

## Diagnosis and Management of Hypertension in Adults and Children

### Classification of Blood Pressure for Adults

The table below provides a classification of blood pressure (BP) for adults ages 18 and older. The classification is based on the average of two or more properly measured, seated BP readings on each of two or more office visits. In contrast to the classification provided in the Sixth Report of the Joint National Committee on Blood Pressure (JNC 6), a new category designated prehypertension has been added, and stages 2 and 3 hypertension have been combined. Patients with prehypertension are at increased risk for progression to hypertension; those in the 130–139/80–89 mmHg BP range are at twice the risk to develop hypertension as those with lower values.

### Classification and Management of Blood Pressure for Adults Aged 18 Years or Older

Evaluation				Management*		
BP Classification	Systolic BP, mm Hg*		Diastolic BP, mm Hg*	Lifestyle Modification	Initial Drug Therapy	
					Without Compelling Indication	With Compelling Indications**
Normal	<120	and	<80	Encourage		
Prehypertension	120-139	or	80-89	Yes	No antihypertensive drug indicated	Drug(s) for the compelling indications***
Stage 1 hypertension	140-159	or	90-99	Yes	Thiazide-type diuretics for most; may consider ACE inhibitor, ARB, beta-blocker, CCB, or combination	Drug(s) for the compelling indications Other antihypertensive drugs (diuretics, ACE inhibitor, ARB, beta-blocker, CCB) as needed
Stage 2 hypertension	≥160	or	≥100	Yes	2-Drug combination for most (usually thiazide-type diuretic and ACE inhibitor or ARB or beta-blocker or CCB)****	Drug(s) for the compelling indications Other antihypertensive drugs (diuretics, ACE inhibitor, ARB, beta-blocker, CCB) as needed

Abbreviations: ACE, angiotensin-converting enzyme; ARB, angiotensin-receptor blocker, BP, blood pressure; CCB, calcium channel blocker

\* Treatment determined by highest BP category.

\*\*\* **Treat patients with chronic kidney disease or diabetes to BP goal of less than 130/80 mm Hg.**

\*\*\*\* Initial combined therapy should be used cautiously in those at risk for orthostatic hypotension.

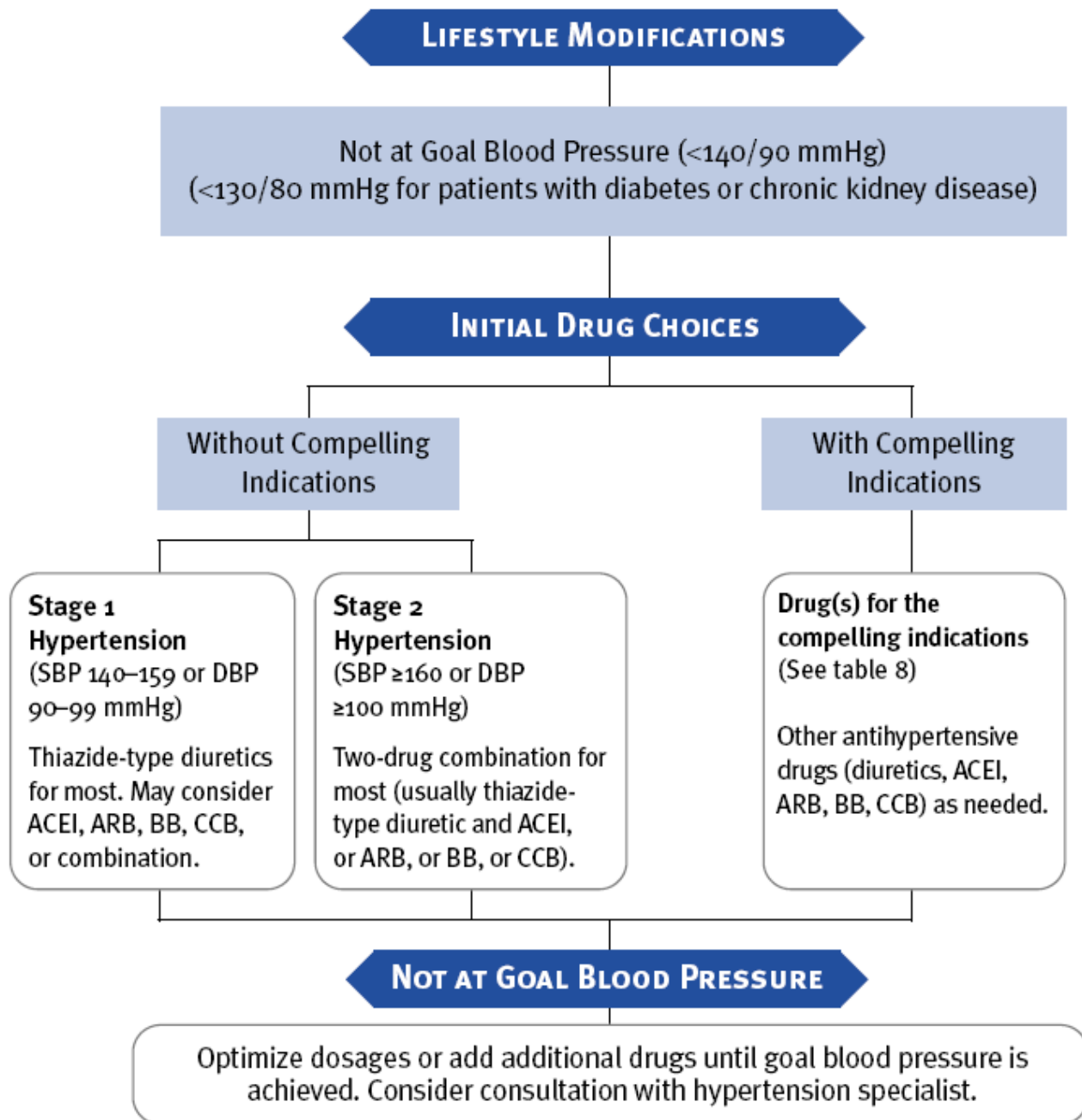
### Key Messages

- In persons older than 50 years, systolic blood pressure greater than 140 mmHg is a much more important cardiovascular disease (CVD) risk factor than diastolic blood pressure.
- The risk of CVD beginning at 115/75 mmHg doubles with each increment of 20/10 mmHg; individuals who are normotensive at age 55 have a 90 percent lifetime risk for developing hypertension.
- Individuals with a systolic blood pressure of 120–139 mmHg or a diastolic blood pressure of 80–89 mmHg should be considered as prehypertensive and require health-promoting lifestyle modifications to prevent CVD.
- Thiazide-type diuretics should be used in drug treatment for most patients with uncomplicated hypertension, either alone or combined with drugs from other classes. Certain high-risk conditions are compelling indications for the initial use of other antihypertensive drug classes (angiotensin converting enzyme inhibitors, angiotensin receptor blockers, beta-blockers, calcium channel blockers).
- Most patients with hypertension will require two or more antihypertensive medications to achieve goal blood pressure (<140/90 mmHg, or <130/80 mmHg for patients with diabetes or chronic kidney disease).
- If blood pressure is >20/10 mmHg above goal blood pressure, consideration should be given to initiating therapy with two agents, one of which usually should be a thiazide-type diuretic.
- The most effective therapy prescribed by the most careful clinician will control hypertension only if patients are motivated. Motivation improves when patients have positive experiences with, and trust in, the clinician. Empathy builds trust and is a potent motivator.

Adapted from The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC VII). 7 May 2003 and The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents NIH Publication No. 05-5267 Originally printed September 1996 (96-3790) Revised May 2005. Quality and Peer Review Advisory Committee (QPRAC) Adopted: 07/20/00 QPRAC Revision/Approval Date: 12/01, 12/03 Clinical Quality Improvement Committee (CQIC) Revision/Approval Date: 6/05, 5/06, 10/07, 11/08. Quality Improvement Committee (QIC) Review Approval Date: 4/09

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**Figure 1. Algorithm for treatment of hypertension**



DBP, diastolic blood pressure; SBP, systolic blood pressure.

Drug abbreviations: ACEI, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker; BB, beta-blocker; CCB, calcium channel blocker.

Adult Algorithm from The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7 Express) December 2003

#### Compelling Indications

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Table 8 describes compelling indications that require certain antihypertensive drug classes for high-risk conditions. The drug selections for these compelling indications are based on favorable outcome data from clinical trials. A combination of agents may be required. Other management considerations include medications already in use, tolerability, and desired BP targets. In many cases, specialist consultation may be indicated.

**Table 8. Clinical trial and guideline basis for compelling indications for individual drug classes**

COMPELLING INDICATION*	RECOMMENDED DRUGS†						CLINICAL TRIAL BASIS‡
	DIURETIC	BB	ACEI	ARB	CCB	ALDO ANT	
Heart failure	•	•	•	•		•	ACC/AHA Heart Failure Guideline, <sup>40</sup> MERIT-HF, <sup>41</sup> COPERNICUS, <sup>42</sup> CIBIS, <sup>43</sup> SOLVD, <sup>44</sup> AIRE, <sup>45</sup> TRACE, <sup>46</sup> ValHEFT, <sup>47</sup> RALES <sup>48</sup>
Postmyocardial infarction		•	•			•	ACC/AHA Post-MI Guideline, <sup>49</sup> BHAT, <sup>50</sup> SAVE, <sup>51</sup> Capricorn, <sup>52</sup> EPHEBUS <sup>53</sup>
High coronary disease risk	•	•	•		•		ALLHAT, <sup>33</sup> HOPE, <sup>34</sup> ANBP2, <sup>36</sup> LIFE, <sup>32</sup> CONVINCED <sup>31</sup>
Diabetes	•	•	•	•	•		NKF-ADA Guideline, <sup>21,22</sup> UKPDS, <sup>54</sup> ALLHAT <sup>33</sup>
Chronic kidney disease			•	•			NKF Guideline, <sup>22</sup> Captopril Trial, <sup>55</sup> RENAAL, <sup>56</sup> IDNT, <sup>57</sup> REIN, <sup>58</sup> AASK <sup>59</sup>
Recurrent stroke prevention	•		•				PROGRESS <sup>35</sup>

\* Compelling indications for antihypertensive drugs are based on benefits from outcome studies or existing clinical guidelines; the compelling indication is managed in parallel with the BP.

† Drug abbreviations: ACEI, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker; Aldo ANT, aldosterone antagonist; BB, beta-blocker; CCB, calcium channel blocker.

‡ Conditions for which clinical trials demonstrate benefit of specific classes of antihypertensive drugs.

Table 8 from The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7 Express) December 2003

## Improving Hypertension Control

### Adherence to Regimens

Behavioral models suggest that the most effective therapy prescribed by the most careful clinician will control hypertension only if the patient is motivated to take the prescribed medication and to establish and maintain a health-promoting lifestyle. Motivation improves when patients have positive experiences with and trust in their clinicians. Empathy both builds trust and is a potent motivator.<sup>75</sup>

Patient attitudes are greatly influenced by cultural differences, beliefs, and previous experiences with the health care system.<sup>76</sup> These attitudes must be understood if the clinician is to build trust and increase communication with patients and families.<sup>20</sup>

Failure to titrate or combine medications, despite knowing the patient is not at goal BP, represents clinical inertia and must be overcome.<sup>77</sup> Decision support systems (i.e., electronic and paper), flow sheets, feedback reminders, and involvement of nurse clinicians and pharmacists can be helpful.<sup>78</sup>

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The clinician and the patient must agree upon BP goals. A patient-centered strategy to achieve the goal and an estimation of the time needed to reach goal are important.<sup>79</sup> When BP is above goal, alterations in the plan should be documented. BP self-monitoring can also be useful. Patients' nonadherence to therapy is increased by misunderstanding of the condition or treatment, denial of illness because of lack of symptoms or perception of drugs as symbols of ill health, lack of patient involvement in the care plan, or unexpected adverse effects of medications. The patient should be made to feel comfortable in telling the clinician all concerns and fears of unexpected or disturbing drug reactions.

The cost of medications and the complexity of care (i.e., transportation, patient difficulty with polypharmacy, difficulty in scheduling appointments, and life's competing demands) are additional barriers that must be overcome to achieve goal BP.

All members of the health care team (e.g., physicians, nurse case managers, and other nurses, physician assistants, pharmacists, dentists, registered dietitians, optometrists, and podiatrists) must work together to influence and reinforce instructions to improve patients' lifestyles and BP control.<sup>80</sup>

### Classification of Hypertension in Children and Adolescents, With Measurement Frequency and Therapy Recommendations

	SBP or DBP Percentile <sup>1</sup>	Frequency of BP Measurement	Therapeutic Lifestyle Changes	Pharmacologic Therapy
<b>Normal</b>	<90th	Recheck at next scheduled physical examination	Encourage healthy diet, sleep, and physical activity	–
<b>Prehypertension</b>	90th to <95th or if BP exceeds 120/80 even if <90th percentile up to <95th percentile <sup>2</sup>	Recheck in 6 mo	Weight-management counseling if overweight; introduce physical activity and diet management <sup>3</sup>	None unless compelling indications such as chronic kidney disease, diabetes mellitus, heart failure, or LVH exist
<b>Stage 1 hypertension</b>	95th-99th percentile plus 5 mm Hg	Recheck in 1-2 wk or sooner if the patient is symptomatic; if persistently elevated on 2 additional occasions, evaluate or refer to source of care within 1 mo	Weight-management counseling if overweight; introduce physical activity and diet management <sup>3</sup>	Initiate therapy based on indications in Table 6 or if compelling indications (as shown above) exist
<b>Stage 2 hypertension</b>	>99th percentile plus 5 mm Hg	Evaluate or refer to source of care within 1 wk or immediately if the patient is symptomatic	Weight-management counseling if overweight; introduce physical activity and diet management <sup>3</sup>	Initiate therapy <sup>4</sup>

<sup>1</sup>For gender, age, and height measured on at least 3 separate occasions; if systolic and diastolic categories are different, categorize by the higher value.

<sup>2</sup>This occurs typically at 12 years old for SBP and at 16 years old for DBP.

<sup>3</sup>Parents and children trying to modify the eating plan to the Dietary Approaches to Stop Hypertension Study eating plan could benefit from consultation with a registered or licensed nutritionist to get them started.

<sup>4</sup>More than 1 drug may be required.

#### Definition of Hypertension in Children and Adolescents

Hypertension is defined as average SBP and/or DBP that is greater than or equal to the 95th percentile for sex, age, and height on three or more occasions.

- Prehypertension in children is defined as average SBP or DBP levels that are greater than or equal to the 90th percentile, but less than the 95th percentile.
- As with adults, adolescents with BP levels greater than or equal to 120/80 mmHg should be considered prehypertensive.
- A patient with BP levels above the 95th percentile in a physician's office or clinic, who is normotensive outside a clinical setting, has white-coat hypertension. Ambulatory BP monitoring (ABPM) is usually required to make this diagnosis.

In children and adolescents, hypertension is defined as BP that is, on repeated measurement, at the 95th percentile or greater adjusted for age, height, and gender.<sup>73</sup> The fifth Korotkoff sound is used to define DBP. Clinicians should be alert to the possibility of identifiable causes of hypertension in younger children (i.e., kidney disease, coarctation of the aorta). Lifestyle interventions are strongly recommended, with pharmacologic therapy instituted for higher levels of BP or if there is insufficient response to lifestyle modifications.<sup>74</sup> Choices of antihypertensive drugs are similar in children and adults, but effective doses for children are often smaller and should be adjusted carefully. ACEIs and ARBs should not be used in pregnant or sexually active girls. Uncomplicated

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hypertension should not be a reason to restrict children from participating in physical activities, particularly because long-term exercise may lower BP. Use of anabolic steroids should be strongly discouraged. Vigorous interventions also should be conducted for other existing modifiable risk factors (e.g., smoking).

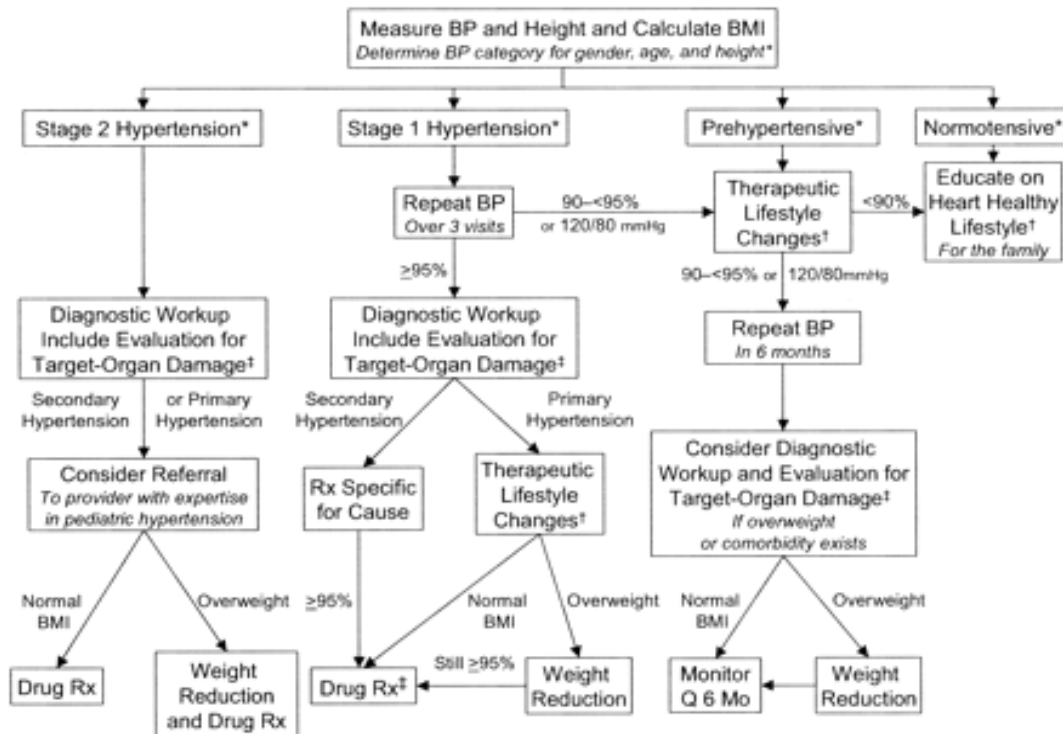
**Measurement of Blood Pressure in Children**

- Children >3 years old who are seen in a medical setting should have their BP measured.
- The preferred method of BP measurement is auscultation.
- Correct measurement requires a cuff that is appropriate to the size of the child’s upper arm.
- Elevated BP must be confirmed on repeated visits before characterizing a child as having hypertension.
- Measures obtained by oscillometric devices that exceed the 90th percentile should be repeated by auscultation.

**Frequency**

Children over the age of 3 years who are seen in medical care settings should have their BP measured at least once during every health care episode. Children under age 3 should have their BP measured in special circumstances. (See table 1.)

Table 1: Conditions Under Which Children < 3 Years Old Should Have Blood Pressure Measured	
<ul style="list-style-type: none"> <li>• History of prematurity, very low birthweight, or other neonatal complication requiring intensive care</li> <li>• Congenital heart disease (repaired or nonrepaired)</li> <li>• Recurrent urinary tract infections, hematuria, or proteinuria</li> <li>• Known renal disease or urologic malformations</li> <li>• Family history of congenital renal disease</li> </ul>	<ul style="list-style-type: none"> <li>• Solid organ transplant</li> <li>• Malignancy or bone marrow transplant</li> <li>• Treatment with drugs known to raise BP</li> <li>• Other systemic illnesses associated with hypertension (neurofibromatosis, tuberous sclerosis, etc.)</li> <li>• Evidence of elevated intracranial pressure</li> </ul>



Child and Adolescent Algorithm from The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. Pediatrics 2004 Aug;114(2 Suppl):555-76.

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### **Measurement of Efficacy of the Clinical Practice Guideline**

Two elements are measured to gauge the efficacy of the practitioner's compliance with the Clinical Practice Guideline.

These two measures are:

#### **1) HEDIS® Measure:**

<b>Clinical Practice Guideline (CPG)</b>	<b>HEDIS® Measure</b>	<b>Measure</b>
CPG Diagnosis and Management of Hypertension	Controlling High Blood Pressure	Representative B/P < 140/90 Diabetic Co-Morbidity < 130/80

#### **2) Clinician Assessment:**

**Minimum of twice a year**

- **Follow-up and Monitoring**

After BP is at goal and stable, follow-up visits can usually be at 3- to 6-month intervals. Comorbidities, such as heart failure, associated diseases such as diabetes, and the need for laboratory tests influence the frequency of visits. Other cardiovascular risk factors should be treated to their respective goals, and tobacco avoidance should be promoted vigorously. 1

#### **3) Use of Thiazide Diuretics**

Thiazide-type diuretics have been the basis of antihypertensive therapy in most outcome trials.<sup>37</sup> In these trials, including the recently published Antihypertensive and Lipid Lowering Treatment to Prevent Heart Attack Trial (ALLHAT),<sup>33</sup> diuretics have been virtually unsurpassed in preventing the cardiovascular complications of hypertension. The exception is the Second Australian National Blood Pressure trial which reported slightly better outcomes in White men with a regimen that began with an ACEI compared to one starting with a diuretic.<sup>36</sup> Diuretics enhance the antihypertensive efficacy<sup>1</sup>

<sup>1</sup>From: The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC VII). 7 May 2003

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