



# RECOGNIZING AND TREATING HYPERTENSION 2007 CLINICAL PRACTICE GUIDELINE FOR ADULTS > 18 YEARS OLD

Guidelines are designed to assist clinicians by providing a framework for the evaluation and treatment of patients. This guideline outlines the preferred approach for most patients. It is not intended to replace a clinician’s judgment or to establish a protocol for all patients. It is understood that some patients will not fit the clinical condition contemplated by a guideline and that a guideline will rarely establish the only appropriate approach to a problem.

## CONTENTS

1. Establishing the Diagnosis .....	2
2. Patient Evaluation .....	2
3. Goal of Therapy.....	2
4. Blood Pressure Classifications and Management .....	2
5. Lifestyle Modification .....	3
6. Treatment of Hypertension .....	4
7. Medication Notes .....	5
Common Fallacies Regarding the Treatment of Hypertension.....	6
8. Quick Reference Guide for Major Classes of Hypertensive Medications .....	7
References .....	8
Acknowledgments .....	8

The purpose of treating hypertension is to reduce the incidence of stroke, myocardial infarction, congestive heart failure and renal failure. **Unless contraindicated or there is a compelling indication to use another medication, low dose diuretic therapy should be used as first or second line therapy.**

## 1. Establishing the Diagnosis

Blood pressure should be measured at each health care encounter. The diagnosis of hypertension should be based on the presence of elevated readings on two or more visits.

- Measure blood pressure after the patient has rested for 5 minutes; use an appropriate-sized cuff.
- The patient should be seated comfortably with the back supported. The arm should also be supported at the level of the heart.
- When the readings are separated by more than 5 mmHg, additional readings should be taken and averaged.
- When the average of two or more readings is elevated, hypertension is suspected.
- Additional readings are recommended in patients suspected of having “white coat” hypertension. Ambulatory or home blood pressure monitoring may be especially useful in these patients.

## 2. Patient Evaluation

Assess lifestyle and identify other cardiovascular risk factors or the presence of target organ damage (TOD) and CVD.

CARDIOVASCULAR RISK FACTORS			TARGET ORGAN DAMAGE/CVD	
<ul style="list-style-type: none"> <li>• Tobacco use</li> <li>• Dyslipidemia</li> <li>• Obesity (BMI <math>\geq 30</math> kg/m<sup>2</sup>)</li> <li>• Physical inactivity</li> </ul>	<ul style="list-style-type: none"> <li>• Diabetes mellitus</li> <li>• Age (&gt;45 years for men &gt;55 years for women)</li> <li>• Microalbuminuria or estimated GFR &lt;60 mL/min</li> </ul>	<ul style="list-style-type: none"> <li>• Family history of early vascular disease (women &lt; age 65 years; men &lt; age 55 years)</li> </ul>	<ul style="list-style-type: none"> <li>• Heart disease (left ventricular hypertrophy, angina, prior MI, prior CABG, heart failure)</li> </ul>	<ul style="list-style-type: none"> <li>• CVA or TIA</li> <li>• Peripheral arterial disease</li> <li>• Chronic kidney disease</li> <li>• Retinopathy</li> </ul>

## 3. Goal of Therapy

To prevent the complications of hypertension, set clear treatment goals based on the patient’s risk.

- Uncomplicated hypertension ..... <140/90 mmHg
- TOD, CVD, diabetes mellitus or chronic kidney disease stages 1-4\* ..... <130/80 mmHg
- Chronic kidney disease with proteinuria > 1 gram/24 hours ..... <125/75 mmHg

\* See Point 7, Compelling Indications, for definition of Chronic Kidney Disease.

## 4. Blood Pressure Classifications and Management

Most patients >20/10 mmHg above goal will require at least 2 medications to reach goal.

BLOOD PRESSURE	SYSTOLIC mmHG	DIASTOLIC mmHG	LIFESTYLE MODIFICATION	WITHOUT COMPELLING INDICATION	WITH COMPELLING INDICATION
Normal	<120	and <80	Encourage		
Prehypertension	120-139	or 80-90	Yes		Drug for the compelling indication <sup>§</sup>
Stage 1	140-159	or 90-99	Yes	Diuretics for most	Drug for the compelling indication <sup>§</sup>
Stage 2	160+	or 100+	Yes	2-Drug combination for most (usually diuretic <b>and</b> ACE inhibitor or calcium blocker)	Drug for the compelling indication <sup>§</sup>

<sup>§</sup>See Point 6, Treatment of Hypertension

Blood pressure is strongly related to CVD mortality, with no evidence of a threshold down to 115/75 mmHg. Compared to patients with normal blood pressure there is a doubling of CVD risk in patients with prehypertension.

## 5. Lifestyle Modification

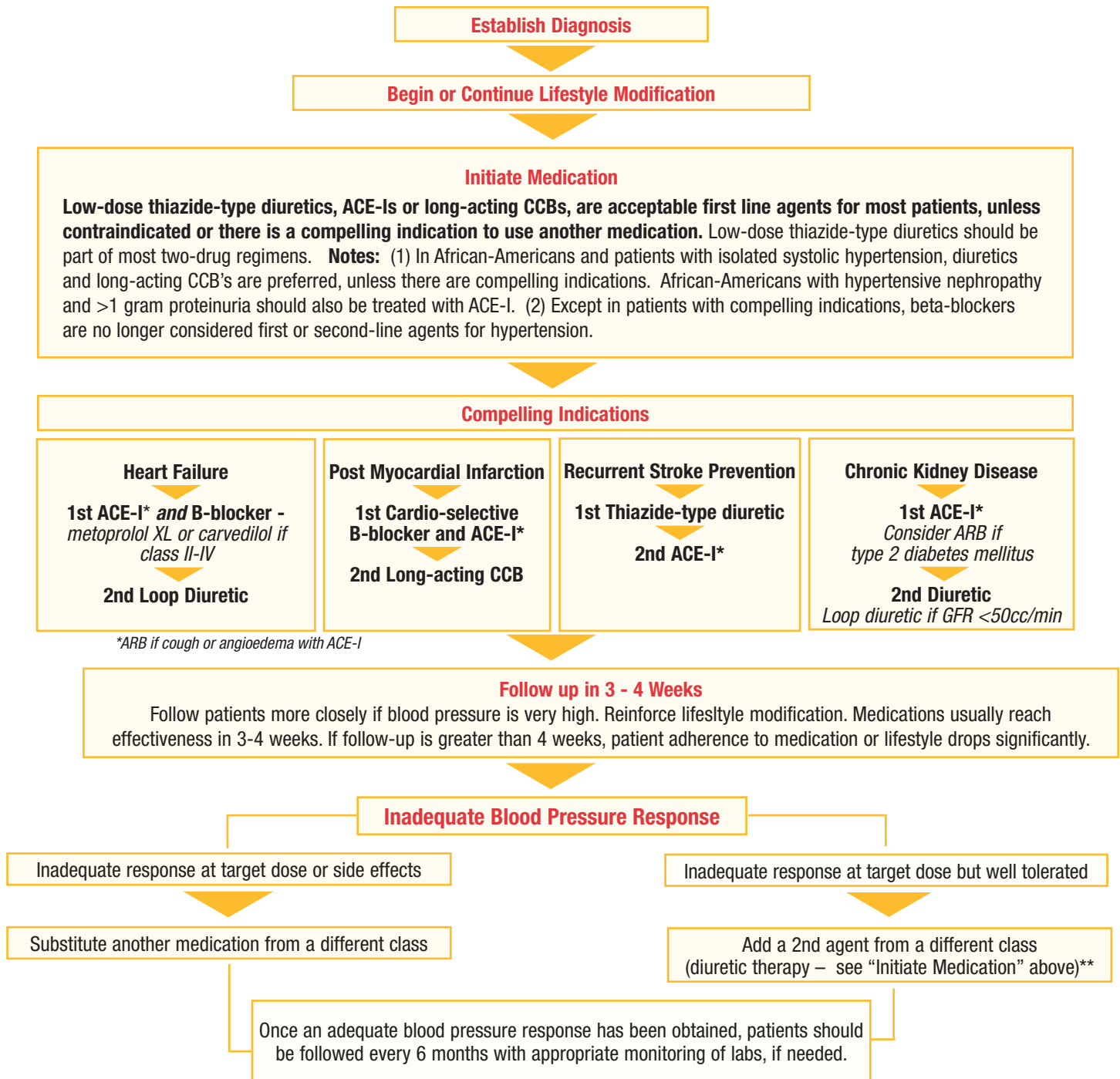
Lifestyle modifications are the cornerstone treatment. They can be as effective as pharmacological monotherapy and may mitigate the need for drug or multi-drug treatment. They may reduce the number and dose of antihypertensive medications. Providers should consider referrals to registered dietitians and exercise experts to help patients initiate lifestyle changes. Lifestyle changes should be reinforced at every patient encounter.

LIFESTYLE ELEMENT (Range of Approximate Systolic Blood Pressure Reduction)	RECOMMENDATIONS	COMMENTS																																																								
<b>Weight</b> (5-20 mmHg/10 kg weight loss)	Weight loss in patients who are overweight or obese.	Weight loss can lower blood pressure, increase the efficacy of anti-hypertensive medications and reduce CV risk factors such as diabetes mellitus and dyslipidemia. As little as a 10 pound loss may improve blood pressure.																																																								
<b>DASH Eating Plan</b> (8-14 mmHg)	Consume a diet rich in fruits, vegetables, and low-fat dairy products with a reduced content of saturated and total fat.	The Dietary Approaches to Stop Hypertension (DASH) study demonstrated significant reductions in blood pressure by dietary change. The DASH diet includes 8-10 servings of fruits and/or vegetables and 2-3 servings of low-fat dairy products per day. This diet leads to an average 11.6/5.3 mmHg blood pressure reduction. The DASH-Sodium diet has a 1500-2400 mg/day sodium limitation and can achieve an additional 3.5/2.2mmHg blood pressure reduction, which is equal to or greater than single-drug therapy. For additional provider and patient information go to <a href="http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/new_dash.pdf">http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/new_dash.pdf</a> .																																																								
<b>Alcohol</b> (2-4 mmHg)	Reduce or eliminate alcohol.	Alcohol is a risk factor for hypertension, contributes excess calories, can reduce efficacy of antihypertensive medications, and increases the risk of stroke. Men should have no more than 2, and women no more than 1, alcoholic drink daily. Examples of one drink are 12 oz. of beer, 4 oz. of wine, or 1 oz. of spirits.																																																								
<b>Physical Activity</b> (4-9 mmHg)	30-45 minutes of moderately intense physical activity most days of the week, with a minimum of 150 minutes per week.	Exercise contributes to weight loss and reduces the risks of CVD and overall mortality. Patients at high-risk or with multiple risk factors should have an exercise stress test. Medically supervised exercise programs should be advised if blood pressure response to exercise is a concern.																																																								
<b>Sodium</b> (2-8 mmHg)	Limit to 2400 mg/day. Additional benefits may be obtained with restriction to 1500mg/day.	African-Americans, older patients and people with hypertension or diabetes mellitus are especially sensitive to changes in sodium intake. Processed foods (canned soups and vegetables, frozen and boxed dinners, chips, luncheon meats, etc) and foods eaten out are responsible for 50-75% of the sodium in the American diet. For additional provider and patient information go to <a href="http://www.nhlbi.nih.gov/hbp/prevent/sodium/sodium.htm">http://www.nhlbi.nih.gov/hbp/prevent/sodium/sodium.htm</a>																																																								
<b>Potassium, Magnesium, and Calcium</b>	Recommendations for good health: Potassium – 4700 mg/day Calcium – 1000 mg/day Magnesium – 400 mg/day.	<p>Adequate intakes of these nutrients contribute to control of hypertension. Food is the best source, since research has not shown consistent blood pressure improvement from supplements. Diets high in potassium are especially effective for reducing blood pressure in African-Americans.</p> <table border="1"> <thead> <tr> <th></th> <th>POTASSIUM</th> <th>mg</th> <th>CALCIUM</th> <th>mg</th> <th>MAGNESIUM</th> <th>mg</th> </tr> </thead> <tbody> <tr> <td>Cooked beans, 1 c.</td> <td>700-1000</td> <td></td> <td>Yogurt or milk, 1 c.</td> <td>300-450</td> <td>Cooked spinach, 1 c.</td> <td>160</td> </tr> <tr> <td>Baked potato, 1 med</td> <td>850</td> <td></td> <td>Sardines w/bones, 3 oz</td> <td>325</td> <td>Pumpkin seeds, 1 oz</td> <td>150</td> </tr> <tr> <td>Squash, sweet potato, 1 c.</td> <td>900</td> <td></td> <td>Fortified cereal, 1 c.</td> <td>300</td> <td>Cooked beans, 1 c.</td> <td>130</td> </tr> <tr> <td>Cooked spinach, 1c.</td> <td>850</td> <td></td> <td>Cooked spinach, 1 c.</td> <td>275</td> <td>Halibut, 4 oz</td> <td>120</td> </tr> <tr> <td>Banana, 1 med.</td> <td>600</td> <td></td> <td>Cooked beans, 1 c.</td> <td>200</td> <td>Brown rice, 1 c.</td> <td>85</td> </tr> <tr> <td>Canned tomato, 1 c.</td> <td>600</td> <td></td> <td>Cottage cheese, 1c.</td> <td>160</td> <td>Nuts, 1 oz</td> <td>70</td> </tr> <tr> <td>Orange jc or melon, 1 c.</td> <td>500</td> <td></td> <td>Tofu, 4 oz</td> <td>130</td> <td>Haddock or cod, 4 oz</td> <td>60</td> </tr> </tbody> </table> <p>Most salt substitutes contain potassium. Although useful for some patients, they should not be used in patients with renal failure. They should be used with caution in patients on ACE inhibitors, angiotensin II receptor blockers, or aldosterone antagonists.</p>		POTASSIUM	mg	CALCIUM	mg	MAGNESIUM	mg	Cooked beans, 1 c.	700-1000		Yogurt or milk, 1 c.	300-450	Cooked spinach, 1 c.	160	Baked potato, 1 med	850		Sardines w/bones, 3 oz	325	Pumpkin seeds, 1 oz	150	Squash, sweet potato, 1 c.	900		Fortified cereal, 1 c.	300	Cooked beans, 1 c.	130	Cooked spinach, 1c.	850		Cooked spinach, 1 c.	275	Halibut, 4 oz	120	Banana, 1 med.	600		Cooked beans, 1 c.	200	Brown rice, 1 c.	85	Canned tomato, 1 c.	600		Cottage cheese, 1c.	160	Nuts, 1 oz	70	Orange jc or melon, 1 c.	500		Tofu, 4 oz	130	Haddock or cod, 4 oz	60
	POTASSIUM	mg	CALCIUM	mg	MAGNESIUM	mg																																																				
Cooked beans, 1 c.	700-1000		Yogurt or milk, 1 c.	300-450	Cooked spinach, 1 c.	160																																																				
Baked potato, 1 med	850		Sardines w/bones, 3 oz	325	Pumpkin seeds, 1 oz	150																																																				
Squash, sweet potato, 1 c.	900		Fortified cereal, 1 c.	300	Cooked beans, 1 c.	130																																																				
Cooked spinach, 1c.	850		Cooked spinach, 1 c.	275	Halibut, 4 oz	120																																																				
Banana, 1 med.	600		Cooked beans, 1 c.	200	Brown rice, 1 c.	85																																																				
Canned tomato, 1 c.	600		Cottage cheese, 1c.	160	Nuts, 1 oz	70																																																				
Orange jc or melon, 1 c.	500		Tofu, 4 oz	130	Haddock or cod, 4 oz	60																																																				
<b>Tobacco and second-hand smoke</b>	Smoking cessation and avoidance of second-hand smoke.	Tobacco and its by-products increase CV risk and may make antihypertensive medications less effective. Each cigarette causes an increase in blood pressure. The CV benefits of smoking cessation are evident in one year.																																																								

For specialty consults or additional nutrition information, contact the UW Health Preventive Cardiology Program at 608-263-7420, the UW Hypertension Clinic at 608-270-5656, the UW Health Nutrition Center at 608-287-2780, or one of the UW Health Outpatient Nutrition Clinics: UW Hospital at 608-263-4360, West Clinic at 608-262-9181, East Clinic at 608-265-7405, or University Station at 608-263-7772. Consult local facilities and providers for additional resources in your area.

## 6. Treatment of Hypertension

This is a simplified algorithm designed to cover a large majority of hypertensive patients. Selection of drug therapy should be based on clinical status of the patient and comorbidities. See "7. Medication Notes" for details.



\*\*The combination of thiazide diuretics and beta-blockers should be avoided in patients at high risk of developing diabetes mellitus, such as patients with a strong family history of diabetes, impaired fasting glucose, obesity or ethnic groups with a high incidence of diabetes (i.e. patients of Hispanic, Asian-Indian, or American-Indian descent).

### For specialty consultations or additional assistance contact:

- UW Preventive Cardiology Program at 608-263-7420 or 608-263-1530,
- UW Kidney Clinic at 608-270-5656, or
- UW Hypertension Clinic at 608-270-5656.

Consult local facilities and providers for additional resources in your area.

Consider referral to specialty clinic in patients with resistant hypertension, hypertension at young age (<30 years old), or patients with suspected secondary hypertension related to renovascular disease, CKD, or endocrine disorders.

### Drug Abbreviation Key

ACE-I . . . . . Angiotensin converting enzyme inhibitor  
 ARB . . . . . Angiotensin receptor blocker  
 B-blocker . . . . . Beta-blocker  
 CCB . . . . . Calcium channel blocker

## 7. Medication Notes - Monitor for possible side effects of medication to help assure patient compliance

### DIURETICS

- Thiazide-type diuretics are recommended for initial or second drug therapy unless there is a compelling indication.
- Diuretics are synergistic with other classes of antihypertensives medications and should be part of most medication regimens.
- Low doses (12.5-25 mg HCTZ or chlorthalidone) should be used unless the patient has heart failure or chronic kidney disease and GFR < 30-50 mL/min, then use a loop diuretic (furosemide).
- Diuretics should be considered part of all 3 medication regimens.
- JNCVII defines "resistant" hypertension as the failure to reach goal blood pressure in patients who are adhering to full doses of an appropriate 3 drug regimen that includes diuretic.
- Diuretics reduce reflex fluid retention associated with lowering blood pressure and must be added prior to calling a patient "hypertension resistant".
- Thiazides in conjunction with beta-blockers can worsen insulin resistance in susceptible individuals, such as those with diabetes mellitus or the metabolic syndrome.

### ACE-I AND ARB

- Use long-acting agents for once per day dosing.
- ARB's are alternatives for patients with ACE-I associated cough or angioedema.
- Contraindicated in pregnant patients. Women of child-bearing potential should be counseled about risks of pregnancy.

### DIABETES MELLITUS

- Combinations of 2 or more drugs usually are needed to achieve the target BP goal of less than 130/80 mmHg.
- In patients with microalbuminuria or clinical albuminuria, use ACE-I or ARB.
- Because thiazides can worsen insulin resistance, some experts advocate using ACE-I as first line therapy. If an ACE-I is used as first line, low-dose thiazide therapy should be the next agent, unless there is a compelling indication for another medication.

### LABS

- Diuretics, ACE-I and ARB – Check BUN, creatinine and potassium 2-3 weeks after initiation and every 6 - 12 months thereafter, unless symptoms suggest renal or electrolyte disorders.
- More frequent monitoring is recommended if other drugs that affect renal function or potassium homeostasis are being used.

### COMPELLING INDICATIONS

#### HEART FAILURE

- Mild symptoms – start with ACE-I.
- ACE-I should be titrated to the highest dose tolerated, even if blood pressure is low, as long as the patient does not become symptomatic or develop impaired renal perfusion.
- B-blockers should be started if the patient has ischemic heart disease, is post MI, has angina or after reaching ACE-I target dose. Titrate to the highest dose tolerated.
- Spironolactone should be considered after the patient is placed on the maximum doses of ACE-I and B-blocker, especially if Class III or IV.
- Diuretics (usually loop) are often used for fluid management.

#### CHRONIC KIDNEY DISEASE (CKD)

##### Stages of Chronic Kidney Disease

Stage	Description	GFR (mL/min/1.73 m <sup>2</sup> )
1	Kidney damage with normal or ↑GFR	≥90
2	Kidney damage with mild ↓GFR	60-89
3	Moderate ↓GFR	30-59
4	Severe ↓GFR	15-29
5	Kidney failure	<15 (or dialysis)

CKD is defined as either kidney damage or GFR <60 mL/min/1.73 m<sup>2</sup> for 3 months. Kidney damage is defined as pathologic abnormalities or markers of damage, including abnormalities in blood or urine tests or imaging studies.

- ACE-I and ARB's have demonstrated favorable effect on slowing progression of kidney disease.
- A limited increase in serum creatinine of as much as 30% above baseline with ACE-I or ARB is acceptable and not a reason to withhold treatment unless hyperkalemia develops.
- In CKD stages 4 and 5 (estimated glomerular filtration rate <30 mL/min per 1.73 m<sup>2</sup>) higher doses of loop diuretics may be needed in combination with other drug classes.

## COMMON FALLACIES REGARDING THE TREATMENT OF HYPERTENSION

TOPIC	FALLACY	TRUTH
<b>Diastolic vs Systolic Hypertension</b>	Diastolic hypertension is associated with greater risk of stroke & mortality.	Systolic hypertension is associated with a greater risk of stroke and mortality and is the most neglected type of hypertension.
	Systolic elevations are usually due to the patient being anxious.	Systolic hypertension is more predictive of events than diastolic blood pressure, especially in patients over 50 years old.
<b>Diuretics</b>	Metabolic and electrolyte disturbances preclude the use of diuretics in many patients.	Low dose (12.5-25 mg) HCTZ or chlorthalidone are unlikely to have a significant effect on blood glucose levels or to deplete electrolytes for most patients; however, these lab values should be checked as in "Labs" on previous page. Concurrent use of a fixed-dose combination, such as triamterene with an ACE-I, may elevate serum potassium.
	If inadequate response on one antihypertensive medication, add a second that is not a diuretic.	When target blood pressure is not reached with one antihypertensive medication, the addition of low-dose thiazide type diuretic therapy is effective and usually should be the next step.
	Diuretics do not lower blood pressure as well as other medications.	In ALLHAT ( The Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial), thiazide type diuretics were most effective at lowering systolic blood pressure.
<b>Beta-Blockers</b>	Beta-blockers should not be used in diabetic patients because of the potential to mask hypoglycemia.	Masking hypoglycemia is rare, especially in patients with type 2 diabetes. Hypoglycemic symptoms might change on a beta-blocker. Beta-blockers are beneficial for patients with coronary artery disease or heart failure, except for those who have had problems with recurrent severe hypoglycemia.
<b>ACE Inhibitors</b>	ACE inhibitors are more expensive than beta-blockers.	Availability of generic ACE inhibitors have made them relatively inexpensive.
<b>Dietary Sodium</b>	Dietary sodium restriction plays a minor contribution to blood pressure control.	Reducing dietary sodium and other nutritional and lifestyle changes can lead to significant drops in blood pressure.
<b>Alcohol</b>	Alcohol is good for the heart.	Alcohol may increase blood pressure in many patients. Men should have no more than 2 alcoholic drinks daily, and women no more than 1.

## 8. Quick Reference Guide For Major Classes of Antihypertensive Medications

For up to date formulary changes, dosing guides and drug interaction check, go to <https://uconnect.wisc.edu>, then select "Drug Information." This link is available to all UWMF wards and clinics, UWMF sites and DFM sites.

CLASS	MEDICATIONS	DOSE STRENGTHS	RELATIVE COST AVG 30 DAY SUPPLY
<b>Diuretic</b>	chlorthalidone	25, 50, 100 mg	\$\$
	hydrochlorothiazide	12.5, 25, 50, 100 mg	\$
	bumetanide (loop)	0.5, 1, 2 mg	\$\$
	furosemide (loop)	20, 40, 80 mg	\$
<b>B-Blocker</b>	acebutolol <sup>o</sup>	200, 400 mg	\$\$
	atenolol <sup>o</sup>	25, 50, 100 mg	\$
	metoprolol <sup>o</sup>	50, 100 mg	\$
	metoprolol XL	25, 50, 100, 200 mg	\$\$\$
	nadolol	20, 40, 80, 120, 160 mg	\$\$
	pindolol	5, 10 mg	\$\$
	propranolol	10, 20, 40, 60, 80, 90 mg	\$
	propranolol LA propranolol LA (InnoPran XL)	60, 80, 120, 160 mg 80, 120 mg	\$\$\$\$ \$\$\$
<b>Alpha/B-Blocker</b>	labetalol	100, 200, 300 mg	\$\$
	carvedilol	3.125, 6.25, 12.5, 25 mg	\$\$\$\$
	carvedilol CR (Coreg CR)	10, 20, 40, 80 mg	\$\$\$\$
<b>ACE-I</b>	benazepril	5, 10, 20, 40 mg	\$
	captopril	12.5, 25, 50, 100 mg	\$
	enalapril	2.5, 5, 10, 20 mg	\$
	lisinopril	2.5, 5, 10, 20, 40 mg	\$
	quinapril	5, 10, 20, 40 mg	\$
	trandolapril (Mavik)	1, 2, 4 mg	\$\$
<b>ARB</b>	candesartan (Atacand)	4, 8, 16, 32 mg	
	losartan (Cozaar)	25, 50, 100 mg	\$\$\$
	olmesartan (Benicar)	5, 20, 40 mg	\$\$
	valsartan (Diovan)	80, 160, 320 mg	\$\$\$
<b>DRI (direct renin inhibitor)</b>	aliskiren (Tekturna)	150, 300, 600 mg	\$\$\$\$
<b>Dihydropyridine CCB (short-acting nifedipine is not listed due to adverse CV side-effect profile)</b>	felodipine	2.5, 5, 10 mg	\$\$
	amlodipine	2.5, 5, 10 mg	\$\$
	nifedipine xl	30, 60, 90 mg	\$
<b>CCB</b>	verapamil extended release-24 hr	120, 180, 240, 360 mg	\$
	diltiazem	30, 60, 90, 120 mg	\$\$
	diltiazem extended release-24 hr	120, 180, 240, 300, 360, 420 mg	\$\$

<sup>o</sup> Cardioselective beta-blocker

COMBINATION THERAPY			
Class	Medications	Dose Strengths	Relative Cost Avg 30-Day Supply
<b>Potassium-sparing Diuretic</b>	triamterene/HCTZ	37.5/25, 50/25, 75/50 mg	\$
<b>B-Blocker Diuretic</b>	atenolol/chlorthalidone	50/25, 100/25 mg	\$
	propranolol/HCTZ	40/25, 80/25 mg	\$
<b>ACE-I Diuretic</b>	benazepril/HCTZ	5/6.25, 10/12.5, 20/25 mg	\$\$
	lisinopril/HCTZ	10/12.5, 20/12.5, 20/25 mg	\$
	enalapril/HCTZ	5/12.5, 10/25 mg	\$
	captopril/HCTZ	25/15, 25/25, 50/15, 50/25 mg	\$\$
<b>ARB Diuretic</b>	Candesartan/HTZ (Atacand HCT)	16/12.5, 32/12.5	\$\$\$
	losartan/HCTZ (Hyzaar)	50/12.5, 100/25 mg	
	olmesartan/HCTZ (Benicar HCT)	20/12.5, 40/12.5, 40/25 mg	
	valsartan/HCTZ (Diovan HCT)	80/12.5, 160/12.5, 160/25 mg	\$\$\$
<b>Dihydropyridine CCB ACE-I</b>	amlodipine/benazepril (Lotrel)	2.5/5, 5/10, 5/20, 10/20 mg	\$\$\$
	felodipine/enalapril (Lexxel)	5/5 mg	\$\$\$

## REFERENCES

1. JNC 7 Report. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *JAMA* 2003;289:2560-2572.
2. The American Heart Association Home Page [resource on World Wide Web]. URL: <http://www.americanheart.org>. Available from Internet. Accessed 5/1/07.
3. American Diabetes Association. The treatment of hypertension in adult patients with diabetes (Technical Review). *Diabetes Care*. 2002; 25:134-147.
4. Sowers JR, et al. for the National Heart Lung Blood Institute, NIH National High Blood Pressure Education Program (NHBPEP). World wide web at [www.nhlbi.nih.gov/health/public/heart/hbp/mp/mp\\_dash.htm](http://www.nhlbi.nih.gov/health/public/heart/hbp/mp/mp_dash.htm). Accessed 5/23/07.
5. Blood Pressure Lowering Treatment Trialists' Collaboration. Effects of different blood-pressure-lowering regimens on major cardiovascular events: results of prospectively-designed overviews of randomized trials. *Lancet* 2003; 362:1527-1535.
6. Pepine CJ, Handberg EM, Cooper-DeHoff RM, et al. A calcium antagonist vs non-calcium antagonist hypertension treatment strategy for patients with coronary artery disease. The International Verapamil-Trandolapril Study (INVEST): a randomized controlled trial. *JAMA* 2003; 290: 2805-16.
7. Nissen SE, Tuzcu EM, Libby P, et al. Effect of antihypertensive agents on cardiovascular events in patients with coronary disease and normal blood pressure. The CAMELOT study: a randomized controlled trial. *JAMA* 2004; 292: 2217-2226.
8. Julius S, Kjeldsen SE, Weber M, et al. Outcomes in hypertensive patients at high cardiovascular risk treated with regimens based on valsartan or amlodipine: the VALUE randomized trial. *Lancet* 2004; 363: 2022-2031.
9. Williams B. Recent hypertension trials. *J Am Coll Cardiol* 2005;45:813-827.
10. Williams B, et al. British Hypertension Society guidelines for hypertension management 2004 (BHS-IV) summary. *BMF* 2004;328:634-640.
11. Sever, P for the The Anglo-Scandinavian Cardiac Outcomes Trial (ASCOT) Investigators. Outcomes from the Blood-Pressure Lowering Arm. Prevention of cardiovascular events with an antihypertensive regimen of amlodipine adding perindopril as required versus atenolol adding bendroflumethiazide as required, in the Anglo-Scandinavian Cardiac Outcomes Trial-Blood Pressure Lowering Arm (ASCOT-BPLA): a multi-centre randomized controlled trial. *The Lancet* - Vol. 366, Issue 9489, 10 September 2005, Pages 895-6.
12. Carlberg B, Samuelson O, Lindholm LH. Atenolol in hypertension: Is it a wise choice? *Lancet* 2004;364:1884-9.
13. PROGRESS Collaborative Group. Randomised trial of a perindopril-based blood-pressure-lowering regimen among 6,105 individuals with previous stroke or transient ischaemic attack. *Lancet* 2001; 359(9287):1033-41.
14. Whelton, PK, Barzilay, J, Cushman WC, et al. Clinical Outcomes in Antihypertensive Treatment of Type 2 Diabetes, Impaired Fasting Glucose Concentration, and Normoglycemia. Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT). *Arch Intern Med* 2005; 165:1401-1409.
15. Jafar TH, et al. Angiotensin-converting enzyme inhibitors and progression of nondiabetic renal disease. A meta-analysis of patient-level data. *Ann Intern Med* 135:73-87, 2001.
16. Brenner BM, et al. Effects of losartan on renal and cardiovascular outcomes in patients with type II diabetes mellitus and nephropathy (RENAAL). *New Engl J Med* 345:861-9, 2001.
17. Wright JT, et al. Effect of blood pressure lowering and antihypertensive drug class on progression of hypertensive kidney disease: results from the AASK trial. *JAMA* 288:2421-31, 2002.
18. The National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF KDOQI™) or KDOQ home page (resource on World Wide Web). URL <http://www.kidney.org/professionals/KDOQI/> Available from the internet. Accessed 5/1/07.
19. Fasting Glucose Levels and Incident Diabetes Mellitus in Older Nondiabetic Adults Randomized to Receive 3 Different Classes of Antihypertensive Treatment: A Report From the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT). Joshua I. Barzilay; Barry R. Davis; Jeffrey A. Cutler; Sara L. Pressel; Paul K. Whelton; Jan Basile; Karen L. Margolis; Stephen T. Ong; Laurie S. Sadler; John Summerson; for the ALLHAT Collaborative Research Group; *Arch Intern Med*. 2006;166:2191-2201.

## ACKNOWLEDGEMENTS

University of Wisconsin Medical Foundation, University of Wisconsin Hospitals and Clinics, Unity Health Insurance, Physicians Plus Insurance Corporation and Group Health Cooperative have cooperated in the revision of these guidelines. This task force was a multidisciplinary work group of physicians, nurse practitioners, pharmacists and a dietitian.

Patrick McBride, MD and James Stein, MD, of the UW Health Preventive Cardiology Program, led the revision efforts. Additional contributors were: Bryan Becker, MD; Richard Day, MD; Lawrence Fleming, MD, MBA; Derek Hubbard, MD; Paul Kellerman, MD; Melissa Meredith, MD; Jessica Bartell, MD.

Please direct questions, comments and suggestions regarding these guidelines to Pam Kittleson, RPh, UWWMF provider education pharmacist, at [pamela.kittleson@uwmf.wisc.edu](mailto:pamela.kittleson@uwmf.wisc.edu).

Reviewed and updated November 2007  
Scheduled for reconsideration fourth quarter 2009.