

Initial evaluation of the hypertensive adult

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INTRODUCTION

Most hypertensive patients present with a modest elevation in blood pressure and no clinical cardiovascular disease or signs of hypertension-related target-organ damage. The diagnosis of hypertension is made in this setting only after an elevated and properly measured blood pressure has been confirmed on at least two occasions or, preferably, if an elevated blood pressure obtained in the office is confirmed by out-of-office measurements ([algorithm 1](#)) [[1-3](#)]. Establishing the diagnosis of hypertension and the methods of measuring blood pressure are discussed elsewhere:

- (See "[Overview of hypertension in adults](#)", section on 'Diagnosis'.)
- (See "[Blood pressure measurement in the diagnosis and management of hypertension in adults](#)".)

The appropriate management of hypertensive patients, defined by persistent blood pressure values ≥ 130 mmHg systolic and/or ≥ 80 mmHg diastolic, depends upon several factors, including the presence or absence of specific comorbidities, the overall cardiovascular risk, and whether or not the hypertension is being caused by a second, potentially reversible disorder [[4](#)].

- (See "[Choice of drug therapy in primary \(essential\) hypertension](#)".)
- (See "[Goal blood pressure in adults with hypertension](#)".)
- (See "[Evaluation of secondary hypertension](#)".)

Thus, after the presence of hypertension has been established, an evaluation should be performed to ascertain the following information:

- The extent of target-organ damage
- The patient's overall cardiovascular risk status (see ["Overview of established risk factors for cardiovascular disease"](#))
- To rule out identifiable (secondary) and often curable causes of hypertension ([table 1](#)) (see ["Evaluation of secondary hypertension"](#))

The patient with a systolic blood pressure ≥ 180 mmHg and/or diastolic blood pressure ≥ 120 mmHg requires immediate evaluation for signs of acute target-organ damage and, possibly, immediate treatment. The complete evaluation for potentially contributing causes is usually delayed in these circumstances until the blood pressure is brought to safe levels.

- (See ["Moderate to severe hypertensive retinopathy and hypertensive encephalopathy in adults"](#).)
- (See ["Evaluation and treatment of hypertensive emergencies in adults"](#).)
- (See ["Management of severe asymptomatic hypertension \(hypertensive urgencies\) in adults"](#).)

THE BASIC WORKUP

The features of the history and physical examination described below are directed specifically toward hypertension. Additional features may need to be included for other indications.

History — The history should search for those facts that help determine the presence of precipitating or aggravating factors, the natural course of the blood pressure, the extent of target-organ damage, and the presence of other risk factors for cardiovascular disease ([table 2](#)). The patient should also be asked about the signs and symptoms that suggest an identifiable cause of hypertension ([table 1](#)). (See ["Clinical presentation and diagnosis of pheochromocytoma"](#).)

One important consideration is the duration of hypertension. Simply asking the patient "How long have you had high blood pressure?" may lead to a misleading answer. Suppose, as an example, that the patient says two years. This should be followed by the question: "When was the last time you were told your blood pressure was normal?" In some cases, the patient will

not have a blood pressure measurement for many years. Thus, the patient may have had undiagnosed hypertension for many years.

Another important consideration, particularly in the patient with very high blood pressures ($\geq 180/\geq 120$ mmHg), is the history of prior treatment for hypertension and nonadherence to antihypertensive medications since this is a common finding in patients with severe hypertension.

Physical examination — Proper technique for measurement of blood pressure is detailed elsewhere. (See ["Blood pressure measurement in the diagnosis and management of hypertension in adults"](#).)

The main goals on the physical examination are to evaluate for signs of end-organ damage (such as retinopathy) and for evidence of a cause of identifiable hypertension ([table 3](#)). (See ["Ocular effects of hypertension"](#).)

The various pulses should be palpated, and the abdomen should be auscultated for a renal artery bruit. The presence of an upper-abdominal bruit with a diastolic component that lateralizes toward one side is highly suggestive of renal artery stenosis.

The 2008 American College of Cardiology/American Heart Association guidelines for adults with congenital heart disease recommend that every patient with hypertension should have the brachial and femoral pulses palpated simultaneously to assess timing and amplitude to evaluate for brachial-femoral delay characteristic of coarctation of the aorta [\[5\]](#). In addition, supine bilateral arm (brachial artery) blood pressures and prone right or left supine leg (popliteal artery) blood pressures should be measured to search for differential pressure. (See ["Examination of the arterial pulse", section on 'Unequal or delayed pulses'](#).)

Laboratory testing — The procedures that should be routinely performed to evaluate for underlying causes (and signs of end-organ damage), as well as cardiovascular risk, are ([table 4](#)) [\[6\]](#):

- Blood chemistries including electrolytes, glucose, and creatinine. An estimated glomerular filtration rate (eGFR) should be determined.
- Lipid profile. Most hypertensive patients will have hyperlipidemia or sufficiently elevated cardiovascular risk to indicate statin therapy [\[7,8\]](#).
- Urinalysis to detect hematuria and an albumin/creatinine ratio to estimate albumin excretion.
- Electrocardiogram (ECG).

If there are abnormalities in the patient with severe hypertension, an attempt should be made to determine whether they are new or were previously documented since the patient with acute changes generally requires more aggressive blood pressure reduction.

Tests that are occasionally performed — Additional tests may be indicated in certain settings. These include:

Ambulatory blood pressure monitoring — Ambulatory blood pressure monitoring is capable of reducing the costs of the management of hypertension by rapidly identifying the 20 percent of patients with "white coat hypertension" and by ensuring adequacy of therapy [9]. However, most third-party payers refuse to pay adequately for this procedure. As a result, the main indication for its use is in the patient with persistent office hypertension but normal out-of-office (self-measured) blood pressure readings, or if self-measurement is not feasible. (See ["Out-of-office blood pressure measurement: Ambulatory and self-measured blood pressure monitoring"](#).)

Echocardiography — Routine echocardiographic evaluation of hypertensive patients is **not** recommended, unless there are specific indications, such as clinically evident heart failure, or if left ventricular dysfunction or coronary artery disease is suspected [10]. Echocardiography is a more sensitive method to detect left ventricular hypertrophy than the ECG. In patients suspected of having coronary artery disease, stress echocardiography (rather than standard echocardiography) may be preferred [11]. (See ["Clinical implications and treatment of left ventricular hypertrophy in hypertension"](#), section on 'Indications for echocardiography in hypertensive patients'.)

Serum uric acid — Hyperuricemia has been found to be a precursor and possible pathogenetic factor for hypertension [12]. It is not known whether the presence of hyperuricemia or its treatment will influence the management of hypertension.

Plasma renin activity — Although the plasma renin activity (PRA) may provide prognostic information [13], the test is usually performed only in patients with possible low-renin forms of hypertension, such as primary mineralocorticoid excess. The PRA may provide guidance in the evaluation and treatment of resistant hypertension [14,15]. (See ["Definition, risk factors, and evaluation of resistant hypertension"](#) and ["Diagnosis of primary aldosteronism"](#) and ["Pathophysiology and clinical features of primary aldosteronism"](#).)

Workup for renovascular hypertension — Additional testing for renovascular disease is indicated **only** in patients in whom the history is suggestive ([table 1](#)). The identification of patients who should be evaluated for renovascular hypertension and the diagnosis of

renovascular hypertension in such patients are presented in detail elsewhere. (See ["Evaluation of secondary hypertension"](#) and ["Establishing the diagnosis of renovascular hypertension"](#).)

ASSESSMENT OF CARDIOVASCULAR RISK

As well defined by data from the Framingham study, a number of other risk factors interact with hypertension to determine the overall risk status of each individual patient [16]. The presence or absence of other risk factors can influence the decision as to whether to institute antihypertensive medications in a patient with borderline values [17]. Several calculators are available to estimate overall cardiovascular risk ([calculator 1](#) and [calculator 2](#) and [calculator 3](#)). The atherosclerotic cardiovascular disease (ASCVD) risk calculator may be more strongly associated with cardiovascular outcomes than other calculators [18]. (See ["Cardiovascular risks of hypertension"](#).)

In patients with stage 1 hypertension, cardiovascular risk assessment is useful to determine the need for pharmacologic therapy. (See ["Overview of hypertension in adults", section on 'Who should be treated with pharmacologic therapy?'](#).)

Cardiovascular risk assessment may also inform goal blood pressure ([table 5](#)).

Albuminuria — In patients with hypertension, moderately increased albuminuria (formerly, microalbuminuria) is associated with an increased incidence of cardiovascular disease. The value of measuring albumin excretion in patients with primary hypertension without diabetes is being increasingly advocated to assess cardiovascular risk; however, it does not have value as a screening tool for nephropathy in nondiabetic patients with hypertension [19,20]. (See ["Moderately increased albuminuria \(microalbuminuria\) and cardiovascular disease"](#) and ["Moderately increased albuminuria \(microalbuminuria\) in type 1 diabetes mellitus"](#) and ["Moderately increased albuminuria \(microalbuminuria\) in type 2 diabetes mellitus"](#).)

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See ["Society guideline links: Hypertension in adults"](#).)

INFORMATION FOR PATIENTS

UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Beyond the Basics topics (see ["Patient education: High blood pressure in adults \(Beyond the Basics\)"](#) and ["Patient education: High blood pressure treatment in adults \(Beyond the Basics\)"](#) and ["Patient education: High blood pressure, diet, and weight \(Beyond the Basics\)"](#)).
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SUMMARY AND RECOMMENDATIONS

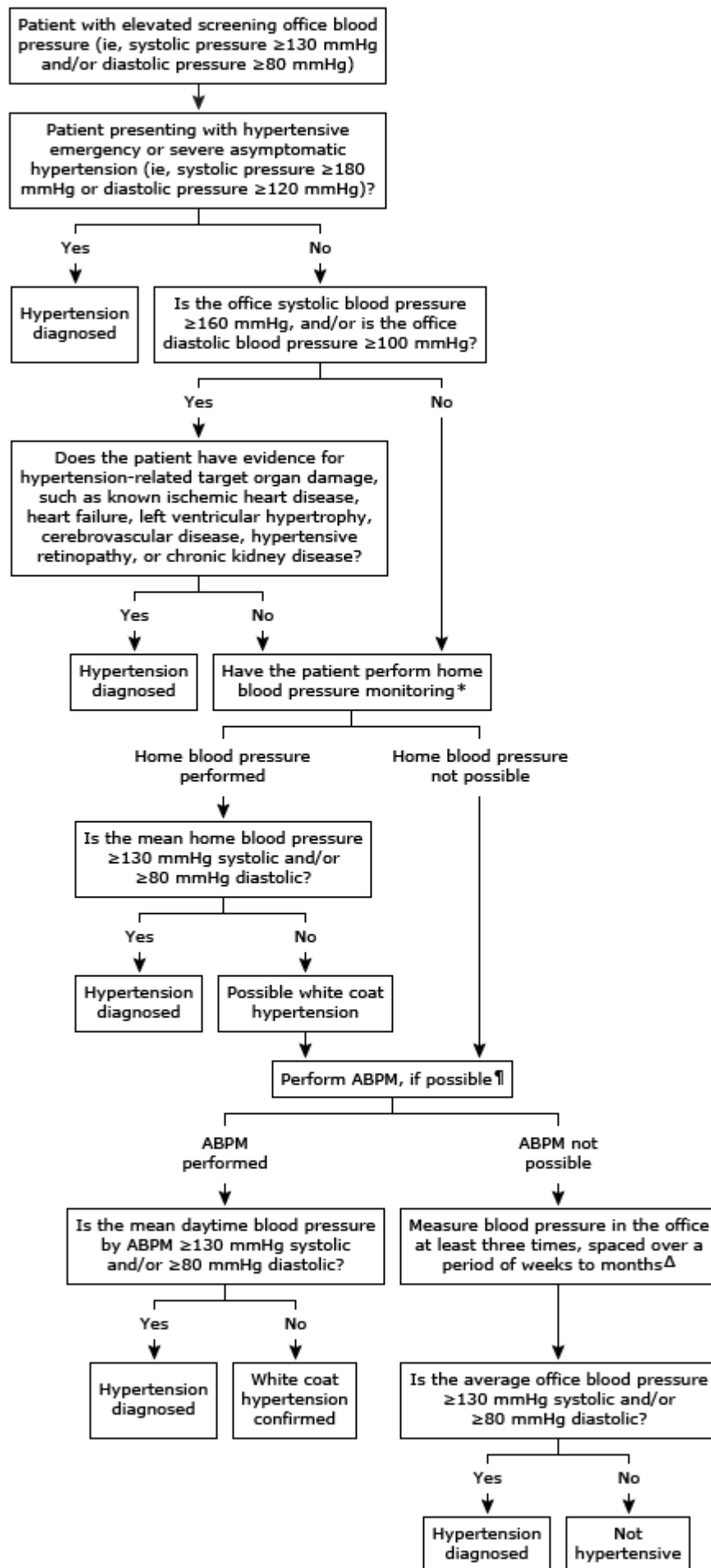
- Among patients with uncomplicated stage 1 hypertension (ie, blood pressure 130 to 139/80 to 89 mmHg) in the absence of clinical cardiovascular disease or signs of hypertension-related target-organ damage), the diagnosis is made only after an elevated and properly measured blood pressure has been confirmed on multiple occasions or, preferably, if an elevated blood pressure obtained in the office is confirmed by out-of-office measurements (either by home or ambulatory monitoring) ([algorithm 1](#)). (See ['Introduction'](#) above.)
- The evaluation should determine the duration of hypertension, the presence and extent of target-organ damage, and the patient's 10-year atherosclerotic cardiovascular disease (ASCVD) risk. Among selected patients, secondary causes of hypertension should be ruled out. (See ['History'](#) above and ['Physical examination'](#) above.)
- The physical examination should include evaluation of end-organ damage. The various pulses should be palpated, and the abdomen should be auscultated for a renal artery bruit. The presence of an upper-abdominal bruit with a diastolic component that lateralizes toward one side is highly suggestive of renal artery stenosis. (See ['Physical examination'](#) above.)

- Laboratory tests should include blood chemistries (electrolytes, glucose, creatinine), an estimated glomerular filtration rate (eGFR), a lipid profile, urinalysis, urine albumin/creatinine ratio, and electrocardiogram (ECG) ([table 4](#)). An attempt should be made to determine whether any abnormalities are new or were previously documented since the patient with acute changes generally requires more aggressive blood pressure reduction. (See '[Laboratory testing](#)' above.)
- Additional tests may be indicated in certain settings. (See '[Tests that are occasionally performed](#)' above.)

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GRAPHICS

Diagnosis of hypertension in adults



ABPM: ambulatory blood pressure monitoring; AOBPM: automated oscillometric blood pressure monitoring.

* Home blood pressure must be performed adequately in order for the measurements to be used for diagnosis and management. To be adequate: The accuracy of the home device should be verified in the clinician's office; the patient should measure their blood pressure while seated (with feet flat on the floor), with arm supported (such as on a table), and after several minutes of rest; the blood pressure should be measured at different times per day and over a series of multiple days. A common strategy is to have the patient measure his or her blood pressure twice daily (once in the morning and once in the evening) for seven days. Readings from the first day are discarded, and the remaining 12 measurements are averaged. Home blood pressure should not be used for diagnosis and management if it cannot be performed adequately. Adequate home blood pressure should be possible in most cases. Inexpensive devices to measure blood pressure at home are available over the counter. Alternatively, such devices can be borrowed (eg, provided by the clinic). Only rarely are such devices unavailable or unaffordable.

¶ ABPM is performed by having the patient wear, typically for 24 hours, an electronic blood pressure device that automatically measures the blood pressure, usually every half-hour during the day and hourly at night. We use the mean daytime value to determine the presence of hypertension. ABPM is possible if it is available in the clinic or via an external vendor and if it can be paid for by the patient's insurance or by the patient.

Δ Blood pressure measured in the office may vary according to the manner in which it is obtained. If blood pressure in the office is to be used for the diagnosis of hypertension (rather than using out-of-office blood pressures), we suggest performing unattended AOBPM (using a device that can average multiple readings while the patient sits alone in a room). Unattended AOBPM may provide a measurement that is 5 to 10 mmHg less than a manual measurement (ie, with a stethoscope). Office blood pressure must be performed with proper technique (eg, patient given time to rest, seated with feet flat on the floor, use of multiple measurements, appropriate-sized cuff placed on bare arm, etc). Office blood pressure measured with improper technique **should not** be used for diagnosis and management of hypertension. Refer to UpToDate topics on measurement of blood pressure for details of proper technique.

Clinical features of several causes of secondary hypertension

Disorder	Suggestive clinical features
General	<ul style="list-style-type: none"> Severe or resistant hypertension An acute rise in blood pressure over a previously stable value Proven age of onset before puberty Age less than 30 years with no family history of hypertension and no obesity
Renovascular disease	<ul style="list-style-type: none"> Unexplained creatinine elevation and/or acute and persistent elevation in serum creatinine of at least 50% after administration of ACE inhibitor, ARB, or renin inhibitor Moderate to severe hypertension in a patient with diffuse atherosclerosis, a unilateral small kidney, or asymmetry in kidney size of more than 1.5 cm that cannot be explained by another reason Moderate to severe hypertension in patients with recurrent episodes of flash pulmonary edema Onset of hypertension with blood pressure >160/100 mmHg after age 55 years Systolic or diastolic abdominal bruit (not very sensitive)
Primary kidney disease	<ul style="list-style-type: none"> Elevated serum creatinine concentration Abnormal urinalysis
Drug-induced hypertension: <ul style="list-style-type: none"> Oral contraceptives Anabolic steroids NSAIDs Chemotherapeutic agents (eg, tyrosine kinase inhibitors/VEGF blockade) Stimulants (eg, cocaine, methylphenidate) Calcineurin inhibitors (eg, cyclosporine) Antidepressants (eg, venlafaxine) 	<ul style="list-style-type: none"> New elevation or progression in blood pressure temporally related to exposure
Pheochromocytoma	<ul style="list-style-type: none"> Paroxysmal elevations in blood pressure Triad of headache (usually pounding), palpitations, and sweating
Primary aldosteronism	<ul style="list-style-type: none"> Unexplained hypokalemia with urinary potassium wasting; however, more than one-half of patients are normokalemic
Cushing's syndrome	<ul style="list-style-type: none"> Cushingoid facies, central obesity, proximal muscle weakness, and ecchymoses May have a history of glucocorticoid use
Sleep apnea syndrome	<ul style="list-style-type: none"> Common in patients with resistant hypertension, particularly if overweight or obese Loud snoring or witnessed apneic episodes Daytime somnolence, fatigue, and morning confusion
Coarctation of the aorta	<ul style="list-style-type: none"> Hypertension in the arms with diminished or delayed femoral pulses and low or unobtainable blood pressures in the legs Left brachial pulse is diminished and equal to the femoral pulse if origin of the left subclavian artery is distal to the coarct
Hypothyroidism	<ul style="list-style-type: none"> Symptoms of hypothyroidism Elevated serum thyroid stimulating hormone
Primary hyperparathyroidism	<ul style="list-style-type: none"> Elevated serum calcium

ACE: angiotensin-converting enzyme; ARB: angiotensin II receptor blocker; NSAID: nonsteroidal antiinflammatory drug; VEGF: vascular endothelial growth factor.

Graphic 56130 Version 13.0

Important aspects of the history in the patient with hypertension

Duration of hypertension	Presence of other risk factors
Last known normal blood pressure	Smoking
Course of the blood pressure	Diabetes
Prior treatment of hypertension	Dyslipidemia
Drugs: types, doses, side effects	Physical inactivity
Intake of agents that may cause hypertension	Dietary history
Nonsteroidal antiinflammatory drugs	Sodium
Estrogens	Processed foods
Adrenal steroids	Alcohol
Cocaine	Saturated fats
Sympathomimetics	Psychosocial factors
Excessive sodium	Family structure
Family history	Work status
Hypertension	Educational level
Premature cardiovascular disease or death	Sexual function
Familial diseases: pheochromocytoma, renal disease, diabetes, gout	Features of sleep apnea
Symptoms of secondary causes	Early morning headaches
Muscle weakness	Daytime somnolence
Spells of tachycardia, sweating, tremor	Loud snoring
Thinning of the skin	Erratic sleep
Flank pain	
Symptoms of target-organ damage	
Headaches	
Transient weakness or blindness	
Loss of visual acuity	
Chest pain	
Dyspnea	
Claudication	

Important aspects of the physical examination in the hypertensive patient

Accurate measurement of blood pressure
General appearance
Distribution of body fat
Skin lesions
Muscle strength
Alertness
Fundoscopy
Hemorrhage
Papilledema
Cotton wool spots
Arteriolar narrowing and arteriovenous nicking
Neck
Palpation and auscultation of carotids
Thyroid
Heart
Size
Rhythm
Sounds
Lungs
Rhonchi
Rales
Abdomen
Renal masses
Bruits over aorta or renal arteries
Femoral pulses
Extremities
Peripheral pulses
Edema
Neurologic assessment
Visual disturbance
Focal weakness
Confusion

Basic and optional laboratory tests for primary hypertension

Basic testing
Fasting blood glucose*
Complete blood count
Lipid profile
Serum creatinine with eGFR*
Serum sodium, potassium, calcium*
Thyroid-stimulating hormone
Urinalysis
Electrocardiogram
Optional testing
Echocardiogram
Uric acid
Urinary albumin to creatinine ratio

* May be included in a comprehensive metabolic panel.

eGFR: estimated glomerular filtration rate.

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Graphic 127491 Version 1.0

Goal blood pressure according to baseline risk for cardiovascular disease and method of measuring blood pressure

	Routine/conventional office blood pressure (manual measurement with stethoscope or oscillometric device)*	Unattended AOBPM, daytime ABPM, or home blood pressure¶
Higher-risk population^Δ		
<ul style="list-style-type: none"> Known ASCVD[◇] Heart failure Diabetes mellitus Chronic kidney disease Age ≥65 years[§] Calculated 10-year risk of ASCVD event ≥10%[¥] 	125 to 130/<80	120 to 125/<80
Lower-risk[‡]		
<ul style="list-style-type: none"> None of the above risk factors 	130 to 139/<90	125 to 135/<90

- All target ranges presented above are in mmHg.
- On average, blood pressure readings are 5 to 10 mmHg lower with digital, unattended, or out-of-office methods of measurement (ie, AOBPM, daytime ABPM, home blood pressure) than with routine/standard methods of office measurement (ie, manual auscultatory or oscillometric measurement), presumably due to the "white coat effect." However, it is critical to realize that this average difference in blood pressures according to the methodology of measurement applies to the population and not the individual. Some patients do not experience a white coat effect, and, therefore, there is some uncertainty in setting goals that are specific to the method of measurement.
- When treating to these goals, a patient may (inadvertently) attain a blood pressure below the given target. Provided the patient does not develop symptoms, side effects, or adverse events as a result of the treatment regimen, then reducing or withdrawing antihypertensive medications is unnecessary.
- Less aggressive goals than those presented in the table may be appropriate for specific groups of patients, including those with postural hypotension, the frail older adult patient, and those with side effects to multiple antihypertensive medications.

AOBPM: automated oscillometric blood pressure monitoring; ABPM: ambulatory blood pressure monitoring; ASCVD: atherosclerotic cardiovascular disease; ACC/AHA: American College of Cardiology/American Heart Association.

* Office blood pressure must be performed adequately in order to use such measurements to manage patients. Critical to an adequate office assessment of blood pressure are proper patient positioning (eg, seated in a chair, feet flat on the floor, arm supported, remove clothing covering the location of cuff placement) and proper technique (eg, calibrated device, proper-sized cuff). The average of multiple measurements should be used for management. Refer to UpToDate topics on measurement of blood pressure. Office readings should not be used to manage blood pressure unless it is performed adequately.

¶ Home blood pressure, like office blood pressure, must be performed adequately in order for the measurements to be used to manage patients. First, the accuracy of the home blood pressure device must be verified in the clinician's office. Second, the clinician should verify that the cuff and bladder that the patient will use are the appropriate size. Third, patients should measure their pressure after several minutes of rest and while seated in a chair (back supported and feet flat on the floor) with their arm supported (eg, resting on a table). Fourth, the blood pressure should be measured at different times per day and over multiple days. The average value of these multiple measurements is used for management. Home blood pressure readings should not be used to manage blood pressure unless it is performed adequately and in conjunction with office blood pressure or ambulatory blood pressure.

Δ The level of evidence supporting the lower goal in higher-risk individuals is stronger for some risk groups (eg, patients with known coronary heart disease, patients with a calculated 10-year risk ≥15%, chronic kidney disease) than for other risk groups (eg, patients with diabetes, patients with a prior stroke). Refer to UpToDate topics on goal blood pressure for a discussion of the evidence.

◇ Prior history of coronary heart disease (acute coronary syndrome or stable angina), prior stroke or transient ischemic attack, prior history of peripheral artery disease.

§ In older adults with severe frailty, dementia, and/or a limited life expectancy, or in patients who are nonambulatory or institutionalized (eg, reside in a skilled nursing facility), we individualize goals and share decision-making with the patient, relatives, and caretakers, rather than targeting one of the blood pressure goals in the table.

¥ The 2013 ACC/AHA cardiovascular risk assessment calculator should be used to estimate 10-year cardiovascular disease risk.

‡ In the large subgroup of patients who have an initial (pretreatment) blood pressure ≥140/≥90 mmHg, but who do not have any of the

other listed cardiovascular risk factors, some experts would set a more aggressive blood pressure goal of <130/<80 mmHg rather than those presented in the table. This more aggressive goal would likely reduce the chance of developing severe hypertension and ultimately lower the relative risk of cardiovascular events in these lower-risk patients over the long term. However, the absolute benefit of more aggressive blood pressure lowering in these patients is comparatively small, and a lower goal would require more intensive pharmacologic therapy and corresponding side effects.

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