

# Prevention, Diagnosis, and Management of Cardiovascular Diseases and Hypertension

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March 27, 2021

I have no conflicts of interest to  
declare related to this topic

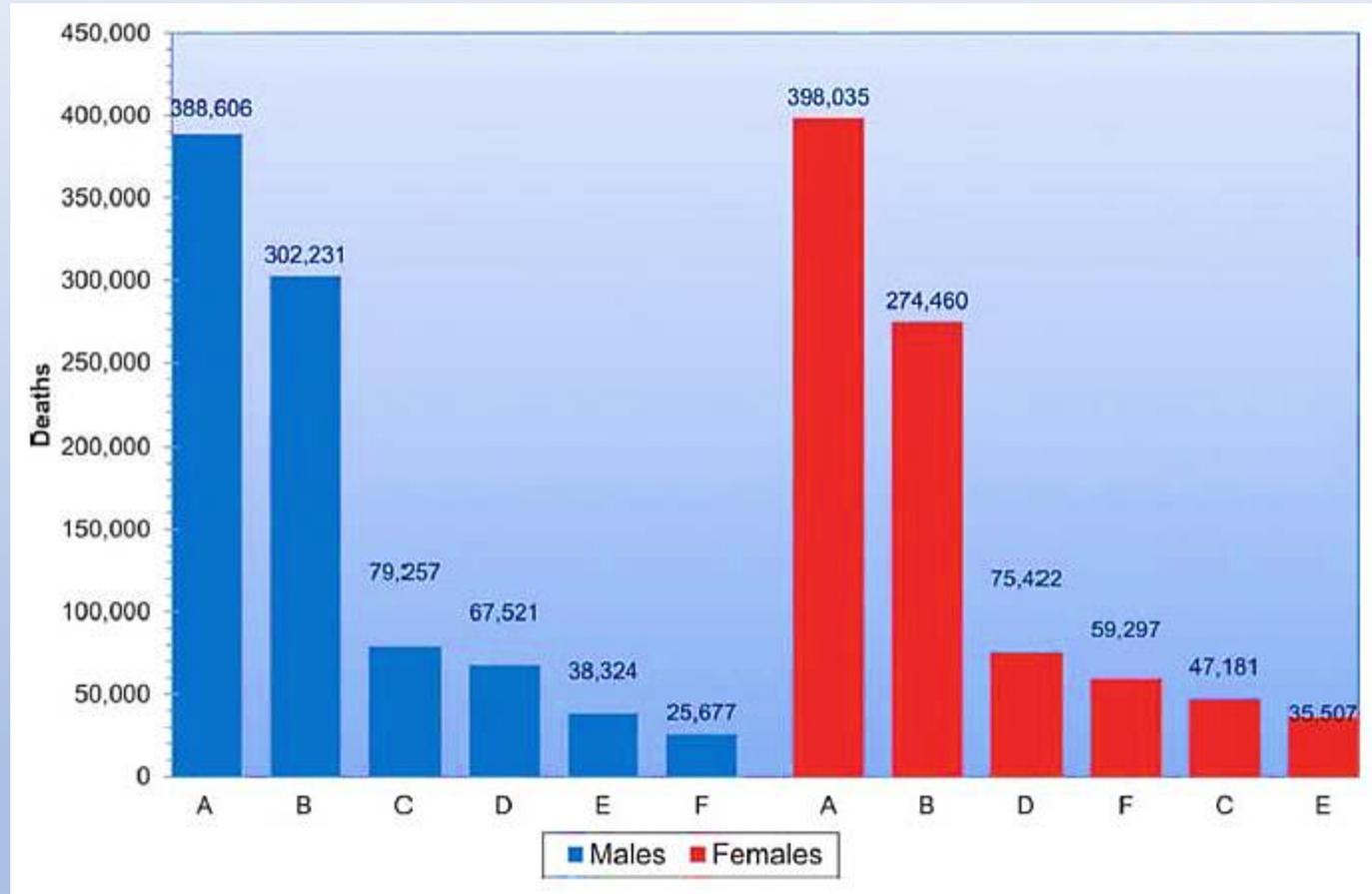
# Objectives

- Introduction
- Modifiable Major Risk Factors
- ASCVD Risk Estimators
- High Blood Pressure
- Major Components of Primary and Secondary Prevention Measures
- Additive Benefits of Multiple Risk Factor Reductions
- Take Home Messages

# Introduction

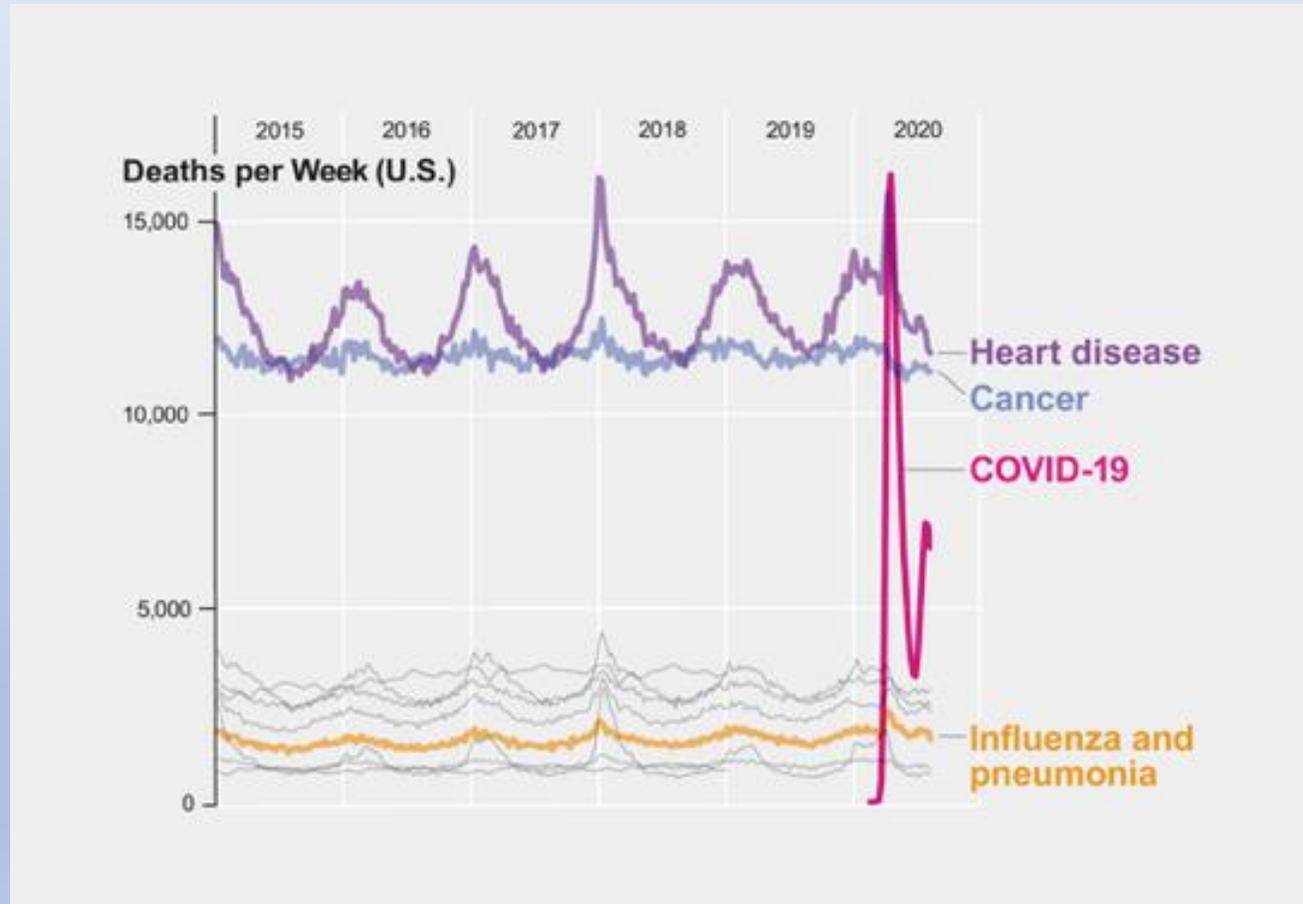
- In most developed countries, CVD is the leading cause of death in men and women
- CVD includes coronary artery disease (CAD), stroke, and periphery vascular artery disease (PAD)
- Aortic atherosclerosis, thoracic and abdominal aortic aneurysms

# Major Causes of Death for Males and Females, 2011



**A** indicates cardiovascular disease plus congenital cardiovascular disease (ICD-10 I00-I99, Q20-Q28); **B**, cancer (C00-C97); **C**, accidents (V01-X59, Y85-Y86); **D**, chronic lower respiratory disease (J40-J47); **E**, diabetes mellitus (E10-E14); **F**, Alzheimer disease (G30). Source: NCHS.

# COVID-19 Is Now the Third Leading Cause of Death in the U.S.



By [Youyou Zhou](#), [Gary Stix](#) on October 8, 2020

Centers for Disease Control and Prevention, National Center for Health Statistics

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

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

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## Primary Prevention: Lifestyle Changes and Team-Based Care



# ASCVD Risk Estimator

- 10-year ASCVD risk
- For individualized, evidence-based, risk-guided intervention
- Projects the impact of specific interventions
- Update risk at follow-up based on patient's response to therapy





Current Age ⓘ \*

Age must be between 20-79

Sex \*

Male  Female

Race \*

White  African American  Other

Systolic Blood Pressure (mm Hg) \*

Value must be between 90-200

Diastolic Blood Pressure (mm Hg) ○

Value must be between 60-130

Total Cholesterol (mg/dL) \*

Value must be between 130 - 320

HDL Cholesterol (mg/dL) \*

Value must be between 20 - 100

LDL Cholesterol (mg/dL) ⓘ ○

Value must be between 30-300

History of Diabetes? \*

Yes  No

Smoker? ⓘ \*

Current ⓘ  Former ⓘ  Never ⓘ

On Hypertension Treatment? \*

Yes  No

On a Statin? ⓘ ○

Yes  No

On Aspirin Therapy? ⓘ ○

Yes  No

**37.5%**  
High

Current 10-Year  
ASCVD Risk\*\*

Lifetime Risk Calculator only provides lifetime risk estimates for individuals 40 to 59 years of age.

Optimal ASCVD Risk: **5.8%**

Smoker? ⓘ \*

Current ⓘ

✓ Former ⓘ

Never ⓘ

How long ago did patient quit smoking? \*

6 months-1.5 years ago ▼

On Hypertension Treatment? \*

Yes

✓ No

On a Statin? ⓘ ○

Yes

✓ No

**37.5%**  
High

Current 10-Year  
ASCVD Risk\*\*

Lifetime Risk Calculator only provides lifetime risk estimates for individuals 40 to 59 years of age.

Optimal ASCVD Risk: **5.8%**

## Project Risk Reduction by Therapy

Reset

View Advice Summary for this Patient

Projected 10-Year ASCVD Risk

**27.5% with BP Medication**



Quit Smoking ⓘ



Start/Intensify Statin ⓘ



Start/Add Blood Pressure Medication(s) ⓘ



Start/continue aspirin therapy ⓘ

# Visit Summary

Below is a summary of patient's risk, treatment options, and treatment advice based on the data provided.

[Email Advice](#)
[Print](#)

## Treatment Advice\*

[Collapse All](#)

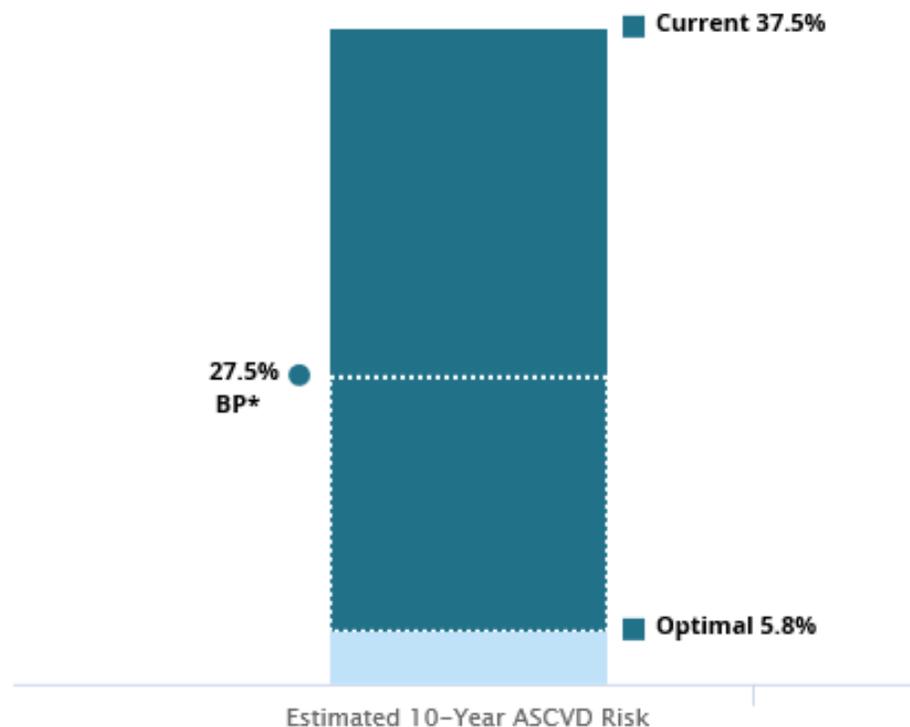
- ▶ [LDL-C Management \(for this Patient\)](#)
- ▶ [Blood Pressure Management \(for this Patient\)](#)
- ▶ [Tobacco Cessation \(for this Patient\)](#)
- ▶ [Diabetes Mellitus Management \(General\)](#)
- ▶ [Lifestyle Recommendations \(General\)](#)
- ▼ [Aspirin Use Recommendations \(for this Patient\)](#)

### Supporting Guideline Recommendations

- **Low dose aspirin (75-100 mg oral daily) may be considered for primary prevention of ASCVD among select higher risk ASCVD adults aged 40-70 years who are not at increased bleeding risk. (IIb, A)**
  - Given the narrow balance between benefits and harms of prophylactic aspirin, there is less justification for aspirin

### ASCVD Risk Profile

10-yr risk for first ASCVD event is:  
**HIGH**



- Actual Risk
- Projected Risk

\*Projected Risk with the following therapies:

ASA = Start or continue taking aspirin

BP = Start, add, or intensify blood pressure medication

# Reynolds Risk scores for CVD

- Designed specifically for women: 2007
  - family history of premature heart disease
  - CRP levels (a marker of inflammation).
- Women's Health Study.
- 40 - 50% of women who would be classified intermediate risk were reclassified as either low- or high-risk –
- Allowing a targeted risk factor management.

# Reynolds Risk Score

Calculating Heart and Stroke Risk for Women and Men

Home

Calculator

FAQ

**If you are healthy and without diabetes, the Reynolds Risk Score is designed to predict your risk of having a future heart attack, stroke, or other major heart disease in the next 10 years.**

In addition to your age, blood pressure, cholesterol levels and whether you currently smoke, the Reynolds Risk Score uses information from two other risk factors, a blood test called hsCRP (a measure of inflammation) and whether or not either of your parents had a heart attack before they reached age 60 (a measure of genetic risk). To calculate your risk, fill in the information below with your most recent values. [Click here](#) for help filling the information.

Gender

Male  Female

Age

Years (Maximum age must be 80)



Do you currently smoke?

Yes  No



Systolic Blood Pressure (SBP)

mm/Hg



Total Cholesterol

mg/DL (or)  mmol/L



HDL or "Good" Cholesterol

mg/DL (or)  mmol/L



High Sensitivity C-Reactive Protein (hsCRP)

mg/L



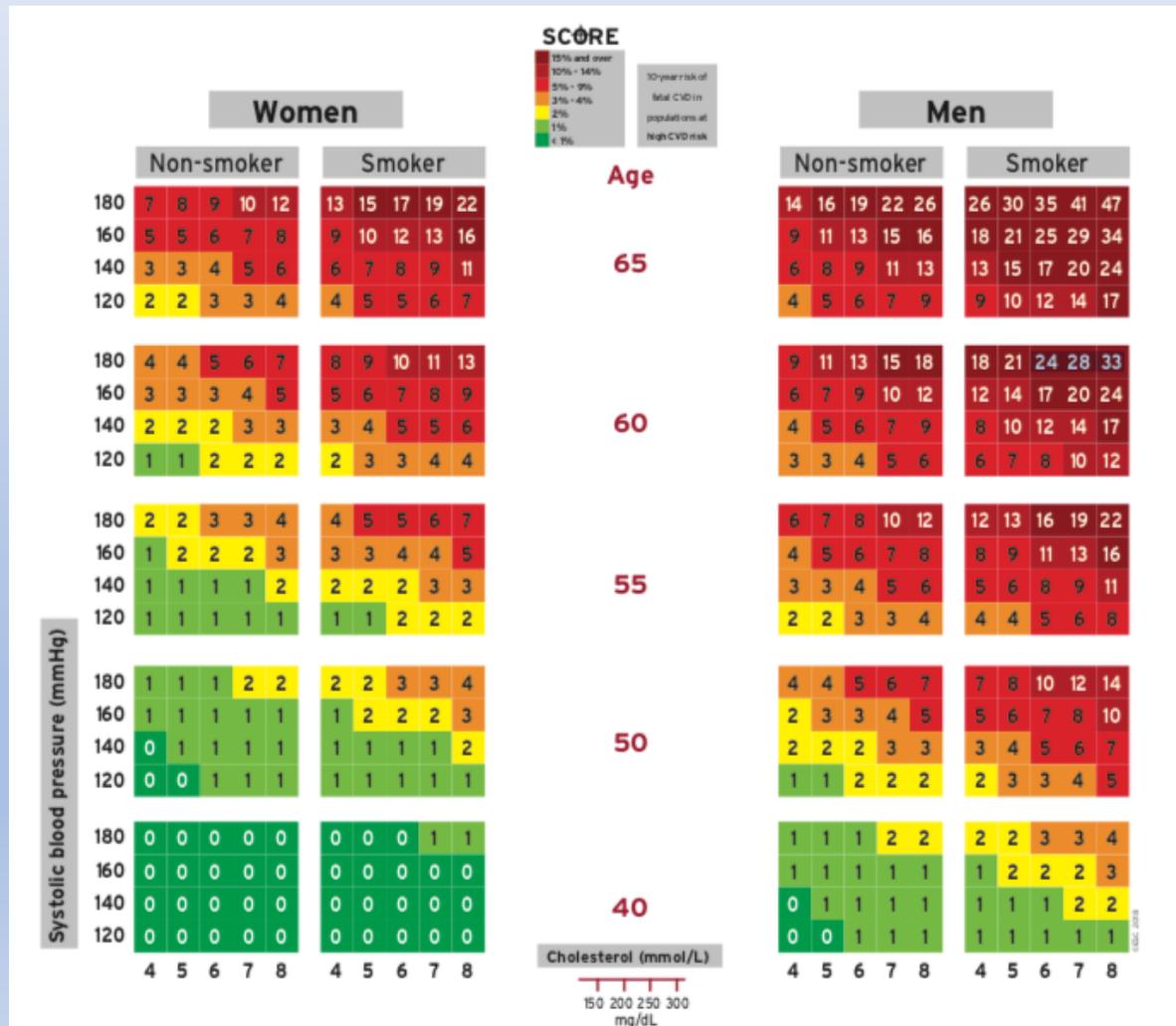
Did your Mother or Father have a heart attack before age 60 ?

Yes  No

Calculate 10 year risk

# SCORE - European High Risk Chart

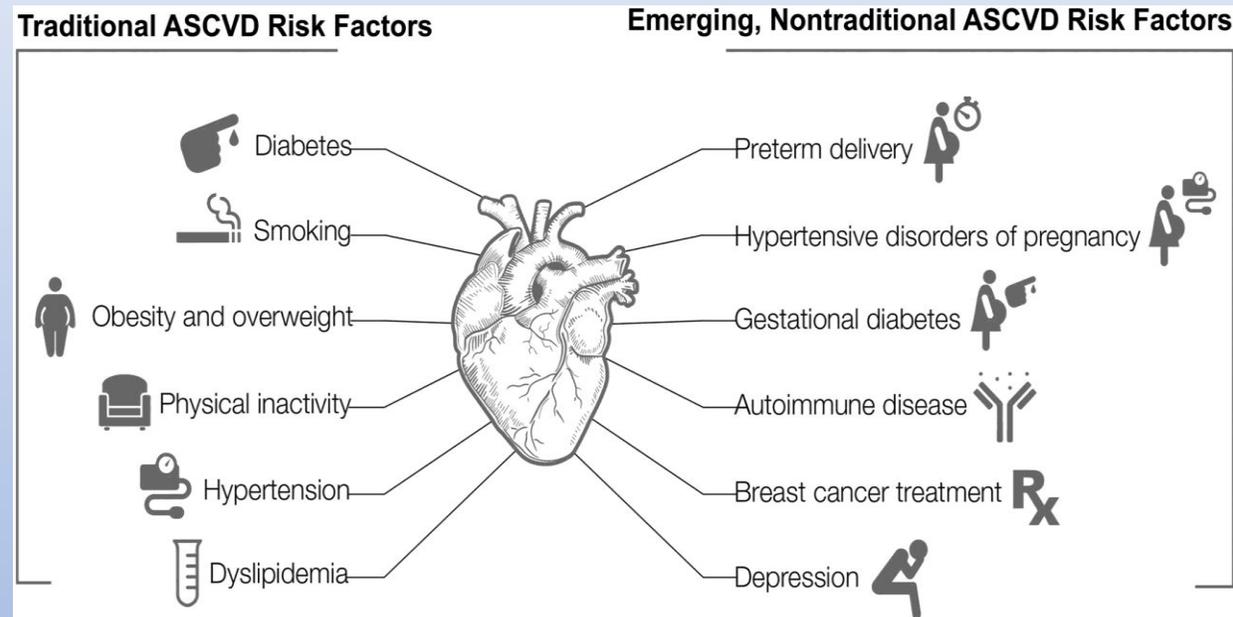
10 year risk of fatal CVD in high risk regions of Europe by gender, age, systolic blood pressure, total cholesterol and smoking status



## Risk modifiers increasing CV risk estimated by the SCORE system

Social deprivation – the origin of many causes of CVD
Obesity (measured by BMI) and central obesity (measured by waist circumference)
Physical inactivity
Psychosocial stress, including vital exhaustion
Family history of premature CVD (occurring at age < 55 years in men and < 60 years in women)
Autoimmune and other inflammatory disorders
Major psychiatric disorders
Treatment for infection with human immunodeficiency virus
Atrial fibrillation
Left ventricular hypertrophy
CKD
Obstructive sleep apnoea syndrome

# Traditional and non-traditional atherosclerotic cardiovascular disease (ASCVD) risk factors in women



# High Blood Pressure

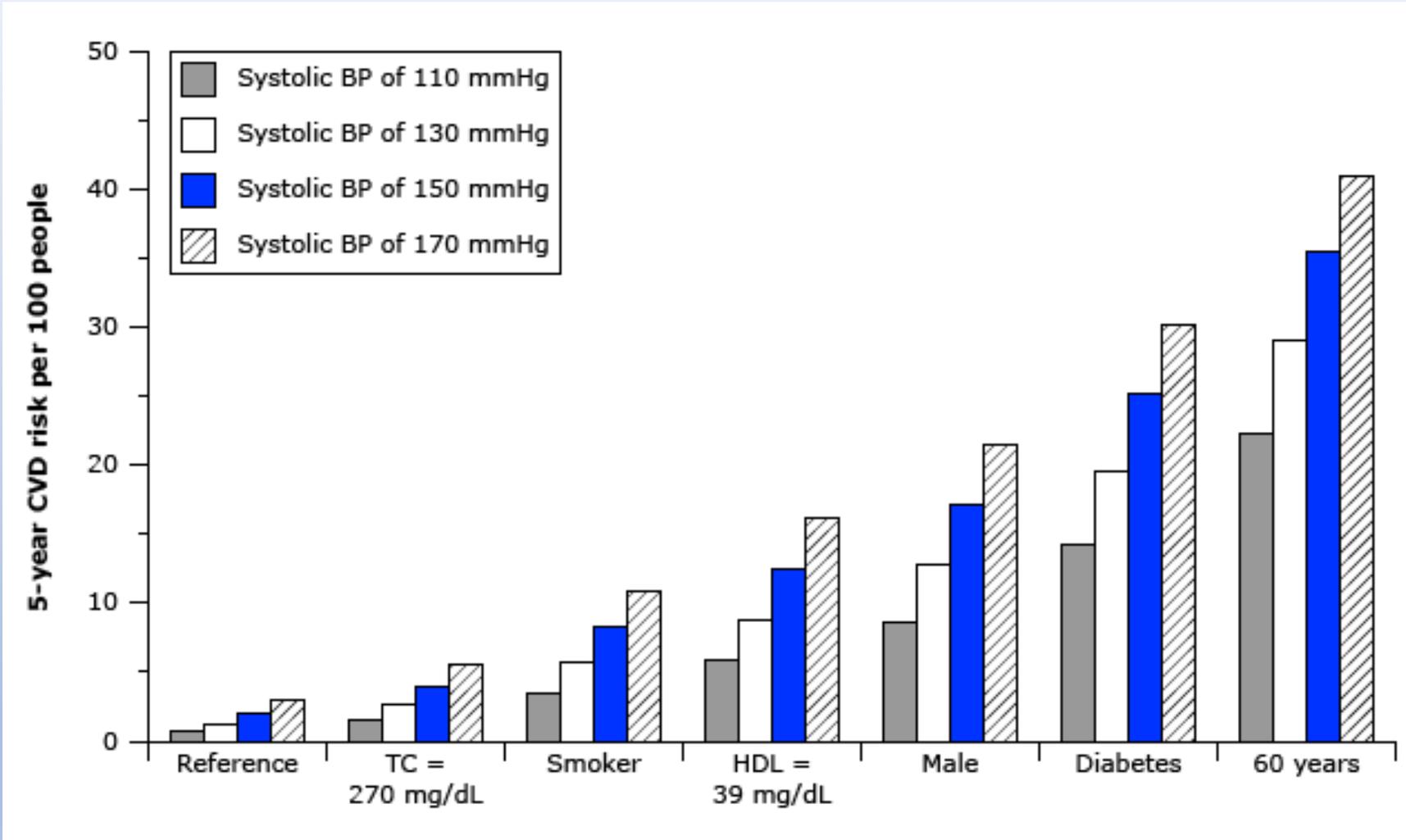


# 2018 ESC-ESH Guidelines for the Management of Arterial Hypertension



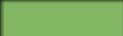
## Classification of office BP and definitions of hypertension grade

Category	Systolic (mmHg)		Diastolic (mmHg)
Optimal	< 120	and	< 80
Normal	120–129	and/or	80–84
High normal	130–139	and/or	85–89
Grade 1 hypertension	140–159	and/or	90–99
Grade 2 hypertension	160–179	and/or	100–109
Grade 3 hypertension	≥ 180	and/or	≥ 110
Isolated systolic hypertension	≥ 140	and	< 90



Adapted from: Jackson R, Lawes CM, Bennett DA, et al. Lancet 2005; 365:434.

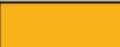
## What is new and what has changed in the 2018 ESC/ESH hypertension guidelines? - 1

Changes in recommendations	
2013	2018
<b>Diagnosis</b> Office BP is recommended for screening and diagnosis of hypertension.	<b>Diagnosis</b> It is recommended to base the diagnosis of hypertension on: <ul style="list-style-type: none"> <li>•Repeated office BP measurements; or</li> <li>•Out-of-office BP measurement with ABPM and/or HBPM if logistically and economically feasible.</li> </ul>
<b>Treatment thresholds</b> <b>High-normal BP (130–139/85–89 mmHg):</b> Unless the necessary evidence is obtained it is not recommended to initiate antihypertensive drug therapy at high-normal BP.	<b>Treatment thresholds</b> <b>High-normal BP (130–139/85–89 mmHg):</b> Drug treatment may be considered when CV risk is very high due to established CVD, especially CAD.
<b>Treatment thresholds</b> <b>Treatment of low-risk grade 1 hypertension:</b> Initiation of antihypertensive drug treatment should also be considered in grade 1 hypertensive patients at low to moderate risk, when BP is within this range at several repeated visits or elevated by ambulatory BP criteria, and remains within this range despite a reasonable period of time with lifestyle measures.	<b>Treatment thresholds</b> <b>Treatment of low-risk grade 1 hypertension:</b> In patients with grade 1 hypertension at low–moderate risk and without evidence of HMOD, BP-lowering drug treatment is recommended if the patient remains hypertensive, after a period of lifestyle intervention.
<b>Treatment thresholds</b> <b>Older patients</b> Antihypertensive drug treatment may be considered in the elderly (at least when younger than 80 years) when SBP is in the 140–159 mmHg range, provided that antihypertensive treatment is well tolerated.	<b>Treatment thresholds</b> <b>Older patients</b> BP-lowering drug treatment and lifestyle intervention is recommended in fit older patients (> 65 years but not > 80 years) when SBP is in the grade 1 range (140–159 mmHg), provided that treatment is well tolerated.
<b>Recommendation Grading</b>	
 Grade I	 Grade IIa
 Grade IIb	 Grade III

## What is new and what has changed in the 2018 ESC/ESH hypertension guidelines? - 2

Changes in recommendations			
2013	2018		
<p><b>BP treatment targets</b></p> <p>A SBP goal of &lt; 140 mmHg is recommended.</p>	<p><b>BP treatment targets</b></p> <ul style="list-style-type: none"> <li>•It is recommended that the first objective of treatment should be to lower BP to &lt;140/90 mmHg <b>in all patients</b> and provided that the treatment is well tolerated, treated BP values should be targeted to 130/80 mmHg or lower, in most patients.</li> <li>•In patients &lt; 65 years it is recommended that SBP should be lowered to a BP range of 120 to &lt; 130 mmHg in most patients.</li> </ul>		
<p><b>BP treatment targets in older patients (65–80 years)</b></p> <p>A SBP target between of 140 and 150 mmHg is recommended for older patients (65–80 years).</p>	<p><b>BP treatment targets in older patients (65–80 years)</b></p> <p>In older patients (≥ 65 years), it is recommended that SBP should be targeted to a BP range of 130 to &lt; 140 mmHg.</p>		
<p><b>BP treatment targets in patients aged over 80 years</b></p> <p>A SBP target between 140 and 150 mmHg should be considered in people older than 80 years, with an initial SBP ≥ 160 mmHg, provided that they are in good physical and mental condition.</p>	<p><b>BP treatment targets in patients aged over 80 years</b></p> <p>A SBP target range of 130 to &lt; 140 mmHg is recommended for people older than 80 years, if tolerated.</p>		
<p><b>DBP targets</b></p> <p>A DBP target of &lt; 90 mmHg is always recommended, except in patients with diabetes, in whom values &lt; 85 mmHg are recommended.</p>	<p><b>DBP targets</b></p> <p>A DBP target of &lt; 80 mmHg should be considered for all hypertensive patients, independent of the level of risk and comorbidities.</p>		
<b>Recommendation Grading</b>			
 Grade I	 Grade IIa	 Grade IIb	 Grade III

## What is new and what has changed in the 2018 ESC/ESH hypertension guidelines? - 3

Changes in recommendations			
2013	2018		
<p><b>Initiation of drug treatment</b></p> <p>Initiation of antihypertensive therapy with a two-drug combination may be considered in patients with markedly high baseline BP or at high CV risk.</p>	<p><b>Initiation of drug treatment</b></p> <p>It is recommended to initiate an antihypertensive treatment with a two-drug combination, preferably in a SPC. The exceptions are frail older patients and those at low risk and with grade 1 hypertension (particularly if SBP is &lt; 150 mmHg).</p>		
<p><b>Resistant hypertension</b></p> <p>Mineralocorticoid receptor antagonists, amiloride, and the alpha-1 blocker doxazosin should be considered if no contraindication exists.</p>	<p><b>Resistant hypertension</b></p> <p>Recommended treatment of resistant hypertension is the addition of low-dose spironolactone to existing treatment, or the addition of further diuretic therapy if intolerant to spironolactone, with either eplerenone, amiloride, higher-dose thiazide/thiazide-like diuretic or a loop diuretic, or the addition of bisoprolol or doxazosin.</p>		
<p><b>Device-based therapy for hypertension</b></p> <p>In case of ineffectiveness of drug treatment, invasive procedures such as renal denervation and baroreceptor stimulation may be considered.</p>	<p><b>Device-based therapy for hypertension</b></p> <p>Use of device-based therapies is not recommended for the routine treatment of hypertension, unless in the context of clinical studies and RCTs, until further evidence regarding their safety and efficacy becomes available.</p>		
Recommendation Grading			
 Grade I	 Grade IIa	 Grade IIb	 Grade III

## Factors influencing CV risk in patients with hypertension - 1

Demographic characteristics and laboratory parameters
Sex (men > women)
Age
Smoking – current or past history
Total cholesterol and HDL-C
Uric acid
Diabetes
Overweight or obesity
Family history of premature CVD (men aged < 55 years and women aged < 65 years)
Family or parental history of early onset hypertension
Early onset menopause
Sedentary lifestyle
Psychosocial and socioeconomic factors
Heart rate (resting values > 80 beats per min)

## Factors influencing CV risk in patients with hypertension - 2

<b>Asymptomatic HMOD</b>
Arterial stiffening: Pulse pressure (in older people) $\geq 60$ mmHg Carotid–femoral PWV $> 10$ m/s
ECG LVH
Echocardiographic LVH
Microalbuminuria or elevated albumin–creatinine ratio
Moderate CKD with eGFR 30–59 mL/min/1.73 m <sup>2</sup> (BSA)
Ankle–brachial index $< 0.9$
Advanced retinopathy: haemorrhages or exudates, papilloedema

## Factors influencing CV risk in patients with hypertension - 3

<b>Established CV or renal disease</b>
Cerebrovascular disease: ischaemic stroke, cerebral haemorrhage, TIA
CAD: myocardial infarction, angina, myocardial revascularization
Presence of atheromatous plaque on imaging
Heart failure, including HFpEF
Peripheral artery disease
Atrial fibrillation
Severe CKD with eGFR < 30 mL/min/1.73 m <sup>2</sup>

**Figure 4. BP Thresholds and Recommendations for Treatment**

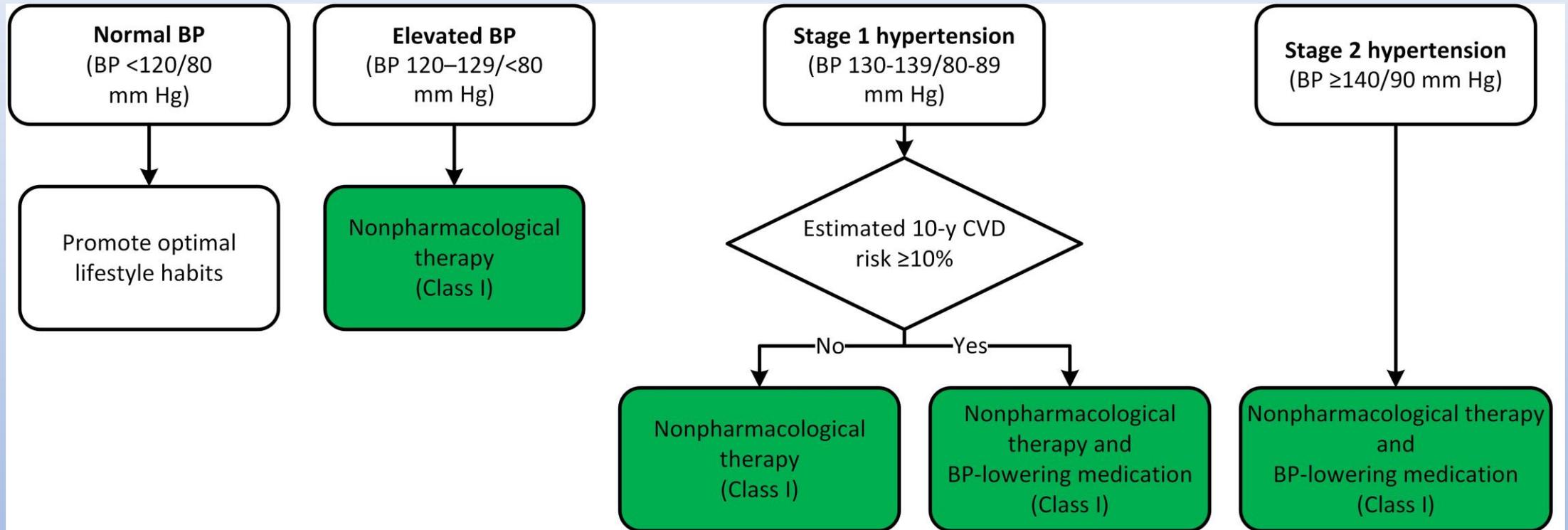


Table 7. Best Proven Nonpharmacological Interventions For the Prevention and Treatment of Hypertension

	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)

Table 7. Best Proven Nonpharmacological Interventions For the Prevention and Treatment of Hypertension (cont'd)

	Nonpharmacological Intervention	Goal	Approximate Impact on SBP		
			Hypertension	Normotension	Reference
Physical activity	Aerobic	<ul style="list-style-type: none"> <li>• 90–150 min/wk</li> <li>• 65%–75% heart rate reserve</li> </ul>	-5/8 mm Hg	-2/4 mm Hg	(S4.4-19, S4.4-20)
	Dynamic resistance	<ul style="list-style-type: none"> <li>• 90–150 min/wk</li> <li>• 50%–80% 1 rep maximum</li> <li>• 6 exercises, 3 sets/exercise, 10 repetitions/set</li> </ul>	-4 mm Hg	-2 mm Hg	(S4.4-19)
	Isometric resistance	<ul style="list-style-type: none"> <li>• 4 × 2 min (hand grip), 1 min rest between exercises, 30%–40% maximum voluntary contraction, 3 sessions/wk</li> <li>• 8–10 wk</li> </ul>	-5 mm Hg	-4 mm Hg	(S4.4-21, S4.4-63)
Moderation in alcohol intake	Alcohol consumption	<p>In individuals who drink alcohol, reduce alcohol<sup>†</sup> to:</p> <ul style="list-style-type: none"> <li>• Men: ≤2 drinks daily</li> <li>• Women: ≤1 drink daily</li> </ul>	-4 mm Hg	-3 mm Hg	(S4.4-20, S4.4-24, S4.4-25)

## Compelling and possible contraindications to the use of specific antihypertensive drugs

Drug	Contraindications	
	Compelling	Possible
Diuretics (thiazides/thiazide-type, e.g. chlorthalidone and indapamide)	<ul style="list-style-type: none"> <li>Gout</li> </ul>	<ul style="list-style-type: none"> <li>Metabolic syndrome</li> <li>Glucose intolerance</li> <li>Pregnancy</li> <li>Hypercalcemia</li> <li>Hypokalemia</li> </ul>
Beta-blockers	<ul style="list-style-type: none"> <li>Asthma</li> <li>Any high-grade sino-atrial or atrioventricular block</li> <li>Bradycardia (heart rate &lt; 60 beats per min)</li> </ul>	<ul style="list-style-type: none"> <li>Metabolic syndrome</li> <li>Glucose intolerance</li> <li>Athletes and physically active patients</li> </ul>
Calcium antagonists (dihydropyridines)		<ul style="list-style-type: none"> <li>Tachyarrhythmia</li> <li>Heart failure (HFrEF, class III or IV)</li> <li>Pre-existing severe leg oedema</li> </ul>
Calcium antagonists (verapamil, diltiazem)	<ul style="list-style-type: none"> <li>Any high-grade sino-atrial or AV block</li> <li>Severe LV dysfunction (LV EF &lt; 40%)</li> <li>Bradycardia (heart rate &lt; 60 beats per min)</li> </ul>	<ul style="list-style-type: none"> <li>Constipation</li> </ul>
ACE inhibitors	<ul style="list-style-type: none"> <li>Pregnancy</li> <li>Previous angioneurotic oedema</li> <li>Hyperkalemia (potassium &gt; 5.5 mmol/L)</li> <li>Bilateral renal artery stenosis</li> </ul>	<ul style="list-style-type: none"> <li>Women of child-bearing potential without reliable contraception</li> </ul>
ARBs	<ul style="list-style-type: none"> <li>Pregnancy</li> <li>Hyperkalemia (potassium &gt; 5.5 mmol/L)</li> <li>Bilateral renal artery stenosis</li> </ul>	<ul style="list-style-type: none"> <li>Women of child-bearing potential without reliable contraception</li> </ul>

## Common causes of secondary hypertension

Cause	Prevalence in hypertensive patients
Obstructive sleep apnoea	5–10%
Renal parenchymal disease	2–10%
<b>Renovascular disease:</b>	
Atherosclerotic renovascular disease	1–10%
Fibromuscular dysplasia	
<b>Endocrine causes:</b>	
Primary Aldosteronism	5–15%
Phaeochromocytoma	< 1%
Cushing's syndrome	< 1%
Thyroid disease (hyper- or hypothyroidism)	1–2%
Hyperparathyroidism	< 1%
<b>Other causes:</b>	
Coarctation of the aorta	< 1%

## Patient characteristics that should raise the suspicion of secondary hypertension

Characteristic
Younger patients (< 40 years) with grade 2 hypertension or onset of any grade of hypertension in childhood
Acute worsening hypertension in patients with previously documented chronically stable normotension
Resistant hypertension
Severe (grade 3) hypertension or a hypertension emergency
Presence of extensive HMOD
Clinical or biochemical features suggestive of endocrine causes of hypertension or CKD
Clinical features suggestive of obstructive sleep apnoea
Symptoms suggestive of pheochromocytoma or family history of pheochromocytoma

## Medications and other substances that may increase BP

Medication/substance	
Oral contraceptive pill	Especially oestrogen containing; cause hypertension in 5% of women, usually mild but can be severe
Diet pills	For example, phenylpropanolamine and sibutramine
Nasal decongestants	For example, phenylephrine hydrochloride and naphazoline hydrochloride
Stimulant drugs	Amphetamine, cocaine, and ecstasy – these substances usually cause acute rather than chronic hypertension
Liquorice	Chronic excessive liquorice use mimics hyperaldosteronism by stimulating the mineralocorticoid receptor and inhibiting cortisol metabolism
Immunosuppressive medications	For example, cyclosporin A (tacrolimus has less effect on BP and rapamycin has almost no effect on BP), and steroids (e.g. corticosteroids, hydrocortisone)
Antiangiogenic cancer therapies	Antiangiogenic drugs, such as VEGF inhibitors (e.g. bevacizumab), tyrosine kinase inhibitors (e.g. sunitinib), and sorafenib, have been reported to increase BP
Other drugs and substances that may raise BP	Anabolic steroids, erythropoietin, non-steroidal anti-inflammatory drugs, herbal remedies (e.g. ephedra, ma huang)

**Table 2. Example Considerations for Addressing Social Determinants of Health to Help Prevent ASCVD**

Topic/Domain	Example Considerations
Cardiovascular risk	<ul style="list-style-type: none"> <li>• Adults should be routinely assessed for psychosocial stressors and provided with appropriate counseling.</li> <li>• Health literacy should be assessed every 4 to 6 y to maximize recommendation effectiveness.</li> </ul>
Diet	<ul style="list-style-type: none"> <li>• In addition to the prescription of diet modifications, body size perception, as well as social and cultural influences, should be assessed.</li> <li>• 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*.</li> </ul>
Exercise and physical activity	<ul style="list-style-type: none"> <li>• In addition to the prescription of exercise, neighborhood environment and access to facilities for physical activity should be assessed.</li> </ul>
Obesity and weight loss	<ul style="list-style-type: none"> <li>• Lifestyle counseling for weight loss should include assessment of and interventional recommendations for psychosocial stressors, sleep hygiene, and other individualized barriers.</li> <li>• Weight maintenance should be promoted in patients with overweight/obesity who are unable to achieve recommended weight loss.</li> </ul>

**Table 2. Example Considerations for Addressing Social Determinants of Health to Help Prevent ASCVD (cont'd)**

Topic/Domain	Example Considerations
Diabetes mellitus	<ul style="list-style-type: none"> <li>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.</li> </ul>
High blood pressure	<ul style="list-style-type: none"> <li>Short sleep duration (&lt;6 h) and poor-quality sleep are associated with high blood pressure and should be considered. Because other lifestyle habits can impact blood pressure, access to a healthy, low-sodium diet and viable exercise options should also be considered.</li> </ul>
Tobacco treatment	<ul style="list-style-type: none"> <li>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.</li> </ul>

### 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<sup>2</sup> with or without albuminuria; not treated with dialysis or kidney transplantation)
- **Chronic inflammatory conditions**, such as psoriasis, RA, lupus, or HIV/AIDS

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.

**Table 3. Risk-Enhancing Factors for Clinician-Patient Risk Discussion (cont'd)**

Risk-Enhancing Factors
<ul style="list-style-type: none"><li>• <b>History of premature menopause (before age 40 y) and history of pregnancy-associated conditions that increase later ASCVD risk, such as preeclampsia</b></li><li>• <b>High-risk race/ethnicity</b> (e.g., South Asian ancestry)</li><li>• <b>Lipids/biomarkers:</b> associated with increased ASCVD risk</li><li>• Persistently elevated,* primary hypertriglyceridemia (<math>\geq 175</math> mg/dL, nonfasting);</li><li>• If measured:<ul style="list-style-type: none"><li>▪ <b>Elevated high-sensitivity C-reactive protein</b> (<math>\geq 2.0</math> mg/L)</li><li>▪ <b>Elevated Lp(a):</b> A relative indication for its measurement is family history of premature ASCVD. An Lp(a) <math>\geq 50</math> mg/dL or <math>\geq 125</math> nmol/L constitutes a risk-enhancing factor, especially at higher levels of Lp(a).</li><li>▪ <b>Elevated apoB</b> (<math>\geq 130</math> mg/dL): A relative indication for its measurement would be triglyceride <math>\geq 200</math> mg/dL. A level <math>\geq 130</math> mg/dL corresponds to an LDL-C <math>&gt; 160</math> mg/dL and constitutes a risk-enhancing factor</li><li>▪ <b>ABI</b> (<math>&lt; 0.9</math>)</li></ul></li></ul>

\*Optimally, 3 determinations.

Table 6. Selected Examples of Candidates for CAC Measurement Who Might Benefit from Knowing Their CAC Score is Zero

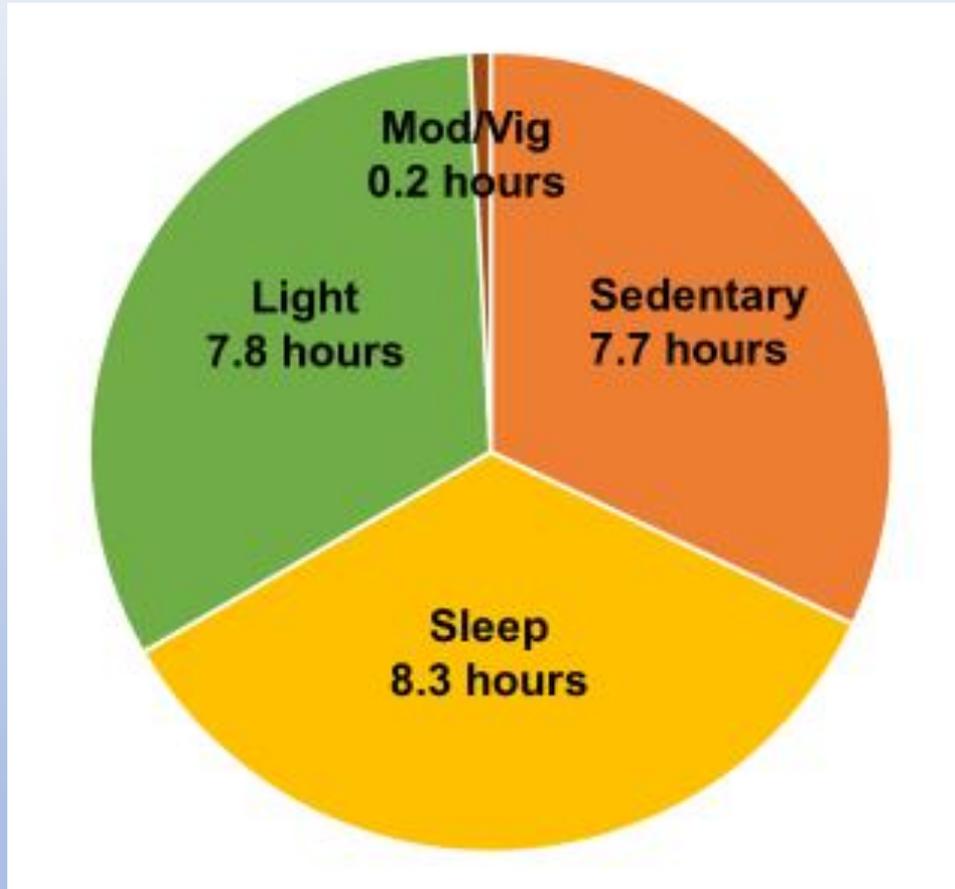
**CAC Measurement Candidates Who Might Benefit from Knowing Their CAC Score Is Zero**

- 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.

# Nutrition and Obesity

- Dietary patterns associated with CVD mortality include—sugar, low-calorie sweeteners, high-carbohydrate diets, low-carbohydrate diets, refined grains, trans fat, saturated fat, sodium, red meat, and processed red meat (such as bacon, salami, ham, hot dogs, and sausage).
- Adults diagnosed as obese (body mass index [BMI]  $\geq 30$  kg/m<sup>2</sup>) or overweight (BMI 25-29.9 kg/m<sup>2</sup>) are at increased risk of ASCVD, heart failure, and atrial fibrillation compared with those of a normal weight.

**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.**

**Table 4. Definitions and Examples of Different Intensities of Physical Activity**

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

\**Sedentary behavior* is defined as any waking behavior characterized by an energy expenditure  $\leq 1.5$  METs while in a sitting, reclining, or lying posture. Standing is a sedentary activity in that it involves  $\leq 1.5$  METs, but it is not considered a component of sedentary behavior. MET indicates metabolic equivalent; mph, miles per hour.



**Fig. 2. Treatment of T2DM for Primary Prevention of CVD**

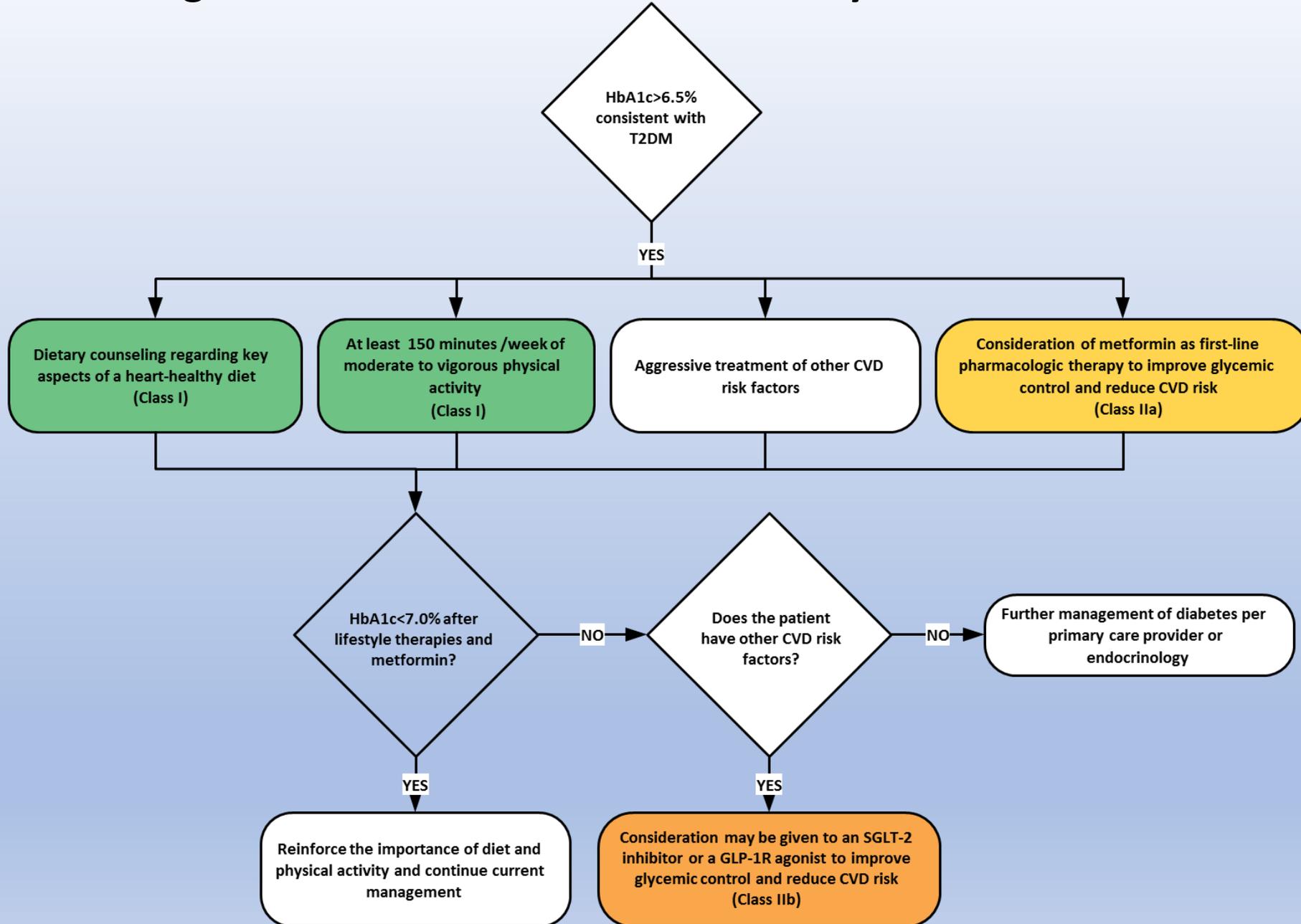


Table 5. Diabetes-Specific Risk Enhancers That Are Independent of Other Risk Factors in Diabetes Mellitus

<b>Risk Enhancers in Diabetic Patients</b>
<ul style="list-style-type: none"><li>• Long duration (<math>\geq 10</math> years for T2DM (S4.3-36) or <math>\geq 20</math> years for type 1 diabetes mellitus (S4.3-16))</li><li>• Albuminuria <math>\geq 30</math> mcg albumin/mg creatinine (S4.3-37)</li><li>• eGFR <math>&lt; 60</math> mL/min/1.73 m<sup>2</sup> (S4.3-37)</li><li>• Retinopathy (S4.3-38)</li><li>• Neuropathy (S4.3-39)</li><li>• ABI <math>&lt; 0.9</math> (S4.3-40, S4.3-41)</li></ul>

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

# Lipids and Statins

- Primary ASCVD prevention requires assessing risk factors beginning in childhood. For those <19 years of age with familial hypercholesterolemia, a statin is indicated.
- For young adults (ages 20-39 years), priority should be given to estimating lifetime risk and promoting a healthy lifestyle.
- Statin should be considered in those with a family history of premature ASCVD and LDL-C  $\geq 160$  mg/dl. ASCVD risk-enhancing factors, (see risk estimate section), should be considered in all patients.

- Patients ages 20-75 years and LDL-C  $\geq 190$  mg/dl, use high-intensity statin without risk assessment.
- T2DM and age 40-75 years, use moderate-intensity statin and risk estimate to consider high-intensity statins. Risk-enhancers in diabetics include  $\geq 10$  years for T2DM and 20 years for type 1 DM,  $\geq 30$  mcg albumin/mg creatinine, eGFR  $< 60$  ml/min/1.73 m<sup>2</sup>, retinopathy, neuropathy, ABI  $< 0.9$ . In those with multiple ASCVD risk factors, consider high-intensity statin with aim of lowering LDL-C by 50% or more.
- Age  $> 75$  years, clinical assessment and risk discussion.
- Age 40-75 years and LDL-C  $\geq 70$  mg/dl and  $< 190$  mg/dl without diabetes, use the risk estimator that best fits the patient and risk-enhancing factors to decide intensity of statin.



Table 8. Highlights of Recommended Behavioral and Pharmacotherapy Tobacco Treatment Modalities

<b>Timing of Behavioral Interventions†</b>		
<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

†Timing of assessment relates to ICD-10 coding.

Table 8. Highlights of Recommended Behavioral and Pharmacotherapy Tobacco Treatment Modalities (cont'd)

Treatment	Dosing‡		Precautions
<b>NRT*</b>			
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	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;	Hiccups/dyspepsia possible; avoid food or beverages 15 min before and after use
Lozenge	2 mg or 4 mg	maximum of 20 lozenges or 24 pieces of gum/d. Chew and park gum*	

\*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.*

‡Dose and duration can be titrated on the basis of response

Table 8. Highlights of Recommended Behavioral and Pharmacotherapy Tobacco Treatment Modalities (cont'd)

Treatment	Dosing‡		Precautions
<b>NRT*</b>			
Nasal spray	10 mg/mL	Starting dose: 1-2 doses/h (1 dose=2 sprays); maximum of 40 doses/d	Local irritation possible; avoid with nasal or reactive airway disorders
Oral inhaler	10, 10-mg cartridge	Starting dose: Puff for 20 min/cartridge every 1-2 h; maximum 6-16 cartridges/d; taper over 3-6 mo§	Cough possible; avoid with reactive airway disorders

\*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.*

‡Dose and duration can be titrated on the basis of response

Table 8. Highlights of Recommended Behavioral and Pharmacotherapy Tobacco Treatment Modalities (cont'd)

Treatment	Dosing‡		Precautions
<b>Other   </b>			
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 (S4.5-21)	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.

‡Dose and duration can be titrated on the basis of response

§See Rx for Change for greater detail: <http://rxforchange.ucsf.edu>)

|| The FDA has issued a removal of black box warnings about neuropsychiatric events

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.

# Aspirin

- Low-dose aspirin might be considered for primary prevention of ASCVD in select higher ASCVD adults aged 40-70 years who are not at increased bleeding risk.
- Low-dose aspirin should not be administered on a routine basis for primary prevention of ASCVD among adults >70 years.
- Low-dose aspirin should not be administered for primary prevention among adults at any age who are at increased bleeding risk.

# Top 10 Take-Home Messages

## **2019 Primary Prevention Guidelines**

# Top 10 Take Home Messages

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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.

# Top 10 Top 10 Take Home Messages

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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. In addition, assessing for other risk-enhancing factors can help guide decisions about preventive interventions in select individuals, as can coronary artery calcium scanning.

# Top 10 Top 10 Take Home Messages

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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**.

# Top 10 Top 10 Take Home Messages

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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.

# Top 10 Top 10 Take Home Messages

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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.

# Top 10 Top 10 Take Home Messages

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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.

# Top 10 Top 10 Take Home Messages

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9. **Statin** therapy is first-line treatment for primary prevention of ASCVD in patients with elevated low-density lipoprotein cholesterol levels ( $\geq 190$  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.

# Top 10 Top 10 Take Home Messages

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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.

**Gracias por su atención**