

**National Heart, Lung, and Blood Institute  
National High Blood Pressure Education Program**



**U.S. Department of  
Health and Human  
Services**



**National Institutes  
of Health**



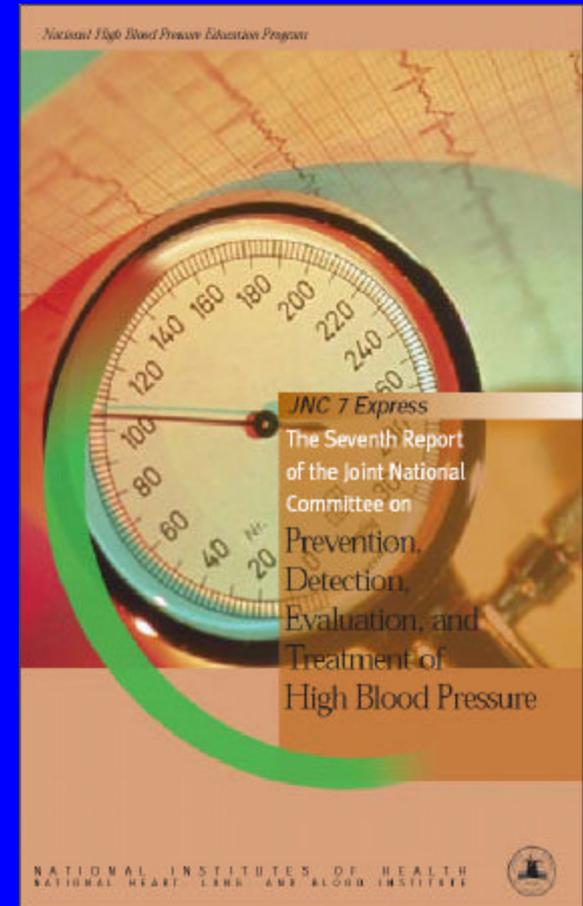
**National Heart, Lung,  
and Blood Institute**

**The Seventh Report of the  
Joint National Committee on  
Prevention, Detection,  
Evaluation, and Treatment of  
High Blood Pressure (JNC 7)**



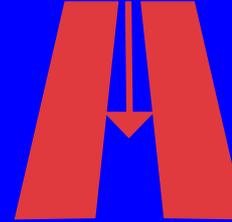
# National Heart, Lung, and Blood Institute National High Blood Pressure Education Program

Seventh Report of the  
Joint National Committee on  
Prevention, Detection,  
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Blood Pressure  
(JNC 7) **EXPRESS**





# Seventh Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure



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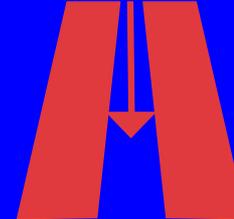
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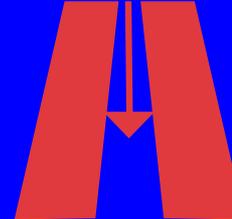


American Academy of Family Physicians  
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American Academy of Physician Assistants  
American Association of Occupational Health Nurses  
American College of Cardiology  
American College of Chest Physicians  
American College of Occupational and Environmental Medicine  
American College of Physicians  
—American Society of Internal Medicine  
American College of Preventive Medicine  
American Dental Association  
American Diabetes Association  
American Dietetic Association  
American Heart Association  
American Hospital Association  
American Medical Association  
American Nurses Association  
American Optometric Association  
American Osteopathic Association  
American Pharmaceutical Association  
American Podiatric Medical Association  
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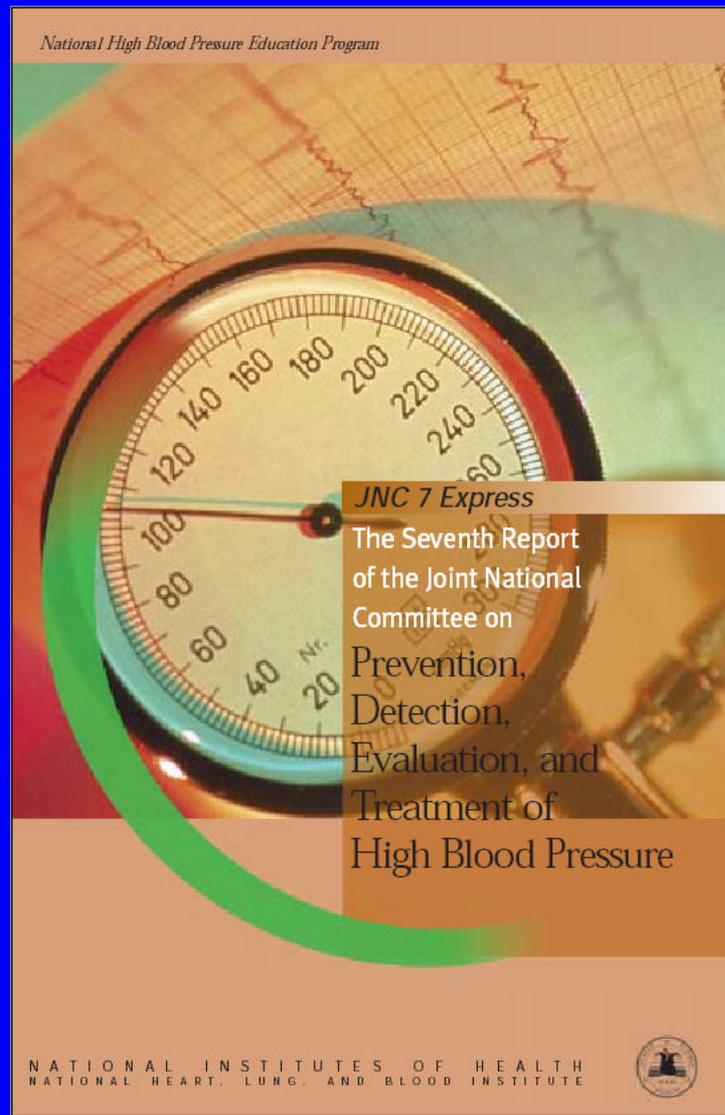
American Society of Health-System Pharmacists  
American Society of Hypertension  
American Society of Nephrology  
Association of Black Cardiologists  
Citizens for Public Action on High Blood Pressure and Cholesterol, Inc.  
Hypertension Education Foundation, Inc.  
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# JNC 7

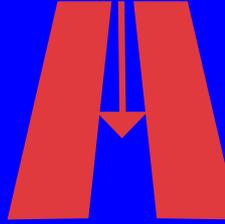


- **Express**—Succinct evidence-based recommendations. Published in *JAMA* May 21, 2003, and as a Government Printing Office publication.
- **Full Report**—comprehensive justification and rationale (coming soon).





# Purpose

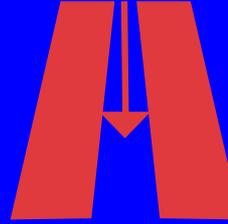


## Why JNC 7?

- Publication of many new studies.
- Need for a new, clear, and concise guideline useful for clinicians.
- Need to simplify the classification of BP.



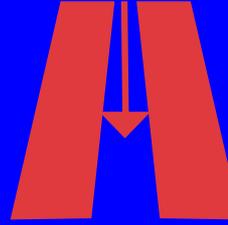
# New Features and Key Messages



- For persons over age 50, SBP is a more important than DBP as CVD risk factor.
- Starting at 115/75 mmHg, CVD risk doubles with each increment of 20/10 mmHg throughout the BP range.
- Persons who are normotensive at age 55 have a 90% lifetime risk for developing HTN.
- Those with SBP 120–139 mmHg or DBP 80–89 mmHg should be considered prehypertensive who require health-promoting lifestyle modifications to prevent CVD.



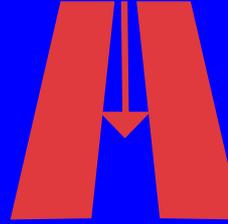
# New Features and Key Messages (Continued)



- Thiazide-type diuretics should be initial drug therapy for most, either alone or combined with other drug classes.
- Certain high-risk conditions are compelling indications for other drug classes.
- Most patients will require two or more antihypertensive drugs to achieve goal BP.
- If BP is  $>20/10$  mmHg above goal, initiate therapy with two agents, one usually should be a thiazide-type diuretic.



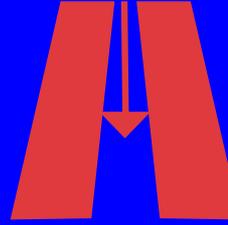
# New Features and Key Messages (Continued)



- The most effective therapy prescribed by the careful clinician will control HTN 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.
- The responsible physician's judgment remains paramount.



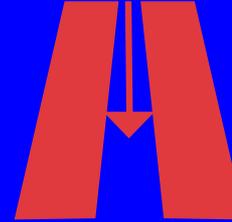
# BP Measurement and Clinical Evaluation



- Classification of BP
- CVD Risk
- Benefits of Lowering BP
- BP Control Rates
- BP Measurement Techniques
  - In-office
  - Ambulatory BP Monitoring
  - Self-measurement
- Patient Evaluation
  - Laboratory Tests and Other Diagnostic Procedures



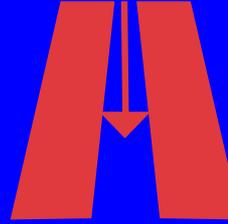
# Blood Pressure Classification



BP Classification	SBP mmHg		DBP mmHg
Normal	<120	and	<80
Prehypertension	120–139	or	80–89
Stage 1 Hypertension	140–159	or	90–99
Stage 2 Hypertension	≥160	or	≥100



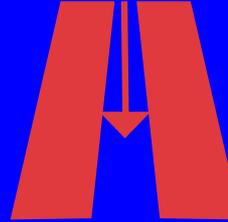
# CVD Risk



- HTN prevalence ~ 50 million people in the United States.
- The BP relationship to risk of CVD is continuous, consistent, and independent of other risk factors.
- Each increment of 20/10 mmHg doubles the risk of CVD across the entire BP range starting from 115/75 mmHg.
- Prehypertension signals the need for increased education to reduce BP in order to prevent hypertension.



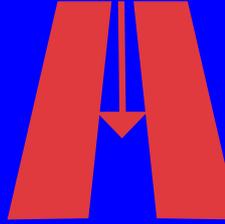
# Benefits of Lowering BP



	<b>Average Percent Reduction</b>
Stroke incidence	35–40%
Myocardial infarction	20–25%
Heart failure	50%



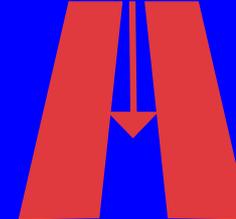
# Benefits of Lowering BP



In stage 1 HTN and additional CVD risk factors, achieving a sustained 12 mmHg reduction in SBP over 10 years will prevent 1 death for every 11 patients treated.



# BP Control Rates



Trends in awareness, treatment, and control of high blood pressure in adults ages 18–74

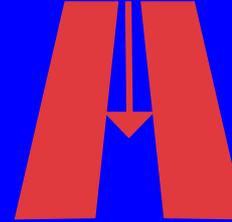
**National Health and Nutrition Examination Survey, Percent**

	II 1976–80	II (Phase 1) 1988–91	II (Phase 2) 1991–94	1999–2000
<b>Awareness</b>	51	73	68	70
<b>Treatment</b>	31	55	54	59
<b>Control</b>	10	29	27	34

Sources: Unpublished data for 1999–2000 computed by M. Wolz, National Heart, Lung, and Blood Institute; JNC 6.



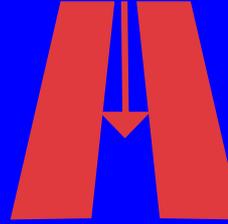
# BP Measurement Techniques



Method	Brief Description
In-office	Two readings, 5 minutes apart, sitting in chair. Confirm elevated reading in contralateral arm.
Ambulatory BP monitoring	Indicated for evaluation of “white-coat” HTN. Absence of 10–20% BP decrease during sleep may indicate increased CVD risk.
Self-measurement	Provides information on response to therapy. May help improve adherence to therapy and evaluate “white-coat” HTN.



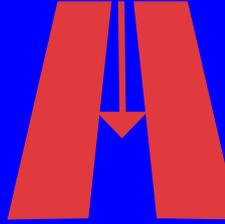
# Office BP Measurement



- Use auscultatory method with a properly calibrated and validated instrument.
- Patient should be seated quietly for 5 minutes in a chair (not on an exam table), feet on the floor, and arm supported at heart level.
- Appropriate-sized cuff should be used to ensure accuracy.
- At least two measurements should be made.
- Clinicians should provide to patients, verbally and in writing, specific BP numbers and BP goals.



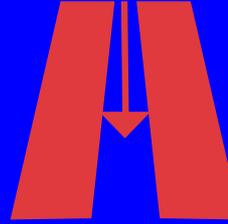
# Ambulatory BP Monitoring



- ABPM is warranted for evaluation of “white-coat” HTN in the absence of target organ injury.
- Ambulatory BP values are usually lower than clinic readings.
- Awake, individuals with hypertension have an average BP of  $>135/85$  mmHg and during sleep  $>120/75$  mmHg.
- BP drops by 10 to 20% during the night; if not, signals possible increased risk for cardiovascular events.



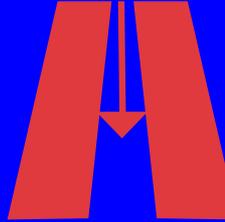
# Self-Measurement of BP



- Provides information on:
  1. Response to antihypertensive therapy
  2. Improving adherence with therapy
  3. Evaluating white-coat HTN
- Home measurement of  $>135/85$  mmHg is generally considered to be hypertensive.
- Home measurement devices should be checked regularly.



# Patient Evaluation

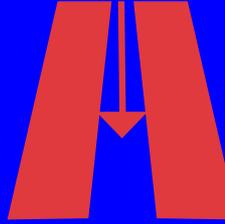


Evaluation of patients with documented HTN has three objectives:

1. Assess lifestyle and identify other CV risk factors or concomitant disorders that affects prognosis and guides treatment.
2. Reveal identifiable causes of high BP.
3. Assess the presence or absence of target organ damage and CVD.



# CVD Risk Factors

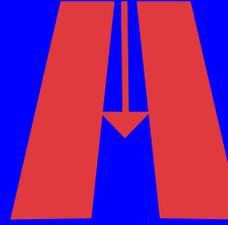


- Hypertension\*
- Cigarette smoking
- Obesity\* (BMI  $\geq 30$  kg/m<sup>2</sup>)
- Physical inactivity
- Dyslipidemia\*
- Diabetes mellitus\*
- Microalbuminuria or estimated GFR <60 ml/min
- Age (older than 55 for men, 65 for women)
- Family history of premature CVD  
(men under age 55 or women under age 65)

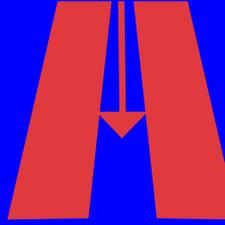
\*Components of the metabolic syndrome.



# Identifiable Causes of Hypertension



- Sleep apnea
- Drug-induced or related causes
- Chronic kidney disease
- Primary aldosteronism
- Renovascular disease
- Chronic steroid therapy and Cushing's syndrome
- Pheochromocytoma
- Coarctation of the aorta
- Thyroid or parathyroid disease

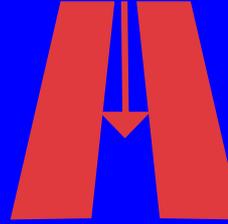


# Target Organ Damage

- Heart
  - Left ventricular hypertrophy
  - Angina or prior myocardial infarction
  - Prior coronary revascularization
  - Heart failure
  
- Brain
  - Stroke or transient ischemic attack
  
- Chronic kidney disease
  
- Peripheral arterial disease
  
- Retinopathy



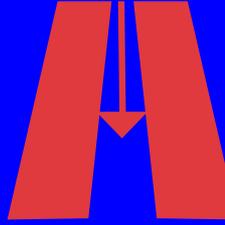
# Laboratory Tests



- Routine Tests
  - Electrocardiogram
  - Urinalysis
  - Blood glucose, and hematocrit
  - Serum potassium, creatinine, or the corresponding estimated GFR, and calcium
  - Lipid profile, after 9- to 12-hour fast, that includes high-density and low-density lipoprotein cholesterol, and triglycerides
- Optional tests
  - Measurement of urinary albumin excretion or albumin/creatinine ratio
- More extensive testing for identifiable causes is not generally indicated unless BP control is not achieved



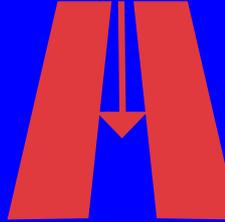
# Treatment Overview



- Goals of therapy
- Lifestyle modification
- Pharmacologic treatment
  - Algorithm for treatment of hypertension
- Classification and management of BP for adults
- Followup and monitoring



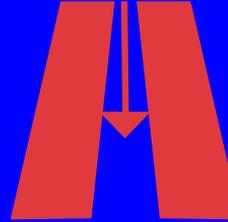
# Goals of Therapy



- Reduce CVD and renal morbidity and mortality.
- Treat to BP <140/90 mmHg or BP <130/80 mmHg in patients with diabetes or chronic kidney disease.
- Achieve SBP goal especially in persons  $\geq 50$  years of age.



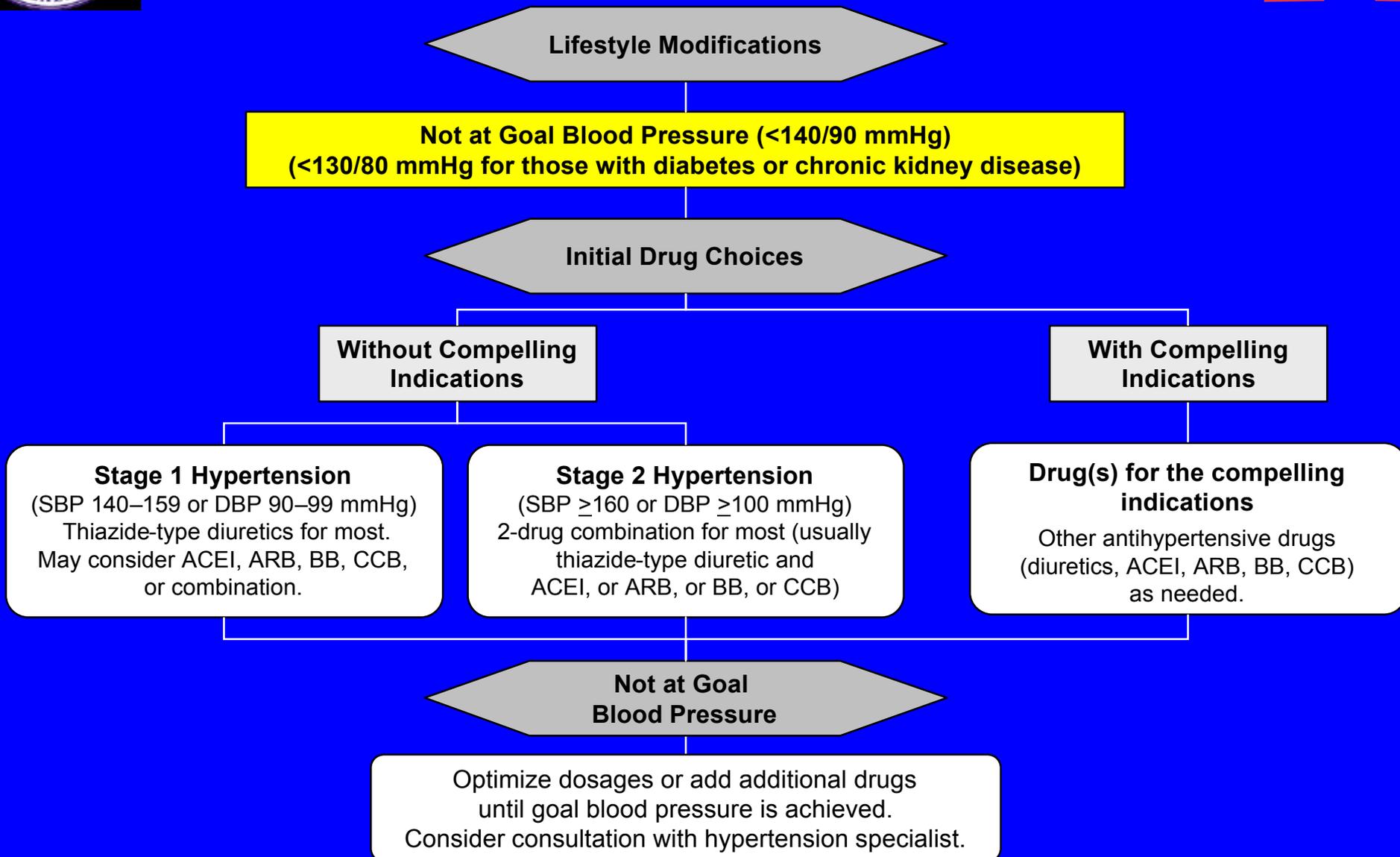
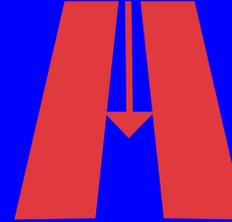
# Lifestyle Modification



Modification	Approximate SBP reduction (range)
Weight reduction	5–20 mmHg/10 kg weight loss
Adopt DASH eating plan	8–14 mmHg
Dietary sodium reduction	2–8 mmHg
Physical activity	4–9 mmHg
Moderation of alcohol consumption	2–4 mmHg

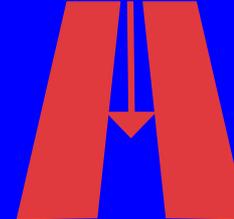


# Algorithm for Treatment of Hypertension





# Classification and Management of BP for adults



BP classification	SBP* mmHg	DBP* mmHg	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 compelling indications. †
Stage 1 Hypertension	140–159	or 90–99	Yes	Thiazide-type diuretics for most. May consider ACEI, ARB, BB, CCB, or combination.	Drug(s) for the compelling indications. †
Stage 2 Hypertension	≥160	or ≥100	Yes	Two-drug combination for most† (usually thiazide-type diuretic and ACEI or ARB or BB or CCB).	Other antihypertensive drugs (diuretics, ACEI, ARB, BB, CCB) as needed.

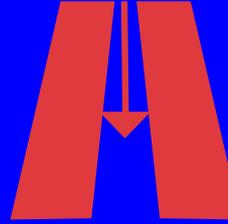
\*Treatment determined by highest BP category.

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

‡Treat patients with chronic kidney disease or diabetes to BP goal of <130/80 mmHg.



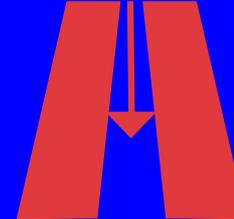
# Followup and Monitoring



- Patients should return for followup and adjustment of medications until the BP goal is reached.
- More frequent visits for stage 2 HTN or with complicating comorbid conditions.
- Serum potassium and creatinine monitored 1–2 times per year.



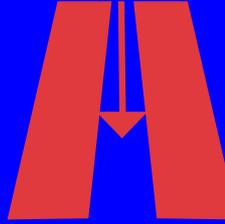
# Followup and Monitoring (continued)



- After BP at goal and stable, followup visits 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.



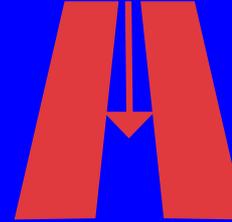
# Special Considerations



- Compelling Indications
- Other Special Situations
  - Minority populations
  - Obesity and the metabolic syndrome
  - Left ventricular hypertrophy
  - Peripheral arterial disease
  - Hypertension in older persons
  - Postural hypotension
  - Dementia
  - Hypertension in women
  - Hypertension in children and adolescents
  - Hypertension urgencies and emergencies



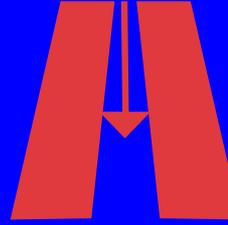
# Compelling Indications for Individual Drug Classes



Compelling Indication	Initial Therapy Options	Clinical Trial Basis
Heart failure	THIAZ, BB, ACEI, ARB, ALDO ANT	ACC/AHA Heart Failure Guideline, MERIT-HF, COPERNICUS, CIBIS, SOLVD, AIRE, TRACE, ValHEFT, RALES
Postmyocardial infarction	BB, ACEI, ALDO ANT	ACC/AHA Post-MI Guideline, BHAT, SAVE, Capricorn, EPHEBUS
High CAD risk	THIAZ, BB, ACE, CCB	ALLHAT, HOPE, ANBP2, LIFE, CONVINC



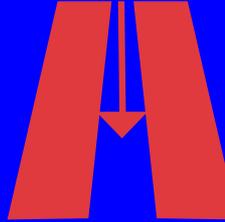
# Compelling Indications for Individual Drug Classes



Compelling Indication	Initial Therapy Options	Clinical Trial Basis
Diabetes	THIAZ, BB, ACE, ARB, CCB	NKF-ADA Guideline, UKPDS, ALLHAT
Chronic kidney disease	ACEI, ARB	NKF Guideline, Captopril Trial, RENAAL, IDNT, REIN, AASK
Recurrent stroke prevention	THIAZ, ACEI	PROGRESS



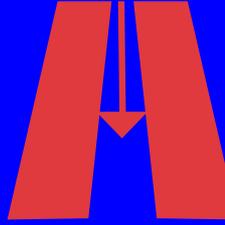
# Minority Populations



- In general, treatment similar for all demographic groups.
- Socioeconomic factors and lifestyle important barriers to BP control.
- Prevalence, severity of HTN increased in African Americans.
- African Americans demonstrate somewhat reduced BP responses to monotherapy with BBs, ACEIs, or ARBs compared to diuretics or CCBs.
- These differences usually eliminated by adding adequate doses of a diuretic.



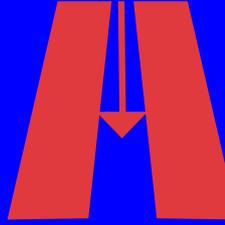
# Left Ventricular Hypertrophy



- LVH is an independent risk factor that increases the risk of CVD.
- Regression of LVH occurs with aggressive BP management: weight loss, sodium restriction, and treatment with all classes of drugs except the direct vasodilators hydralazine and minoxidil.



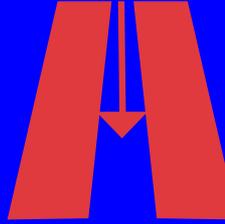
# Peripheral Arterial Disease (PAD)



- PAD is equivalent in risk to ischemic heart disease.
- Any class of drugs can be used in most PAD patients.
- Other risk factors should be managed aggressively.
- Aspirin should be used.



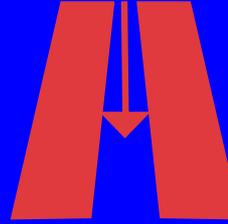
# Hypertension in Older Persons



- More than two-thirds of people over 65 have HTN.
- This population has the lowest rates of BP control.
- Treatment, including those who with isolated systolic HTN, should follow same principles outlined for general care of HTN.
- Lower initial drug doses may be indicated to avoid symptoms; standard doses and multiple drugs will be needed to reach BP targets.



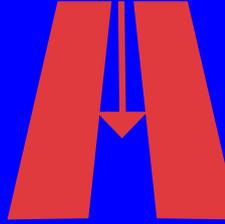
# Postural Hypotension



- Decrease in standing SBP  $>10$  mmHg, when associated with dizziness/fainting, more frequent in older SBP patients with diabetes, taking diuretics, venodilators, and some psychotropic drugs.
- BP in these individuals should be monitored in the upright position.
- Avoid volume depletion and excessively rapid dose titration of drugs.



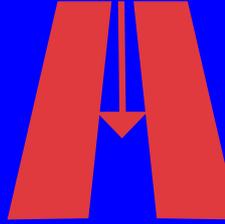
# Dementia



- Dementia and cognitive impairment occur more commonly in people with HTN.
- Reduced progression of cognitive impairment occurs with effective antihypertensive therapy.



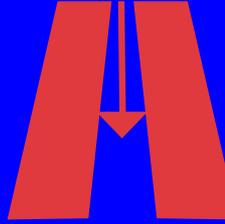
# Hypertension in Women



- Oral contraceptives may increase BP, and BP should be checked regularly. In contrast, HRT does not raise BP.
- Development of HTN—consider other forms of contraception.
- Pregnant women with HTN should be followed carefully. Methyldopa, BBs, and vasodilators, preferred for the safety of the fetus. ACEI and ARBs contraindicated in pregnancy.



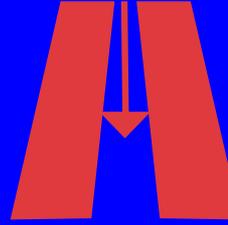
# Children and Adolescents



- HTN defined as BP—95th percentile or greater, adjusted for age, height, and gender.
- Use lifestyle interventions first, then drug therapy for higher levels of BP or if insufficient response to lifestyle modifications.
- Drug choices similar in children and adults, but effective doses are often smaller.
- Uncomplicated HTN not a reason to restrict physical activity.



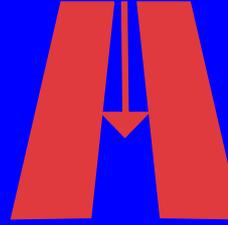
# Hypertensive Urgencies and Emergencies



- Patients with marked BP elevations and acute TOD (e.g., encephalopathy, myocardial infarction, unstable angina, pulmonary edema, eclampsia, stroke, head trauma, life-threatening arterial bleeding, or aortic dissection) require hospitalization and parenteral drug therapy.
- Patients with markedly elevated BP but without acute TOD usually do not require hospitalization, but should receive immediate combination oral antihypertensive therapy.



# Additional Considerations in Antihypertensive Drug Choices

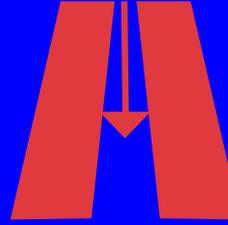


## Potential favorable effects

- Thiazide-type diuretics useful in slowing demineralization in osteoporosis.
- BBs useful in the treatment of atrial tachyarrhythmias/fibrillation, migraine, thyrotoxicosis (short-term), essential tremor, or perioperative HTN.
- CCBs useful in Raynaud's syndrome and certain arrhythmias.
- Alpha-blockers useful in prostatism.



# Additional Considerations in Antihypertensive Drug Choices

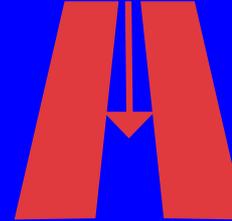


## Potential unfavorable effects

- Thiazide diuretics should be used cautiously in gout or a history of significant hyponatremia.
- BBs should be generally avoided in patients with asthma, reactive airways disease, or second- or third-degree heart block.
- ACEIs and ARBs are contraindicated in pregnant women or those likely to become pregnant.
- ACEIs should not be used in individuals with a history of angioedema.
- Aldosterone antagonists and potassium-sparing diuretics can cause hyperkalemia.



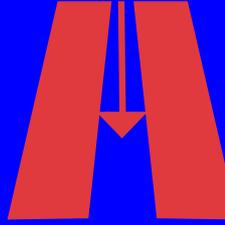
# Improving Hypertension Control



- Adherence to regimens
- Resistant hypertension



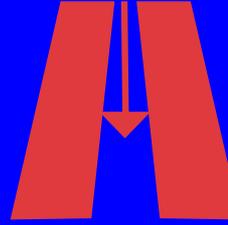
# Strategies for Improving Adherence to Regimens



- Clinician empathy increases patient trust, motivation, and adherence to therapy.
- Physicians should consider their patients' cultural beliefs and individual attitudes in formulating therapy.



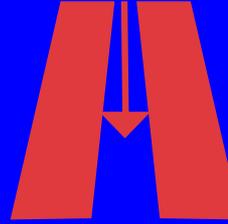
# Causes of Resistant Hypertension



- Improper BP measurement
- Excess sodium intake
- Inadequate diuretic therapy
- Medication
  - Inadequate doses
  - Drug actions and interactions (e.g., nonsteroidal anti-inflammatory drugs (NSAIDs), illicit drugs, sympathomimetics, oral contraceptives)
  - Over-the-counter (OTC) drugs and herbal supplements
- Excess alcohol intake
- Identifiable causes of HTN



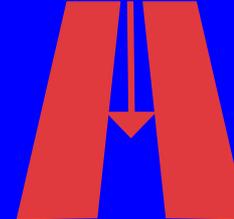
# Public Health Challenges and Community Programs



- Public health approaches (e.g. reducing calories, saturated fat, and salt in processed foods and increasing community/school opportunities for physical activity) can achieve a downward shift in the distribution of a population's BP, thus potentially reducing morbidity, mortality, and the lifetime risk of an individual's becoming hypertensive.
- These public health approaches can provide an attractive opportunity to interrupt and prevent the continuing costly cycle of managing HTN and its complications.



# Population-Based Strategy



## SBP Distributions

After Intervention — Before Intervention

Reduction in BP

Reduction in SBP  
mmHg

% Reduction in Mortality  
Stroke CHD Total

2

-6

-4

-3

3

-8

-5

-4

5

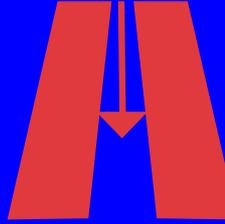
-14

-9

-7



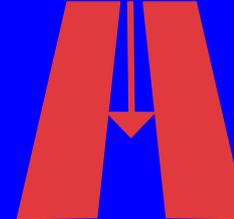
# Supporting Materials



- Web site [www.nhlbi.nih.gov/](http://www.nhlbi.nih.gov/)
- For patients and the general public
  - “Facts About the DASH Eating Plan” (Revised May 2003)
  - “Your Guide to Lowering Blood Pressure”
- For health professionals
  - Reference Card
  - Slide Show



# Web site [www.nhlbi.nih.gov/](http://www.nhlbi.nih.gov/)



## *NATIONAL HIGH BLOOD PRESSURE EDUCATION PROGRAM*

### *The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7)*

#### **The Guidelines**

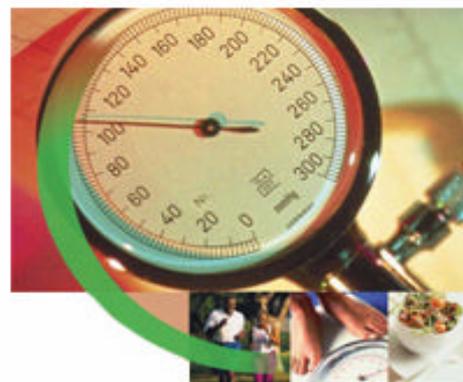
- ▶ [JNC 7 Express](#)

#### **Information for Patients**

- ▶ [Your Guide to Lowering Blood Pressure](#)
- ▶ [Facts About the DASH Eating Plan](#)  
(revised, May 2003)

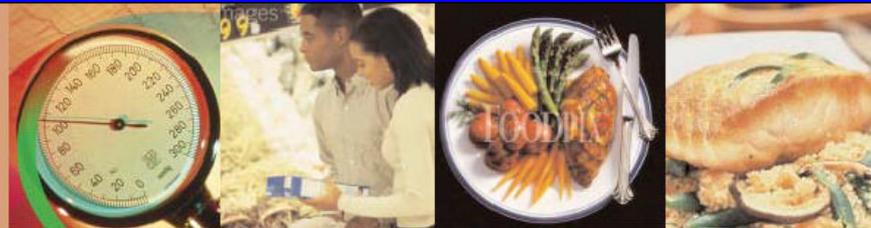
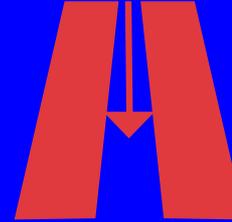
#### **Information for Health Professionals**

- ▶ [Physician Reference Card](#)
- ▶ [Slide Show](#)





# DASH Fact Sheet



FACTS ABOUT

## The *DASH* Eating Plan



Research has found that diet affects the development of high blood pressure, or hypertension (the medical term). Recently, two studies showed that following a particular eating plan—called the DASH eating plan—and reducing the amount of sodium consumed lowers blood pressure.

While each step alone lowers blood pressure, the combination of the eating plan and a reduced sodium intake gives the biggest benefit and may help prevent the development of high blood pressure.

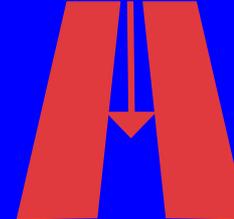
This fact sheet, based on the DASH research findings, tells about high blood pressure, and how to follow the DASH eating plan and reduce the amount of sodium you consume. It offers tips on how to start and stay on the eating plan, as well as a week of menus and some recipes. The menus and recipes are given for two levels of daily sodium consumption—2,400 milligrams (the upper limit of current recommendations by the Federal Government's National High Blood Pressure Education Program, or NHBPEP, and the amount used to figure food labels' Nutrition Facts Daily Value) and 1,500 milligrams.

Those with high blood pressure may especially benefit from following the eating plan and reducing their sodium intake. But the combination is a heart-healthy recipe that all adults can follow.





# Your Guide to Lowering Blood Pressure

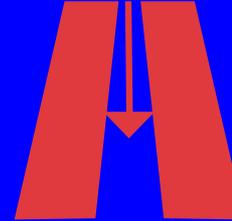
A collage of images related to blood pressure management. The top half shows a close-up of a blood pressure monitor's gauge with a needle pointing to approximately 100 mmHg. Below this, there are three smaller images: a man and a woman talking, a person's hand on a blood pressure cuff, and a bowl of fresh salad. A green curved line highlights the gauge and the lifestyle images.

Your  
Guide to  
Lowering  
Blood Pressure

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
National Institutes of Health  
National Heart, Lung, and Blood Institute



# Reference Card



## Reference Card From the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7)

### EVALUATION

#### CLASSIFICATION OF BLOOD PRESSURE (BP)\*

CATEGORY	SBP MMHg	and	DBP MMHg
Normal	<120	and	<80
Prehypertension	120-139	or	80-89
Hypertension, Stage 1	140-159	or	90-99
Hypertension, Stage 2	≥160	or	≥100

\* See Blood Pressure Measurement Techniques (reverse side)  
Key: SBP = systolic blood pressure DBP = diastolic blood pressure

#### DIAGNOSTIC WORKUP OF HYPERTENSION

- Assess risk factors and comorbidities.
- Reveal identifiable causes of hypertension.
- Assess presence of target organ damage.
- Conduct history and physical examination.
- Obtain laboratory tests: urinalysis, blood glucose, hematocrit and lipid panel, serum potassium, creatinine, and calcium. Optional: urinary albumin/creatinine ratio.
- Obtain electrocardiogram.

#### ASSESS FOR MAJOR CARDIOVASCULAR DISEASE (CVD)

##### RISK FACTORS

- Hypertension
- Obesity (body mass index  $\geq 30$  kg/m<sup>2</sup>)
- Dyslipidemia
- Diabetes mellitus
- Cigarette smoking
- Physical inactivity
- Microalbuminuria, estimated glomerular filtration rate  $< 60$  mL/min
- Age ( $> 55$  for men,  $> 65$  for women)
- Family history of premature CVD (men age  $< 55$ , women age  $< 65$ )

#### ASSESS FOR IDENTIFIABLE CAUSES OF HYPERTENSION

- Sleep apnea
- Drug induced/related
- Chronic kidney disease
- Primary aldosteronism
- Renovascular disease
- Cushing's syndrome or steroid therapy
- Pheochromocytoma
- Coarctation of aorta
- Thyroid/parathyroid disease



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### TREATMENT

#### PRINCIPLES OF HYPERTENSION TREATMENT

- Treat to BP  $< 140/90$  mmHg or BP  $< 130/80$  mmHg in patients with diabetes or chronic kidney disease.
- Majority of patients will require two medications to reach goal.

#### ALGORITHM FOR TREATMENT OF HYPERTENSION

