice guidelines into a single guidance document focused on the primary prevention of ASCVD. However, this guideline also includes newly generated recommendations for aspirin use, exercise and physical activity, and tobacco use, in addition to recommendations related to team-based care, shared decision-making, and assessment of social determinants of health, to create a comprehensive yet targeted ACC/AHA guideline on the prevention of ASCVD. This guideline has been formatted in the modular chunk format to facilitate readability and future updating.

Prevention strategies occur at the population level but must also engage individual adults to slow the development of ASCVD. The most important way to prevent ASCVD is to promote a healthy lifestyle throughout life. Prevention strategies must include a strong focus on lifestyle optimization (improvements in diet, physical activity, and avoidance of tobacco use and exposure to secondhand smoke) to minimize the risk of future ASCVD events.

A comprehensive patient-centered approach that addresses all aspects of a patient's lifestyle habits and estimated risk of a future ASCVD event is the first step in deciding on where there may be a need for pharmacotherapy. Even if a blood pressure (BP)-reducing medication, lipid-lowering medication, or diabetes medication is ultimately prescribed, lifestyle goals should be emphasized on a regular basis. Only when a person's risk is sufficiently high should medications to reduce ASCVD risk be considered as part of a shared decision-making process for optimal treatment. In summary, clinicians and individuals should focus attention on living a healthy lifestyle by referring to these evidence-based recommendations to help prevent ASCVD.

1.1. Methodology and Evidence Review

This guideline continues the ACC and AHA effort to design a comprehensive yet succinct compilation of practical guidance for the primary prevention of ASCVD and to promote optimal dissemination of information by using concise language and formatting. The recommendations listed in this guideline are evidence based and supported by an extensive evidence review. A search for literature derived from research involving human subjects, published in English, and indexed in Ovid MEDLINE, PubMed, Cochrane Library, National Institute for Health and Care Excellence (NICE), and other selected databases relevant to this guideline, was conducted between May and July 2018. For specific search terms used and years searched per section, please see Appendix 1.

Randomized controlled trials (RCTs), systematic reviews of RCTs, meta-analyses, and large, United States–based, high-quality cohort studies, as well as observational studies and systematic reviews of observational studies, were evaluated for their content on the prevention of ASCVD outcomes related to the following 9 topic areas: risk assessment, diet, exercise/physical activity, obesity and weight loss, type 2 diabetes mellitus (T2DM), blood cholesterol, hypertension, smoking cessation, and aspirin use. Previous ACC/AHA guidelines, as well as U.S. Preventive Services Task Force (USPSTF) reviews and other guidance relevant to this guideline, were also assessed. The final evidence tables included in the Online Data Supplement summarize the evidence used to formulate recommendations. References selected and published in this document are representative and not all-inclusive.

Avalere Health, a healthcare advisory services firm contracted by ACC/AHA, served as the document manager for this guideline to facilitate its development process. As document manager, Avalere facilitated the

deliberations of the Writing Committee and led the modified Delphi process for establishing the Class of Recommendation and the Level of Evidence. In parallel, an independent health data and epidemiology expert, Lee Ann Prebil, conducted a systematic evidence review for the key topic of exercise and physical activity and conducted targeted literature searches to support this document's discussion of patient-centered approaches, including team-based care, shared decision-making, and assessment of social determinants of health. A targeted literature search was also conducted for this guideline's cost and value considerations. These searches are available as downloadable Excel files (http://jaccjacc.acc.org/Clinical_Document/Prevention_GL_Targeted_Literature_Searches.pdf).

Recommendations and supportive text relevant to cardiovascular risk, blood cholesterol, and high BP were taken directly from 2 recently released ACC/AHA guidelines, the 2017 Hypertension Clinical Practice Guidelines (S1.1-1) and the 2018 Cholesterol Clinical Practice Guideline (S1.1-2), and were adapted for the present guideline, which aims to provide an overview of the primary prevention of ASCVD among adults. Recommendations that were adapted from previous publications are noted in the recommendation tables, and both the original published recommendation and the adapted version are provided in the guideline Web Supplement.

The results of these evidence reviews were evaluated by the writing committee for incorporation into the present guideline. (See Table S1 in the Web Supplement for a list of relevant publications and statements used in support of the guideline's recommendations.) Each topic area was assigned a primary writer, as well as a primary, and sometimes secondary, reviewer. These assignments were based on areas of particular expertise of writing committee members. All recommendations were fully reviewed and discussed among the full committee to allow for diverse perspectives and considerations for this guideline. Recommendations were then voted upon, with a modified Delphi process used to reach consensus.

1.2. Organization of the Writing Committee

The writing committee consisted of clinicians, cardiologists, health services researchers, epidemiologists, internists, nurses, and a lay representative. The writing committee included representatives from the ACC and AHA. Appendix 2 of the present document lists writing committee members' relevant RWI. For the purposes of full transparency, the writing committee members' comprehensive disclosure information is available online.

1.3. Document Review and Approval

This document was reviewed by 5 official reviewers nominated by the ACC and AHA (1 reviewer from the ACC/AHA Task Force for Practice Guidelines, 2 reviewers from the AHA, and 2 reviewers from the ACC); 3 reviewers on behalf of the American Association of Cardiovascular and Pulmonary Rehabilitation, the American Society for Nutrition, and the American Society of Preventive Medicine; and 23 individual content reviewers. Reviewers' RWI information was distributed to the writing committee and is published in this document (Appendix 3). This document was approved for publication by the governing bodies of the ACC and AHA.

1.4. Scope of the Guideline

This guideline is intended to be a resource for the clinical and public health practice communities. It addresses the primary prevention of CVD in adults (≥18 years of age), focused on outcomes of ASCVD (i.e., acute coronary syndromes, MI, stable or unstable angina, arterial revascularization, stroke, transient ischemic attack, or peripheral arterial disease of atherosclerotic origin), as well as heart failure and atrial fibrillation. The guideline presents recommendations to prevent CVD that are related to lifestyle factors (e.g., diet and exercise or physical activity), other factors affecting CVD risk (e.g., obesity, diabetes, blood cholesterol, high BP, smoking, aspirin use), patient-centered approaches (e.g., team-based care, shared decision-making, assessment of social determinants of health), and considerations of the cost and value of primary prevention.

1.5. Class of Recommendation and Level of Evidence

Recommendations are designated with both a Class of Recommendation (COR) and a Level of Evidence (LOE). The COR indicates the strength of recommendation, encompassing the estimated magnitude and certainty of benefit in proportion to risk. The LOE rates the quality of scientific evidence supporting the intervention on the basis of the type, quantity, and consistency of data from clinical trials and other sources (**Table 1**) (S1.5-1).

TABLE 1 **Applying Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care (Updated August 2015)**

CLASS (STRENGTH) OF RECOMMENDATION	
CLASS I (STRONG)	**Benefit >>> Risk**
Suggested phrases for writing recommendations: ■ Is recommended ■ Is indicated/useful/effective/beneficial ■ Should be performed/administered/other ■ Comparative-Effectiveness Phrases†: ○ Treatment/strategy A is recommended/indicated in preference to treatment B ○ Treatment A should be chosen over treatment B	
CLASS IIa (MODERATE)	**Benefit >> Risk**
Suggested phrases for writing recommendations: ■ Is reasonable ■ Can be useful/effective/beneficial ■ Comparative-Effectiveness Phrases†: ○ Treatment/strategy A is probably recommended/indicated in preference to treatment B ○ It is reasonable to choose treatment A over treatment B	
CLASS IIb (WEAK)	**Benefit ≥ Risk**
Suggested phrases for writing recommendations: ■ May/might be reasonable ■ May/might be considered ■ Usefulness/effectiveness is unknown/unclear/uncertain or not well established	
CLASS III: No Benefit (MODERATE) *(Generally, LOE A or B use only)*	**Benefit = Risk**
Suggested phrases for writing recommendations: ■ Is not recommended ■ Is not indicated/useful/effective/beneficial ■ Should not be performed/administered/other	
CLASS III: Harm (STRONG)	**Risk > Benefit**
Suggested phrases for writing recommendations: ■ Potentially harmful ■ Causes harm ■ Associated with excess morbidity/mortality ■ Should not be performed/administered/other	

LEVEL (QUALITY) OF EVIDENCE‡	
LEVEL A	
■ High-quality evidence‡ from more than 1 RCT ■ Meta-analyses of high-quality RCTs ■ One or more RCTs corroborated by high-quality registry studies	
LEVEL B-R	**(Randomized)**
■ Moderate-quality evidence‡ from 1 or more RCTs ■ Meta-analyses of moderate-quality RCTs	
LEVEL B-NR	**(Nonrandomized)**
■ Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies ■ Meta-analyses of such studies	
LEVEL C-LD	**(Limited Data)**
■ Randomized or nonrandomized observational or registry studies with limitations of design or execution ■ Meta-analyses of such studies ■ Physiological or mechanistic studies in human subjects	
LEVEL C-EO	**(Expert Opinion)**
Consensus of expert opinion based on clinical experience	

COR and LOE are determined independently (any COR may be paired with any LOE).

A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

* The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information).

† For comparative-effectiveness recommendations (COR I and IIa; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

‡ The method of assessing quality is evolving, including the application of standardized, widely used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.

1.6. Abbreviations

Abbreviation	Meaning/Phrase
ASCVD	atherosclerotic cardiovascular disease
AU	Agatston units
BMI	body mass index
BP	blood pressure
CHD	coronary heart disease
CKD	chronic kidney disease
CVD	cardiovascular disease
DASH	Dietary Approaches to Stop Hypertension
DBP	diastolic blood pressure
DM	diabetes mellitus
ENDS	electronic nicotine delivery systems
FDA	U.S. Food and Drug Administration

Continued in the next column

Abbreviation	Meaning/Phrase
GLP-1R	glucagon-like peptide-1 receptor
HbA1c	hemoglobin A1c
HDL-C	high-density lipoprotein cholesterol
HbA1c	hemoglobin A1c
LDL-C	low-density lipoprotein cholesterol
MI	myocardial infarction
PCE	pooled cohort equations
RCT	randomized controlled trial
SBP	systolic blood pressure
SGLT-2	sodium-glucose cotransporter 2
T2DM	type 2 diabetes mellitus
USPSTF	U.S. Preventive Services Task Force

2. OVERARCHING RECOMMENDATIONS FOR ASCVD PREVENTION EFFORTS

2.1. Patient-Centered Approaches to Comprehensive ASCVD Prevention

Recommendations for Patient-Centered Approaches to Comprehensive ASCVD Prevention
Referenced studies that support recommendations are summarized in Online Data Supplements 1 and 2.

COR	LOE	RECOMMENDATIONS
I	A	1. A team-based care approach is recommended for the control of risk factors associated with ASCVD (S2.1-1–S2.1-14).
I	B-R	2. Shared decision-making should guide discussions about the best strategies to reduce ASCVD risk (S2.1-15–S2.1-18).
I	B-NR	3. Social determinants of health should inform optimal implementation of treatment recommendations for the prevention of ASCVD (S2.1-19–S2.1-25).

Table 2 outlines key considerations related to social determinants of health and ASCVD prevention.

TABLE 2 Example Considerations for Addressing Social Determinants of Health to Help Prevent ASCVD Events

Topic/Domain	Example Considerations
Cardiovascular risk	■ Adults should be routinely assessed for psychosocial stressors and provided with appropriate counseling (S2.1-26). ■ Health literacy should be assessed every 4 to 6 y to maximize recommendation effectiveness (S2.1-27).
Diet	■ In addition to the prescription of diet modifications, body size perception, as well as social and cultural influences, should be assessed (S2.1-28,S2.1-29). ■ Potential barriers to adhering to a heart-healthy diet should be assessed, including food access and economic factors; these factors may be particularly relevant to persons from vulnerable populations, such as individuals residing in either inner-city or rural environments, those at socioeconomic disadvantage, and those of advanced age* (S2.1-30).
Exercise and physical activity	■ In addition to the prescription of exercise, neighborhood environment and access to facilities for physical activity should be assessed (S2.1-31–S2.1-33).
Obesity and weight loss	■ Lifestyle counseling for weight loss should include assessment of and interventional recommendations for psychosocial stressors, sleep hygiene, and other individualized barriers (S2.1-34–S2.1-36). ■ Weight maintenance should be promoted in patients with overweight/obesity who are unable to achieve recommended weight loss.
Diabetes mellitus	■ In addition to the prescription of type 2 diabetes mellitus interventions, environmental and psychosocial factors, including depression, stress, self-efficacy, and social support, should be assessed to improve achievement of glycemic control and adherence to treatment (S2.1-37–S2.1-40).
High blood pressure	■ Short sleep duration (<6 h) and poor-quality sleep are associated with high blood pressure and should be considered (S2.1-41). Because other lifestyle habits can impact blood pressure, access to a healthy, low-sodium diet and viable exercise options should also be considered.
Tobacco treatment	■ Social support is another potential determinant of tobacco use. Therefore, in adults who use tobacco, assistance and arrangement for individualized and group social support counseling are recommended (S2.1-42,S2.1-43).

*Advanced age generally refers to age ≥75 years.
ASCVD indicates atherosclerotic cardiovascular disease.

2.2. Assessment of Cardiovascular Risk

Recommendations for Assessment of Cardiovascular Risk
Referenced studies that support recommendations are summarized in Online Data Supplement 3.

COR	LOE	RECOMMENDATIONS
I	B-NR	1. For adults 40 to 75 years of age, clinicians should routinely assess traditional cardiovascular risk factors and calculate 10-year risk of ASCVD by using the pooled cohort equations (PCE) (S2.2-1,S2.2-2).
IIa	B-NR	2. For adults 20 to 39 years of age, it is reasonable to assess traditional ASCVD risk factors at least every 4 to 6 years (S2.2-1–S2.2-3).
IIa	B-NR	3. In adults at borderline risk (5% to <7.5% 10-year ASCVD risk) or intermediate risk (≥7.5% to <20% 10-year ASCVD risk), it is reasonable to use additional risk-enhancing factors to guide decisions about preventive interventions (e.g., statin therapy) (S2.2-4–S2.2-14).
IIa	B-NR	4. In adults at intermediate risk (≥7.5% to <20% 10-year ASCVD risk) or selected adults at borderline risk (5% to <7.5% 10-year ASCVD risk), if risk-based decisions for preventive interventions (e.g., statin therapy) remain uncertain, it is reasonable to measure a coronary artery calcium score to guide clinician–patient risk discussion (S2.2-15–S2.2-31).
IIb	B-NR	5. For adults 20 to 39 years of age and for those 40 to 59 years of age who have <7.5% 10-year ASCVD risk, estimating lifetime or 30-year ASCVD risk may be considered (S2.2-1,S2.2-2,S2.2-32–S2.2-35).

Among adults at borderline (5% to <7.5%) and intermediate (≥7.5% to <20%) risk, one may consider additional individual risk-enhancing clinical factors (**Table 3**) that can be used to revise the 10-year ASCVD risk estimate (S2.2-4). These factors may include having a family history of premature ASCVD (S2.2-5), chronic inflammatory disease [rheumatoid arthritis (S2.2-6), lupus (S2.2-7), or HIV infection (S2.2-12)], South Asian ancestry (S2.2-13), a history of preeclampsia (S2.2-8) or preterm delivery (S2.2-9), early menopause (S2.2-10), erectile dysfunction (S2.2-11), chronic kidney disease (CKD), metabolic syndrome, persistently elevated inflammatory markers (S2.2-14), or elevated lipid biomarkers (S2.2-4). After these clinically available risk-enhancing factors have been considered, if there is still uncertainty about the reliability of the risk estimate for individuals in the

TABLE 3 Risk-Enhancing Factors for Clinician–Patient Risk Discussion

Risk-Enhancing Factors

- **Family history of premature ASCVD** (males, age <55 y; females, age <65 y)
- **Primary hypercholesterolemia** (LDL-C 160–189 mg/dL [4.1–4.8 mmol/L]; non–HDL-C 190–219 mg/dL [4.9–5.6 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-C [<40 mg/dL in men; <50 mg/dL in women] are factors; a tally of 3 makes the diagnosis)
- **Chronic kidney disease** (eGFR 15–59 mL/min/1.73 m^2 with or without albuminuria; not treated with dialysis or kidney transplantation)
- **Chronic inflammatory conditions,** such as psoriasis, RA, lupus, or HIV/AIDS
- **History of premature menopause (before age 40 y) and history of pregnancy-associated conditions that increase later ASCVD risk, such as preeclampsia**
- **High-risk race/ethnicity** (e.g., 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** (≥2.0 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-C >160 mg/dL and constitutes a risk-enhancing factor
    - **ABI** (<0.9)

*Optimally, 3 determinations.

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

borderline- or intermediate-risk categories, further testing to document subclinical coronary atherosclerosis is reasonable to more accurately reclassify the risk estimate upward or downward (S2.2-17–S2.2-19,S2.2-36).

3. LIFESTYLE FACTORS AFFECTING CARDIOVASCULAR RISK

3.1. Nutrition and Diet

Recommendations for Nutrition and Diet
Referenced studies that support recommendations are summarized in Online Data Supplements 4 and 5.

COR	LOE	RECOMMENDATIONS
I	B-R	1. A diet emphasizing intake of vegetables, fruits, legumes, nuts, whole grains, and fish is recommended to decrease ASCVD risk factors (S3.1-1–S3.1-11).
IIa	B-NR	2. Replacement of saturated fat with dietary monounsaturated and polyunsaturated fats can be beneficial to reduce ASCVD risk (S3.1-12,S3.1-13).
IIa	B-NR	3. A diet containing reduced amounts of cholesterol and sodium can be beneficial to decrease ASCVD risk (S3.1-9,S3.1-14–S3.1-16).
IIa	B-NR	4. As a part of a healthy diet, it is reasonable to minimize the intake of processed meats, refined carbohydrates, and sweetened beverages to reduce ASCVD risk (S3.1-17–S3.1-23).
III-Harm	B-NR	5. As a part of a healthy diet, the intake of *trans* fats should be avoided to reduce ASCVD risk (S3.1-12, S3.1-17, S3.1-25–S3.1-27).

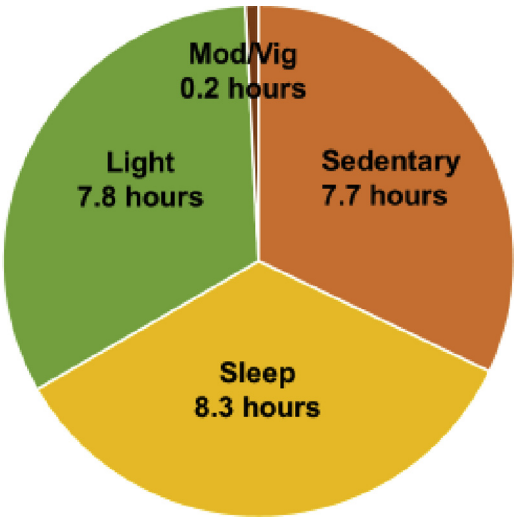
3.2. Exercise and Physical Activity

Recommendations for Exercise and Physical Activity
Referenced studies that support recommendations are summarized in Online Data Supplements 6 and 7.

COR	LOE	RECOMMENDATIONS
I	B-R	1. Adults should be routinely counseled in healthcare visits to optimize a physically active lifestyle (S3.2-1, S3.2-2).
I	B-NR	2. Adults should engage in at least 150 minutes per week of accumulated moderate-intensity or 75 minutes per week of vigorous-intensity aerobic physical activity (or an equivalent combination of moderate and vigorous activity) to reduce ASCVD risk (S3.2-3–S3.2-8).
IIa	B-NR	3. For adults unable to meet the minimum physical activity recommendations (at least 150 minutes per week of accumulated moderate-intensity or 75 minutes per week of vigorous-intensity aerobic physical activity), engaging in some moderate- or vigorous-intensity physical activity, even if less than this recommended amount, can be beneficial to reduce ASCVD risk (S3.2-5,S3.2-6).
IIb	C-LD	4. Decreasing sedentary behavior in adults may be reasonable to reduce ASCVD risk (S3.2-3,S3.2-9–S3.2-11).

Other activity states that comprise a 24-hour period for an average individual include sleep, light-intensity physical activity, and sedentary behavior (**Figure 1**). *Sedentary behavior* refers to waking behavior with an energy expenditure of ≤1.5 metabolic equivalents while in a sitting or reclining posture (**Table 4**) (S3.2-12).

FIGURE 1 Hours Per Day Spent in Various States of Activity



U.S. adults spend >7 h/d on average in sedentary activities. Replacing sedentary time with other physical activity involves increasing either moderate- to vigorous-intensity physical activity or light-intensity physical activity. Data modified from Young et al. (S3.2-12).

TABLE 4 Definitions and Examples of Different Intensities of Physical Activity

Intensity	METs	Examples
Sedentary behavior*	1–1.5	Sitting, reclining, or lying; watching television
Light	1.6–2.9	Walking slowly, cooking, light housework
Moderate	3.0–5.9	Brisk walking (2.4–4 mph), biking (5–9 mph), ballroom dancing, active yoga, recreational swimming
Vigorous	≥6	Jogging/running, biking (≥10 mph), singles tennis, swimming laps

Sedentary behavior is defined as any waking behavior characterized by an energy expenditure ≤1.5 METs while in a sitting, reclining, or lying posture. Standing is a sedentary activity in that it involves ≤1.5 METs, but it is not considered a component of sedentary behavior.

MET indicates metabolic equivalent; mph, miles per hour.

4. OTHER FACTORS AFFECTING CARDIOVASCULAR RISK

4.1. Adults With Overweight and Obesity

Recommendations for Adults With Overweight and Obesity
Referenced studies that support recommendations are summarized in Online Data Supplements 8 and 9.

COR	LOE	RECOMMENDATIONS
I	B-R	1. In individuals with overweight and obesity, weight loss is recommended to improve the ASCVD risk factor profile (S4.1-1).
I	B-R	2. Counseling and comprehensive lifestyle interventions, including calorie restriction, are recommended for achieving and maintaining weight loss in adults with overweight and obesity (S4.1-1,S4.1-2).
I	C-EO	3. Calculating body mass index (BMI) is recommended annually or more frequently to identify adults with overweight and obesity for weight loss considerations.
IIa	B-NR	4. It is reasonable to measure waist circumference to identify those at higher cardiometabolic risk (S4.1-3–S4.1-6).

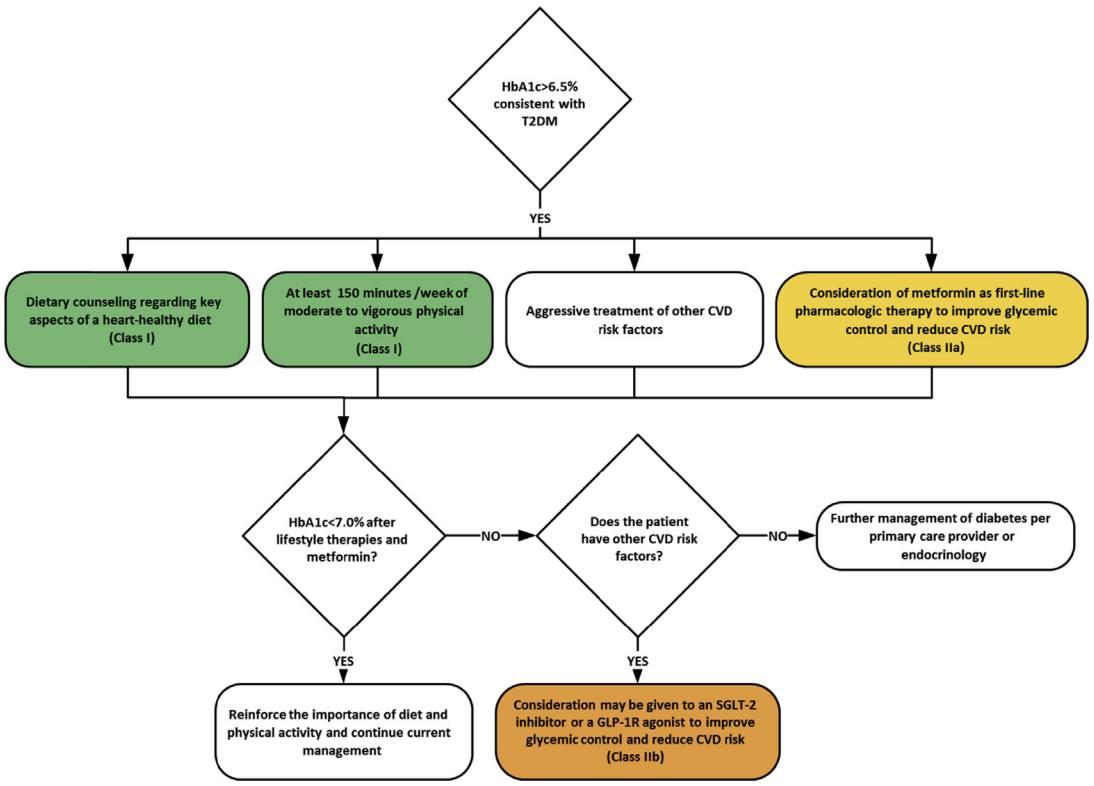
4.2. Adults With Type 2 Diabetes Mellitus

See **Figure 2** for an algorithm for treatment of T2DM for primary prevention of cardiovascular disease.

Recommendations for Adults With Type 2 Diabetes Mellitus
Referenced studies that support recommendations are summarized in Online Data Supplement 10.

COR	LOE	RECOMMENDATIONS
I	A	1. For all adults with T2DM, a tailored nutrition plan focusing on a heart-healthy dietary pattern is recommended to improve glycemic control, achieve weight loss if needed, and improve other ASCVD risk factors (S4.2-1,S4.2-2).
I	A	2. Adults with T2DM should perform at least 150 minutes per week of moderate-intensity physical activity or 75 minutes of vigorous-intensity physical activity to improve glycemic control, achieve weight loss if needed, and improve other ASCVD risk factors (S4.2-3,S4.2-4).
IIa	B-R	3. For adults with T2DM, it is reasonable to initiate metformin as first-line therapy along with lifestyle therapies at the time of diagnosis to improve glycemic control and reduce ASCVD risk (S4.2-5–S4.2-8).
IIb	B-R	4. For adults with T2DM and additional ASCVD risk factors who require glucose-lowering therapy despite initial lifestyle modifications and metformin, it may be reasonable to initiate a sodium-glucose cotransporter 2 (SGLT-2) inhibitor or a glucagon-like peptide-1 receptor (GLP-1R) agonist to improve glycemic control and reduce CVD risk (S4.2-9–S4.2-14).

FIGURE 2 Treatment of T2DM for Primary Prevention of Cardiovascular Disease



CVD indicates cardiovascular disease; GLP-1R, glucagon-like peptide-1 receptor; HbA1c, hemoglobin A1c; SGLT-2, sodium-glucose cotransporter 2; and T2DM, type 2 diabetes mellitus.

4.3. Adults With High Blood Cholesterol

Recommendations from the 2018 Cholesterol Clinical Practice Guidelines (S4.3-1) are included and adapted below.

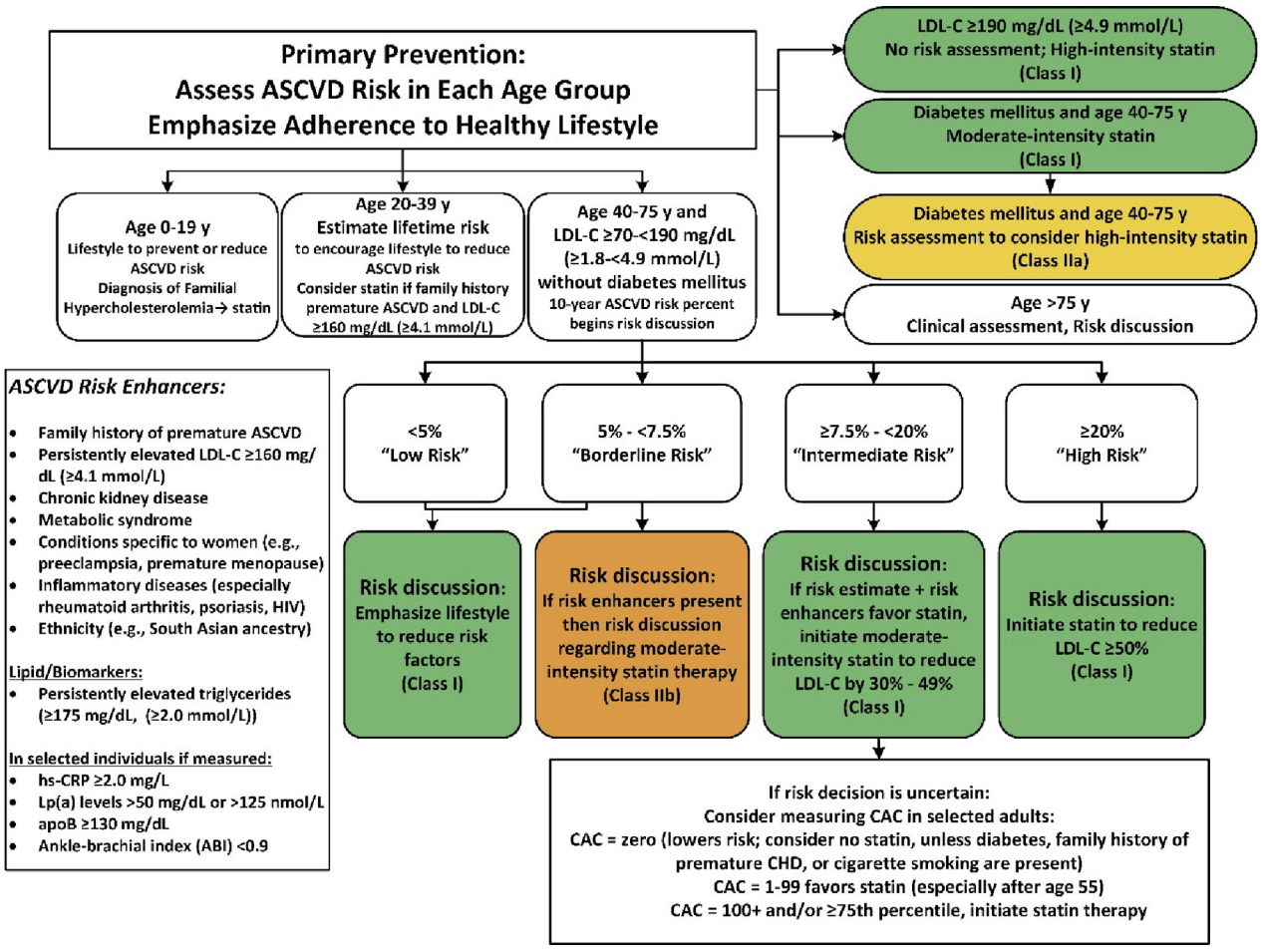
Recommendations for Adults With High Blood Cholesterol
Referenced studies that support recommendations are summarized in Online Data Supplements 11 and 12.

COR	LOE	RECOMMENDATIONS
I	A	1. In adults at intermediate risk (≥7.5% to <20% 10-year ASCVD risk), statin therapy reduces risk of ASCVD, and in the context of a risk discussion, if a decision is made for statin therapy, a moderate-intensity statin should be recommended (S4.3-2–S4.3-9). Adapted from recommendations in the 2018 Cholesterol Clinical Practice Guidelines (S4.3-1).
I	A	2. In intermediate risk (≥7.5% to <20% 10-year ASCVD risk) patients, LDL-C levels should be reduced by 30% or more, and for optimal ASCVD risk reduction, especially in patients at high risk (≥20% 10-year ASCVD risk), levels should be reduced by 50% or more (S4.3-2,S4.3-5–S4.3-10). Adapted from recommendations in the 2018 Cholesterol Clinical Practice Guidelines (S4.3-1).
I	A	3. In adults 40 to 75 years of age with diabetes, regardless of estimated 10-year ASCVD risk, moderate-intensity statin therapy is indicated (S4.3-11–S4.3-19). Included from recommendations in the 2018 Cholesterol Clinical Practice Guidelines (S4.3-1).
I	B-R	4. In patients 20 to 75 years of age with an LDL-C level of 190 mg/dL (≥4.9 mmol/L) or higher, maximally tolerated statin therapy is recommended (S4.3-2,S4.3-20–S4.3-25). Included from recommendations in the 2018 Cholesterol Clinical Practice Guidelines (S4.3-1).
IIa	B-R	5. In adults with diabetes mellitus who have multiple ASCVD risk factors, it is reasonable to prescribe high-intensity statin therapy with the aim to reduce LDL-C levels by 50% or more (S4.3-2,S4.3-7). Included from recommendations in the 2018 Cholesterol Clinical Practice Guidelines (S4.3-1).
IIa	B-R	6. In intermediate-risk (≥7.5% to <20% 10-year ASCVD risk) adults, risk-enhancing factors favor initiation or intensification of statin therapy (S4.3-7,S4.3-26–S4.3-33). Adapted from recommendations in the 2018 Cholesterol Clinical Practice Guidelines (S4.3-1).
IIa	B-NR	7. In intermediate-risk (≥7.5% to <20% 10-year ASCVD risk) adults or selected borderline-risk (5% to <7.5% 10-year ASCVD risk) adults in whom a coronary artery calcium score is measured for the purpose of making a treatment decision, AND ■ If the coronary artery calcium score is zero, it is reasonable to withhold statin therapy and reassess in 5 to 10 years, as long as higher-risk conditions are absent (e.g., diabetes, family history of premature CHD, cigarette smoking); ■ If coronary artery calcium score is 1 to 99, it is reasonable to initiate statin therapy for patients ≥55 years of age; ■ If coronary artery calcium score is 100 or higher or in the 75th percentile or higher, it is reasonable to initiate statin therapy (S4.3-28,S4.3-34). Adapted from recommendations in the 2018 Cholesterol Clinical Practice Guidelines (S4.3-1).
IIb	B-R	8. In patients at borderline risk (5% to <7.5% 10-year ASCVD risk), in risk discussion, the presence of risk-enhancing factors may justify initiation of moderate-intensity statin therapy (S4.3-28,S4.3-35). Adapted from recommendations in the 2018 Cholesterol Clinical Practice Guidelines (S4.3-1).

Primary ASCVD prevention requires attention to ASCVD risk factors beginning early in life (**Figure 3**). The benefit from statin therapy is related to both global risk and intensity of treatment (S4.3-2), and no RCTs of high-intensity statin therapy have been carried out in cohorts of patients exclusively with diabetes. On the basis of these considerations and the fact that patients with diabetes have a higher trajectory of lifetime risk than do those without diabetes, high-intensity statin therapy is preferred in patients with diabetes as they develop risk modifiers (**Table 5**).

Selected examples of candidates who might benefit from knowing their coronary artery calcium score is zero are listed in **Table 6**.

FIGURE 3 Primary Prevention



Colors correspond to Class of Recommendation in Table 1. ABI indicates ankle-brachial index; apoB, apolipoprotein B; ASCVD, atherosclerotic cardiovascular disease; CAC, coronary artery calcium; CHD, coronary heart disease; HIV, human immunodeficiency virus; hs-CRP, high-sensitivity C-reactive protein; LDL-C, low-density lipoprotein cholesterol; and Lp(a), lipoprotein (a). Reproduced with permission from Grundy et al. (S4.3-1). Copyright © 2018, American Heart Association, Inc., and American College of Cardiology Foundation.

TABLE 5 Diabetes-Specific Risk Enhancers That Are Independent of Other Risk Factors in Diabetes Mellitus

Risk Enhancers in Diabetic Patients
Long duration (≥10 years for T2DM (S4.3-36) or ≥20 years for type 1 diabetes mellitus (S4.3-16))
Albuminuria ≥30 mcg albumin/mg creatinine (S4.3-37)
eGFR <60 mL/min/1.73 m^2 (S4.3-37)
Retinopathy (S4.3-38)
Neuropathy (S4.3-39)
ABI <0.9 (S4.3-40,S4.3-41)

ABI indicates ankle-brachial index; eGFR, estimated glomerular filtration rate; and T2DM, type 2 diabetes mellitus.

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TABLE 6 Selected Examples of Candidates for Coronary Artery Calcium Measurement Who Might Benefit From Knowing Their Coronary Artery Calcium Score Is Zero

Coronary Artery Calcium Measurement Candidates Who Might Benefit from Knowing Their Coronary Artery Calcium Score Is Zero
■ Patients reluctant to initiate statin who wish to understand their risk and potential for benefit more precisely
■ Patients concerned about need to reinstitute statin therapy after discontinuation for statin-associated symptoms
■ Older patients (men 55–80 y of age; women 60–80 y of age) with low burden of risk factors (S4.4-42) who question whether they would benefit from statin therapy
■ Middle-aged adults (40–55 y of age) with PCE-calculated 10-year risk for ASCVD 5% to <7.5% with factors that increase their ASCVD risk, although they are in a borderline risk group.

Caveats: If patient is at intermediate risk and if a risk decision is uncertain and a coronary artery calcium score is obtained, it is reasonable to withhold statin therapy unless higher-risk conditions, such as cigarette smoking, family history of premature ASCVD, or diabetes mellitus, are present and to reassess the coronary artery calcium score in 5 to 10 years. Moreover, if coronary artery calcium is recommended, it should be performed in facilities that have current technology and expertise to deliver the lowest radiation possible.

ASCVD indicates atherosclerotic cardiovascular disease; LDL-C, low-density lipoprotein cholesterol; and PCE, pooled cohort equations.

4.4. Adults With High Blood Pressure or Hypertension

Recommendations from the 2017 Hypertension Clinical Practice Guidelines (S4.4-1) are adapted below.

Recommendations for Adults With High Blood Pressure or Hypertension
Referenced studies that support recommendations are summarized in Online Data Supplements 13 and 14.

COR	LOE	RECOMMENDATIONS
I	A	1. In adults with elevated blood pressure (BP) or hypertension, including those requiring antihypertensive medications nonpharmacological interventions are recommended to reduce BP. These include: ■ weight loss (S4.4-2–S4.4-5); ■ a heart-healthy dietary pattern (S4.4-6–S4.4-8); ■ sodium reduction (S4.4-9–S4.4-13); ■ dietary potassium supplementation (S4.4-14–S4.4-18); ■ increased physical activity with a structured exercise program (S4.4-3, S4.4-5, S4.4-11,S4.4-19–S4.4-23); and ■ limited alcohol (S4.4-24–S4.4-29). Adapted from recommendations in the 2017 Hypertension Clinical Practice Guidelines (S4.4-1).
I	SBP: A DBP: C-EO	2. In adults with an estimated 10-year ASCVD risk* of 10% or higher and an average systolic BP (SBP) of 130 mm Hg or higher or an average diastolic BP (DBP) of 80 mm Hg or higher, use of BP-lowering medications is recommended for primary prevention of CVD (S4.4-30–S4.4-38). Adapted from recommendations in the 2017 Hypertension Clinical Practice Guidelines (S4.4-1).
I	SBP: $B\text{-}R_{SR}$ DBP: C-EO	3. In adults with confirmed hypertension and a 10-year ASCVD event risk of 10% or higher, a BP target of less than 130/80 mm Hg is recommended (S4.4-33,S4.4-39–S4.4-42). Adapted from recommendations in the 2017 Hypertension Clinical Practice Guidelines (S4.4-1).
I	SBP: $B\text{-}R_{SR}$ DBP: C-EO	4. In adults with hypertension and chronic kidney disease, treatment to a BP goal of less than 130/80 mm Hg is recommended (S4.4-43–S4.4-48). Adapted from recommendations in the 2017 Hypertension Clinical Practice Guidelines (S4.4-1).
I	SBP: $B\text{-}R_{SR}$ DBP: C-EO	5. In adults with T2DM and hypertension, antihypertensive drug treatment should be initiated at a BP of 130/80 mm Hg or higher, with a treatment goal of less than 130/80 mm Hg (S4.4-33, S4.4-47, S4.4-49–S4.4-54). Adapted from recommendations in the 2017 Hypertension Clinical Practice Guidelines (S4.4-1).

(Continued)

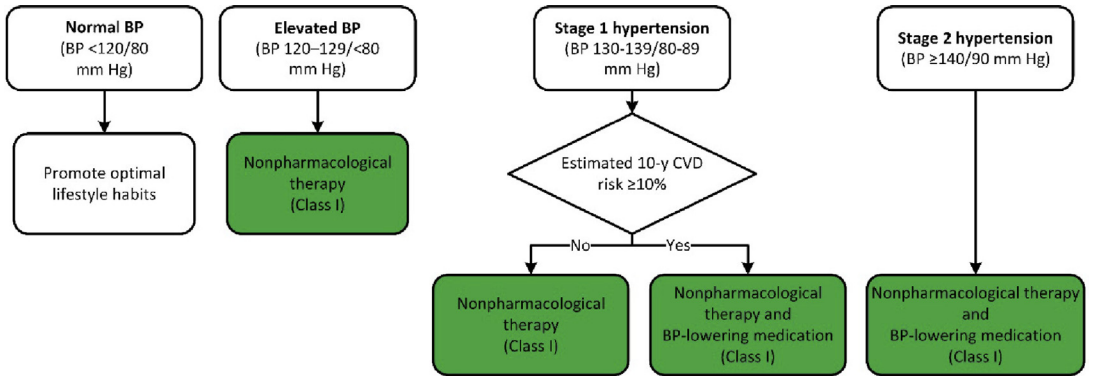
I	C-LD	6. In adults with an estimated 10-year ASCVD risk <10% and an SBP of 140 mm Hg or higher or a DBP of 90 mm Hg or higher, initiation and use of BP-lowering medication are recommended (S4.4-36,S4.4-55-S4.4-58). Adapted from recommendations in the 2017 Hypertension Clinical Practice Guidelines (S4.4-1).
IIb	SBP: B-NR DBP: C-EO	7. In adults with confirmed hypertension without additional markers of increased ASCVD risk, a BP target of less than 130/80 mm Hg may be reasonable (S4.4-59-S4.4-62). Adapted from recommendations in the 2017 Hypertension Clinical Practice Guidelines (S4.4-1).

*ACC/AHA pooled cohort equations to estimate 10-year risk of ASCVD.

See **Figure 4** for the BP thresholds and treatment recommendations algorithm and refer to the 2017 Hypertension Clinical Practice Guidelines for comprehensive details (S4.4-1).

See **Table 7** for recommended dose and approximate impact on SBP.

FIGURE 4 BP Thresholds and Recommendations for Treatment



Colors correspond to Class of Recommendation in **Table 1**. BP indicates blood pressure; and CVD, cardiovascular disease. Adapted with permission from Whelton et al. (S4.4-1). Copyright © 2017, American College of Cardiology Foundation and the American Heart Association, Inc.

TABLE 7 Best Proven Nonpharmacological Interventions for Prevention and Treatment of Hypertension*

	Nonpharmacological Intervention	Goal	Approximate Impact on SBP		
			Hypertension	Normotension	Reference
Weight loss	Weight/body fat	Best goal is ideal body weight, but aim for at least a 1-kg reduction in body weight for most adults who are overweight. Expect about 1 mm Hg for every 1-kg reduction in body weight.	-5 mm Hg	-2/3 mm Hg	(S4.4-2)
Healthy diet	DASH dietary pattern†	Consume a diet rich in fruits, vegetables, whole grains, and low-fat dairy products, with reduced content of saturated and total fat.	-11 mm Hg	-3 mm Hg	(S4.4-7, S4.4-8)
Reduced intake of dietary sodium	Dietary sodium	Optimal goal is <1500 mg/d, but aim for at least a 1000-mg/d reduction in most adults.	-5/6 mm Hg	-2/3 mm Hg	(S4.4-12, S4.4-10)
Enhanced intake of dietary potassium	Dietary potassium	Aim for 3500–5000 mg/d, preferably by consumption of a diet rich in potassium.	-4/5 mm Hg	-2 mm Hg	(S4.4-14)

Continued on the next page

TABLE 7 Continued

	Nonpharmacological Intervention	Goal	Approximate Impact on SBP		
			Hypertension	Normotension	Reference
Physical activity	Aerobic	■ 90–150 min/wk ■ 65%–75% heart rate reserve	-5/8 mm Hg	-2/4 mm Hg	(S4.4-19, S4.4-20)
	Dynamic resistance	■ 90–150 min/wk ■ 50%–80% 1 rep maximum ■ 6 exercises, 3 sets/exercise, 10 repetitions/set	-4 mm Hg	-2 mm Hg	(S4.4-19)
	Isometric resistance	■ 4 × 2 min (hand grip), 1 min rest between exercises, 30%–40% maximum voluntary contraction, 3 sessions/wk ■ 8–10 wk	-5 mm Hg	-4 mm Hg	(S4.4-21, S4.4-63)
Moderation in alcohol intake	Alcohol consumption	In individuals who drink alcohol, reduce alcohol‡ to: ■ Men: ≤2 drinks daily ■ Women: ≤1 drink daily	-4 mm Hg	-3 mm Hg	(S4.4-20, S4.4-24, S4.4-25)

*Type, dose, and expected impact on BP in adults with a normal BP and with hypertension.
†Detailed information about the DASH diet is available via the NHLBI (S4.4-65) and Dashdiet.org (S4.4-66).
‡In the United States, 1 "standard" drink contains roughly 14 g of pure alcohol, which is typically found in 12 oz of regular beer (usually about 5% alcohol), 5 oz of wine (usually about 12% alcohol), and 1.5 oz of distilled spirits (usually about 40% alcohol) (S4.4-64).

BP indicates blood pressure; DASH, Dietary Approaches to Stop Hypertension; NHLBI, National Heart, Lung, and Blood Institute; and SBP, systolic blood pressure.

4.5. Treatment of Tobacco Use

Recommendations for Treatment of Tobacco Use
Referenced studies that support recommendations are summarized in Online Data Supplements 15 and 16.

COR	LOE	RECOMMENDATIONS
I	A	1. All adults should be assessed at every healthcare visit for tobacco use and their tobacco use status recorded as a vital sign to facilitate tobacco cessation (S4.5-1).
I	A	2. To achieve tobacco abstinence, all adults who use tobacco should be firmly advised to quit (S4.5-2).
I	A	3. In adults who use tobacco, a combination of behavioral interventions plus pharmacotherapy is recommended to maximize quit rates (S4.5-2,S4.5-3).
I	B-NR	4. In adults who use tobacco, tobacco abstinence is recommended to reduce ASCVD risk (S4.5-4,S4.5-5).
IIa	B-R	5. To facilitate tobacco cessation, it is reasonable to dedicate trained staff to tobacco treatment in every healthcare system (S4.5-1).
III: Harm	B-NR	6. All adults and adolescents should avoid secondhand smoke exposure to reduce ASCVD risk (S4.5-6).

In alignment with previous expert consensus regarding strategies for tobacco cessation (S4.5-7), **Table 8** summarizes recommended behavioral interventions and pharmacotherapy for tobacco treatment. There are 7 FDA-approved cessation medications, including 5 forms of nicotine replacement. *Note that the black box warnings about neuropsychiatric events have been removed by the FDA* (S4.5-8, 4.5-9).

TABLE 8 Highlights of Recommended Behavioral and Pharmacotherapy Tobacco Treatment Modalities for Prescribers*

Timing of Behavioral Interventions†			
<3 min of tobacco status assessment with cessation counseling at each clinic encounter	>3-10 min of tobacco status assessment with cessation counseling at each clinic encounter		>10 min of tobacco status assessment with cessation counseling at each clinic encounter
Treatment	**Dosing‡**		**Precautions**
NRT*			
Patch	21 mg, 14 mg, or 7 mg	Starting dose: 21 mg for ≥10 CPD; 14 mg for <10 CPD	Local irritation possible; avoid with skin disorders; may remove for sleep if needed
Gum Lozenge	2 mg or 4 mg 2 mg or 4 mg	Starting dose: 4 mg if first tobacco use is ≤30 min after waking; 2 mg if first tobacco use is >30 min after waking; maximum of 20 lozenges or 24 pieces of gum/d. Chew and park gum*	Hiccups/dyspepsia possible; avoid food or beverages 15 min before and after use
Nasal spray	10 mg/mL	Starting dose: 1-2 doses/h (1 dose=1 spray each nostril) maximum of 40 doses/d	Local irritation possible; avoid with nasal or reactive airway disorders
Oral inhaler	10-mg cartridge	Starting dose: Puff for 20 min/cartridge every 1-2 h; maximum 16 cartridges/d	Cough possible; avoid with reactive airway disorders
Other§			
Bupropion (Zyban [GlaxoSmithKline], Wellbutrin SR [GlaxoSmithKline])	150 mg SR	150 mg once daily (am) for 3 d; then 150 mg twice daily; may use in combination with NRT (S4.5-9)	Avoid with history/risk of seizures, eating disorders, MAO inhibitors, or CYP 2D6 inhibitor
Varenicline (Chantix [Pfizer])	0.5 mg or 1 mg	0.5 mg once daily (am) for 3 d; then 0.5 mg twice daily for 4 d; then 1 mg twice daily (use start pack followed by continuation pack) for 3-6 mo	Nausea common; take with food. Renal dosing required. Very limited drug interactions; near-exclusive renal clearance.

*CPD can guide dosing. 1 CPD is ≈1-2 mg of nicotine. *Note: Use caution with all NRT products for patients with recent (≤2 wk) MI, serious arrhythmia, or angina; patients who are pregnant or breastfeeding; and adolescents.*
†Timing of assessment relates to ICD-10 coding.
‡Dose and duration can be titrated on the basis of response (S4.5-9).
§The FDA has issued a removal of black box warnings about neuropsychiatric events (S4.5-8,S4.5-9).
am indicates morning; CPD, cigarettes smoked per day; FDA, U.S. Food and Drug Administration; ICD-10, *International Classification of Diseases, Tenth Revision*; MAO, monoamine oxidase; NRT, nicotine replacement; and SR, sustained release.

4.6. Aspirin Use

Recommendations for Aspirin Use
Referenced studies that support recommendations are summarized in Online Data Supplements 17 and 18.

COR	LOE	RECOMMENDATIONS
IIb	A	1. Low-dose aspirin (75-100 mg orally daily) might be considered for the primary prevention of ASCVD among select adults 40 to 70 years of age who are at higher ASCVD risk but not at increased bleeding risk (S4.6-1-S4.6-8).
III: Harm	B-R	2. Low-dose aspirin (75-100 mg orally daily) should not be administered on a routine basis for the primary prevention of ASCVD among adults >70 years of age (S4.6-9).
III: Harm	C-LD	3. Low-dose aspirin (75-100 mg orally daily) should not be administered for the primary prevention of ASCVD among adults of any age who are at increased risk of bleeding (S4.6-10).

5. COST AND VALUE CONSIDERATIONS

The growing need to consider value stems directly from the goal of achieving the best possible health outcomes with finite healthcare resources in the primary prevention of CVD (S5-1). *Value* in healthcare can be defined as the incremental health benefits of a therapy or procedure relative to its incremental net long-term costs. The consideration of cost and value in the guideline development process supports key goals, including: 1) enhancing overall value in the delivery of cardiovascular care and 2) involving healthcare professionals in the challenging care decisions that must be made to increase value in the U.S. healthcare system (S5-2).

The integration of value assessments into our national guidelines involves inherent methodological challenges, including: 1) variability in costs across different healthcare settings; 2) variability in costs and benefits across different patient subgroups; 3) variability over time; 4) variability in who bears the burden of the health outcome (i.e., typically the individual patient) versus who bears the burden of the healthcare cost (e.g., often spread beyond the individual to third-party payers, taxpayers); and 5) an inadequate literature base on which to render a sound, evidence-based assessment of certain specific therapies (S5-1,S5-2).

There are additional challenges specific to the prevention realm. As described in the 2011 AHA policy statement, "Value of Primordial and Primary Prevention in CVD" (S5-1):

> *"Assessing the value of prevention in apparently healthy patients is generally more difficult than evaluating therapy for established disease because the time horizon to the clinical manifestation of disease is generally long—many decades in the young. Thus, it is difficult, perhaps impossible, to assess long-term effectiveness in terms of survival or quality-adjusted life-years (QALYs) or associated costs because of increasing uncertainty about outcome the further one tries to look into the future."*

Furthermore, the principle of *discounting*, which places relative emphasis on current costs and benefits while deemphasizing downstream costs and benefits, creates disadvantages for prevention because costs often accrue in the present while the benefit may only be fully realized long into the future. These methodological challenges notwithstanding, prior AHA statements have highlighted the public policies, community efforts, and pharmacological interventions that are likely to be cost-effective and, at times, cost-saving prevention tactics compared with common benchmarks. For example, robust evidence suggests that both antihypertensive therapy (S5-3–S5-6) and statin therapy (S5-7–S5-9), particularly with low-cost generic drug formulations, are high-value interventions across a wide spectrum of risk and age strata.

The incorporation of the value category into clinical practice guidelines is one of several considerations in medical decision-making and resource allocation. Clinicians, researchers, and policymakers alike must continue to place cost-effective analyses in the proper context, extracting key value determinations while acknowledging the challenges in fully characterizing and incorporating the downstream benefits of a given therapeutic prevention tactic. Further research and methodological advances are needed to comprehensively characterize the full spectrum of benefits produced by the prevention approach, thereby rendering cost-effectiveness assessments more consequential to clinical practice.

6. CONCLUSION

Most ASCVD events are avoidable through primordial prevention (i.e., the prevention of risk factor development) and control of traditional cardiovascular risk factors. Tobacco avoidance is critically important for ASCVD prevention, and all adults should strive to engage in regular brisk physical activity most days of the week and adhere to a healthy dietary pattern to help lower future ASCVD risk. A diet high in fruits, vegetables, and whole grains is best. Fish, legumes, and poultry are the preferred sources of protein. Minimizing the consumption of *trans* fats, added sugars (including sugar-sweetened beverages), red meats, sodium, and saturated fats is also important. Clinicians should work in partnership with patients to assess their readiness for sustained lifestyle improvements, identify potential barriers to change, and encourage them to try to achieve measurable goals and continue to monitor their progress (S6-1). Finally, social determinants of ASCVD risk—and their impact on the patient's ability to prevent or treat risk factors—must be taken into account. Clinicians need to consider patients' health literacy and education levels and assess patients' motivation to improve their lifestyle habits.

The goal of the clinician is to match the intensity of preventive efforts with an individual's absolute risk of a future ASCVD event and with the individual's willingness and capacity to implement preventive strategies. Risk estimation is imperfect and based on group averages that are then applied to individual patients. The clinician must balance an understanding of a patient's estimated ASCVD risk with potential benefits and adverse risk from pharmacological therapy in the context of a risk discussion. To determine the appropriateness of pharmacological

therapy after quantitative risk estimation in cases that are unclear, risk-enhancing factors or selective use of a coronary artery calcium measurement can inform decision-making for cholesterol-lowering or antihypertensive medication use in intermediate-risk individuals.

This primary-prevention guideline strives to provide clinicians with the information they need to help their patients reduce their risk of ASCVD and encourage them to make healthier lifestyle changes when needed.

PRESIDENTS AND STAFF

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6. CONCLUSION

S6-1. Lehr AL, Driver SL, Stone NJ. The ABCDs of lifestyle counseling. JAMA Cardiol. 2016;1:505–6.

APPENDIX 1. SEARCH CRITERIA

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5. Guirguis-Blake JM, Evans CV, Senger CA, et al. Aspirin for the primary prevention of cardiovascular events: a systematic evidence review for the U.S. Preventive Services Task Force. Ann Intern Med. 2016; 164:804–13.

KEY WORDS ACC/AHA Clinical Practice Guidelines, guidelines, antihypertensive agents, aspirin, atherosclerosis, atherosclerotic cardiovascular disease, atrial fibrillation, behavior modification, behavior therapy, blood cholesterol, blood pressure, body mass index, cardiovascular team-based care, cardiovascular, cardiovascular disease, cholesterol, chronic kidney disease, coronary artery calcium score, coronary disease, coronary heart disease, cost, diet, dietary patterns, dietary fats, dietary sodium, dyslipidemia, e-cigarettes, exercise, healthcare disparities, health services accessibility, heart failure, hypertension, LDL-cholesterol, diabetes mellitus, lifestyle, lipids, measurement, myocardial infarction, nicotine, nonpharmacological treatment, nutrition, physical activity, prejudice, primary prevention, psychosocial deprivation, public health, quality indicators, quality measurement, risk assessment, risk-enhancing factors, risk factors, risk reduction, risk reduction discussion, risk treatment discussion, secondhand smoke, sleep, smoking, smoking cessation, social determinants of health, socioeconomic factors, statin therapy, systems of care, tobacco, tobacco smoke pollution, treatment adherence, treatment outcomes, type 2 diabetes mellitus, waist circumference, weight loss

APPENDIX 1. SEARCH CRITERIA

The rapid review conducted by the Evidence-based Practice Center to complete this literature search, in the limited timeframe provided, built on existing systematic reviews conducted on behalf of the USPSTF.

Medical Subject Headings (MeSH) Terms	Key Words
Nutrition and Diet	
Search since the 2017 review (1)	
exp Diet/	diet*
exp Diet Therapy/	cardiovascular
Healthy Diet	coronary
Primary Prevention/	heart
	myocardial infarction
	MI
	CVD
	CHD
	cerebrovascular
	stroke
	microvascular
	mortality
	prevent*
Obesity and Weight Loss	
Search since the 2018 review (2)	
exp Obesity/	obes*
exp Weight Loss	overweight
Primary Prevention/	weight
	cardiovascular
	coronary
	heart
	myocardial infarction
	MI
	CVD
	CHD
	cerebrovascular
	stroke
	microvascular
	mortality
	prevent*
Type 2 Diabetes Mellitus	
Search since the 2015 review (3)	
exp Diabetes Mellitus, Type 2/	impaired fasting glucose
Prediabetic State/	impaired glucose tolerance
Glucose Intolerance/	Ifg
Primary Prevention/	Igt
	prediabetes*
	type 2 diabet*
	DM
	cardiovascular
	coronary
	heart
	myocardial infarction
	MI
	CVD
	CHD
	cerebrovascular
	stroke
	microvascular
	mortality
	prevent*
Tobacco Use	
Search since the 2015 review (4)	
Smoking/	smoking
exp "Tobacco Use Cessation"/	cigarette*
"Tobacco Use Disorder"/	tobacco
Electronic Cigarettes/	nicotine
Primary Prevention/	vape
	vaping
	e-cigarette
	electronic cigarette
	electronic nicotine delivery system*
	ENDS
	cardiovascular
	coronary
	heart
	myocardial infarction
	MI
	CVD
	CHD
	cerebrovascular
	stroke
	microvascular
	mortality
	prevent*

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APPENDIX 1. CONTINUED

Medical Subject Headings (MeSH) Terms	Key Words
Aspirin Use	
Search since the 2016 review (5)	
Aspirin	aspirin
exp Cerebrovascular Disorders/	acetylsalicylic acid
exp Cardiovascular Diseases/	clopidogrel
Primary Prevention/	cardiovascular
	coronary
	heart
	myocardial infarction
	MI
	CVD
	CHD
	cerebrovascular
	stroke
	microvascular
	mortality
	prevent*
Social Determinants of Health	
Search limited to English. No date restrictions (conducted 7/11/2018) **Similar articles searches were also conducted where potentially highly relevant papers were found**	
NONE SPECIFIED, BUT DUE TO AUTOMATIC TERM MAPPING IN PUBMED, SOME MeSH TERMS MAY HAVE BEEN EMPLOYED	Social determinants of health
	Equity
	Social status
	Social deprivation
	Neighborhood
	Neighborhood conditions
	Uninsured
	Housing
	Immigration
	Adverse childhood events
	Social gradient
	Educational status
	Inequalities
	Sexuality
	Atherosclerosis
	cardiovascular

Continued in the next column

Medical Subject Headings (MeSH) Terms	Key Words
Team Based Care	
Search limited to English, 1/1/2010-10/14/2018 (though earlier articles may have been identified through related articles search) **Related articles searches were also conducted where potentially highly relevant papers were found**	
NONE SPECIFIED, BUT DUE TO AUTOMATIC TERM MAPPING IN PUBMED, SOME MeSH TERMS MAY HAVE BEEN EMPLOYED	team
	Team care
	Collaborative care
	Multidisciplinary
	"team based"
	"team approach"
	prevention
	Primary prevention
	Cardiovascular disease,
	Cholesterol
	Aspirin
	Smoking
	Obesity
	Heart disease
	Atherosclerosis
	stroke
Shared Decision Making	
Search limited to English, 1/1/2010-10/24/2018 (though earlier articles may have been identified through related articles search) **Related articles searches were also conducted where potentially highly relevant papers were found**	
NONE SPECIFIED, BUT DUE TO AUTOMATIC TERM MAPPING IN PUBMED, SOME MeSH TERMS MAY HAVE BEEN AUTOMATICALLY EMPLOYED	Shared decision making
	Prevention
	Cardiovascular
	Atherosclerosis
	Stroke
	Heart
	Hypertension
	Lipids
	Cholesterol
	diabetes

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APPENDIX 1. CONTINUED

Medical Subject Headings (MeSH) Terms	Key Words
Exercise & Physical Activity	
Search limits: Not ACP Journal Club OR Summaries for patients OR Editorial OR case-report OR letter OR letter OR abstract OR newspaper article OR comment OR baseline characteristics OR study design OR methodology	
Terms to identify clinical trials/SRs/Mas:	
Filters: Meta-Analysis, Systematic Reviews, Clinical Trial, Controlled Clinical Trial, Randomized Controlled Trial, From 2011/01/01 to 2018/05/25, Humans, English, Adult: 19+ years	
Terms to identify observational studies:	
2011/01/01 to 2018/12/31, Humans, English, Epidemiologic Studies, Case-Control Studies, Cohort Studies, Cross-Sectional Studies, epidemiolog* AND stud*, case control, cohort stud*, cross sectional, cohort analys*, follow up stud*, longitudinal, retrospective, prospective, observational AND stud*	
Filters: Adult: 19+ years	
Waist Circumference	
Search limited to adult populations, 01/01/2010-10/3/18, English language	
Acute Coronary Syndrome	Acute coronary syndromes
Angina Unstable	Unstable angina?, "Angina Unstable"
Myocardial infarction	Myocardial infarctions
Shock cardiogenic	"shock cardiogenic"
Myocardial Stunning	"myocardial stunning"
No Reflow Phenomenon	
Heart Arrest	
St elevation myocardial infarction	STEMI
Non-st elevated myocardial infarction	NSTEMI
	"death/sudden cardiac"
Stroke	
Brain Infarction	
Brain Stem Infarctions	
Lateral Medullary Syndrome	
Cerebral Infarction	
	Myocardial ischemia
	"Dementia Multi infarct"
	"infarction anterior cerebral artery"
	"infarction middle cerebral artery"
	"infarction posterior cerebral artery"
Myocardial revascularization	
Coronary artery bypass	
Internal mammary coronary artery anastomosis	
Angioplasty	"angioplasty transluminal percutaneous coronary"

Continued in the next column

Medical Subject Headings (MeSH) Terms	Key Words
Heart failure	
Hospitalization	Hospitalization? OR rehospitalization?
	"atherectomy coronary"
	Coronary stent
	CABG
	"bypass grafts"
	"Carotid"
	pathology
	physiopathology
	Non-coronary revascularization procedure
	Carotid revascularization?
	Lower extremity revascularization?
	Percutaneous transluminal angioplast?
	Stent placement?
	Abdominal aortic aneurysm repair?
	AAA repair?
	complications
	Event? OR outcome? OR episode?
	Risk score
	Coronary risk modification
Cardiovascular diseases	Cardiovascular OR CVD
Cardiovascular disease	
Coronary disease	coronary
Coronary artery disease	
Myocardial infarction	
Heart failure	CHF OR CHD
Cerebrovascular disorders	
	"dyspnea paroxysmal"
	"edema cardiac"
Physical fitness	
Motor activity	
Exercise tolerance	
Metabolic equivalent	Metabolic equivalent
Exercise test	Graded exercise test OR gxt
Life style or lifestyle	
Exercise	
Training	

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APPENDIX 1. CONTINUED

Medical Subject Headings (MeSH) Terms	Key Words
Walking	
	Vo2
	Maximal met
	Mets
	Physical activity
	Maximal metabolic?
Acute Coronary Syndrome	Acute coronary syndromes
Angina Unstable	Unstable angina?, "Angina Unstable"
Myocardial infarction	Myocardial infarctions
Shock cardiogenic	"shock cardiogenic"
Myocardial Stunning	"myocardial stunning"
No Reflow Phenomenon	
Heart Arrest	
St elevation myocardial infarction	STEMI
Non-st elevated myocardial infarction	NSTEMI
	"death/sudden cardiac"
Stroke	
Brain Infarction	
Brain Stem Infarctions	
Lateral Medullary Syndrome	
Cerebral Infarction	
	Myocardial ischemia
	"Dementia Multi infarct"
	"infarction anterior cerebral artery"
	"infarction middle cerebral artery"
	"infarction posterior cerebral artery"
Myocardial revascularization	
Coronary artery bypass	
Internal mammary coronary artery anastomosis	
Angioplasty	"angioplasty transluminal percutaneous coronary"

Continued in the next column

Medical Subject Headings (MeSH) Terms	Key Words
Heart failure	
Hospitalization	Hospitalization? OR rehospitalization?
	"atherectomy coronary"
	Coronary stent
	CABG
	"bypass grafts"
	"Carotid"
	pathology
	physiopathology
	Non-coronary revascularization procedure
	Carotid revascularization?
	Lower extremity revascularization?
	Percutaneous transluminal angioplast?
	Stent placement?
	Abdominal aortic aneurysm repair?
	AAA repair?
	complications
	Event? OR outcome? OR episode?
	Risk score
	Coronary risk modification
Cardiovascular diseases	Cardiovascular OR CVD
Cardiovascular disease	
Coronary disease	coronary
Coronary artery disease	
Myocardial infarction	
Heart failure	CHF OR CHD
Cerebrovascular disorders	
	"dyspnea paroxysmal"
	"edema cardiac"

Because of automatic term mapping in PubMed, some MeSH terms may have been used even when not explicitly specified.

APPENDIX 2. AUTHOR RELATIONSHIPS WITH INDUSTRY AND OTHER ENTITIES (RELEVANT)—2019 ACC/AHA GUIDELINE ON THE PRIMARY PREVENTION OF CARDIOVASCULAR DISEASE

Committee Member	Employment	Consultant	Speakers Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness
Donna K. Arnett *(Co-Chair)*	University of Kentucky College of Public Health—Dean and Professor of Epidemiology	None	None	None	None	None	None
Roger S. Blumenthal *(Co-Chair)*	Johns Hopkins University—Professor of Medicine and Director, Ciccarone Center for the Prevention of Heart Disease	None	None	None	None	None	None
Michelle A. Albert	UCSF School of Medicine—Professor of Medicine and Director, UCSF NURTURE Center	None	None	None	None	None	None
Andrew B. Buroker	Faegre Baker Daniels LLP, Partner	None	None	None	None	None	None
Zachary D. Goldberger	University of Wisconsin School of Medicine and Public Health—Associate Professor of Medicine, Division of Cardiology	None	None	None	None	None	None
Ellen J. Hahn	University of Kentucky College of Nursing—Professor & Director, BREATHE, Deputy Director, UK-CARES & Leader, and Community Engagement Core; Marcia A. Dake Professor of Nursing	None	None	None	None	None	None
Cheryl Dennison Himmelfarb	Johns Hopkins School of Nursing—Professor; Associate Dean Research, Office for Science and Innovation; and Deputy Director, Johns Hopkins Institute for Clinical and Translational Research	None	None	None	None	None	None
Amit Khera	UT Southwestern School of Medicine—Professor of Internal Medicine and Director, Preventive Cardiology Program	None	None	None	None	None	None
Donald Lloyd-Jones	Northwestern University—Eileen M. Foell Professor; Senior Associate Dean for Clinical and Translational Research; Chair, Department of Preventive Medicine; and Director, Clinical and Translational Sciences Institute	None	None	None	None	None	None
J. William McEvoy	National University of Ireland, Galway Campus—Professor of Preventive Cardiology; National Institute for Preventive Cardiology, Galway—Medical and Research Director; and University Hospital Galway, Ireland—Consultant Cardiologist.	None	None	None	None	None	None
Erin D. Michos	Johns Hopkins School of Medicine—Associate Professor of Medicine and Associate Director of Preventive Cardiology, Ciccarone Center for the Prevention of Heart Disease; Johns Hopkins Bloomberg School of Public Health—Associate Professor of Epidemiology	None	None	None	None	None	None
Michael D. Miedema	Minneapolis Heart Institute—Research Cardiologist	None	None	None	None	None	None
Daniel Muñoz	Vanderbilt University Medical Center—Assistant Professor of Medicine, Division of Cardiology, Medical Director for Quality, Vanderbilt Heart & Vascular Institute, and Associate Medical Director, Cardiovascular ICU	None	None	None	None	None	None
Sidney C. Smith, Jr	University of North Carolina, Chapel Hill—Professor of Medicine, Division of Cardiology	None	None	None	None	None	None
Salim S. Virani	Baylor College of Medicine—Professor, Section of Cardiovascular Research and Director for Research, Cardiology Fellowship Training Program; Michael E. DeBakey VA Medical Center—Staff Cardiologist and Investigator, Health Policy, Quality & Informatics Program, Center for Innovations in Quality, Effectiveness and Safety	None	None	None	None	None	None

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APPENDIX 2. CONTINUED

Committee Member	Employment	Consultant	Speakers Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness
Kim A. Williams, Sr	Rush Medical College—James B. Herrick Professor and Chief, Division of Cardiology, Department of Internal Medicine	None	None	None	None	None	None
Joseph Yeboah	Wake Forest Baptist Health—Associate Professor, Internal Medicine, Cardiovascular	None	None	None	None	None	None
Boback Ziaeian	University of California at Los Angeles/U.S. Department of Veterans Affairs Greater Los Angeles Healthcare System, David Geffen School of Medicine–Assistant Professor, Division of Cardiology	None	None	None	None	None	None

This table represents the relationships of committee members with industry and other entities that were determined to be relevant to this document. These relationships were reviewed and updated in conjunction with all meetings and/or conference calls of the writing committee during the document development process. The table does not necessarily reflect relationships with industry at the time of publication. A person is deemed to have a significant interest in a business if the interest represents ownership of ≥5% of the voting stock or share of the business entity, or ownership of ≥$5,000 of the fair market value of the business entity; or if funds received by the person from the business entity exceed 5% of the person's gross income for the previous year. Relationships that exist with no financial benefit are also included for the purpose of transparency. Relationships in this table are modest unless otherwise noted.

According to the ACC/AHA, a person has a relevant relationship IF: a) the relationship or interest relates to the same or similar subject matter, intellectual property or asset, topic, or issue addressed in the document; or b) the company/entity (with whom the relationship exists) makes a drug, drug class, or device addressed in the document or makes a competing drug or device addressed in the document; or c) the person or a member of the person's household, has a reasonable potential for financial, professional or other personal gain or loss as a result of the issues/content addressed in the document.

ACC indicated American College of Cardiology; AHA, American Heart Association; ICU, Intensive Care Unit; LLP, Limited Liability Partnership; UCSF, University of California, San Francisco; UT, University of Texas; and VA, Veterans Affairs.

APPENDIX 3. REVIEWER RELATIONSHIPS WITH INDUSTRY AND OTHER ENTITIES (COMPREHENSIVE)—2019 ACC/AHA GUIDELINE ON THE PRIMARY PREVENTION OF CARDIOVASCULAR DISEASE

Reviewer	Representation	Employment	Consultant	Speakers Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness	Salary
Amy Peterson	Official Reviewer—AHA	Hospital Affiliations: American Family Children's Hospital; UnityPoint Health—Meriter; UW School of Medicine and Public Health Department of Pediatrics	None	None	None	None	None	None	None
Kim K. Birtcher	Official Reviewer—ACC/AHA Task Force on Clinical Practice Guidelines Lead Reviewer	University of Houston, College of Pharmacy, Clinical Professor	■ Jones & Bartlett Learning	None	None	None	■ Accreditation Council for Clinical Lipidology (Other category)†	None	None
Sanjay Gandhi	Official Reviewer—ACC	Metro Health Medical Center Cleveland, Associate Professor, Case Western Reserve University School of Medicine	None	None	None	■ Cleveland Heart Lab ■ Juventas	■ Athersys (Data Safety Monitoring Board) ■ Tendyne (Other category)	None	None
Andrea Price	Official Reviewer—ACC Science and Quality Committee	Quality Databases at Indiana University Health, Director	None	None	None	None	■ ACC*	None	None
Jennifer E. Sanner Beauchamp	Content Reviewer—AHA	University of Texas Health Science Center, Cizik School of Nursing, Associate Professor	None	None	None	None	None	None	None
Glenn N. Levine	Content Reviewer—ACC/AHA Task Force on Clinical Practice Guidelines	Professor of Medicine at Baylor College of Medicine in Houston, Texas	None	None	None	None	None	■ Out of hospital cardiopulmonary arrest 2017 (Defendant)* ■ Out of hospital death 2018 (Defendant)*	None

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APPENDIX 3. CONTINUED

Reviewer	Representation	Employment	Consultant	Speakers Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness	Salary
Patrick T. O'Gara	Content Reviewer—ACC/AHA Task Force on Clinical Practice Guidelines	Director of Strategic Planning for the Cardiovascular Division at Brigham and Women's Hospital, the Watkins Family Distinguished Chair in Cardiology and Professor of Medicine at Harvard Medical School	None	None	None	None	■ Edwards Scientific (Other)† ■ Medtronic (Other) ■ NIH (Other)*	None	None
Joshua A. Beckman	Content Reviewer—ACC/AHA Task Force on Clinical Practice Guidelines	Director, Vascular Medicine; Professor of Medicine at Vanderbilt University	■ Aralez Pharmaceuticals* ■ AstraZeneca Pharmaceuticals* ■ Janssen Scientific Affairs* ■ ER Squibb & Sons ■ Boehringer Ingelheim Pharmaceuticals* ■ Merck ■ Sanofi	■ AstraZeneca Pharmaceuticals	None	■ Bristol-Myers Squibb*	■ Bayer (Data Safety Monitoring Board)* ■ Novartis Corporation (Data Safety Monitoring Board) ■ Vascular Interventional Advances (Officer, Director, Trustee, or other Fiduciary Role)* ■ EMX† ■ JanaCare†	None	None
Anita Deswal	Content Reviewer—ACC/AHA Task Force on Clinical Practice Guidelines	Chief, Cardiology, Michael E. DeBakey VA Medical Center & Baylor College of Medicine, Professor, Baylor College of Medicine	None	None	None	■ NIH*	■ ACC/AHA (Other) ■ Novartis Corporation (Other)† ■ AHA Get With The Guidelines Steering Committee (Other)† ■ Heart Failure Society of America (Other)† ■ Immediate Past Chair and Member, AHA Committee on Heart Failure and Transplantation (Other)† ■ NIH (Other)†	None	None

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APPENDIX 3. CONTINUED

Reviewer	Representation	Employment	Consultant	Speakers Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness	Salary
Federico Gentile	Content Reviewer—ACC/AHA Task Force on Clinical Practice Guidelines	Centro Medico Diagnostico—Director, Cardiovascular Disease	None	None	None	None	None	None	None
José A. Joglar	Content Reviewer—ACC/AHA Task Force on Clinical Practice Guidelines	Program Director, Clinical Cardiac Electrophysiology Fellowship Program; Professor, UT Southwestern Medical Center	None	None	None	None	None	None	None
Duminda N. Wijeysundera	Content Reviewer—ACC/AHA Task Force on Clinical Practice Guidelines	Associate Professor Anesthesia, University of Toronto	None	None	None	■ Canadian Institutes of Health Research* ■ Ministry of Health and Longterm Care of Ontario (Canada)* ■ NIH*	■ PCORI (Data Safety Monitoring Board)†	None	■ Canadian Institutes of Health Research (Ottawa, Ontario, Canada)*
Eileen M. Handberg	Content Reviewer—ACC	Research Professor of Medicine; Director, Clinical Trials Program; Program Director, Florida CARES, UF Health	■ Bristol-Myers Squibb Company	None	None	■ Aastrom Biosciences* ■ Amorcyte, Inc* ■ Biocardia, Inc* ■ Brigham and Women's Hospital* ■ Capricor* ■ Cytori Therapeutics, Inc.* ■ Department of Defense* ■ Direct Flow Medical* ■ Duke Clinical Research Institute* ■ East Carolina University* ■ Everyfit Inc* ■ MEDTRONIC* ■ Merck & Co., Inc.* ■ Mesoblast Inc* ■ NIH* ■ PCORI* ■ Sanofi Aventis*	■ Amgen (Other) ■ AstraZeneca (Other) ■ Boehringer Ingelheim (Other) ■ Daiichi Sankyo (Other) ■ Gilead Sciences, Inc. (Other) ■ Ionis (Other) ■ Relypsa (Other)	None	None

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APPENDIX 3. CONTINUED

Reviewer	Representation	Employment	Consultant	Speakers Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness	Salary
Prem Soman	Content Reviewer—ACC	Associate Professor of Medicine (Cardiology), Director, Nuclear Cardiology, UPMC	■ Alnylam Pharma	None	■ American Society of Nuclear Cardiology*	■ Astellas Pharma US*	None	None	None
Eric Stecker	Content Reviewer—ACC	Associate Professor of Medicine, Division of Cardiovascular Medicine School of Medicine, OHSU	None	None	■ Hygeia / Desi MD*	■ American Heart Association* ■ Medical Research Foundation of Oregon*	None	None	None
Pamela Morris	Content Reviewer—ACC	Professor, Medical University of South Carolina	■ Amgen Inc. ■ Sanofi ■ Regeneron	None	None	None	None	None	None
Andrew Freeman	Content Reviewer—ACC	Director, Clinical Cardiology and Operations; Co-Director, Nuclear Cardiology, National Jewish Health	None	■ Boehringer Ingelheim*	None	None	None	None	None
Carl J. Lavie	Content Reviewer—ACC	Medical Director, Cardiac Rehabilitation and Prevention, Ochsner Clinic Foundation	None	■ Amgen* ■ ER Squibb & Sons ■ Pfizer* ■ Aralez Pharmaceuticals ■ Amarin Pharma ■ Sanofi Aventis*	None	None	None	None	None
James Stein	Content Reviewer—ACC	Director, UW Health Preventive Cardiology Program, Robert Turell Professor in Cardiovascular Research, UW School of Medicine and Public Health	■ Eli Lilly and Company (DSMB)	None	None	None	■ Up To Date (Other) ■ Wisconsin Alumni Research Foundation (Other)	None	None

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APPENDIX 3. CONTINUED

Reviewer	Representation	Employment	Consultant	Speakers Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness	Salary
Heather Johnson	Content Reviewer—ACC	Associate Professor in the Division of Cardiovascular Medicine at the University of Wisconsin School of Medicine and Public Health	None	None	None	None	■ Pfizer	None	None
Nanette Wenger	Content Reviewer—ACC	Professor of Medicine, Division of Cardiology, Emory University School of Medicine	■ Janssen Pharmaceuticals, Inc* ■ Amgen ■ AstraZeneca ■ Gilead Sciences ■ Merck	None	None	■ Gilead Sciences* ■ NHLBI* ■ Pfizer* ■ Society for Women's Health Research*	None	None	None
Michael Blaha	Content Reviewer—AHA	Director of Clinical Research, Ciccarone Center for the Prevention of Heart Disease Associate Professor of Medicine, Johns Hopkins Medicine	■ Ferring Pharmaceuticals ■ Regeneron Pharmaceuticals ■ Sanofi-Aventis* ■ Amgen ■ Akcea ■ MedImmune ■ Novartis ■ Novo Nordisk ■ Siemens* ■ ACC	None	None	■ Aetna† ■ Amgen† ■ AHA† ■ FDA† ■ NIH†	None	None	None
Laurence Sperling	Content Reviewer—ACC/AHA	Founder and Director of Preventive Cardiology at the Emory Clinic, Co-Director of the Cardiovascular Disease Fellowship Program at Emory, Professor of Medicine (Cardiology) at the Emory University School of Medicine	None	None	None	None	None	None	None

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APPENDIX 3. CONTINUED

Reviewer	Representation	Employment	Consultant	Speakers Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness	Salary
Seth Martin	Content Reviewer—ACC/AHA	Director, Advanced Lipid Disorders Program of the Ciccarone Center; Associate Professor of Medicine at Johns Hopkins Medicine	■ Amgen ■ Akcea Therapeutics ■ Quest Diagnostics ■ Sanofi-Regeneron ■ Esperion ■ Novo Nordisk	None	None	■ Aetna Foundation* ■ Apple* ■ Google* ■ iHealth* ■ Maryland Innovation Initiative* ■ AHA*	■ Corrie Health (Officer, Director, Trustee, or other Fiduciary Role)† ■ Co-inventor on pending patent filed by Johns Hopkins University for method of LDL-C estimation (Other)†	None	None
Samia Mora	Content Reviewer—ACC/AHA	Associate Professor of Medicine, Harvard Medicine School Director, Center for Lipid Metabolomics, Brigham and Women's Hospital	■ Pri-Med* ■ Pfizer ■ Quest Diagnostics	None	None	None	■ C3 Conference (Other) ■ European Atherosclerosis Society (Other) ■ FEBS Congress (Other) ■ Oregon Health & Science University (Other) ■ Vascular Biology Working Group Meeting (Other) ■ Atherotech Diagnostics* ■ Pfizer* ■ Quest Diagnostics* ■ NHLBI* ■ NIDDK*	None	None
Clyde Yancy	Content Reviewer—ACC/AHA	Chief of Cardiology in the Department of Medicine, Northwestern Medicine	None	None	None	None	■ *JAMA Cardiology* (Other)*	None	None
Quinn Pack	AACVPR	Assistant Professor of Medicine at University of Massachusetts Medical School	None	None	None	None	None	None	None
Frank Sacks	ASN	Professor of Cardiovascular Disease Prevention, Harvard School of Public Health	■ Amgen ■ Pfizer* ■ AstraZeneca*	None	None	None	None	None	None

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APPENDIX 3. CONTINUED

Reviewer	Representation	Employment	Consultant	Speakers Bureau	Ownership/ Partnership/ Principal	Personal Research	Institutional, Organizational, or Other Financial Benefit	Expert Witness	Salary
Salvatore Lacagnina	ACPM	System Medical Director of Wellness & Employee Health, Lee Health	None	None	None	None	None	None	None
Ron Blankstein	ASPC	Co-Director, Cardiovascular Imaging Training Program, Associate Physician, Preventive Cardiology, Director, Cardiac Computed Tomography, Brigham Health, Associate Professor in Medicine and Radiology, Harvard Medical School	■ Ekos Corporation ■ Amgen	None	None	■ Amgen† ■ Astellas† ■ Sanofi-Aventis†	■ American Society of Nuclear Cardiology (Officer, Director, Trustee, or other Fiduciary Role)† ■ Intersocietal Accreditation Commission for Computed Tomography (Officer, Director, Trustee, or other Fiduciary Role)† ■ Society of Cardiovascular Computed Tomography (Officer, Director, Trustee, or other Fiduciary Role)†	None	None
Jo-Ann Eastwood	PCNA	Associate Professor, UCLA School of Nursing	None	None	None	None	None	None	None
Stuart Haines	Content Reviewer—ACC/AHA	Professor of Pharmacy Practice, University of Mississippi	None	None	■ Rx Instructional Systems*	None	■ American Association of Colleges of Pharmacy (Officer, Director, Trustee, or other Fiduciary Role)†	None	None
Michael Rich	AGS	Professor of Medicine, Washington University School of Medicine in St. Louis	None	None	None	None	None	None	None

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*Significant relationship.

†No financial benefit.

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