What goes up must come down: Hypertension and the JNC-8 guidelines

What you need to know about the new treatment guidelines

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ESSENTIAL (primary) hypertension is one of the most important preventable contributors to illness and death in the United States. Frequently termed the silent killer, hypertension progresses with few symptoms until blood pressure (BP) rises to dangerous levels. An estimated 78 million nonpregnant Americans ages 20 and older have hypertension, making this disease the most common reason for primary care physician visits—and making antihypertensive drugs the most frequently prescribed medications. (See *Hypertension by the numbers.*)

We still have a long way to go to control this disease. In 2014, the Eighth Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (known as JNC-8) developed evidence-based guidelines for managing hypertension in adults. These guidelines focus on pharmacologic management and treatment criteria, but retain the definitions of hypertension and prehypertension, as well as lifestyle modifications, of the previous report (JNC-7).

Normal BP is defined as systolic BP below 120 mm Hg and a diastolic BP below 80 mm Hg. Higher values indicate prehypertension and varying stages of hypertension, depending on the specific BP reading. (See *Hypertension stages.*)

Risk factors

Hypertension results from several genetic and lifestyle factors. Genetic factors, such as one or both parents with hypertension, double the risk. Even though systolic BP naturally increases with age, obesity contributes to an earlier rise. A high-sodium diet, excessive alcohol consumption, and lack of physical activity are modifiable risk factors.

Complications

Hypertension is a major risk factor for diseases of the heart, brain, kidneys, and eyes. It's also the most common comorbidity, especially in patients with cardiovascular disorders. For example, 51% of patients with cardiovascular disease have a history of hypertension.

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LEARNING OBJECTIVES

1. Identify the stages of hypertension.
2. Describe complications associated with hypertension.
3. Discuss management of hypertension based on the JNC-8 guidelines.

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Cardiovascular complications

Left ventricular hypertrophy (LVH) is a common manifestation of chronic hypertension. The left ventricle encounters greater resistance than the right, so the muscle becomes larger and thicker, much like a weightlifter's muscles get bigger with training. LVH increases the likelihood of myocardial ischemia because the increased muscle mass demands a greater blood supply; also, when overall demand increases, ability of the coronary arteries to dilate diminishes.

Increased left ventricular mass also strains the cardiac conduction system, prolonging the depolarization/repolarization sequence in the ventricles. Called prolonged QT interval, this effect increases the ventricle's relative refractory period, making the myocardium vulnerable to potentially fatal ventricular arrhythmias, such as ventricular tachycardia, torsades de pointes, and ventricular fibrillation.

Because hypertrophied ventricles don't pump blood efficiently, the risk of heart failure (HF) associated with impaired systolic and diastolic function increases. Among patients with HF, 74% have a history of hypertension. The higher average BP a person experiences over time, the greater the HF risk. In addition, 69% of patients who experience acute myocardial infarction (AMI) are hypertensive. AMI patients with hypertension are at significantly

Hypertension by the numbers

For more than 40 years, campaigns to increase Americans' awareness of their blood pressure (BP) and how hypertension contributes to illness and death have been fairly successful. More American adults are now aware of their BP values. Of Americans diagnosed with hypertension, 82% are aware of their condition, 75% are prescribed antihypertensive medications, and 53% maintain their target BP.

Hypertension accounts for roughly $46 billion in direct and indirect medical costs in the United States.

Hypertension stages

The chart below shows systolic and diastolic blood pressure ranges for the four stages of hypertension.

Stage	Systolic blood pressure	Diastolic blood pressure
Prehypertension (untreated or undiagnosed hypertension)	120 to 139 mm Hg	80 to 89 mm Hg
Stage 1 hypertension	140 to 159 mm Hg	90 to 99 mm Hg
Stage 2 hypertension	Equal to or above 160 mm Hg	100 mm Hg or higher
Hypertensive crisis		Above 120 mm Hg with acute end-organ damage

Blood pressure criteria are based on The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-7).

higher risk for HF than normotensive AMI patients.

Neurovascular complications

Hypertension is the most common cause of nontraumatic intracerebral hemorrhage in adults. The primary vessels involved are the penetrator arteries branching at 90-degree angles to the parent vessel (commonly the middle cerebral artery). The increased force of blood flow caused by hypertension weakens the arterial wall, eventually causing small breaks in the wall itself. Microhemorrhages occur, leading to clot formation. Significant symptoms rarely arise. If the hemorrhage becomes too large to be contained by the normal thrombus formation, a hemorrhagic stroke ensues. Neuronal ischemia stems both from edema at the site and the hematoma itself.

Hypertension also is a major preventable cause of ischemic stroke in adults. Of patients presenting with their first stroke, 77% are hypertensive. Hypertension aggravates atherosclerosis of the carotid arteries and aortic arch and causes atherosclerosis in the brain's small blood vessels. In this case, abrupt BP changes lead to a dramatic decrease in cerebral blood flow from arterial stiffness and subsequent lack of compliance. With stroke ranking as one of the top causes of death in the United States, we need to eliminate this preventable risk factor.

Renal complications

Hypertension increases the risk for renal disease and hastens its progression; it also raises the risk of complications from renal disease. Decreased renal function caused by hypertension starts without symptoms. When symptoms arise, nocturia presents early due to the kidney's diminished ability to concentrate urine. In individuals with both hypertension and diabetes, microalbuminuria arises as a warning sign of underlying renal damage that may result in chronic and ultimately end-stage renal disease (ESRD).

Even individuals with prehypertension have an increased risk of chronic kidney disease. Among the various cultural groups, African Americans have the highest prevalence of hypertension in the world. In African American adults, hypertension occurs at a younger age and average BP is higher than in other racial and cultural groups. Hypertensive African American have a 4.2 greater risk of ESRD and a twofold risk of fatal stroke.

Eye complications

Hypertension causes retinal damage, including arterial narrowing, retinal ischemia, optic disc edema, arteriosclerosis, star-shaped exudates, and vascular wall thickening. Individuals typically experience few or no symptoms until damage is advanced. When symptoms occur, they include blurred vision, headache, or both. Otherwise asymptomatic hypertension may be identified when an optometrist refers a patient with visual changes to a primary care provider. Without treatment to control BP, permanent retinal damage occurs.

Treatment goals

JNC-8 guidelines for hypertension treatment stress the importance of systolic and diastolic BP control, using age and comorbidities for treatment recommendations. (See *Recommended blood pressure goals.*) Lifestyle modifications are recommended for all patients with hypertension, but diet and exercise alone aren't always enough to reduce BP to optimal levels.

Lifestyle changes

Evidence-based lifestyle changes

can be highly effective in lowering BP and are first-line recommendations for all patients with hypertension. Such changes include home BP monitoring, diet, exercise, and weight reduction when indicated. Smoking cessation is highly recommended to reduce all cardiovascular disease risk.

Home BP monitoring gives patients the opportunity to take ownership and become a partner in managing hypertension. Seeing evidence of reduced BP firsthand can encourage patients to continue to make healthy lifestyle changes and adhere to the prescribed medication regimen. Conversely, when home monitoring indicates an increase in BP, the patient is more likely to make further changes or seek medical attention in a timely manner.

Weight loss and sodium restriction through dietary changes are evidence-based methods of decreasing BP. Approximately 25% of Americans with hypertension are overweight or obese. Even modest weight loss can lower blood pressure. Systolic BP decreases approximately 1 mm Hg for every pound of weight lost.

The DASH diet (Dietary Approaches to Stop Hypertension) is rich in fruits, vegetables, low-fat dairy products, whole grains, poultry, fish, and nuts and low in sweets, red meat, and saturated fats. According to the American Heart Association, eating the DASH diet can lower systolic BP an average of 5 mm Hg. Current recommendations for sodium intake range from 1,500 to 2,300 mg/day. However, most Americans consume at least 50% more than the recommended amount. Foods highest in sodium include processed meats, baked goods, processed cheese, frozen dinners, and salad dressings. Reducing sodium intake to the recommended daily amount can decrease BP as much as 8 mm Hg.

Other lifestyle modifications include limiting alcohol consumption to one or two drinks per day and increasing physical activity. Engaging in such activities as brisk walking at least 30 minutes daily 5 days a week can reduce systolic BP as much as 9 mm Hg. What's more, physical activity improves general cardiovascular health.

Recommended blood pressure goals

The chart below shows blood pressure (BP) goals according to population, as recommended by the Eight Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure.

Population	Systolic BP goal	Diastolic BP goal
General population ages 60 and older	Below 150 mm Hg	Below 90 mm Hg
General population younger than age 60	Below 140 mm Hg	Below 90 mm Hg
Adults ages 18 and older with chronic kidney disease	Below 140 mm Hg	Below 90 mm Hg
Adults ages 18 and older with diabetes	Below 140 mm Hg	Below 90 mm Hg

Source: James PA, Oparil S, Carter BL, et al. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC-8). *JAMA*. 2014;311:507-20.

Pharmacologic treatment

JNC-8 recommendations focus on the main purpose of hypertension treatment—achieving and maintaining BP in the goal range. If lifestyle changes alone aren't sufficient to meet BP goals, pharmacologic treatment is recommended, with follow-up within 1 month. Failure to meet goal BP values warrants an increased dosage, additional medications, or both. (See *Antihypertensive classes.*)

First-line antihypertensives

JNC-8 limits first-line antihypertensives to calcium channel blockers (CCBs), thiazide-type diuretics, angiotensin-converting enzyme inhibitors (ACEIs), and angiotensin II receptor blockers (ARBs).

CCBs. These drugs bind to L-type calcium channels in vascular smooth muscle, cardiac nodal cells, and cardiac myocytes. They relax vascular smooth muscle, which decreases systemic vascular resistance and ultimately reduces BP. The two major types of CCBs are the dihydropyridines and non-dihydropyridines.

- *Dihydropyridines* are potent vasodilators with minimal effect on conduction and cardiac contractility.
- *Non-dihydropyridines* primarily affect cardiac conduction and contractility, with a minimal vasodilator effect.

Adverse effects of CCBs include dizziness, headache, peripheral edema, flushing, and light-headedness. Constipation, a major adverse effect of verapamil, affects 25% of patients. Peripheral edema associated with CCBs stems from fluid redistribution from the vascular space to the interstitial space, allowing transmission of more systemic pressure to the capillary system. Edema from CCBs remains resistant to diuretic therapy. Concurrent use of CCBs with angiotensin-converting enzyme inhibitors (ACEIs) reduces frequency of peripheral edema. Venous dilation from ACEIs allows removal of sequestered fluid in the interstitial space by arterial dilation caused by CCBs.

Nursing actions for patients receiving CCBs include the following:

Antihypertensive medication classes

This chart lists antihypertensive medication classes recommended by the Eight Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-8). These drugs should be prescribed according to JNC-8 recommendations—*not* the order in which they appear below.

First-line drug therapy	Second- or third-line drug therapy	Later-line drug therapy
• Calcium channel blockers (CCBs) *Examples:* amlodipine, diltiazem ER, nicardipine • Angiotensin-converting enzyme inhibitors (ACEIs) *Examples:* captopril, enalapril, lisinopril • Thiazide-type diuretics *Examples:* chlorthalidone, hydrochlorothiazide, indapamide • Angiotensin receptor blockers (ARBs) *Examples:* irbesartan, valsartan	• Increased doses of first-line drugs • Combination of thiazide-type diuretics and CCBs, ACEIs, or ARBs	• Alpha-1 blockers, beta blockers *Examples:* doxazosin mesylate, metoprolol, terazosin given concurrently with atenolol • Vasodilating beta blockers *Example:* nebivolol • Central alpha-2 adrenergic agonists *Example:* methyldopa • Direct vasodilators *Example:* hydralazine • Loop diuretics *Example:* furosemide • Aldosterone antagonists *Example:* spironolactone • Peripherally acting adrenergic antagonists *Example:* reserpine

Source: James PA, Oparil S, Carter BL, et al. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *JAMA*. 2014;311:507-20.

- Monitor for bradycardia, because these drugs are contraindicated in third-degree heart block.
- Teach the patient the importance of taking daily weights.
- Advise patients that verapamil commonly causes constipation.
- Caution patients not to drink grapefruit juice during CCB therapy because this can increase medication levels in the blood, causing a more pronounced antihypertensive effect.

Thiazide-type diuretics. These drugs reduce BP by blocking the sodium-chloride transport mechanism in the distal convoluted tubule, which causes fluid loss and reduces blood volume and cardiac output. In patients with both hypertension and HF, these medications improve HF outcomes. Antihypertensive regimens in patients older than age 75 with impaired renal function should include thiazide-type diuretics and CCBs instead of ACE inhibitors and ARBs, because the latter increase the risk of hyperkalemia and further renal impairment.

Side effects of thiazide-type diuretics may include hypokalemia, hyponatremia, hypomagnesemia, hyperuricemia, and increased glucose and cholesterol levels. However, low-dose therapy can mitigate these effects.

Nursing actions for patients receiving thiazide-type diuretics include the following:

- Instruct patients to weigh themselves daily.
- Assess fluid volume and electrolyte balance.
- In males, watch for adverse effects on sexuality, including decreased libido and impotence.
- Be aware that chlorthalidone is a thiazide-type diuretic and has a more pronounced antihypertensive effect than hydrochlorothiazide.

ACEIs. These drugs lower BP primarily by reducing angiotensin II. They also decrease breakdown of kinins, which may affect BP from direct dilation and increased production of vasodilator prostaglandins. Captopril reduces BP by inhibiting the enzyme that converts angiotensin I to angiotensin II and stimulating the kallikrein-kinin system. This results in decreased peripheral vascular resistance.

In addition, ACEIs also are prescribed to treat HF and chronic kidney disease (CKD). In CKD, these drugs reduce urinary protein excretion. (High urinary protein levels are linked to decreased glomerular filtration rates.) Because of the association between hypertension and albuminuria, ACEIs may be given to patients with diabetes; albuminuria increases as CKD progresses.

In addition, ACEIs promote regression of left ventricular hypertrophy to a greater extent than beta blockers. Unlike beta blockers and diuretics, they don't adversely affect cholesterol and glucose levels. However, they frequently cause creatinine elevations, resulting in

hyperkalemia. Hyperkalemia also can occur when ACEIs are given with potassium-sparing diuretics. If the patient's creatinine and potassium levels rise, the dosage must be adjusted or the drug may need to be discontinued.

Side effects of ACEIs include hypotension, hyperkalemia, and acute renal failure. Cough, angioedema, and anaphylactic reactions stem from increased kinins.

Nursing actions for patients receiving ACEIs include the following:

- Monitor for creatinine elevations and hyperkalemia.
- Advise patients to change position slowly to avoid orthostatic hypotension.
- Monitor blood pressure after the initial dose to evaluate the patient's response. Hypotension or syncope may occur when therapy is initiated, usually with the first several doses.
- Be aware that captopril may cause neutropenia, agranulocytosis, anemia, and thrombocytopenia. Bone marrow depression is more common in patients with preexisting renal disease or collagen vascular disorders.
- Know that these drugs are contraindicated in pregnant patients because they may cause fetal birth defects and fetal death.

ARBs. Like ACEIs, ARBs target the renin-angiotensin system. However, they are more selective, with no effect on bradykinin. JNC-8 guidelines recommend that clinicians prescribe either an ACEI or an ARB for all patients older than age 18 with a history of CKD, regardless of ethnicity. This recommendation is based on evidence of improved renal outcomes with these medications. (Evidence supporting the use of an ACEI or ARB in patients with cardiovascular disease and CKD is lacking.)

Side effects of ARBs may include hypotension (more common with ARBs than ACEIs), hyperkalemia, syncope, anaphylactic reactions, angioedema, and increased serum creatinine levels. Cough, when present, may be less pronounced with ARBs than ACEIs. Anaphylactic reactions are more likely in hemodialysis patients who are dialyzed with a synthetic noncellulose membrane, which is highly permeable and causes increased kinin production.

Like ACEIs, ARBs can cause acute renal failure. With ACEIs, this is more likely to occur in patients with bilateral renal artery stenosis. In patients receiving ARBs, acute renal failure may result from extreme volume depletion. Olmesartan may cause a sprue-like enteropathy that develops months or years after drug initiation. Hallmarks of this condition include marked diarrhea with weight loss and intestinal biopsy that reveals villous atrophy. Signs and symptoms resolve with drug discontinuation but recur if the drug is reintroduced.

Nursing actions for patients receiving ARBs include the following:

- Monitor for bone marrow suppression.
- Assess for orthostatic hypotension.
- Evaluate fluid and electrolyte status.
- Check for signs and symptoms of angioedema.
- Know that ARBs are contraindicated in pregnant patients because they can cause fetal birth defects and fetal death.

Later-line antihypertensives

According to JNC-8 guidelines, second-and third-line antihypertensive therapy includes higher doses or combinations of thiazide-type diuretics, CCBs, ACEIs, and ARBs.

JNC-8 classifies beta blockers as a later-line alternative, due to an increased rate of cardiovascular death, stroke, and myocardial infarction. Other later-line drugs include alpha blockers (which may lead to worse cerebrovascular and cardiovascular outcomes), direct vasodilators, aldosterone antagonists, and peripherally acting adrenergic antagonists.

Going where the evidence leads us

Hypertension is a preventable contributor to cardiovascular disease, renal disease, and neurovascular disease—often with devastating results. Patient awareness of BP readings and their meaning can go a long way toward making patients active participants in their health care. Evidence-based lifestyle modifications, including diet, physical activity, sodium reduction, and moderation of alcohol use, significantly decrease BP and help prevent complications. Nurses can play an important role in educating and encouraging patients to make necessary lifestyle changes.

JNC-8 recommendations for pharmacologic treatment of hypertension are evidence-based guidelines. Recommended antihypertensives have demonstrated effectiveness and safety in lowering BP and reducing complications of hypertension. Through a combination of lifestyle modifications and pharmacologic treatment, patients can work together with healthcare providers to reduce BP to normal levels and optimize their well-being for many years. ✯

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POST-TEST • What goes up must come down: Hypertension and the JNC-8 guidelines

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Please mark the correct answer online.

1. Your patient's blood pressure is 135/88 mm Hg, which places him in which stage of hypertension?

a. Prehypertension
b. Stage 1 hypertension
c. Stage 2 hypertension
d. Hypertensive crisis

2. You check your patient in acute kidney failure and find her blood pressure is 180/124 mm Hg. This places her in which stage of hypertension?

a. Prehypertension
b. Stage 1 hypertension
c. Stage 2 hypertension
d. Hypertensive crisis

3. Which of the following hypertension risk factors cannot be modified?

a. High-sodium diet
b. Both parents with hypertension
c. Lack of physical activity
d. Excessive alcohol intake

4. Which statement about cardiovascular complications of hypertension is correct?

a. Right ventricular hypertrophy is a common complication.
b. Patients with such complications commonly have a shortened QT interval.
c. Left ventricular hypertrophy increases the likelihood of myocardial ischemia.
d. Patients who experience myocardial infarction rarely have hypertension.

5. Which statement about neurovascular complications of hypertension is correct?

a. Hypertension is the most common cause of nontraumatic intracerebral hemorrhage in adults.
b. Hypertension typically is not a preventable cause of ischemic stroke in adults.
c. Vessels involved in a nontraumatic intracerebral hemorrhage are the recessive arteries.
d. The carotid arteries and aortic arch are not affected by the presence of hypertension.

6. Which statement about hypertension and African Americans is correct?

a. Hypertension in African Americans tends to start at an older age than in other racial groups.
b. Hypertensive African Americans have a fourfold risk of fatal stroke.
c. Hypertensive African Americans have a 2.2 greater risk of end-stage renal disease.
d. African Americans have the highest prevalence of hypertension in the world.

7. The blood pressure goal for the general population younger than age 60 is:

a. systolic below 135 mm Hg, diastolic below 80 mm Hg.
b. systolic below 140 mm Hg, diastolic below 90 mm Hg.
c. systolic below 140 mm Hg, diastolic below 80 mm Hg.
d. systolic below 150 mm Hg, diastolic below 90 mm Hg.

8. Which statement about diet and blood pressure is correct?

a. The DASH diet (Dietary Approaches to Stop Hypertension) is low in sweets, red meat, and saturated fats.
b. The DASH diet can lower systolic blood pressure an average of 15 mm.
c. Current recommendations for sodium intake range from 2,000 to 5,000 mg/day.
d. Current recommendations for sodium intake range from 1,000 to 2,000 mg/day.

9. Which of the following is a first-line antihypertensive drug category?

a. Aldosterone antagonists
b. Direct vasodilators
c. Angiotensin-converting enzyme inhibitors
d. Beta blockers

10. The nurse practitioner orders a calcium channel blocker for your patient with hypertension that hasn't responded to lifestyle changes. Which statement about this class of drugs is accurate?

a. One category of calcium channel blockers is dihydropyridines, which are potent vasoconstrictors.
b. Drinking grapefruit juice can increase medication levels in the blood, causing a more pronounced antihypertensive effect.
c. Drinking grapefruit juice can decrease medication levels in the blood, causing a decreased antihypertensive effect.
d. One category of calcium channel blockers is non-dihydropyridines, which are potent vasodilators.

11. Which statement about angiotensin-converting enzyme inhibitors is true?

a. They lower blood pressure primarily by reducing angiotensin II.
b. They adversely affect cholesterol and glucose levels.
c. They are not prescribed for the treatment of heart failure.
d. They increase breakdown of kinins in the bloodstream.

12. The physician has ordered captopril for your patient with hypertension. You know that this drug can cause:

a. neutropenia.
b. neturophilia.
c. thrombocythemia.
d. polycythemia.

13. Which statement about angiotensin II receptor blockers is correct?

a. They can cause paradoxical hypertension.
b. They are not contraindicated in pregnant patients.
c. They affect bradykinin levels.
d. They can cause acute renal failure.

14. An example of later-line drug therapy for hypertension is:

a. irbesartan.
b. diltiazem ER.
c. furosemide.
d. lisinopril.