

Relevance to Population: Hypertension or high blood pressure affects nearly 1 in 3 adults in the United States.¹ More men than women have hypertension until about age 45. From age 45 to age 54, the percentages of men and women with hypertension are similar. After that, a much higher percentage of women have hypertension than do men.² Information from NHANES data 2005-2008 showed that of those adults age 18 and older with hypertension, and taking medication, 28.3% did not have it controlled.¹³ Nonpersistence of anti-hypertensive medications (complete discontinuation of therapy prematurely) has decreased overall, but remains significantly higher in certain U.S. populations, including younger people (12 times higher in people < 30 years old), men, Hispanics, low income, those with no health insurance, and those with no doctor visit within the past year. About three-fourths of Americans with cardiovascular conditions also have hypertension. In 2005-2006, an additional 28% of U.S. adults had prehypertension (systolic BP 120-139 mm Hg or diastolic BP 80-89 mm Hg) and were not treated with medication.³ These adults are at twice the risk to develop hypertension than those with lower values.⁴

Hypertension Definition: The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) defines hypertension according to numerical BP values (Table 1). The American Society of Hypertension (ASH) has proposed a revised definition that is unpublished and under review by the National Heart, Lung, and Blood Institute (NHLBI). It characterizes hypertension as a progressive disease with many causes that result in both functional and structural changes to the heart and vascular system. It emphasizes a continuous relationship between blood pressure and overall cardiovascular risk. The goal is to improve how physicians conceptualize, diagnose, and treat hypertension. It is intended to raise physician consciousness about early and aggressive management of hypertension in order to reduce rates of hypertension and related end-organ disease such as heart attack, stroke, and renal failure.⁴

Population Covered by Guideline: All adult members age 18 and over with hypertension.

Clinical Indicators Measured by Piedmont WellStar HealthPlans, Inc.:

1. The percentage of members with a diagnosis of hypertension and whose blood pressure was adequately controlled <140/90 during the measurement year. HEDIS[®]
2. The percentage of members with a diagnosis of hypertension and diabetes whose blood pressure was adequately controlled <130/80 during the measurement year. HEDIS[®]
3. The percentage of members with a diagnosis of hypertension (excluding those with renal failure, diabetes, and gout) that are treated with a diuretic.

Hypertension Management:

The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure, U.S. Department of Health and Human Resources, National Institutes of Health, National Heart, Lung, and Blood Institute, National High Blood Pressure Education Program, December 2003. The current guideline is available at <http://www.nhlbi.nih.gov/guidelines/hypertension/express.pdf>.

(With this or any other clinical guideline, the physician's judgment remains paramount)

Key Points of the Guideline (JNC 7):

- Starting at a BP of 115/75, the risk of cardiovascular disease doubles with each systolic/diastolic BP increment of 20/10 mmHg.
- Patients with BP readings 120-139/80-89 mmHg are considered prehypertensive and require health-promoting lifestyle modifications and aggressive risk factor management to prevent cardiovascular disease.
- Most patients will require 2 or more antihypertensive agents to reach BP goals recommended by current clinical guidelines (< 140/90 mmHg or < 130/80 mmHg for patients with diabetes* or chronic kidney disease^{4,5}).

* Evidence from the ACCORD and INVEST trials is causing reconsideration of BP goals in diabetes due to



lack of demonstrated CV benefits and potential for harm with BP goals <120 and <130 mmHg systolic. Less stringent BP control (systolic 130-139) may be appropriate for individual patients based on response to therapy, tolerance to medication side effects, and/or co-morbid coronary artery disease.^{6,7}

- If BP >20/10mmHg above goal, consider initiating therapy with 2 agents, one of which should be a thiazide- type diuretic.⁸
- For management of members with resistant hypertension (the failure to reach goal), the use of 3-4 drug combination therapy may be required. Look for other factors, including volume overload, improper blood pressure measurement, obesity, and secondary causes of hypertension (Table 2).⁴
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Certain medications can interfere with BP control ⁹:

Predictors for poor BP control, resistant hypertension and/or the need for more drugs to achieve control include ⁹:

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| <ul style="list-style-type: none"> ➤ Chronic kidney disease defined as creatinine \geq 1.5 mg/dL ➤ Older age, especially > 75 years ➤ LVH ➤ Obesity with BMI \geq 30 kg/m² ➤ Higher baseline BP ➤ Diabetes and hypertension ➤ African American race ➤ Female gender ➤ Excess dietary salt ➤ Heavy alcohol intake | <ul style="list-style-type: none"> ➤ NSAIDS (COX I and II inhibitors) ➤ Sympathomimetic agents (decongestants, diet pills, cocaine) ➤ Stimulants (methylphenidate, dexamethylphenidate, dextroamphetamine, amphetamine, methamphetamine, modafinil) ➤ Alcohol ➤ Oral contraceptives ➤ Cyclosporine and Tacrolimus ➤ Erythropoietin ➤ Natural licorice ➤ Herbal compounds including ephedra and ma huang |
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- Agents that block the renin-angiotensin system are associated with a lower incidence of new-onset diabetes.⁵
- Optimal BP control requires patient motivation, which improves when the patient has positive experiences and trust in an empathetic physician.

Patient Evaluation:

1. To assess lifestyle and identify other cardiovascular risk factors or concomitant disorders that may affect prognosis and guide treatment.
2. To reveal identifiable secondary causes of high blood pressure (Table 2).
3. To assess the presence or absence of target organ damage and CVD.

Cardiovascular Disease History ⁴	Physical Examination ⁴	Laboratory Tests and Other Diagnostic Procedures ⁴
Identify Cardiovascular Risk Factors: <ul style="list-style-type: none"> • Hypertension • Cigarette smoking: Assess for tobacco/nicotine use. • Obesity (BMI \geq 30 kg/m²) • Physical inactivity • Dyslipidemia • Diabetes mellitus • Microalbuminuria or estimated GFR < 60 ml/min. • Age: older than 55 for men, 65 for women • Family history of premature cardiovascular disease: men under age 55, women under age 65 • Evidence of target organ damage: <ul style="list-style-type: none"> ○ Left ventricular hypertrophy 	<ul style="list-style-type: none"> • Appropriate measurement of BP: Take 2 BP readings, 5 minutes apart, in the sitting position. Confirm elevated BP readings with measurement in the contralateral arm. • Fundoscopic exam to rule out hypertensive retinopathy • Calculation of the BMI • Waist measurement • Auscultation for carotid, abdominal, and femoral bruits • Palpation of the thyroid gland • Thorough examination of the heart and lungs • Examination of the abdomen for enlarged kidneys, masses, and abnormal aortic pulsation • Palpation of the lower extremities for edema and pulses • Neurological assessment 	Routine laboratory test recommended before initiating therapy: <ul style="list-style-type: none"> • Electrocardiogram • Urinalysis • Blood glucose, hematocrit • Serum potassium, creatinine or corresponding estimated GFR, and calcium • Fasting lipid profile Optional tests include: <ul style="list-style-type: none"> • Urinary albumin excretion or albumin/creatinine ratio More extensive tests for identifiable causes not indicated generally unless BP control is not achieved.



<ul style="list-style-type: none"> ○ Coronary artery disease/ coronary revascularization ○ Congestive heart failure ○ Stroke/Transient ischemic attack ○ Chronic kidney disease ○ Peripheral artery disease ○ Hypertensive retinopathy 	<p>Presence of hypertension, elevated BMI, waist measurement > 40” in men and 35” in women, and laboratory evidence of diabetes, dyslipidemia, and insulin resistance may be indicative of metabolic syndrome.</p> <p>Follow-up: Once BP measurements are at goal and stable, follow-up visits may be performed at 3 to 6 month intervals. Serum potassium and creatinine should be monitored at least 1 to 2 times/year.</p>
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BP Classification	SBP (mmHG)	DBP mmHG	Lifestyle Modification	Initial Drug Therapy	
				Without Compelling Indication	With Compelling Indications (Table 2)
Normal	< 120	and < 80	Encourage	Aggressively manage all other cardiovascular risk factors.	
Prehypertension	120-139	or 80-90	Yes	No antihypertensive drug therapy indicated; aggressively manage all other cardiovascular risk factors.	Use appropriate drugs for compelling indications; goal BP for diabetes and chronic kidney disease is < 130/80 and ≤ 120/75 when severe proteinuria exists.
Stage 1 Hypertension	140-159	or 90-99	Yes	Thiazide-type diuretics will be effective for most patients. Consider combination therapy with ACEI/ARB, CCB, BB as necessary to achieve optimal control.	Use drugs for compelling indications (table 2); combine with other antihypertensive agents as necessary to achieve optimal control.
Stage 2 Hypertension	≥ 160	or ≥ 100	Yes	Two-drug combination will be required initially for most patients; many may require 3-4 drug combinations to achieve optimal control (thiazide diuretic and ACEI or ARB and/or CCB and/or BB).*	Include antihypertensive drugs specific for compelling indications as part of a combined antihypertensive regimen to achieve optimal BP control (Table 2): thiazides, ACE or ARB and/or CCB and/or BB.

* Combination Antihypertensive Therapy:

- Rules of 3:¹⁴
 - 3 Drugs to achieve BP goal
 - 3 months to achieve BP goal
 - 3 behaviors (activity, diet, alcohol and tobacco control)
 - 3 partners (patient, family, provider)
- Benefits of Combination Antihypertensive Therapy:¹⁵
 - Achieve BP goal more effectively and more quickly than with monotherapy
 - Decreased side effects by using smaller doses of more than one drug and the effects of one drug may counteract side effects of another (e.g., ACEI may offset the hypokalemia of thiazides)
 - Fixed dose combination drugs can increase compliance by reducing dosing frequency

If not at BP goal in 6 months, consider and address medication non-compliance and/or secondary causes of hypertension (Table 2.)¹⁶

Table 2 - Secondary identifiable and potentially reversible causes of hypertension: ⁴	
<ul style="list-style-type: none"> • Sleep disordered breathing (SDB): A significant percentage of patients with poorly controlled hypertension despite adequate doses of 2-3 drugs will have SDB; consider referring these patients for a sleep study. • Drug-induced: alcohol, herbal agents, illicit drug use, sympathomimetic amines, NSAIDs, adrenal or anabolic steroids • Chronic kidney disease • Primary hyperaldosteronism • Renovascular disease (renal artery stenosis) • Cushing's syndrome • Pheochromocytoma • Coarctation of the aorta • Thyroid or parathyroid disease 	

Table 3 - Clinical trial and guideline basis for compelling indications for individual drug classes ⁴							
	Recommended Drugs						Clinical Trial Evidence
	Diuretic	BB	ACEI	ARB	CCB	AtDoANT	
Compelling Indications Heart failure	•	•	•	•		•	ACC/AHA Heart Failure Guideline, MERIT-HF, COPERNICUS, CIBIS, SOLVD, AIRE, TRACE, ValHEFT, RALES
Post myocardial infarction		•	•			•	ACC/AHA Post-MI Guideline, BHAT, SAVE, Capricorn, EPHEBUS
High coronary disease risk	•	•	•		•		ALLHAT, HOPE, ANBP2, LIFE, CONVINCe
Diabetes	•	•	•	•	•		NKF-ADA Guideline, UKPDS, ALLHAT
Chronic kidney disease			•‡	•‡			NKF Guideline, Captopril Trial, RENAAL, IDNT, REIN, AASK
Recurrent stroke prevention	•		•				PROGRESS
<p>Demonstrated favorable effects on the progression of diabetic and non-diabetic renal disease. Discontinue with advanced renal disease (GFR<30 ml/min) corresponding to a serum creatinine of 2.5-3.0 mg/dl. Do not use in pregnant women. ACEI-induced angioedema is 2-4 times more likely to occur in African Americans than other racial groups.</p>							
Goals of Therapy				Adherence to Therapy			
<ul style="list-style-type: none"> • Reduction of cardiovascular and renal morbidity and mortality • Treating SBP and DBP to targets that are <140/90 mmHg • In patients with hypertension and diabetes or renal disease, the BP goal is <130/80 mmHg and ≤ 120/75 mmHg in patients with type 2 diabetes and severe proteinuria 				<ul style="list-style-type: none"> • Clinician empathy increases patient trust, motivation, and adherence to therapy. • Physicians should consider their patients' cultural beliefs and individual attitudes in formulating therapy. 			



Table 4 ⁴		
Principles of Lifestyle Modification:		
<ul style="list-style-type: none"> • Encourage healthy lifestyles for all individuals. • Prescribe lifestyle changes for all patients with prehypertension and hypertension. • Components of lifestyle modifications include weight reduction, DASH eating plan, and moderation of alcohol consumption. • The 2005 Dietary Guidelines recommendation is not to exceed 1500 mg/day of dietary sodium for people w/HTN, for African Americans, and for middle aged and older adults. Restrict dietary sodium to less than the 2300 mg per day (1 level teaspoon of table salt) recommended for general population. 		
Modification	Recommendation	Approximate SBP Reduction (Range)
Weight reduction	Maintain normal body weight (BMI 18.5-24.9 kg/m ²).	5–20 mmHg/10kg
Adopt DASH eating plan	Consume a diet rich in fruits, vegetables, and low-fat dairy products with a reduced content of saturated and total fat. Insufficient potassium may be an etiologic factor in hypertension. Potassium intake of ≥ 3.5g/day recommended in the absence of renal insufficiency.	8–14 mmHg
Dietary sodium reduction	Reduce dietary sodium intake to less than 2300 mg per day (1 level teaspoon of table salt).	2–8 mmHg
Aerobic physical activity	Regular aerobic physical activity (e.g., brisk walking) at least 30 minutes per day, most days of the week.	4–9 mmHg
Moderation of alcohol consumption	Limit consumption to no more than 2 drinks (1 oz or 30 ml ethanol; e.g., 24 oz beer, 10 oz wine, or 3 oz 80-proof whiskey) per day in most men and to no more than 1 drink per day in women and lighter weight persons.	2–4 mmHg

**ALGORITHM FOR TREATMENT OF
HYPERTENSION ⁴**

Begin or Continue Lifestyle Modifications



Not at goal blood pressure (<140/90 mmHg or <130/80 mmHg for members with diabetes* or chronic kidney failure)
 * Less stringent BP control (systolic 130-139) may be appropriate for individual patients based on response to therapy, tolerance to medication side effects, and/or co-morbid coronary artery disease.^{6,7}



Initial Drug Choices			
Without Compelling Indications		Compelling Indications (Table 5)	
Stage 1 Hypertension SBP 140-159 or DBP 90-99 Thiazide-type diuretics for most. If goal not achieved with a single agent, then combine therapy with an ACEI/ARB, CCB, and/or BB.	Stage 2 Hypertension SBP ≥ 160 or DBP ≥ 100 Initiate 2 drug combination for most (usually a thiazide-type diuretic and ACEI, or ARB, CCB, and/or BB). 3-4+ drugs may be needed to reach goal BP.	Drugs for the compelling indications	
		Heart failure	THIAZ, BB, ACE1, ARB, ALDO ANT
		Post MI	BB, ACE1, ALDO ANT
		High CVD risk	THIAZ, BB, ACE1, CCB
		Diabetes	THIAZ, BB, ACE1, ARB, CCB
		Chronic kidney disease	ACE1, ARB
		Recurrent stroke prevention	THIAZ, ACE1
Key: Thiaz = thiazide diuretic ACE1 = angiotensin converting enzyme inhibitor ARB = angiotensin receptor blocker BB = beta-blocker CCB = calcium channel blocker ALDO = aldosterone antagonist			

NOT AT GOAL BLOOD PRESSURE



- Assess and address potential medication non-compliance
- Identify and reverse contributing lifestyle factors (obesity, physical inactivity, excessive alcohol ingestion, high salt, low fiber diet)
- Discontinue or minimize interfering substances (NSAIDs, sympathomimetics, stimulants, oral contraceptives, licorice, ephedra)
- Reconsider secondary causes of HTN, such as renal artery stenosis or sleep disordered breathing.* See “identifiable causes of hypertension” (Table 3).
- Optimize dosages or add additional drugs until goal blood pressure is achieved.
- Reassess diuretic dose in relation to level of renal function.
- Multidrug combinations, 3+ (with a diuretic) may be required.
- Consider consultation with hypertension specialist.



Clinical practice guidelines are designed to assist clinicians by providing a framework for the evaluation and treatment of patients. The hypertension clinical practice guideline is based on the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, U.S. Department of Health and Human Resources, National Institutes of Health, National Heart, Lung, and Blood Institute, National High Blood Pressure Education Program, December 2003. The current guideline is available at

<http://www.nhlbi.nih.gov/guidelines/hypertension/express.pdf>.⁴

Additional Resources for Piedmont WellStar HealthPlans, Inc. Members

- **MyHealth Advice Line** is staffed by experienced Registered Nurses and is available 24/7 to provide telephone support to members. Call 855-514-3679.
- **Online** interactive preventive health programs and resources are available in partnership with WebMD by logging in at www.pwplans.org/individuals.

Scientific Evidence Sources:

1. Fields LE, Burt VL, Cutler JA, et al. The burden of adult hypertension in the United States 1999 to 2000: a rising tide. *Hypertension*;44:398–404, 2004.
<http://hyper.ahajournals.org/content/44/4/398.full.pdf+html>
2. National Center for Health Statistics. *Health, United States, 2011*. With Special Feature on Socioeconomic Status and Health. Hyattsville, MD: National Center for Health Statistics; 2012. Available at: <http://www.cdc.gov/nchs/data/hus/11.pdf>
3. Ostchega Y, Yoon SS, Hughes J, Louis T. Hypertension Awareness, Treatment, and Control – Continued Disparities in Adults: United States, 2005-2006. NCHS data brief no Hyattsville, MD: National Center for Health Statistics. 2008. <http://www.cdc.gov/nchs/data/databriefs/db03.pdf>
4. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure. U.S. Department of Health and Human Resources. National Institutes of Health. National Heart, Lung, and Blood Institute. National High Blood Pressure Education Program. December 2003. <http://www.nhlbi.nih.gov/guidelines/hypertension/express.pdf>.
5. Nash, MD, DT. Rationale for Combination Therapy in Hypertension Management: Focus on Angiotensin Receptor Blockers and Thiazide Diuretics. *Southern Medical Journal* Vol. 100 No.4:386-391, 2007.
http://journals.lww.com/smajournalonline/Fulltext/2007/04000/Rationale_for_Combination_Therapy_in_Hypertension.14.aspx
6. American Diabetes Association. “Standards of Medical Care in Diabetes—2012.” *Diabetes Care*, January 2012; 35(S1):S4-S10.
http://care.diabetesjournals.org/content/35/Supplement_1/S4.full.pdf+html
7. Cooper-DeHoff RM et al. “Tight Blood Pressure Control and Cardiovascular Outcomes Among Hypertensive Patients With Diabetes and Coronary Artery Disease.” *JAMA*, July 7, 2010; 304(1):61-68.
<http://jama.ama-assn.org/content/304/1/61.full.pdf+html>
8. Cheung BM, Ong KL, Man YB, et al. Prevalence, awareness, treatment, and control of hypertension: United States National Health and Nutrition Examination Survey 2001-2002. *Journal of Clinical Hypertension (Greenwich)*; 8:93–98, 2006. <http://hyper.ahajournals.org/content/49/1/69>
9. Calhoun DA, Jones, D, Textor, S, et al. Resistant Hypertension: Diagnosis, Evaluation, and Treatment: A Scientific Statement from the American Heart Association Professional Education Committee of the Council for High Blood Pressure Research. *Hypertension*. 2008;51:1403-1419
<http://hyper.ahajournals.org/content/51/6/1403>.
10. Wong ND, Lopez VA, L'Italien G, et al. Inadequate control of hypertension in U.S. adults with cardiovascular disease comorbidities in 2003-2004. *Arch Intern Med*. 167:2431-2436, 2007.
<http://archinte.ama-assn.org/cgi/reprint/167/22/2431>
11. Bautista LE. Predictors of Persistence With Antihypertensive Therapy: Results From the NHANES. *Am J Hypertens*. Published online ahead of print January 10, 2008.
<http://www.nature.com/ajh/journal/v21/n2/pdf/ajh200733a.pdf>
12. AACE Hypertension Task Force. American Association of Clinical Endocrinologists medical guidelines for clinical practice for the diagnosis and treatment of hypertension. *Endocr Pract*. 12(2):193-222, Mar-Apr 2006. <https://www.aace.com/files/hypertension-guidelines.pdf>
13. Centers for Disease Control and Prevention. Control of Hypertension Among Adults – National Health and Nutrition Examination Survey, United States, 2005-2008. *MMWR* 2012;61(Suppl; June 15, 2012):19-25. <http://www.cdc.gov/mmwr/pdf/other/su6102.pdf>
14. Levine D et al. “Getting Blood Pressure to Goal.” CME Presentation sponsored by the National Kidney Foundation of Michigan and the Michigan Department of Community Health.
www.kidney.org/site/306/pdf/GettingBPtoGoalpresentation.ppt
15. Arauz-Pacheco C et al. “The Treatment of Hypertension in Adult Patients With Diabetes.” *Diabetes Care*, 2002 January;25(1):134-147.
16. U.S. Department of Health and Human Services. JNC 7 Express, December 2003, NIH Publication No. 03- 5233.