ICSI

INSTITUTE FOR CLINICAL SYSTEMS IMPROVEMENT

Health Care Guideline:
Hypertension Diagnosis and Treatment

Twelfth Edition
October 2008

The information contained in this ICSI Health Care Guideline is intended primarily for health professionals and the following expert audiences:

- physicians, nurses, and other health care professional and provider organizations;
- health plans, health systems, health care organizations, hospitals and integrated health care delivery systems;
- health care teaching institutions;
- health care information technology departments;
- medical specialty and professional societies;
- researchers;
- federal, state and local government health care policy makers and specialists; and
- employee benefit managers.

This ICSI Health Care Guideline should not be construed as medical advice or medical opinion related to any specific facts or circumstances. If you are not one of the expert audiences listed above you are urged to consult a health care professional regarding your own situation and any specific medical questions you may have. In addition, you should seek assistance from a health care professional in interpreting this ICSI Health Care Guideline and applying it in your individual case.

This ICSI Health Care Guideline is designed to assist clinicians by providing an analytical framework for the evaluation and treatment of patients, and is not intended either to replace a clinician's judgment or to establish a protocol for all patients with a particular condition. An ICSI Health Care Guideline rarely will establish the only approach to a problem.

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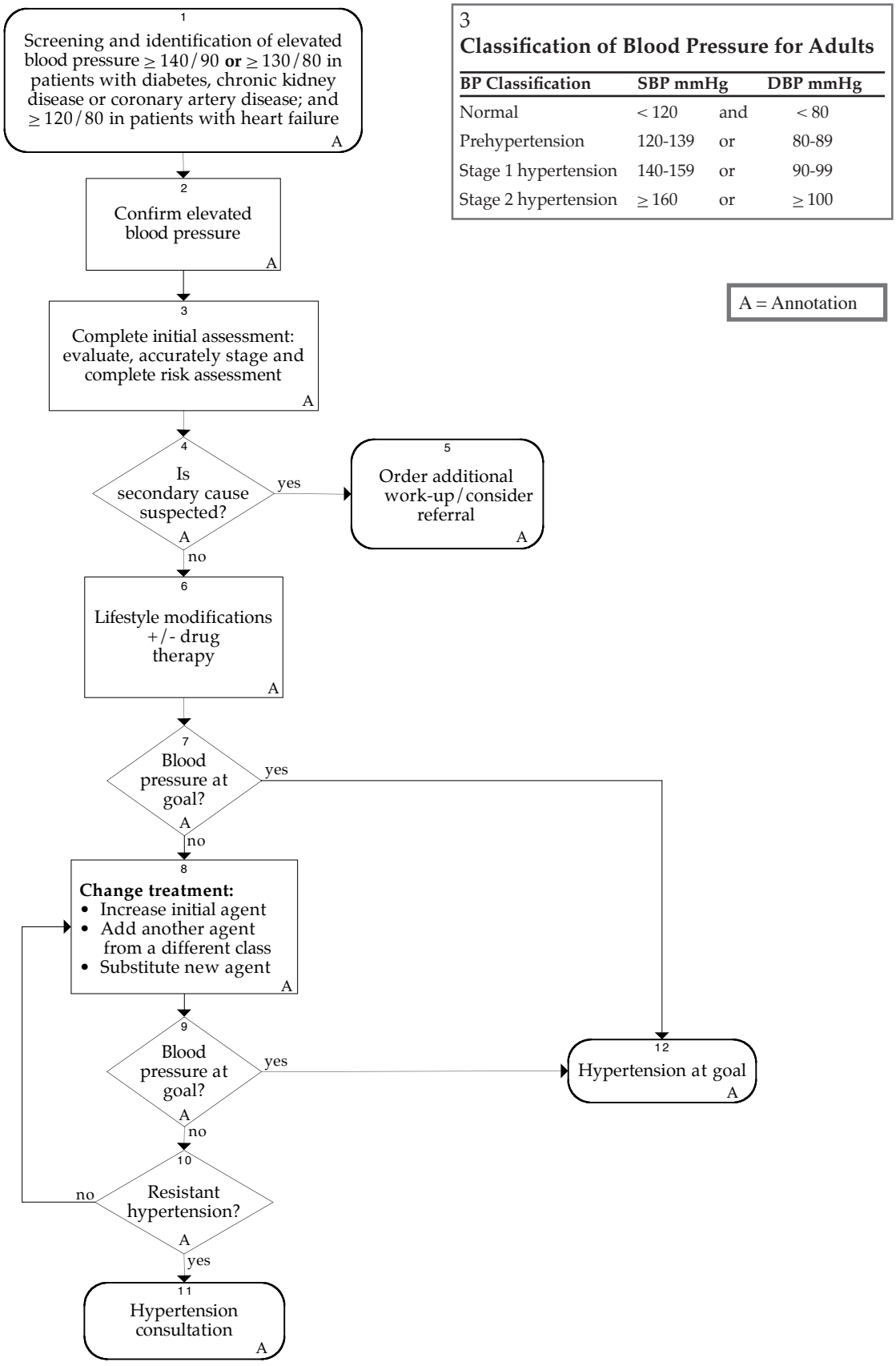

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Classification of Blood Pressure for Adults

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

A = Annotation

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Foreword

Scope and Target Population

Adults age 18 or older.

Clinical Highlights and Recommendations

- Confirmation of hypertension is based on the initial visit, plus two follow-up visits with at least two blood pressure measures at each visit. *(Annotation #2)*
- Standardized blood pressure measurement techniques (including out-of-office or home blood pressure measurements) should be employed when confirming an initially elevated blood pressure and for all subsequent measures during follow-up and treatment for hypertension. *(Annotation #2, Appendix A)*
- A thiazide-type diuretic should be considered as initial therapy in most patients with uncomplicated hypertension. (*Annotation #6)*
- Physician reluctance to initiate and intensify treatment is a major obstacle to achieving treatment goals. *(Annotations #8, 10)*
- Systolic blood pressure level should be the major factor for the detection, evaluation and treatment of hypertension, especially in adults 50 years and older. (*Annotation #7)*
- Fewer than 50% of patients with hypertension will be controlled with a single drug. *(Annotation #8)*

Priority Aims

1. Increase the percentage of adult patients in blood pressure control. *(Annotation #7)*
2. Improve the assessment of adult patients with hypertension. *(Annotation #2)*
3. Increase the percentage of adult patients with hypertension who receive patient education, with a focus on the use of non-pharmacological treatments. *(Appendix C)*
4. Increase the percentage of adult patients not in blood pressure control who have a care plan. *(Annotations #3, 6)*
5. Increase the percentage of adult patients not at blood pressure goal who have a change in subsequent therapy. *(Annotation #8)*

Key Implementation Recommendations

The following system changes were identified by the guideline work group as key strategies for health care systems to incorporate in support of the implementation of this guideline.

1. Develop systems that provide for staff education on proper blood pressure measurement. (See Appendix A, "Standards for Blood Pressure Measurement.") Based on surveys that show the variability of blood pressure measurement, training sessions should be arranged by your medical facility (review the steps in Appendix A and the rationale that accompanies the document). Accurate, reproducible blood pressure measurement is important to correctly classify blood pressure. Inconsistencies may result from using defective equipment and not standardizing the technique. The education and training standards found in Appendix A are consistent with American Heart Association and National Heart, Lung, and Blood Institute recommendations.
2. Develop systems for providing patient education on hypertension management. (See Appendix C, "Recommended Education Messages.") The appendix contains educational messages that will support goals of patient education and self-involvement in ongoing hypertension management. Major components of the education are:
   - basic information about "What is blood pressure?", what the blood pressure numbers mean, and how high blood pressure affects your life;
   - lifestyle modifications;
   - pharmacologic therapy;
   - ongoing management.

Related ICSI Scientific Documents

Guidelines

- Diagnosis and Initial Treatment of Ischemic Stroke
- Heart Failure in Adults
- Lipid Management in Adults
- Diagnosis and Management of Type 2 Diabetes Mellitus in Adults
- Preventive Services for Adults
- Stable Coronary Artery Disease
- Atrial Fibrillation
- Diagnosis and Treatment of Chest Pain and Acute Coronary Syndrome (ACS)
- Prevention and Management of Obesity (Mature Adolescents and Adults)

Technology Assessment Reports

- Gastric Restrictive Surgery for Clinically Severe Obesity in Adults (#14, 2000)
- Pharmacological Approaches to Weight Loss in Adults (#71, 2003)
- Behavioral Therapy Programs for Weight Loss in Adults (#87, 2005)
- Diet Programs for Weight Loss in Adults (#83, 2004)
- Treatment of Obesity in Children and Adolescents (#90, 2005)

Disclosure of Potential Conflict of Interest

ICSI has adopted a policy of transparency, disclosing potential conflict and competing interests of all individuals who participate in the development, revision and approval of ICSI documents (guidelines, order sets and protocols). This applies to all work groups (guidelines, order sets and protocols) and committees (Committee on Evidence-Based Practice, Cardiovascular Steering Committee, Women's Health Steering Committee, Preventive & Health Maintenance Steering Committee and Respiratory Steering Committee).

Participants must disclose any potential conflict and competing interests they or their dependents (spouse, dependent children, or others claimed as dependents) may have with any organization with commercial, proprietary, or political interests relevant to the topics covered by ICSI documents. Such disclosures will be shared with all individuals who prepare, review and approve ICSI documents.

Anthony Woolley receives research / grant funding from Pfizer, 100% of which is administered through his organization.

No other work group members have potential conflicts of interest to disclose.

Introduction to ICSI Document Development

This document was developed and/or revised by a multidisciplinary work group utilizing a defined process for literature search and review, document development and revision, as well as obtaining input from and responding to ICSI members.

For a description of ICSI's development and revision process, please see the Development and Revision Process for Guidelines, Order Sets and Protocols at http://www.icsi.org.

Evidence Grading System

A. Primary Reports of New Data Collection:

Class A: Randomized, controlled trial

Class B: Cohort study

Class C: Non-randomized trial with concurrent or historical controls
Case-control study
Study of sensitivity and specificity of a diagnostic test
Population-based descriptive study

Class D: Cross-sectional study
Case series
Case report

B. Reports that Synthesize or Reflect Upon Collections of Primary Reports:

Class M: Meta-analysis
Systematic review
Decision analysis
Cost-effectiveness analysis

Class R: Consensus statement
Consensus report
Narrative review

Class X: Medical opinion

Citations are listed in the guideline utilizing the format of *(Author, YYYY [report class])*. A full explanation of ICSI's Evidence Grading System can be found at http://www.icsi.org.

Algorithm Annotations

1. Screening and Identification of Elevated Blood Pressure Greater Than or Equal to 140/90, OR Greater Than or Equal to 130/80 in Patients with Diabetes, Chronic Kidney Disease or Coronary Artery Disease; and Greater Than or Equal to 120/80 in Patients with Heart Failure

The entry point to this guideline is through the ICSI Preventive Services for Adults guideline. Patients should receive routine blood pressure screening and identification of elevated blood pressure in the manner recommended in that guideline.

2. Confirm Elevated Blood Pressure

Key Points:

- All elevated blood pressure readings should be confirmed.
- A standardized blood pressure measurement process is important for correctly identifying hypertensive patients.
- Self-monitoring of blood pressure should be encouraged in most patients.

If an elevated blood pressure reading has been obtained, the blood pressure level should be confirmed. Confirmation is based on the initial visit, plus two follow-up visits with at least two blood pressure readings at each visit. Explain the rationale, emphasize the reason for return and the need for confirmation of elevated blood pressure. Unconfirmed hypertension should be coded with CPT code 796.2. Confirmation and follow-up recommendations are noted in Table 1, "JNC7 Classification of Blood Pressure for Adults Aged 18 Years and Older" later in this annotation.

Standardized Office Blood Pressure Measurement

Accurate, reproducible blood pressure measurement is important to allow comparisons between blood pressure values and to correctly classify blood pressure. Incorrectly labeling a hypertensive patient as normotensive may increase risk for vascular events, since risk rises with increasing blood pressure. Labeling a patient with normal blood pressure as a hypertensive can affect insurability, employment, morbidity from medications, loss of time from work, and unnecessary lab and physician visits.

(Hajjar, 2003 [D]; Pickering, 2005 [R])

Standardized blood pressure technique should be employed when confirming an elevated reading and for all subsequent readings during follow-up and treatment for hypertension. See Appendix A, "Standards for Blood Pressure Measurement."

Confirmed elevated blood pressure should be classified as to the appropriate hypertension stage.

Out-of-Office Blood Pressure Measurement

Out-of-office, self-measured blood pressure readings provide important information regarding the diagnosis and treatment of hypertension and should be a routine component of blood pressure monitoring in most patients *(Pickering, 2008 [R])*. Home blood pressure monitoring identifies patients with white-coat hypertension, i.e., patients with elevated office blood pressure who lack evidence of hypertensive target organ damage,

and who have normal out-of-office blood pressure readings, and home readings are a stronger predictor of subsequent cardiovascular events than are office readings. Moreover, home blood pressure measurements can identify patients with "masked hypertension," i.e., normal office and elevated home readings *(Bobrie, 2004 [B])*. Studies have shown that uncertainty about the "true blood pressure" is a common reason for lack of change in treatment during a clinic visit despite an elevated office blood pressure reading. Additional readings from self-monitoring will reduce this uncertainty. It is recommended that patients obtain 2-3 readings while rested in the seated position, both in the morning and at night for one week prior to a clinic visit *(Pickering, 2008 [R])*. Fully automated oscillometric devices using an appropriately sized upper arm cuff are preferred over aneroid devices or automated devices that measure blood pressure at the wrist or on the finger. Accuracy of the patient's automated device should be confirmed initially upon acquisition and periodically (e.g., annually) by the patient's health care professional *(Canzanello, 2005 [D])*. The general home blood pressure goal with treatment is less than 135/85 mmHg or less than 130/80 mmHg in patients with diabetes, chronic kidney disease, coronary artery disease or heart failure.

24-Hour Blood Pressure Measurement

Ambulatory blood pressure monitoring provides information about blood pressure during daily activities and sleep. It is particularly helpful in the confirmation of white-coat or office hypertension. This phenomenon may be present in 20% to 35% of patients diagnosed with hypertension *(Clement, 2003 [B])*. In general, however, this diagnosis can be reliably established without ambulatory blood pressure monitoring in patients with elevated office readings who lack target organ damage, and who have accurately measured out-of-office blood pressure readings that are consistently less than 135/85 mmHg. Other clinical situations in which ambulatory blood pressure monitoring may be helpful include the assessment of drug resistance, hypotensive symptoms, episodic hypertension and suspected autonomic dysfunction. Ambulatory blood pressure monitoring predicts subsequent cardiovascular events more reliably than office blood pressure measurements. Ambulatory blood pressure monitoring may be inaccurate with atrial fibrillation. Thresholds for ambulatory hypertension are 140/85 mmHg for awake average, 120/70 mmHg for asleep average and 130/80 for 24-hour average blood pressure *(Kikuya, 2007 [C])*.

Table 1.

JNC7 Classification of Blood Pressure for Adults Aged 18 Years and Older*

	Blood pressure, mmHg		
Category	**Systolic (mmHg)**		**Diastolic (mmHg)**
Normal**	less than 120	and	less than 80
Prehypertension	120-139	or	80-89
Hypertension***			
Stage 1	140-159	or	90-99
Stage 2	greater than or equal to 160	or	greater than or equal to 100

* Not taking antihypertensive drugs and not acutely ill. When systolic and diastolic pressure fall into different categories, the higher category should be selected to classify the individual's blood pressure status. (Isolated systolic hypertension [ISH] is defined as SBP greater than or equal to 140 mmHg and DBP less than 90 mmHg and staged appropriately [e.g., 170/82 mmHg is defined as Stage 2 ISH].) In addition to classifying stages of hypertension on the basis of average blood pressure levels, clinicians should specify presence or absence of target organ disease and additional risk factors. This information is important for risk assessment and treatment.

** Optimal blood pressure with respect to cardiovascular risk is SBP less than 120 mmHg and DBP less than 80 mmHg. However, unusually low readings should be evaluated for clinical significance.

*** Based on the average of two or more readings taken at each of two or more visits after an initial screening.

Taken from the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension* 2003;42:1206-52. (Class R)

For patients with prehypertension, early intervention with healthy lifestyle changes could reduce blood pressure, decrease the rate of the progression of blood pressure to hypertensive levels with age, or prevent hypertension entirely.

Table 2. Recommendations for Follow-Up Based on Initial Blood Pressure Measurements for Adults without Acute End Organ Damage

Initial Blood Pressure, mm Hg*	Follow-Up Recommended†
Normal	Recheck in two years
Prehypertension	Recheck in one year††
Stage 1 hypertension	Confirm within two months††
Stage 2 hypertension	Evaluate or refer to source of care within one month. For those with high pressures (e.g., greater than 180/110 mm Hg), evaluate and treat immediately or within one week depending on clinical situation and complications.

*If systolic and diastolic categories are different, follow recommendations for shorter time follow-up (e.g., 160/86 mm Hg should be evaluated or referred to source of care within one month).

† Modify the scheduling or follow-up according to reliable information about past BP measurements, other cardiovascular risk factors, or target organ disease.

†† Provide advice about lifestyle modifications (see Annotation 6, "Lifestyle Modifications +/- Drug Therapy").

Taken from the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension* 2003;42:1206-52. (Class R)

Blood Pressure Screening Clarification

Because all stages of hypertension are associated with increased vascular events, the previous classifications of mild and moderate hypertension were discarded in favor of stages that emphasize these risks. The current classification emphasizes systolic as well as diastolic standards, as systolic hypertension has been associated with increased fatal and nonfatal cardiovascular events, and treatment has been shown to reduce cardiovascular morbidity and mortality *(Chobanian, 2003 [R]; Liu, 1998 [C]; SHEP Cooperative Research Group, 1991 [A]; Staessen, 1997 [A]; World Health Organization/International Society of Hypertension, 1999 [R])*.

A proposed follow-up schedule – based on the initial blood pressure level as well as prior diagnosis and treatment of cardiovascular disease and risk factors – is noted in Table 2 *(Chobanian, 2003 [R])*.

Initial encounter is defined as an ICD-9 code of 796.2 ("Elevated blood pressure reading without diagnosis of hypertension. Note: this category is to be used to record an episode of elevated blood pressure in a patient in whom no formal diagnosis of hypertension has been made, or as an incidental finding").

This guideline encourages increased use of this 796.2 ICD-9 code because elevated blood pressure without hypertension is currently believed to be underreported.

3. Complete Initial Assessment: Evaluate, Accurately Stage and Complete Risk Assessment

Key Points:

- It is important to assess and accurately stage newly confirmed hypertension.
- A complete review of all medications (prescription and over-the-counter) and herbal supplements is very important.

The goal of the clinical evaluation in newly confirmed hypertension is to determine whether the patient has primary or secondary hypertension, target organ disease, and other cardiovascular risk factors (risk assessment).

Absolute risk of non-fatal and fatal cardiovascular diseases in individuals with hypertension is determined by the presence of non-hypertensive cardiovascular risk factors and the presence or absence of damage to the target organs of hypertension. The absolute risk increases progressively with the level of blood pressure, the number of non-hypertensive cardiovascular risk factors, and the severity and extent of target organ damage. Using information from the Framingham epidemiologic study, a 10-year coronary heart disease risk level can be estimated for an individual based on the combination of the individual's age, total high-density lipoprotein-cholesterol levels, systolic blood pressure level, smoking status, and whether the individual has diabetes and left ventricular hypertrophy by electrocardiogram *(Levy, 1993 [R])*. See Appendix B, "Ten-Year Cardiovascular Disease Risk Calculator (Risk Assessment)." This method of risk assessment makes clear the need not only to control blood pressure but to prevent target organ damage and control all cardiovascular risk factors to maximize risk reduction.

The decision to treat hypertension initially with both lifestyle modification and drugs is reasonable when absolute individual risk is high.

Specific values for the diagnosis and treatment of dyslipidemia are reviewed in the ICSI Lipid Management in Adults guideline.

- **Accurately Stage**

  This treatment guideline is designed to be used in new or previously diagnosed hypertensive patients in conjunction with the ICSI Preventive Services in Adults guideline. See Appendix A, "Standards for Blood Pressure Measurement."

Hypertension Stages	Systolic		Diastolic
Prehypertension	120-139	or	80-89
Stage 1 hypertension	140-159	or	90-99
Stage 2 hypertension	greater than or equal to 160	or	greater than or equal to 100

  Modified from the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension* 2003;42:1206-52. (Class R)

  When systolic and diastolic pressure fall into different categories, the higher category should be selected in classifying the individual's blood pressure status.

- **Risk Assessment**

  The risk for cardiovascular disease in patients with hypertension is determined not only by the level of blood pressure, but also by the presence or absence of target organ damage and other risk factors such as smoking, dyslipidemia and diabetes, as shown in the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. These factors independently modify the risk for subsequent cardiovascular disease, and their presence or absence is determined during the routine evaluation of patients with hypertension (i.e., history, physical examination, laboratory tests).

- **Medical History**

  The history should focus on modifiable lifestyle factors including weight change, dietary intake of sodium and cholesterol, level of exercise, psychosocial stressors and patterns of alcohol and tobacco use.

Determine all medications being used – including herbal supplements, over-the-counter, prescription and illicit drugs – as many agents may temporarily elevate blood pressure and/or adversely affect blood pressure control *(Awe, 2005 [M]; Priya, 2000 [R])*. See Appendix C, "Recommended Education Messages."

A family history of hypertension, cardiovascular disease, cerebrovascular disease, diabetes mellitus and dyslipidemia should be documented.

Assess for symptoms and signs of target organ disease and secondary hypertension via a directed history.

- **Physical examination**

  The initial physical examination should include the following:

  - Two or more blood pressure measurements separated by two minutes with the patient seated and after standing for at least two minutes in accordance with the recommended techniques as stated in Appendix A, "Standards for Blood Pressure Measurement"
  - Verification in the contralateral arm (if values are different, the higher value should be used)
  - Measurement of height, weight and waist circumference. Waist circumference provides incremental information regarding cardiovascular risk related to obesity *(Baik, 2000 [B]; Lean, 1998 [D]; Yusuf, 2006 [C])*. See ICSI guideline Prevention and Management of Obesity (Mature Adolescents and Adults) for additional information and instructions on how to measure waist circumference.
  - Funduscopic examination for hypertensive retinopathy (i.e., arteriolar narrowing, focal arteriolar constrictions, arteriovenous crossing changes, hemorrhages and exudates, disc edema). While the reproducibility of office funduscopic findings is poor, there are clinical findings (in particular, retinal hemorrhages, papiledema) that instruct important clinical decisions.
  - Examination of the neck for carotid bruits, distended veins or an enlarged thyroid gland
  - Examination of the heart for abnormalities in rate and rhythm, increased size, precordial heave, clicks, murmurs, and third and fourth heart sounds
  - Examination of the lungs for rales and evidence of bronchospasm
  - Examination of the abdomen for bruits, enlarged kidneys, masses and abnormal aortic pulsation
  - Examination of the extremities for diminished or absent peripheral arterial pulsations, bruits and edema
  - Neurological assessment

- **Initial laboratory studies**

  Initial lab screen should include 12-lead electrocardiogram, urinalysis, fasting blood glucose, hematocrit, serum sodium, potassium, creatinine (estimated or measured glomerular filtration rate, calcium and lipid profile (total cholesterol, high-denisty lipoprotein cholesterol, low-density lipoprotein cholesterol and triglycerides). Additional laboratory and diagnostic studies may be required in individuals with suspected secondary hypertension and/or evidence of target organ disease *(Chobanian, 2003 [R])*.

  Some of these tests are needed for determining presence of target organ disease and possible causes of hypertension. Others relate to cardiovascular risk factors or provide baseline values for judging biochemical effects of therapy.

Additional tests may be ordered at the discretion of the provider based on clinical findings. These may include but are not limited to complete blood count, chest x-ray, uric acid and urine microalbumin.

See Appendix D, "Clinical Evaluation of Confirmed Hypertension."

(Vasan, 2001 [B]; Wolf, 1991 [B]; World Health Organization/International Society of Hypertension, 1999 [B])

JNC7* Cardiovascular Risk Factors/Target Organ Damage

Major risk factors
- Hypertension
- Age (older than 55 for men, 65 for women)†
- Diabetes mellitus**
- Elevated LDL cholesterol
- Low HDL cholesterol**
- Estimated GFR less than 60 mL/min***
- Microalbuminuria
- Family history of premature cardiovascular disease (men younger than 55 or women younger than 65)
- Obesity** (body mass index greater than or equal to 30 kg/m^2, waist circumference greater than 40 inches for men and greater than 35 inches in women)
- Physical inactivity
- Tobacco usage, particularly cigarettes

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

* Modified from the Seventh Report of the Joint National Committee in Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension* 2003;42:1206-52. (Class R)

† Increased risk begins at approximately 55 and 65 for men and women, respectively. Adult Treatment Panel III used earlier age cut points to suggest the need for earlier action.

** Components of the metabolic syndrome. Reduced HDL and elevated triglycerides are components of the metabolic syndrome. Abdominal obesity is also a component of metabolic syndrome.

*** GFR indicates glomerular filtration rate.

A point scale approach for estimating 10-year coronary heart disease risk can also be used. See Appendix B, "Ten-Year Cardiovascular Disease Risk Calculator (Risk Assessment)."

4. Is Secondary Cause Suspected?

The term "secondary hypertension" implies that a patient's blood pressure elevation is the result of an underlying discoverable disease process. Secondary causes account for only a small percentage of all documented cases of hypertension, but their detection is important as appropriate intervention may be curative and lead to reversal of hypertension.

Evaluate for features suggestive of secondary hypertension. Suspect a diagnosis of secondary hypertension in patients with an abrupt onset of symptomatic hypertension, with Stage 2 hypertension, hypertensive crisis, sudden loss of blood pressure control after many years of stability on drug therapy, drug resistant hypertension, and in those individuals with no family history of hypertension. Differential diagnosis of secondary hypertension includes:

- Chronic kidney disease/obstructive uropathy
- Thyroid and parathyroid disease
- Drugs (prescription, over-the-counter, herbal supplements, illicit drugs)
- Excessive alcohol use
- Obstructive sleep apnea
- Primary aldosteronism
- Renal artery stenosis
- Pheochromocytoma
- Cushing's syndrome
- Aortic coarctation
- Obesity

See Appendix E, "Suspicion of Secondary Hypertension."

Note recommendations for additional diagnostic procedures. Be sure advanced testing is correctly chosen and done properly to avert the need for repeat studies. This may require discussion with or referral to a specialist.

5. Order Additional Work-Up/Consider Referral

Consider appropriate referral or additional work-up if secondary hypertension is identified or suspected.

If you suspect a diagnosis of secondary hypertension, it is recommended that you perform a phone consultation and/or refer the patient to a specialist early in order to confirm the most efficient and cost-effective approach to patient evaluation and management *(Chobanian, 2003 [R]; Gifford Jr, 1989 [R])*.

6. Lifestyle Modifications +/- Drug Therapy

Key Point:

- Lifestyle modifications should be the cornerstone of the initial therapy for hypertension.

Clinical studies show that the blood-pressure-lowering effects of lifestyle modifications can be equivalent to drug monotherapy *(Elmer, 2006 [A])*. Lifestyle modification is best initiated and sustained through

an educational partnership between the patient and a multidisciplinary health care team. While team members may vary by clinical setting, behavior change strategies should include nutrition, exercise, and smoking cessation services. Lifestyle modifications should be reviewed and reemphasized at least annually.

Some patient education should occur and be documented at every hypertension care visit. For recommended education messages, see Appendix C, "Recommended Education Messages."

Table 3. Lifestyle Modifications to Prevent and Manage Hypertension*

Modification	Recommendation	Approximate Systolic Blood Pressure Reduction (Range)†
Weight reduction	Maintain normal body weight (body mass index 18.5-24.9 kg/m^2).	5-20 mmHg/10 kg
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.	8-14 mmHg
Dietary sodium reduction	Reduce dietary sodium intake to no more than 100 mmol per day (2.4 g sodium or 6 g sodium chloride).	2-8 mmHg
Physical activity	Engage in regular aerobic physical activity such as brisk walking (at least 30-45 minutes per day, most days of the week).	4-9 mmHg
Moderation of alcohol consumption	Limit consumption to no more than two drinks (e.g., 24 oz. beer, 10 oz. wine, or 3 oz. 80 proof whiskey) per day in most men and to no more than one drink per day in women and lighter-weight persons.	2-4 mmHg

*For overall cardiovascular risk reduction, stop smoking.

**DASH indicates Dietary Approaches to Stop Hypertension.

† The effects of implementing these modifications are dose- and time-dependent and could be greater for some individuals.

Taken from the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. *Hypertension* 2003;42:1206-52. (Class R)

Weight Reduction and Maintenance

Hypertension is closely correlated with excess body weight *(National High Blood Pressure Education Program Working Group, 1993 [R])*. Approximately 50% of hypertensive patients are overweight *(Romero, 2007 [D])*. In the Framingham study, 60% to 70% of hypertension could be attributed to being overweight or obese *(Kannel, 1993 [B])*.

Research studies have documented the positive effects of weight reduction as a strategy for blood pressure control *(Trials of Hypertension Prevention Collaborative Research Group, The, 1992 [A])*. In adults with hypertension, meta-analysis shows that weight loss through diet or use of orlistat is related to a modest

reduction of blood pressure by up to 6 mmHg systolic and 3 mmHg diastolic; however, use of sibutramine increased blood pressure despite weight loss *(Horvath, 2008 [M])*. Whenever indicated, weight reduction should be recommended. Even an initial loss of as little as 10 pounds can have a beneficial effect on blood pressure. Weight loss can also improve the efficacy of antihypertensive medications and the cardiovascular risk profile.

Initial weight loss and long-term weight control are both enhanced by a regular exercise program.

Patient education and/or nutritional counseling should be provided.

(Appel, 1997 [A]; Chobanian, 2003 [R]; Flegal, 2002 [D]; Moore, 2005 [D])

Dietary Interventions

Use of a DASH (Dietary Approaches to Stop Hypertension) eating plan has been shown in cohort studies to reduce incidence of congestive heart failure by 25% and incidence of stroke by 17% in women *(Fung, 2008 [B])*.

A relationship between dietary sodium intake and blood pressure has been demonstrated in multiple clinical and epidemiological studies *(Law, 2000 [R])*. Modest sodium restriction may also reduce the amount of antihypertensive medications required *(Appel, 2001 [A])*. However, individuals vary in response to a reduced sodium intake. Among hypertensives, African Americans, older patients and patients with renal disease seem to be more sodium sensitive *(Sacks, 2001 [A])*.

(Neaton, 1993 [A]; Whelton, 1998 [A])

Moderation of Alcohol Intake

Alcohol consumption has complex effects on the cardiovascular system. Alcohol consumption raises both systolic and diastolic pressures, but its effects appear to be greater on systolic pressure. Significant elevations in blood pressure have been shown in individuals who consumed an average of at least three standard drinks per day compared with non-drinkers. Alcoholism may cause hypertension, and an alcoholic is less likely to respond to any hypertension treatment recommendations *(Friedman, 1990 [R])*. Some persons may develop transitory hypertension during the first days of detoxification. Alcohol is a concentrated calorie source that does not provide any nutrients, so reducing alcohol intake can hasten weight reduction and may decrease triglyceride levels. Although cohort studies suggest that modest alcohol consumption may reduce the rate of myocardial ischemic events, alcohol use of up to 2 ounces per day neither increases nor decreases total mortality or cardiovascular mortality in those with hypertension *(Beulens, 2007 [B])*. The recommendation is to not exceed a daily alcohol intake of one ounce of ethanol. One ounce (30 mL) of ethanol is equivalent to two drinks per day. It is recommended that men have no more than one ounce of ethanol per day (two drinks) and women have no more than 0.5 ounce of ethanol per day (one drink). One drink is 12 ounces of beer, 5 ounces of wine or 1.5 ounces of 80 proof liquor.

(Maheswaran, 1991 [D])

Adequate Physical Activity

Epidemiological studies suggest that regular aerobic physical activity may be beneficial for both prevention and treatment of hypertension, to enable weight loss, for functional health status, and to diminish all-cause mortality and risk of cardiovascular disease. Thirty to forty-five minutes of brisk walking or other activity most days of the week at target heart rate ([220-age] x 75% = target heart rate) is adequate, inexpensive and effective *(Pate, 1995 [R])*. However, regular physical activity of even lower intensity and duration has been shown to be associated with about a 20% decrease in mortality in cohort studies *(Leitzmann, 2007 [B])*. Other aerobic activities (biking, swimming, jogging, etc.) may be more enjoyable. Resistive isotonic activities, when done as the only form of exercise training, are not recommended to lower blood pressure in hypertensive patients.

(World Hypertension League, 1991 [R])

Potassium

There is no direct evidence that potassium supplementation lowers blood pressure chronically *(Cappuccio, 1991 [M]; Fotherby, 1992 [A]; Whelton, 1997 [M])*.

Tobacco Avoidance

Recent data using ambulatory blood pressure monitoring suggests that nicotine may indeed increase blood pressure and could account for some degree of blood pressure lability *(Bolinder, 1998 [C])*. In addition, it is a major risk factor for atherosclerotic cardiovascular disease. At each visit, establish tobacco use status.

Relaxation and Stress Management

Although studies have not demonstrated a significant long-term effect of relaxation methods on blood pressure reduction, relaxation therapy may enhance an individual's quality of life and may have independent effects on lowering coronary heart disease risk *(Eisenberg, 1993 [M]; Johnston, 1991 [R])*.

Drug Therapy

A thiazide-type diuretic should be considered as initial therapy in most patients with uncomplicated hypertension *(Appel, 2002 [R])*. Because thiazide-type diuretics have been shown to be as good or superior to other drug classes in preventing cardiovascular disease morbidity and mortality, they should be considered preferred initial therapy in most patients *(Chobanian, 2003 [R])*. However, studies support the use of specific alternative drugs as initial therapy in the presence of specific co-existing diseases. Diuretics have been shown to be as good or superior to other classes of drug therapy in preventing cardiovascular disease morbidity and mortality, and they are inexpensive *(ALLHAT Officers, Coordinators for the ALLHAT Collaborative Research Group, The, 2002 [A]; Psaty, 2003 [M])*. Thiazide-type diuretics are especially useful for patients age 55 years or older with hypertension and additional risk factors for cardiovascular disease including the metabolic syndrome and for patients age 60 years or older with isolated systolic hypertension *(ALLHAT Officers, Coordinators for the ALLHAT Collaborative Research Group, The, 2000 [A]; Wright, 2008 [A])*. The risk of diabetes mellitus is higher with diuretic and beta-blockers than other first-line choices, and this may be a consideration for patients at higher risk for this disorder *(Elliott, 2007 [M])*. Studies have demonstrated the cost effectiveness in older patients of selecting drugs using evidence-based guidelines *(Fischer, 2004 [M])*. In patients for whom diuretics are contraindicated or poorly tolerated, use of an ACE inhibitor, angiotensin receptor blocker, beta-blocker or calcium antagonist is appropriate. Other considerations when selecting initial drug therapy include age, race, cost, drug interactions, side effects and quality of life issues. See Appendix F, "Therapies," and Appendix G, "Cost of Antihypertensive Drugs." In general, diuretics and calcium channel blockers appear to be more effective as an initial treatment of hypertension in African Americans. The lowest recommended dose of the chosen drug should be used initially. If tolerated, the dose can be increased or additional medications added to achieve goal blood pressure.

Other classes of drugs should be reserved for special situations or as additive therapy. See Appendix F, "Therapies." Co-existing medical conditions may also justify the use of one of these classes of drugs. An example is the use of an ACE inhibitor in a patient with heart failure or diabetic nephropathy. Please see ICSI's Diagnosis and Management of Type 2 Diabetes Mellitus in Adults guideline for further information. ACE inhibitors and angiotensin receptor blockers have been shown to be beneficial for patients with renal disease (both diabetic and non-diabetic) by reducing proteinuria and slowing the rate of decline in renal function *(Agodoa, 2001 [A]; Brenner, 2001 [A]; Jafar, 2001 [M]; Jafar, 2003 [M])*. ACE inhibitors have also been shown to provide symptomatic relief and prolong life for patients with heart failure and are the initial drug of choice for this condition. ACE inhibitors and angiotensin-receptor blockers have similar blood-pressure-lowering effects, but angiotensin-receptor blockers are less often associated with the side effect of cough *(Matchar, 2008 [M])*. Initial monotherapy with one of these agents is appropriate in these patient populations. A diuretic should be added if blood pressure response is not satisfactory. Evidence from a recent large trial suggests that ACE inhibitors may be less effective in African Americans than

thiazide-type diuretics in controlling blood pressure and in preventing stroke and cardiovascular disease *(Appel, 2002 [R])*.

Based on meta-analyses of previous studies, beta-blockers may be less efficacious than other first-line alternatives in patients who are 60 years and older, especially for stroke prevention *(Lindholm, 2005 [M])*. Thus, use of these drugs as initial therapy in older patients probably should be restricted to situations where there is another indication for their use (e.g., heart failure, previous myocardial infarction, angina.) They still should be considered alternative first-line agents in younger patients, where they appear to lessen cardiovascular morbidity as well as other recommended drugs. Beta-blockers reduce the risk of sudden death and recurrent myocardial infarction for patients with an initial myocardial infarction. ACE inhibitors also reduce the risk of subsequent myocardial infarction and progression to heart failure for patients who experience a large myocardial infarction associated with impairment of left ventricular function. They also may reduce risk for patients with (or at high risk for) cardiovascular disease *(Heart Outcomes Prevention Evaluation Study Investigators, The, 2000 [A])*.

Long-acting dihydopyridine calcium antagonists have been shown to be effective for patients age 60 years or older with isolated systolic hypertension. Co-existing medical conditions may also justify the use of one of these classes of drugs. Evidence from a recent large study refutes concerns about increased risk of myocardial infarction, cancer or gastrointestinal bleeding from use of long-acting calcium antagonists. However, data does suggest that this class of drugs may be less effective in preventing heart failure *(ALLHAT Officers, Coordinators for the ALLHAT Collaborative Research Group, The, 2000 [A])*. The work group suggests these drugs be limited to those conditions listed in Appendix F, "Therapies." Data supporting potential dangers of calcium antagonists are limited to short-acting preparations (especially nifedipine) that are not approved for the treatment of hypertension.

A majority of patients will require more than one drug for blood pressure control. Combination therapies that include a diuretic are often effective, lessen the risk for side effects (by use of low doses of each component drug), and enhance adherence by simplification of the treatment program. For patients with chronic kidney disease, three or more drugs may be needed to achieve goal.

(Borhani, 1996 [A]; Curb, 1996 [A]; Dahlof, 2002 [A]; Dahlöf, 2005 [A]; Estacio, 1998 [A]; Gottlieb, 1998 [B]; Grimm, 1997 [A]; Khan, 2006 [M]; Kostis, 1997 [A]; Lewis, 2001 [A]; Neaton, 1993 [A]; Parving, 2001 [A]; Pitt, 2003 [A]; PROGRESS Collaborative Group, The, 2003 [A]; Rahman, 2005 [A]; Salpeter, 2002 [M]; SHEP Cooperative Research Group, 1991 [A]; Soumerai, 1997 [B]; Staessen, 1997 [A]; Staessen, 1998 [A]; STOP-Hypertension-2 Study Group, The, 1999 [A]; UK Prospective Diabetes Study Group, 1998 [A]; Whelton, 2005 [A]; Wing, 2003 [A])

7. Blood Pressure at Goal?

Key Points:

- Isolated systolic hypertension is an important modifiable cardiovascular risk factor.
- Accurate home monitoring systems are an important tool for assessing blood pressure control.
- Review drugs, over-the-counter medications and herbal therapies that may interfere with blood pressure goal.

Goal office blood pressures should be less than 140/90 mmHg for adults with uncomplicated hypertension (in the absence of comorbidities). *[Conclusion Grade II: See Conclusion Grading Worksheet A – Annotation #7 (Goal Blood Pressure for Patients with Cardiovascular Disease)]*. Goal blood pressures measured out of the office setting should be less than 135 mmHg systolic and less than 85 mmHg diastolic. Goals differ in the office setting.

Patients with comorbid conditions including diabetes or chronic kidney disease should have a goal office blood pressure of less than 130/80 mmHg *(Jafar, 2003 [M])*. *[Conclusion Grade II: See Conclusion Grading Worksheet A – Annotation #7 (Goal Blood Pressure for Patients with Cardiovascular Disease)]*. Progressive reduction of systolic blood pressure to as low as 110 mmHg has been shown to be associated with lower risk of microvascular and macrovascular complications in diabetes *(Adler, 2000 [B]; Bakris, 2003 [A])*.

Recent American Heart Association/American College of Cardiology guidelines have called for goal office blood pressures less than 120/80 mmHg for patients with a history of heart failure *(Packer, 2002 [A])*. Patients with coronary artery disease should have a goal office blood pressure less than 130/80 mmHg *[Conclusion Grade II: Conclusion Grading Worksheet A – Annotation #7 (Goal Blood Pressure for Patients with Cardiovascular Disease)] (Rosendorff, 2007 [R])*. These recommendations are based on expert opinion and limited clinical evidence. Pursuing these lower goals should be considered on an individual patient basis based on clinical judgment and patient preference.

Systolic hypertension in patients age 60 and older is an important modifiable cardiovascular risk factor *(Kannel, 2000 [R])*. Drug therapy for patients in this age group with systolic blood pressures of 160 mmHg or higher has been effective in reducing cardiovascular morbidity and mortality (*Forrette, 1998 [A]; Haider, 2003 [B]; Kostis, 1997 [A]; Somes, 1999 [A]; Staessen, 1997 [A]; Staessen, 2001 [M])*. This is true even for patients above 80 years of age *(Beckett, 2008 [A])*.

For patients 60 years or older with isolated systolic hypertension who have markedly increased systolic blood pressure levels prior to treatment, it may not be possible to lower systolic blood pressure to less than 140 mmHg. An interim goal of 160 mmHg or what can be achieved by optimal doses of three antihypertensive drugs would be reasonable.

The benefit of drug therapy in terms of reducing cardiovascular morbidity and mortality for patients age 60 and older with isolated systolic hypertension defined as a baseline systolic blood pressure of 140 mmHg or greater has not yet been demonstrated by randomized clinical trials. The increased cardiovascular risks in this age group with blood pressures in the 140-159 mmHg range, however, have been well demonstrated and have led most guidelines to recommend treatment of this group of patients *(Chobanian, 2003 [R]),* particularly if associated with other comorbidities or risk factors such as diabetes mellitus, kidney disease, coronary artery disease or heart failure (WHO, AHA/ACC, etc.).

Concerns have been raised that excessive lowering of diastolic blood pressure increases the risk of coronary events in patients with established coronary artery disease or left ventricular hypertrophy by lowering diastolic perfusion pressure in the coronary circulation. This is known as the J-curve hypothesis. Recent studies have also raised concerns about a J-curve relationship between diastolic blood pressure level and risk for stroke in elderly patients treated for isolated systolic hypertension. No such J-shaped relationship has been observed between adverse event rates and systolic blood pressure level *(Farnett, 1991 [M])*. Although not resolved, caution should be applied in lowering diastolic blood pressure below 70 mmHg in patients with coronary artery disease or left ventricular hypertrophy, or below 55 mmHg in all elderly patients with isolated systolic hypertension *(Fagard, 2007 [A]; Messerli, 2006 [M])*. In the latter situation, this may require compromise of the goal level of systolic blood pressure achieved.

(Hansson, 1998 [A]; Hypertension Detection Follow-Up Program Cooperative Group, 1979; Hypertension Detection Follow-Up Program Cooperative Group, 1982 [A]; Izzo, 2000 [R]; Lazarus, 1997 [A]; Sarnak, 2005 [C]; UK Prospective Diabetes Study Group, 1998 [A]; Vasan, 2002 [B]; Voko, 1999 [B])

8. Change Treatment

Once antihypertensive drug therapy is initiated, most patients should return for follow-up and medication adjustments at least at monthly intervals until blood pressure goal is reached.

Fewer than 50% of patients with hypertension will be controlled with a single drug.

If blood pressure goals are not met, the clinician has three options for subsequent therapy:

- Increase the dose of the initial drug toward maximal levels.
- Substitute an agent from another class.
- Add a second drug from another class.

Individualized drug selection is based on several principles:

- If the initial response to one drug is adequate, continue the same drug.
- If the response is partial on one agent, increase the dose or add a second drug of a different class.
- If there is little response, substitute another single drug from a different class.
- Consider low-dose diuretic use early or as a first addition.
- Consider loop diuretic agents instead of thiazide or thiazide-like diuretics when creatinine is greater than 2.0 mg/dL or estimated glomerular filtration rate is less than 30 mL/min per 1.73m^2.
- Do not combine two drugs of the same class.
- The use of combination agents can be effective.

For most patients, two or more drugs in combination may be needed to reach hypertension goals. This is especially true for high-risk patients with treatment goals less than 130/80 mmHg or with cardiovascular disease comorbidities. Systolic blood pressure control for adults with cardiovascular comorbidities is poor *(Wong, 2007 [D])*. The combination of a diuretic appropriate for level of renal function with an angiotensin-converting enzyme inhibitor or angiotensin receptor blocker is often an effective two-drug program. A diuretic ACE inhibitor combination has been shown to reduce both the macrovascular and microvascular complications of type II diabetes *(ADVANCE Collaborative Group, 2007 [A])*.

The combination of an ACE inhibitor with an angiotensin receptor blocker has little additional effect on blood pressure compared to either monotherapy and may be associated with increased risk of adverse effects including renal dysfunction and hyperkalemia *(ONTARGET Investigators, The, 2008 [A])*; however, this combination is more effective than either monotherapy alone in reducing proteinuria *(Kunz, 2008 [M])*.

The combination of a calcium channel antagonist with an ACE inhibitor is as effective or more effective than the traditional combination of a diuretic with a beta-blocker in lowering blood pressure and reducing cardiovascular events *(Bevan, 1993 [A]; Chobanian, 2003 [R]; Dahlöf, 2005 [A])*.

9. Blood Pressure at Goal?

Key Points:

- Carefully review potential barriers to long-term adherence to therapy, including the possible secondary diagnosis of depression.
- Systolic hypertension is an important modifiable cardiovascular risk factor.

- Accurate home monitoring systems are an important tool for assessing blood pressure control.
- Review drugs (prescription and over-the-counter) and herbal therapies that may interfere with blood pressure goal.

If at this point acceptable response has not been achieved, several issues should be addressed or revisited. These include adherence to appropriate lifestyle modifications, consistent use of prescribed drugs, and tolerance of treatment modalities. Non-adherence rates to prescribed medications are estimated at 50% and are slightly higher for both elderly and adolescent patients *(Nichols-English, 2000 [R])*. Since there is not a simple test to accurately measure adherence, there are some practical methods that can be used for all patients: asking the patient about missed doses, watching treatment response, tracking missed appointments, tracking prescription refills, asking about issues of cost, and monitoring side effects. Although patients will generally overestimate their adherence, simply asking the question will help identify up to 50% of low-adherence patients. Standardized instruction in self-blood-pressure measurement will allow assessment of "white-coat" syndrome. Interfering substances that can adversely affect treatment include non-steroidal anti-inflammatory drugs, oral contraceptives, sympathomimetics, antidepressants, glucocorticoids, nasal decongestants, licorice-containing substances (e.g., chewing tobacco), cocaine, cyclosporine and erythropoietin. Intermittent use of alcohol, particularly in alcoholics who are binge drinkers, may cause difficulties with widely fluctuating blood pressures.

Non-specific symptoms such as fatigue, lightheadedness or vaguely impaired cognition may be due to an acute decline in blood pressure level and may resolve within four to six weeks while continuing the drug. Other minor drug-related symptoms unrelated to blood pressure change may also resolve in time without discontinuing the drug. Non-office-standardized blood pressure measurement is desirable to monitor blood pressure control.

The factors that lead to non-adherence are multifactorial: misunderstanding of the treatment and the reason for it, adverse reactions (or fear of them), complex dosing regimens, financial constraints or simple forgetfulness. Depression has also been identified as a risk factor in noncompliance with treatment for acute or chronic conditions *(DiMatteo, 2000 [M])*. Asking open-ended/non-judgmental questions about treatment regimens can lead to a good discussion between the provider and patient about why the patient may have difficulty adhering. There are a number of recommendations that in various combinations may lead to better patient adherence. These suggestions are based on available evidence from randomized clinical trials that evaluated the usefulness of adherence interventions. To increase adherence on a long-term basis, provide education about the medication and how it fits with the treatment plan, simplify the regimen (e.g., less frequent dosing, [data shows compliance rates average 79% with once-daily dosing, 69% with twice-daily dosing, 65% with three-times-daily dosing and 51% with four-times-daily dosing] *(Claxton, 2001 [M])* combination medications, controlled release dosage forms), use patient adherence aids (e.g., pillboxes, alarms), offer support group sessions, send reminders for medication refills and appointments, cue medications to daily events (e.g., breakfast, bedtime), offer positive reinforcement (acknowledge the patient's efforts to adhere), monitor with regular physician follow-up, and actively involve family members and significant others *(Haynes, 2002 [R])*. When choosing antihypertensive drugs, preference should be given to long-acting drugs that can be dosed once daily to enhance long-term compliance *(Osterberg, 2005 [R])*.

(McDonald, 2002 [M])

10. Resistant Hypertension?

A patient has resistant hypertension when blood pressure goals are not met despite compliance with optimal doses of three antihypertensive drugs of different classes with one of the agents being a diuretic. Blood pressure remains uncontrolled most often because of elevated systolic blood pressure. Patient characteristics

associated with resistant hypertension include older age, female gender, African American race, obesity and the presence of chronic kidney disease, diabetes, or left ventricular hypertrophy. Numerous reasons may exist for an inadequate or poor response *(Calhoun, 2008 [R]; Taler, 2002 [A]; Yakovlevitch, 1991 [D])*.

Consider causes of pseudo-resistant hypertension:

- Improper blood pressure measurement (overinflation of the cuff inducing a pain response, using a cuff that is too small for the arm, or measurement of blood pressure before letting the patient rest quietly in the sitting position) can lead to inaccurately high readings.
- Poor adherence to antihypertensive therapy. Lack of complete adherence to the drug program may be present in up to 40% of patients on multiple drug programs. Patients should be asked in a non-threatening way how successful they are in taking all of their medications in the doses prescribed. Questions should be directed to out-of-pocket costs, side effects and dosing inconvenience. Family members may provide useful information regarding compliance. Review of pharmacy records for timely prescription renewals may be helpful.
- Brachial arteries may be heavily calcified or arteriosclerotic and cannot be fully compressed (pseudo-hypertension), leading to inaccurately high cuff measurements.
- Clinic or white-coat hypertension.

Consider lifestyle factors:

- Obesity
- Excessive dietary sodium intake directly increases blood pressure and blunts the effectiveness of most antihypertensive drugs. Effects of salt are most pronounced in the elderly, African Americans and in patients with chronic kidney disease.
- Excessive alcohol intake

Consider drug-related causes:

- Several classes of drugs may directly increase blood pressure or interfere with the blood-pressure-lowering effect of antihypertensive therapies. These include non-steroidal anti-inflammatory agents, sympathomimetics (decongestants, diet pills, cocaine), stimulants (methylphenidate, dexmethylphenidate, dextroamphetamine, amphetamine, methamphetamine, modafinil), alcohol, oral contraceptives, cyclosporine, erythropoietin, corticosteroids, natural licorice and herbal compounds (ephedra, huang).

Consider secondary causes:

- Common causes include obesity, obstructive sleep apnea, chronic kidney disease, primary aldosteronism and renal artery stenosis. Uncommon causes include pheochromocytoma, Cushing's syndrome and aortic coarctation.

A common cause of resistant hypertension is lack of control of extra-cellular volume due to inadequate diuretic therapy. Full doses of a diuretic appropriate for level of renal function should be used. In patients with chronic kidney disease who have an estimated glomerular filtration rate less than 30 mL/minute, loop diuretics are necessary for effective volume control. Furosemide is short acting and should be given twice daily. Longer acting loop diuretics can be used once daily (torsemide). The drug regimen should also include near maximal doses of two of the following additional classes of drugs:

- Beta-adrenergic-blocker or other anti-adrenergic agent
- Direct vasodilator
- Calcium channel blocker

- ACE inhibitor
- Angiotensin receptor blocker

11. Hypertension Consultation

Consider hypertension consultation if a patient's blood pressure is not controlled on two medications or if secondary hypertension is suspected. All patients with blood pressure that is not controlled on three medications should be referred for consultation.

12. Hypertension at Goal

Key Points:

- On follow-up visits, history and physical examination should be directed toward detection of hypertensive target organ damage.
- In patients with office blood presssure at goal who demonstrate progressive target organ disease, home monitoring may be beneficial.

Once blood pressure is at goal and stable, the patient should be seen usually at three- to six-month intervals by the provider to assess patient adherence, patient satisfaction and any changes in target organ status. Patients' comorbidities such as heart failure, associated diseases such as diabetes, and need for laboratory tests influence the frequency of visits *(Chobanian, 2003 [R])*. Lifestyle modifications should be reviewed, reemphasized and documented annually. Patients should monitor blood pressure more frequently by home monitoring or by other allied health professionals.

Ongoing care can be facilitated by physicians or specially trained allied health care professionals who provide education, reinforcement, realistic short- and long-term goal-setting and adjustment of medications according to the individual clinical situation. Intervention strategies that seek to involve the patient in decision-making can improve long-term adherence to therapy and thus improve blood pressure control. Additionally, such an ongoing relationship might better identify those patients who are suitable candidates for a reduction or withdrawal from antihypertensive drug therapy following a prolonged interval of excellent blood pressure control *(Nelson, 2001 [M])*.

On follow-up visits, history and physical examination should be directed toward detection of hypertensive target organ damage.

One may consider decreasing the dosage or number of antihypertensive drugs while maintaining lifestyle modification if:

- patient has uncomplicated hypertension that is well controlled; and
- blood pressure has been maintained and documented for at least one year.

Appendix A – Standards for Blood Pressure Measurement

Accurate, reproducible blood pressure measurement is important to correctly classify blood pressure. Inconsistencies may result from using defective equipment and not standardizing the technique. Review the following steps and the accompanying rationale. Based on surveys that show the variability of blood pressure measurement, training sessions should be arranged by your medical facility.

These standards are consistent with American Heart Association and National Heart, Lung, and Blood Institute recommendations.

SELECTING EQUIPMENT:	RATIONALE:
Use mercury manometer or a recently calibrated aneroid manometer with the center of the mercury column or aneroid dial at eye level.	*If the meniscus of the Hg or aneroid gauge is not level with your vision, a reading may be read as too high or too low.*
Select appropriate cuff size. The width of the bladder should be 40% of the arm circumference, and the length of the bladder should encircle at least 80% of the arm.	*A too-small cuff will give falsely high readings. A too-large cuff may rarely give a false low reading but with less clinical significance.*
Use the bell of the stethoscope. Ideally, the bell should be placed above the medial epicondyle and medial to the biceps tendon (brachial artery).	*The stethoscope bell is designed to listen to low-pitched sounds. The early and late blood pressure sounds are low pitched.*

PREPARING THE PATIENT:	RATIONALE:
The patient should avoid eating, smoking, caffeine, exercise, and drinking alcohol one-half to one hour before blood pressure measurement.	*Readings will vary after exercise, eating, smoking, drinking alcohol or having caffeine (e.g. differences of 5-15 mmHg with 150 mg caffeine within 15 minutes).*
Have the patient sit quietly for a period at rest with both feet flat on the floor and back supported prior to measurement.	*Any change in posture or activity causes blood pressure to change. Some patients may experience an alerting reaction initially.*
No clothing should be between the blood pressure cuff and the arm. Place the center of the cuff's bladder over the brachial artery on the upper arm.	*Extra noise from the bell of the stethoscope rubbing against clothing could cause a false blood pressure reading. Failure to center the cuff can result in a falsely high reading.*
Use the patient's same arm for blood pressure readings and record arm and cuff size used.	*This allows for consistency and better comparison.*
The patient's arm should be supported or allowed to rest on a solid surface so the inner aspect of the bend of the elbow is level with the heart.	*The difference between lower and higher positions of the arm can cause differences in measurements of as much as 10 mmHg systolic and diastolic. For every cm the cuff sits above or below heart level, the blood pressure varies by 0.8 mmHg. If the patient's arm is tense, measurement can vary by up to 15 mmHg (systolic more than diastolic.)*

These standards are consistent with American Heart Association and National Heart, Lung, and Blood Institute recommendations.

TAKING AN INITIAL MEASUREMENT:	RATIONALE:
Secure the blood pressure cuff evenly and snugly around the arm, 1 to 1-1/2 inches above the antecubital space (at the elbow). Center the bladder (inflatable bag) over the brachial artery.	*A loose blood pressure cuff may balloon in the center, decreasing the effective width of the cuff. Since pressure transmitted through larger tissue bulk requires more external pressure to compress the underlying artery, a falsely higher lever of systolic and diastolic pressure may be heard.*
Initially perform a palpatory estimate of systolic pressure. Wait 15-30 seconds before taking the auscultatory reading.	*This step provides knowledge of the range of the systolic pressure. An auscultatory gap (absence of sound for 20-40 mmHg) occurs in 5% of hypertensives. The estimate will help to avoid incorrectly recording the systolic below the gap.*
Inflate the cuff quickly to 30 mmHg above the palpatory blood pressure.	*Inflating the cuff too high can cause pain and result in a falsely high reading.*
Deflate bladder at 2-3 mmHg per second.	*If the pressure is released too quickly, you could record the systolic blood pressure falsely low as the first systolic tap is missed and the diastolic is falsely high. If you deflate too slowly, you could record the diastolic falsely high.*
Record the first of at least two consecutive sounds as the systolic. Diastolic is identified by the last sound heard. If blood pressure is normal (systolic less than 140 and diastolic less than 90), inform the patient. Helpful hint: If the tones are difficult to hear, confirm brachial artery location by palpitation, then elevate arm for 15 seconds to drain the veins. With arm still overhead, inflate the cuff to 60 mmHg above palpatory blood pressure. Then lower arm and repeat auscultation.	*The last sound heard is easier than muffling for observers to accurately record. In some patients (for example, children or pregnant women), sounds are heard to near 0. In these cases, record both muffling and 0, e.g., 150/80/0. The muffling value is then considered the diastolic pressure.*

CONFIRMING INITIAL ELEVATION:	RATIONALE:
If blood pressure is elevated and the patient had initially waited quietly for five minutes, repeat blood pressure in one-two minutes. Record both measurements and inform the patient.	*Because blood pressure normally varies up to 10 mmHg, it is necessary to take two readings to obtain the most accurate present blood pressure.*
If blood pressure is elevated but the patient had not initially waited quietly for five minutes, now allow for a five-minute rest. Remeasure blood pressure and record it as the first reading. If this blood pressure is still elevated, repeat the measurement in one-two minutes, record it as the second measurement, and inform the patient.	*A time interval of one-two minutes between cuff inflations is necessary to reduce forearm engorgement.*

This form was developed by Park Nicollet Health Services.

Appendix B – Ten-Year Cardiovascular Disease Risk Calculator (Risk Assessment)

Table 1.

	Points				
Age	**20-39**	**40-49**	**50-59**	**60-69**	**70-79**
Non-smoker	0	0	0	0	0
Smoker-Male	8	5	3	1	1
Smoker-Female	9	7	4	2	1

Table 2.

Points				
Systolic BP	**Untreated**		**Treated**	
	Male	**Female**	**Male**	**Female**
< 120	0	0	0	0
120-129	0	1	1	3
130-139	1	2	2	4
140-159	1	3	2	5
≥ 160	2	4	3	6

Table 3.

HDL	Points
≥ 60	-1
50-59	0
40-49	1
< 40	2

Table 4.

	Points	
Age	**Male**	**Female**
20-34	-9	-7
35-39	-4	-3
40-44	0	0
45-49	3	3
50-54	6	6
55-59	8	8
60-64	10	10
65-69	11	12
70-74	12	14
75-79	13	16

Table 5.

Points										
Age	**20-39**		**40-49**		**50-59**		**60-69**		**70-79**	
Total Cholesterol	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
< 160	0	0	0	0	0	0	0	0	0	0
160-199	4	4	3	3	2	2	1	1	0	1
200-239	7	8	5	6	3	4	1	2	0	1
240-279	9	11	6	8	4	5	2	3	1	2
> 280	11	13	8	10	5	7	3	4	1	2

Table 6.

Table 1+2+3+4+5	10-Year Risk %	
Point Total	**Male**	**Female**
< 0	< 1	< 1
0	1	< 1
1	1	< 1
2	1	< 1
3	1	< 1
4	1	< 1
5	2	< 1
6	2	< 1
7	3	< 1
8	4	< 1
9	5	1
10	6	1
11	8	1
12	**10**	1
13	**12**	2
14	**16**	2
15	*20*	3
16	*25*	4
17	*> 30*	5
18	*> 30*	6
19	*> 30*	8
20	*> 30*	11
21	*> 30*	14
22	*> 30*	17
23	*> 30*	22
24	*> 30*	27
> 25	*> 30*	> 30

There is an online downloadable CV risk calculator that is used in assessing 10-year risk of CV disease. The link is **http://hin.nhlbi.nih.gov/atpiii/calculator.asp?usertype=prof**

Appendix C – Recommended Education Messages

Purpose

The following educational messages will support the goals of patient education and self-involvement in ongoing hypertension management:

Health Care Provider Visits

Basic Information

- Discuss:
  - What is blood pressure?
  - What do the numbers mean?
  - Factors affecting blood pressure, e.g., OTC medications
  - How high blood pressure affects health

Lifestyle Modification

- Recommend appropriate lifestyle modification:
  - Weight reduction and maintenance
  - Moderation of dietary sodium
  - Moderation of alcohol intake
  - Adequate physical activity
  - Incorporation of DASH diet
- Recommend interventions for cardiovascular risk factors (e.g., smoking, hyperlipidemia, diabetes).

Pharmacologic Therapy

- Reinforce lifestyle modification and cardiovascular risk factor interventions.
- Provide medication information (e.g., what, when and why taking medication, possible side effects).
- Advise when to call with problems.

Ongoing Management

- Advise on necessity for follow-up.
- Set realistic goals in partnership with the patient.
- Reinforce educational messages.
- Adopt an attitude of concern along with hope and interest in the patient's future.
- Provide positive feedback for BP and behavioral improvement.

* Resource: "Hypertension = High Blood Pressure," a patient education brochure developed by Hypertension Screening guideline team (see educational resource list)

Appendix D – Clinical Evaluation of Confirmed Hypertension

This table is used to help define etiology, to define target organ damage and to identify cardiovascular risk factors.

Medical History	**Pertinent Medical History in the Initial Evaluation of Hypertension:** • Symptoms suggesting secondary hypertension • History of high blood pressure, including duration and levels • Results and side effects of previous antihypertensive therapy • Use of oral contraceptives, steroids, NSAIDs, nasal decongestants, appetite suppressants, tricyclic/tetracyclic antidepressants, MAO inhibitors, cocaine and other illicit drugs, alcohol, and/or herbal supplements • History of tobacco use, diabetes, hyperlipidemia • History of weight gain, exercise, sodium and fat intake • History or symptoms of stroke, transient ischemic attack, angina, previous myocardial infarction, coronary revascularization procedure, heart failure, claudication, renal disease • Family history of coronary artery disease, stroke, renal disease and hypertension • Psychosocial and environmental factors that may influence blood pressure • Snoring, daytime somnolence
Physical Examination	**Pertinent Features on Physical Examination:** • Tachycardia • Unequal blood pressures in arms (more than 10 mmHg) • Cushingoid appearance • Obesity • Orthostatic drop after standing for two minutes • Arteriolar narrowing, arterio-venous nicking, papilloedema, hemorrhages or exudates in the fundi • Thyromegaly or thyroid nodules • Carotid bruits or diminished upstroke • Cardiomegaly • Murmurs, gallops or arrythmias • Signs of heart failure • Abdominal bruits or masses • Delayed or diminished peripheral pulses • Aneurysms • Peripheral edema • Neurological deficits on exam • Radial/femoral pulse delay • Café au lait spots • Oral facial neuromas • Neurofibromas • Marfinoid habitus

Initial Pertinent Labs

Order tests as necessary, especially if not done within past year.

(Each institution's lab profiles may vary as to which are most cost effective and efficient.)

Routine Labs:

- 12-lead ECG
- Urinalysis
- Fasting blood glucose
- Hematocrit
- Serum sodium
- Potassium
- Creatinine (estimate GFR*)
- Calcium
- Lipid profile (total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol and triglycerides)

*Estimate of glomerular filtration rate = (140 - age in years) x (weight in kilograms) x (0.85 if patient female)/72 x (serum creatinine). Glomerular filtration rate calculator available at http://www.hdcn.com/calcf/gfr.htm

Appendix E – Suspicion of Secondary Hypertension

Early discussion or consultation with an appropriate subspecialist may lead to the most accurate and cost-effective work-up.

Clinical Findings:	*Recommended Test/Referral:*
Elevated serum creatinine, abnormal urine sediment, hematuria on two occasions, or structural renal abnormality	Consider referral to nephrology.
Isolated proteinuria on two occasions	Quantify proteinuria and refer if appropriate.
Features of renovascular hypertension: • Initial onset before age 30 or after age 50 years • Blood pressure over 180/110 • Hemorrhages and exudates in the fundi • Presence of abdominal bruit over renal arteries • Diminishing blood pressure control • Women of childbearing age • Sudden worsening of previously controlled hypertension • Unexplained episodes of pulmonary edema • Acute decline in renal function with ACE inhibitor or angiotension receptor blocker • Unexplained decline in renal function	Hypertensive intravenous pyleograms are not recommended. There is no single test for renovascular hypertension. Consult experts in your institution.
Low serum potassium in absence of diuretics on two occasions	Consider primary aldosteronism and referral to nephrology or endocrinology.
Cushingoid features	24-hour urine for cortisol
Features of pheochromocytoma: • Spells - Headaches - Palpitations - Perspiration - Pallor • Extremely labile blood pressure	Plasma metanephrines or 24-hour urine metanephrines if plasma results not available

Appendix F – Therapies

Drug	Associated Conditions Where Indicated	Associated Conditions Where Useful	Associated Conditions Requiring Caution	Contraindications	Drug Interactions*	Potential Side Effects*
Thiazide Diuretics • preferred initial therapy for most patients with uncomplicated hypertension • especially effective in African Americans	- ISH in elderly - heart failure - diabetes - high coronary risk	- edema states - renal insufficiency (loop agents for CR > 2.0 mg/dl)	- cardiac arrythmias - glucose intolerance - elevated triglycerides - gout - hypertrophic cardiomyopathy	- sensitivity to thiazides	- increase lithium blood levels - action blocked by NSAIDs - hypokalemia enhances digoxin toxicity - ACE inhibitors lessen hypokalemia	- hypokalemia - hyperuricemia - hyponatremia - hyperglycemia - dizziness - fatigue - erectile dysfunction - dry mouth - nausea - constipation - orthostatic hypotension - rash
Beta-Blockers	- previous MI (non-ISA)* - heart failure - diabetes - high coronary risk	- angina pectoris - supraventricular arrythmias - suppression of PVCs - prophylaxis for migraines - hypertrophic cardiomyopathy - anxiety - essential tremor - glaucoma	- COPD with mild bronchospasm** - rhinitis - variant angina - Raynaud's disease - peripheral vascular disease - hyperlipidemia - pheochromocytoma - depression - mild asthma**	- asthma (moderate or severe) - COPD with significant bronchospasm - sinus bradycardia (non-ISA) - 2nd or 3rd degree heart block - sensitivity to beta-blockers - hypoglycemia-prone IDDM	- cimetidine and nicotine reduce bioavailability of liver-metabolized drugs - liver-metabolized beta-blockers may increase warfarin activity - additive negative inotropic effect with verapamil - addition of reserpine - bradycardia and syncope - combined with verapamil may cause complete heart block	- erectile dysfunction - fatigue - lightheadedness - dizziness - dyspnea - wheezing - cold extremities - claudication - confusion - vivid dreams - insomnia - depression - diarrhea - bradycardia

* ISA = intrinsic sympathomimetic activity (acebutolol, penbutolol, pindolol)
** Use cardioselective agents

Drug	Associated Conditions Where Indicated	Associated Conditions Where Useful	Associated Conditions Requiring Caution	Contraindications	Drug Interactions*	Potential Side Effects*
ACE Inhibitors	- type 1 diabetes with renal disease - congestive heart failure - previous MI with impaired LV function - non-diabetic renal diseases associated with proteinuria - high coronary risk	- nephrotic syndrome - unilateral renovascular hypertension - type 2 diabetes with renal disease	- renal insufficiency (renal function and hyperkalemia) - bilateral renal artery stenosis - renal artery stenosis in solitary kidney - hypertrophic cardiomyopathy - less effective for monotherapy in African Americans	- pregnancy† - sensitivity to ACE inhibitors	- antihypertensive effect blocked by NSAIDs - NSAIDs (hyperkalemia) - potassium supplements (hyperkalemia) - potassium sparing diuretics (less hypokalemia or hyperkalemia)	- angioedema - cough - tachycardia - increase in serum creatinine - increase in serum potassium - nausea - hypotension - diarrhea - fatigue - taste disorders (rare) - agranulocytosis (rare)
Calcium Channel Blockers	- ISH in elderly patients 60 (long-acting dihydropyiridines) - diabetes - high coronary risk	- angina pectoris - variant angina pectoris - migraine prophylaxis (verapamil) - Raynaud's disease (nifedipine) - esophageal spasm - hypertrophic cardiomyopathy without obstruction (verapamil, diltiazem) - supraventricular tachycardia (verapamil) - pulmonary hypertension (nifedipine)	- mild heart failure (verapamil > diltiazem > dihydropyiridines) - liver disease - high risk for heart failure	- severe heart failure (verapamil) - 2nd or 3rd degree heart block - sick sinus syndrome (verapamil, diltiazem) - Wolf-Parkinson-White syndrome (verapamil) - previous MI with heart failure (diltiazem) - sensitivity to calcium channel blockers	- additive negative inotropic effect with beta-blockers (verapamil) - verapamil increases digoxin blood levels - cimetidine increases nifedipine blood levels	- dizziness - peripheral edema - headache - flushing - constipation (verapamil) - heart block (verapamil) - rash - abnormal live enzymes - hypotension

* For a complete listing of side effects and drug interactions for any particular drug, consult the PDR or academic pharmacology texts.
Cooper, 2006

Drug	Associated Conditions Where Indicated	Associated Conditions Where Useful	Associated Conditions Requiring Caution	Contraindications	Drug Interactions*	Potential Side Effects*
Angiotensin Receptor Blockers	- type 2 diabetes with renal disease - non-diabetic renal disease with proteinuria - heart failure - left ventricular hypertrophy	- congestive heart failure - type 1 diabetes with renal involvement - nephrotic syndrome - unilateral renovascular hypertension	- renal insufficiency (renal function and hyperkalemia) - bilateral renal artery stenosis - renal artery stenosis in solitary kidney - hypertrophic cardiomyopathy	- pregnancy - sensitivity to angiotensin receptor blockers	- antihypertensive effect blocked by NSAIDs - NSAIDs (hyperkalemia) - potassium supplements (hyperkalemia) - potassium sparing diuretics (less hypokalemia or hyperkalemia)	- angioedema - tachycardia - increase in serum creatinine - increase in serum potassium - hypotension - fatigue

* For a complete listing of side effects and drug, interactions for any particular drug, consult the PDR or academic pharmacology texts.

Chobanian AV, Bakris GL, Black HR, et al. Seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure. *Hypertension* 2003;42:1206-52. (Class R)

Appendix G – Cost of Antihypertensive Drugs

Approximate average wholesale price cost to the patient for a 30-day supply of hypertension starting dose of medication. Based on medication formulary issues for each health plan and pharmacy, these costs may vary. Treatment reflects the lowest dose tablet or capsule from retail pharmacies nationwide.

Diuretics

Drug	HTN Starting Dose	Cost
Thiazide-Type		
Chlorothiazide – generic	250	$
Hydrochlorothiazide – generic	25 mg tablets	$
Microzide	12.5 mg capsules	$$
Chlorthalidone – generic	25 mg tablets	$$
Thalitone	15 mg tablets	$$$
Indapamide – generic	1.25 mg tablets	$$
Lozol	1.25 mg tablets	$$$
Metolazone – generic	2.5 mg tablets	$$$
Loop		
Bumetanide – generic	0.5 mg tablets	$$
Bumex	1 mg tablets	$$
Ethacrynic acid – *Edecrin*	25 mg tablets	$$$
Furosemide – generic	40 mg tablets	$
Lasix	40 mg tablets	$$
Torsemide – generic	5 mg tablets	$$
Demadex	5 mg tablets	$$$
Potassium-Sparing		
Amiloride – generic	5 mg tablets	$$
Eplerenone – generic	50 mg tablets	$$$$$
Inspra		$$$$$
Spironolactone – generic	50 mg tablets	$$
Aldactone	50 mg tablets	$$$
Triamterene – *Dyrenium*	100 mg capsules	$$$

$0-10 = $
$11-30 = $$
$31-50 = $$$
$51-70 = $$$$
Greater than $71 = $$$$$

Angiotensin-Converting Enzyme Inhibitors

Drug	Starting Dose	Cost
Benazepril – generic	10 mg tablets	$$$
Lotensin	10 mg tablets	$$$
Captopril – generic	25 mg tablets	$$$$
Capoten	25 mg tablets	$$$$$
Enalapril – generic	5 mg tablets	$$
Vasotec	5 mg tablets	$$$$
Fosinopril – generic	10 mg tablets	$$$
Monopril	10 mg tablets	$$$
Lisinopril – generic	10 mg tablets	$$
Prinivil/Zestril	10 mg tablets	$$$
Moexipril – generic	7.5 mg tablets	$$$
Univasc	7.5 mg tablets	$$$$
Perindopril – *Aceon*	4 mg tablets	$$$$
Quinapril – generic	10 mg tablets	$$$
Accupril	10 mg tablets	$$$$
Ramipril – generic	2.5 mg capsules	$$$$
Altace	2.5 mg capsules	$$$$
Trandolapril – generic	1 mg tablets	$$$
Mavik	1 mg tablets	$$$

Angiotensin Receptor Blockers (ARBs)

Drug	Starting Dose	Cost
Candesartan – *Atacand*	16 mg tablets	$$$$
Eprosartan – *Teveten*	600 mg tablets	$$$$$
Irbesartan – *Avapro*	150 mg tablets	$$$$
Losartan – *Cozaar*	50 mg tablets	$$$$
Olmesartan – *Benicar*	20 mg tablets	$$$$
Telmisartan – *Micardis*	40 mg tablets	$$$$
Valsartan – *Diovan*	80 mg tablets	$$$$$

$0-10 = $
$11-30 = $$
$31-50 = $$$
$51-70 = $$$$
Greater than $71 = $$$$$

Beta-Adrenergic Blockers

Drug	Starting Dose	Cost
Atenolol – generic	50 mg tablets	$$
Tenormin	50 mg tablets	$$$$
Betaxolol – generic	10 mg tablets	$$$
Bisoprolol – generic	5 mg tablets	$$
Zebeta	5 mg tablets	$$$$$
Metoprolol – generic	50 mg tablets	$$$
Lopressor	50 mg tablets	$$$$$
Toprol-XL	50 mg ER tablets	$$$
Nadolol – generic	40 mg tablets	$$$
Corgard	40 mg tablets	$$$$$
Propranolol – generic	40 tablets	$$$
extended-release	120 mg tablets	$$$$
Inderal-LA	80 mg ER capsules	$$$$$
InnoPran XL	80 mg ER capsules	$$$$$
Timolol – generic	10 mg tablets	$$
Beta-Blockers with Intrinsic Sympathomimetic Activity		
Acebutolol – generic	400 mg capsules	$$$
Penbutolol – *Levatol*	20 mg tablets	$$$$
Pindolol – generic	5 mg tablets	$$$
Beta-Blockers with Alpha Blocking Activity		
Carvedilol – generic	6.25 mg tablets	$$$$$
Coreg	6.25 mg tablets	$$$$$
Coreg CR	20 mg tablets	$$$$$
Labetalol – generic	100 mg tablets	$$
Trandate	100 mg tablets	$$$

$0-10 = $
$11-30 = $$
$31-50 = $$$
$51-70 = $$$$
Greater than $71 = $$$$$

Calcium-Channel Blockers

Drug	Starting Dose	Cost
Diltiazem –	60 mg ER capsules	$$$
extended-release (twice/d) generic		
extended-release (once/d) generic	120 mg ER capsules	$$$
Cardizem CD	180 mg ER capsules	$$$$$
Cardizem LA	180 mg ER tablets	$$$$$
Cartia XT	180 mg ER capsules	$$$
Dilacor XR	180 mg ER capsules	$$$$$
Verapamil – generic	80 mg tablets	$$$
Calan extended-release		$$$
generic (tabs)	180 mg ER tablets	$$$
generic (caps)	180 mg ER capsules	$$$
Calan SR	180 mg ER tablets	$$$$$
Covera-HS	180 mg ER tablets	$$$$
Verelan	120 mg ER capsules	$$$$$
Verelan PM	200 mg ER capsules	$$$$$
Dihydropyridines		
Amlodipine – generic	5 mg tablets	$
Norvasc	5 mg tablets	$$$$
Felodipine – generic	5 mg ER tablets	$$$
Plendil	5 mg ER tablets	$$$$
Isradipine – generic extended-release	2.5 mg capsules	$$$$$
DynaCirc CR	5 mg ER tablets	$$$$$
Nicardipine – generic	20 mg capsules	$$$
Cardene SR	30 mg ER capsules	$$$$$
Nifedipine – extended-release generic	30 mg ER tablets	$$$
Adalat CC	30 mg ER tablets	$$$
Procardia XL	30 mg ER tablets	$$$$
Nisoldipine – generic	20 mg ER tablets	$$$$$

$0-10 = $
$11-30 = $$
$31-50 = $$$
$51-70 = $$$$
Greater than $71 = $$$$$

Alpha-Adrenergic Blockers

Drug	Starting Dose	Cost
Prazosin – generic	1 mg capsules	$$
Minipress	1 mg capsules	$$$
Terazosin – generic	1 mg capsules	$$$
Doxazosin – generic	1 mg tablets	$$
Cardura	1 mg tablets	$$$
Cardura XL	4 mg tablets	$$$

Other Antihypertensives

Drug	Starting Dose	Cost
Central Alpha-Andrenergic Agonists		
Clonidine – generic	0.1 mg tablets	$$
Catapres	0.1 mg tablets	$$$$$
Catapres TTS (transdermal)	0.2 mg patches	$$$$$
Guanabenz – generic	4 mg tablets	$$$$
Guanfacine – generic	1 mg tablets	$$
Tenex		$$$$$
Methyldopa – generic	250 mg tablets	$$
Direct Vasodilators		
Hydralazine – generic	25 mg tablets	$$$$
Minoxidil – generic	10 mg tablets	$$
Renin Inhibitors		
Aliskiren – Tekturna	150 mg tablets	$$$$$

$0-10 = $
$11-30 = $$
$31-50 = $$$
$51-70 = $$$$
Greater than $71 = $$$$$

Some Combination Products

Drug and Starting Dose	Cost
Ace Inhibitors and Diuretics	
Benazepril 10 mg/hydrochlorothiazide 12.5 mg generic	$$$
Captopril 25 mg/hydrochlorothiazide 15 mg generic	$$
Enalapril 10 mg/hydrochlorothiazide 25 mg generic	$$$
Vaseretic	$$$$$
Fosinopril 10 mg/hydrochlorothiazide 12.5 mg generic	$$$
Monopril HCT	$$$
Lisinopril 10 mg/hydrochlorothiazide 12.5 mg generic	$$$
Prinzide	$$$
Moexipril 7.5 mg/hydrochlorothiazide 12.5 mg generic	$$$
Uniretic	$$$
Quinapril 10 mg/hydrochlorothiazide 12.5 mg generic	$$$
Accuretic	$$$$
Angiotensin Receptor Blockers and Diuretics	
Candesartan 16 mg/hydrochlorothiazide 12.5 mg *Atacand HCT*	$$$$$
Eprosartan 600 mg/hydrochlorothiazide 12.5 mg *Teveten HCT*	$$$$$
Irbesartan 150 mg/ hydrochlorothiazide 12.5 mg *Avalide*	$$$$$
Losartan 50 mg/hydrochlorothiazide 12.5 mg *Hyzaar*	$$$$
Olmesarten 20 mg/hydrochlorothiazide 12.5 mg *Benicar HCT*	$$$$$
Telmisartan 40 mg/hydrochlorothiazide 12.5 mg *Micardis HCT*	$$$$$
Valsartan 80 mg/hydrochlorothiazide 12.5 mg *Diovan HCT*	$$$$$
Beta-Andrenergic Blockers and Diuretics	
Atenolol 50 mg/chlorthialidone 25 mg generic	$$
Tenoretic	$$$$
Bisoprolol 5 mg/hydrochlorothiazide 6.25 mg generic	$$$
Ziac	$$$$$
Metoprolol 100 mg/hydrochlorothiazide 25 mg generic	$$$$
Lopressor HCT	$$$$$
Propranolol 40 mg/hydrochlorothiazide 25 mg generic	$$
Diuretic Combinations	
Hydrochlorothiazide 25 mg/spironolactone 25 mg generic	$$
Aldactazide	$$$
Hydrochlorothiazide 25 mg/triamterene 37.5 mg generic	$$
Dyazide	$$$
Maxzide	$$
Hydrochlorothiazide 50 mg/amiloride 5 mg generic	$$
Direct Vasodilators and Diuretics	
Hydralazine 25 mg/hydrochlorothiazide 25 mg generic	$$
Central Alpha/Andrenergic Agonist and Diuretics	
Methyldopa 250 mg/hydrochlorothiazide 25 mg generic	$$
Calcium Channel Blockers and Ace Inhibitors	
Amiodipine 5 mg/benazepril 10 mg generic *Lotrel*	$$$$$
Felodipine 5 mg/enalapril 5 mg *Lexxel*	$$$$
Verapamil extended-release 180 mg/trandolapril 2 mg *Tarka*	$$$$$
Renin Inhibitor and Diuretic	
Aliskiren 150 mg/12.5 mg hydrochlorothiazide *Tekturna HCT*	$$$$$

$0-10 = $
$11-30 = $$
$31-50 = $$$
$51-70 = $$$$
Greater than $71 = $$$$$

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Availability of references

References cited are available to ICSI participating member groups on request from the ICSI office. Please fill out the reference request sheet included with your guideline and send it to ICSI.

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Brief Description of Evidence Grading

Individual research reports are assigned a letter indicating the class of report based on design type: A, B, C, D, M, R, X.

A full explanation of these designators is found in the Foreword of the guideline.

II. CONCLUSION GRADES

Key conclusions (as determined by the work group) are supported by a conclusion grading worksheet that summarizes the important studies pertaining to the conclusion. Individual studies are classed according to the system defined in the Foreword and are assigned a designator of +, -, or ø to reflect the study quality. Conclusion grades are determined by the work group based on the following definitions:

Grade I: The evidence consists of results from studies of strong design for answering the question addressed. The results are both clinically important and consistent with minor exceptions at most. The results are free of any significant doubts about generalizability, bias, and flaws in research design. Studies with negative results have sufficiently large samples to have adequate statistical power.

Grade II: The evidence consists of results from studies of strong design for answering the question addressed, but there is some uncertainty attached to the conclusion because of inconsistencies among the results from the studies or because of minor doubts about generalizability, bias, research design flaws, or adequacy of sample size. Alternatively, the evidence consists solely of results from weaker designs for the question addressed, but the results have been confirmed in separate studies and are consistent with minor exceptions at most.

Grade III: The evidence consists of results from studies of strong design for answering the question addressed, but there is substantial uncertainty attached to the conclusion because of inconsistencies among the results from different studies or because of serious doubts about generalizability, bias, research design flaws, or adequacy of sample size. Alternatively, the evidence consists solely of results from a limited number of studies of weak design for answering the question addressed.

Grade Not Assignable: There is no evidence available that directly supports or refutes the conclusion.

The symbols **+**, **–**, **ø**, and **N/A** found on the conclusion grading worksheets are used to designate the quality of the primary research reports and systematic reviews:

+ indicates that the report or review has clearly addressed issues of inclusion/exclusion, bias, generalizability, and data collection and analysis;

– indicates that these issues have not been adequately addressed;

ø indicates that the report or review is neither exceptionally strong or exceptionally weak;

N/A indicates that the report is not a primary reference or a systematic review and therefore the quality has not been assessed.

References

Adler AI, Stratton IM, Neil AW, et al. Association of systolic blood pressure with macrovascular and microvascular complications of type 2 diabetes (UKPDS 36): prospective observational study. *BMJ* 2000;321:412-19. (Class B)

ADVANCE Collaborative Group. Effects of a fixed combination of perindopril and indapamide on macrovascular and microvascular outcomes in patients with type 2 diabetes mellitus (the ADVANCE trial): a randomised controlled trial. *Lancet* 2007;370:829-40. (Class A)

Agodoa LY, Appel L, Bakris GL, et al. Effect of ramipril vs amlodipine on renal outcomes in hypertensive nephrosclerosis. *JAMA* 2001;285:2719-28. (Class A)

ALLHAT Officers, Coordinators for the ALLHAT Collaborative Research Group, The. Major cardiovascular events in hypertensive patients randomized to doxazosin vs chlorthalidone: the Antihypertensive and Lipid-lowering Treatment to Prevent Heart Attack Trial (ALLHAT). *JAMA* 2000;283:1967-75. (Class A)

ALLHAT Officers, Coordinators for the ALLHAT Collaborative Research Group, The. Major outcomes in high-risk hypertensive patients randomized to angiotensin-converting enzyme inhibitor or calcium channel blocker vs diuretic: the antihypertensive and lipid-lowering treatment to prevent heart attack trial (ALLHAT). *JAMA* 2002;288:2981-97. (Class A)

Appel LJ. The verdict from ALLHAT – thiazide diuretics are the preferred initial therapy for hypertension. *JAMA* 2002;288:3039-42. (Class R)

Appel LJ, Espeland MA, Easter L, et al. Effects of reduced sodium intake on hypertension control in older individuals. *Arch Intern Med* 2001;161:685-93. (Class A)

Appel LJ, Moore TJ, Obarzanek E, et al. A clinical trial of the effects of dietary patterns on blood pressure. *N Engl J Med* 1997;336:1117-24. (Class A)

Aw T, Haas SJ, Liew D, Krum H. Meta-analysis of cyclooxygenase-2 inhibitors and their effects on blood pressure. *Arch Intern Med* 2005;165:490-96. (Class M)

Baik I, Ascherio A, Rimm EB, et al. Adiposity and mortality in men. *Am J Epidemiol* 2000;152:264-71. (Class B)

Bakris GL, Weir MR, Shanifar S, et al. Effects of blood pressure level on progression of diabetic nephropathy: results from the RENAAL study. *Arch Intern Med* 2003;163:1555-65. (Class A)

Beckett NS, Peters R, Fletcher AE, et al. Treatment of hypertension in patients 80 years of age or older. *N Engl J Med* 2008;358:1887-98. (Class A)

Beulens JWJ, Rimm EB, Ascherio A, et al. Alcohol consumption and risk for coronary heart disease among men with hypertension. *Ann Intern Med* 2007;146:10-19. (Class B)

Bevan EG, Pringle SD, Waller PC, et al. Comparison of captopril, hydralazine and nifedipine as third drug in hypertensive patients. *J Hum Hypertens* 1993;7:83-88. (Class A)

Bobrie G, Chatellier G, Genes N, et al. Cardiovascular prognosis of "masked hypertension" detected by blood pressure self-measurement in elderly treated hypertensive patients. *JAMA* 2004;291:1342-49. (Class B)

Bolinder G, de Faire U. Ambulatory 24-h blood pressure monitoring in healthy, middle-aged smokeless tobacco users, smokers, and nontobacco users. *Am J Hypertens* 1998;11:1153-63. (Class C)

Borhani NO, Mercuri M, Borhani PA, et al. Final outcome results of the multicenter isradipine diuretic atherosclerosis study (MIDAS): a randomized controlled trial. *JAMA* 1996;276:785-91. (Class A)

References

Brenner BM, Cooper ME, De Zeeuw D, et al. Effects of losartan on renal and cardiovascular outcomes in patients with type 2 diabetes and nephropathy. *N Engl J Med* 2001;345:861-69. (Class A)

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. *Circulation* 2008;117:e510-26. (Class R)

Canzanello VJ, Jensen PL, Schwartz LL, et al. Improved blood pressure control with a physician-nurse team and home blood pressure management. *Mayo Clin Proc* 2005;80:31-36. (Class D)

Cappuccio FP, MacGregor GA. Does potassium supplementation lower blood pressure? A meta-analysis of published trials. *J Hypertens* 1991;9:465-73. (Class M)

Chobanian AV, Bakris GL, Black HR, et al. Seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure. *Hypertension* 2003;42:1206-52. (Class R)

Claxton AJ, Cramer J, Pierce C. A systematic review of the associations between dose regimens and medication compliance. *Clin Therapeutics* 2001;23:1296-1310. (Class M)

Clement DL, De Buyzere ML, De Bacquer DA, et al. Prognostic value of ambulatory blood-pressure recordings in patients with treated hypertension. *N Engl J Med* 2003;348:2407-15. (Class B)

Cooper WO, Hernandez-Diaz S, Arbogast PG, et al. Major congenital malformations after first-trimester exposure to ACE inhibitors. *N Engl J Med* 2006;354:2443-51. (Class C)

Corrigan SA, Raczynski JM, Swencionis C, et al. Weight reduction in the prevention and treatment of hypertension: a review of representative clinical trials. *Am J Health Promot* 1991;5:208-14. (Class R)

Curb JD, Pressel SL, Cutler JA, et al. Effect of diuretic-based antihypertensive treatment on cardiovascular disease risk in older diabetic patients with isolated systolic hypertension. *JAMA* 1996;276:1886-92. (Class A)

Dahlöf B, Devereux RB, Kjeldsen SE, et al. Cardiovascular morbidity and mortality in the losartan intervention for endpoint reduction in hypertension study (LIFE): a randomised trial against atenolol. *Lancet* 2002;359:995-1003. (Class A)

Dahlöf B, Sever PS, Poulter NR, et al. 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 multicentre randomised controlled trial. *Lancet* 2005;366:895-906. (Class A)

DiMatteo MR, Lepper HS, Croghan TW. Depression is a risk factor for noncompliance with medical treatment: meta-analysis of the effects of anxiety and depression on patient adherence. *Arch Intern Med* 2000;160:2101-07. (Class M)

Eisenberg DM, Delbanco TL, Berkey CS, et al. Cognitive behavioral techniques for hypertension: are they effective? *Ann Intern Med* 1993;118:964-72. (Class M)

Elliott WJ, Meyer PM. Incident diabetes in clinical trials of antihypertensive drugs: a network meta-analysis. *Lancet* 2007;369:201-07. (Class M)

Elmer PJ, Obarzanek E, Vollmer WM, et al. Effects of comprehensive lifestyle modification on diet, weight, physical fitness, and blood pressure control: 18-month results of a randomized trial. *Ann Intern Med* 2006;144:485-95. (Class A)

Estacio RO, Jeffers BW, Hiatt WR, et al. The effect of nisoldipine as compared with enalapril on cardiovascular outcomes in patients with non-insulin-dependent diabetes and hypertension. *N Engl J Med* 1998;338:645-52. (Class A)

Fagard RH, Staessen JA, Thijs L, et al. On-treatment diastolic blood pressure and prognosis in systolic hypertension. *Arch Intern Med* 2007;167:1884-91. (Class A)

Farnett L, Mulrow CD, Linn WD, et al. The J-curve phenomenon and the treatment of hypertension: is there a point beyond which pressure reduction is dangerous? *JAMA* 1991;265:489-95. (Class M)

Fischer MA, Avorn J. Economic implications of evidence-based prescribing for hypertension: can better care cost less? *JAMA* 2004;291:1850-56. (Class M)

Flegal KM, Carroll MD, Ogden CL, Johnson CL. Prevalence and trends in obesity among U.S. adults, 1999-2000. *JAMA* 1723-27, 2002. (Class D)

Forette F, Seux L-M, Staessen JA, et al. Prevention of dementia in randomised double-blind placebo-controlled systolic hypertension in Europe (syst-Eur) trial. *Lancet* 1998;352:1347-51. (Class A)

Fotherby MD, Potter JF. Potassium supplementation reduces clinic and ambulatory blood pressure in elderly hypertensive patients. *J Hypertens* 1992;10:1403-08. (Class A)

Friedman HS. Alcohol and hypertension. *Alcohol Health Res World* 1990;14:313-19. (Class R)

Fung TT, Chiuve SE, McCullough ML, et al. Adherence to a DASH-style diet and risk of coronary heart disease and stroke in women. *Arch Intern Med* 2008;168:713-20. (Class B)

Gifford RW Jr, Kirkendall W, O'Connor DT, et al. Office evaluation of hypertension: a statement for health professionals by a writing group of the council for high blood pressure research, American Heart Association. *Circulation* 1989;79:721-31. (Class R)

Gottlieb SS, McCarter RJ, Vogel RA. Effect of beta-blockade on mortality among high-risk and low-risk patients after myocardial infarction. *N Engl J Med* 1998;339:489-97. (Class B)

Grimm RH, Grandits GA, Cutler JA, et al. Relationships of quality-of-life measures to long-term lifestyle and drug treatment in the treatment of mild hypertension study. *Arch Intern Med* 1997;157:638-48. (Class A)

Haider AW, Larson MG, Franklin SS, Levy D. Systolic blood pressure, diastolic blood pressure, and pulse pressure as predictors of risk for congestive heart failure in the Framingham heart study. *Ann Intern Med* 2003;138:10-16. (Class B)

Hajjar I, Kotchen TA. Trends in prevalence, awareness, treatment, and control of hypertension in the United States, 1988-2000. *JAMA* 2003;290:199-206. (Class D)

Hansson L, Zanchetti A, Carruthers SG, et al. Effects of intensive blood pressure lowering and low-dose aspirin in patients with hypertension: principal results of the Hypertension Optional Treatment (HOT) randomised trial. *Lancet* 1998;351:1755-62. (Class A)

Haynes RB, McDonald HP, Garg AX. Helping patients follow prescribed treatment: clinical applications. *JAMA* 2002;288:2880-83. (Class R)

Heart Outcomes Prevention Evaluation Study Investigators, The. Effects of an angiotensin-converting enzyme inhibitor, ramipril, on cardiovascular events in high-risk patients. *N Engl J Med* 2000;342:145-53. (Class A)

Horvath K, Jeitler K, Siering U, et al. Long-term effects of weight-reducing interventions in hypertensive patients: systematic review and meta-analysis. *Arch Intern Med* 2008;168:571-80. (Class M)

Hypertension Detection Follow-Up Program Cooperative Group. Five-year findings of the hypertension detection and follow-up program: I. reduction in mortality of persons with high blood pressure, including mild hypertension. *JAMA* 1979;242:2562-71. (Class A)

Hypertension Detection Follow-Up Program Cooperative Group. The effect of treatment on mortality in 'mild' hypertension: results of the hypertension detection and follow-up program. *N Engl J Med* 1982;307:976-80 . (Class A)

Izzo JL, Levy D, Black HR. Importance of systolic blood pressure in older Americans. *Hypertension* 2000;35:1021-24. (Class R)

Jafar TH, Schmid CH, Landa M, et al. Angiotensin-converting enzyme inhibitors and progression of nondiabetic renal disease. *Ann Intern Med* 2001;135:73-87. (Class M)

Jafar TH, Stark PC, Schmid CH, et al. Progression of chronic kidney disease: the role of blood pressure control, proteinuria, and angiotensin-converting enzyme inhibition: a patient-level meta-analysis. *Ann Intern Med* 2003;139:244-52. (Class M)

Johnston DW. Stress management in the treatment of mild primary hypertension. *Hypertens* 1991;17(supp III):III-63-68. (Class R)

Kahn N, McAlister FA. Re-examining the efficacy of beta-blockers for the treatment of hypertension: a meta-analysis. *CMAJ* 2006;174:1737-42. (Class A)

Kannel WB. Elevated systolic blood pressure as a cardiovascular risk factor. *Am J Cardiol* 2000;85:251-55. (Class R)

Kannel WB, Garrison RJ, Dannenberg AL. Secular blood pressure trends in normotensive persons: the Framingham study. *Am Heart J* 1993;125:1154-58. (Class B)

Kikuya M, Hansen TW, Thijs L, et al. Diagnostic thresholds for ambulatory blood pressure monitoring based on 10-year cardiovascular risk. *Circulation* 2007;115:2145-52. (Class C)

Kostis JB, Davis BR, Cutler J, et al. Prevention of heart failure by antihypertensive drug treatment in older persons with isolated systolic hypertension. SHEP Cooperative Research Group. *JAMA* 1997;278:212-16. (Class A)

Kunz R, Friedrich C, Wolbers M, Mann JFE. Meta-analysis: effect of monotherapy and combination therapy with inhibitors of the renin-angiotensin system on proteinuria in renal disease. *Ann Intern Med* 2008;148:30-48. (Class M)

Law M. Salt, blood pressure and cardiovascular diseases. *J Cardiovasc Risk* 2000;7:5-8. (Class R)

Lazarus JM, Bourgoignie JJ, Bukalew VM, et al. Achievement and safety of a low blood pressure goal in chronic renal disease: the modification of diet in renal disease study group. *Hypertension* 1997;29:641-49. (Class A)

Lean MEJ, Han TS, Seidell JC. Impairment of health and quality of life in people with large waist circumference. *Lancet* 1998;351:853-56. (Class D)

Leitzmann MF, Park Y, Blair A, et al. Physical activity recommendations and decreased risk of mortality. *Arch Intern Med* 2007;167:2453-60. (Class B)

Levy D. A multifactorial approach to coronary disease risk assessment. *Clin Exper Hypertens* 1993;15:1077-86. (Class R)

Lewis EJ, Hunsicker LG, Clarke WR, et al. Renoprotective effect of the angiotensin-receptor antagonist irbesartan in patients with nephropathy due to type 2 diabetes. *N Engl J Med* 2001;345:851-60. (Class A)

Lindholm LH, Carlberg B, Samuelsson O. Should beta blockers remain first choice in the treatment of primary hypertension? a meta-analysis. *Lancet* 2005;366:1545-53. (Class M)

Liu L, Wang JG, Gong L, et al. Comparison of active treatment and placebo in older Chinese patients with isolated systolic hypertension. *J Hypertens* 1998;16:1823-29. (Class C)

Maheswaran R, Gill JS, Davies P, et al. High blood pressure due to alcohol: a rapidly reversible effect. *Hypertens* 1991;17:787-92. (Class D)

Matchar DB, McCrory DC, Orlando LA, et al. Systematic review: comparative effectiveness of angiotensin-converting enzyme inhibitors and angiotensin II receptor blockers for treating essential hypertension. *Ann Intern Med* 2008;148:16-29. (Class M)

McDonald HP, Garg AX, Haynes RB. Interventions to enhance patient adherence to medication prescriptions: scientific review. *JAMA* 2002;288:2868-79. (Class M)

Messerli FH, Mancia G, Conti R, et al. Dogma disputed: can aggressively lowering blood pressure in hypertensive patients with coronary artery disease be dangerous? *Ann Intern Med* 2006;144:884-93. (Class M)

Moore LL, Visioni AJ, Qureshi M, et al. Weight loss in overweight adults and the long-term risk of hypertension: the Framingham study. *Arch Intern Med* 2005;165:1298-1303. (Class D)

National High Blood Pressure Education Program Working Group. National High Blood Pressure Education Program Working Group report on primary prevention of hypertension. *Arch Intern Med* 1993;153:186-207. (Class R)

Neaton JD, Grimm RH Jr, Prineas RJ, et al. Treatment of mild hypertension study: final results. *JAMA* 1993;270:713-24. (Class A)

Nelson M, Reid C, Krum H, McNeil J. A systematic review of predictors of maintenance of normotension after withdrawal of antihypertensive drugs. *Hypertension* 2001;14:98-105. (Class M)

Nichols-English G, Poirier S. Optimizing adherence to pharmaceutical care plans. *J Am Pharm Assoc* 2000;40:475-85. (Class R)

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;292:2217-26. (Class A)

ONTARGET Investigators, The. Telmisartan, ramipril, or both in patients at high risk for vascular events. *N Engl J Med* 2008;358:1547-59. (Class A)

Osterberg L, Blaschke T. Adherence to medication. *N Engl J Med* 2005;353:487-97. (Class R)

Packer M, Fowler MB, Roecker EB, et al. Effect of carvedilol on the morbidity of patients with severe chronic heart failure: results of the carvedilol prospective randomized cumulative survival (COPERNICUS) study. *Circulation* 2002;106:2194-99. (Class A)

Parving HH, Lehnert H, Brochner-Mortensen J, et al. The effect of irbesartan on the development of diabetic nephropathy in patients with type 2 diabetes. *N Engl J Med* 2001;345:870-78. (Class A)

Pate RR, Pratt M, Blair SN, et al. Physical activity and public health: a recommendation from the centers for disease control and prevention and the American college of sports medicine. *JAMA* 1995;273:402-07. (Class R)

Pickering TG, Hall JE, Appel LJ, et al. Recommendations for blood pressure measurement in humans and experimental animals: part 1: blood pressure measurement in humans: a statement for professionals from the subcommittee on professional and public education of the American Heart Association council on high blood pressure research. *Circulation* 2005;111:697-716. (Class R)

Pickering TG, Miller NH, Ogedegbe G, et al. Call to action on use and reimbursement for home blood pressure monitoring: executive summary. A joint scientific statement from the American heart association, American society of hypertension, and preventive cardiovascular nurses association. *J Clin Hypertens* 2008;10:467-76. (Class R)

Pitt B, Remme W, Zannad F, et al. Eplerenone, a selective aldosterone blocker, in patients with left ventricular dysfunction after myocardial infarction. *N Engl J Med* 2003;348:1309-21. (Class A)

Priya D, Kochar MS. Herbs and hypertension. *VHSJ* 60-64, July 2000. (Class R)

PROGRESS Collaborative Group, The. Effects of blood pressure lowering with perindopril and indapamide therapy in dementia and cognitive decline in patients with cerebrovascular disease. *Arch Intern Med* 2003;163:1069-75. (Class A)

Prospective Studies Collaboration. Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet* 2002;360:1903-13. (Class M)

Psaty BM, Lumley T, Furberg CD, et al. Health outcomes associated with various antihypertensive therapies used as first-line agents: a network meta-analysis. *JAMA* 2003;289:2534-44. (Class M)

Rahman M, Pressel S, Davis BR, et al. Renal outcomes in high-risk hypertensive patients treated with an angiotensin-converting enzyme inhibitor or a calcium channel blocker vs a diuretic: a report from the antihypertensive and lipid-lowering treatment to prevent heart attack trial (ALLHAT). *Arch Intern Med* 2005;165:936-46. (Class A)

Romero R, Bonet J, De La Sierra A, et al. Undiagnosed obesity in hypertension: clinical and therapeutic implications. *Blood Pressure* 2007;16:347-53. (Class D)

Rosendorff C, Black HR, Cannon CP, et al. Treatment of hypertension in the prevention and management of ischemic heart disease: a scientific statement from the American heart association council for high blood pressure research and the councils on clinical cardiology and epidemiology and prevention. *Circulation* 2007;115:2761-88. (Class R)

Sacks FM, Svetkey LP, Vollmer WM, et al. Effects on blood pressure of reduced dietary sodium and the dietary approaches to stop hypertension (DASH) diet. *N Engl J Med* 2001;344:3-10. (Class A)

Salpeter SR, Ormiston TM, Salpeter EE. Cardioselective β-blockers in patients with reactive airway disease: a meta-analysis. *Ann Intern Med* 2002;137:715-25. (Class M)

Sarnak MJ, Greene T, Wang X, et al. The effect of a lower target blood pressure on the progression of kidney disease: long-term follow-up of the modification of diet in renal disease study. *Ann Intern Med* 2005;142:342-51. (Class C)

SHEP Cooperative Research Group. Prevention of stroke by antihypertensive drug treatment in older persons with isolated systolic hypertension: final results of the systolic hypertension in the elderly program (SHEP). *JAMA* 1991;265:3255-64. (Class A)

Somes G, Pahor M, Shorr R, et al. The role of diastolic blood pressure when treating isolated systolic hypertension. *Arch Intern Med* 1999;159:2004-09. (Class A)

Soumerai SB, McLaughlin TJ, Spiegelman D, et al. Adverse outcomes of underuse of beta-blockers in elderly survivors of acute myocardial infarction. *JAMA* 1997;277:115-21. (Class B)

Staessen JA, Fagard R, Thijs L, et al. Randomised double-blind comparison of placebo and active treatment for older patients with isolated systolic hypertension. *Lancet* 1997;350:757-64. (Class A)

Staessen JA, Fagard R, Thijs L, et al. Subgroup and per-protocol analysis of the randomized European trial on isolated systolic hypertension in the elderly. *Arch Intern Med* 1998;158:1681-91. (Class A)

Staessen JA, Fagard R, Thijs L, et al. for The Systolic Hypertension in Europe (Syst-Eur) Trial Investigators. Randomised double-blind comparison of placebo and active treatment for older patients with isolated systolic hypertension. *Lancet* 1997;350:757-64. (Class A)

Staessen JA, Gasowski J, Wang JG, et al. Risks of untreated and treated isolated systolic hypertension in the elderly: meta-analysis of outcome trials. *Lancet* 2000;355:865-72. (Class M)

STOP-Hypertension-2 Study Group, The. Randomised trial of old and new hypertensive drugs in elderly patients: cardiovascular mortality and morbidity the Swedish Trial in Old Patients with Hypertension-2 Study. *Lancet* 1999;354:1751-56. (Class A)

Taler SJ, Textor SC, Augustine JE. Resistant hypertension: comparing hemodynamic management to specialist care. *Hypertension* 2002;39:982-88. (Class A)

Trials of Hypertension Prevention Collaborative Research Group, The. The effects of nonpharmacologic interventions on blood pressure of persons with high-normal levels: results of the trials of hypertension prevention, phase I. *JAMA* 1992;267:1213-20. (Class A)

UK Prospective Diabetes Study Group. Efficacy of atenolol and captopril in reducing risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 39. *BMJ* 1998;317:713-20. (Class A)

UK Prospective Diabetes Study Group. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. *BMJ* 1998;317:703-13. (Class A)

Vasan RS, Beiser A, Seshadri S, et al. Residual lifetime risk for developing hypertension in middle-aged women and men: the Framingham heart study. *JAMA* 2002;287:1003-10. (Class B)

Vasan RS, Larson MG, Leip EP, et al. Impact of high-normal blood pressure on the risk of cardiovascular disease. *N Engl J Med* 2001;345:1291-97. (Class B)

Vokó Z, Bots ML, Hofman A, et al. J-shaped relation between blood pressure and stroke in treated hypertensives. *Hypertension* 1999;34:1181-85. (Class B)

Whelton PK, Appel LJ, Espeland MA, et al. Sodium reduction and weight loss in the treatment of hypertension in older persons: a randomized controlled trial of nonpharmacologic interventions in the elderly (TONE). *JAMA* 1998;279:839-46. (Class A)

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;165:1401-09. (Class A)

Whelton PK, He J, Cutler JA, et al. Effects of oral potassium on blood pressure: meta-analysis of randomized controlled clinical trials. *JAMA* 1997;277:1624-32. (Class M)

Wing LMH, Reid CM, Ryan P, et al. A comparison of outcomes with angiotensin-converting-enzyme inhibitors and diuretics for hypertension in the elderly. *N Engl J Med* 2003;348:583-92. (Class A)

Wolf PA, D'Agostino RB, Belanger AJ, et al. Probability of stroke: a risk profile from the Framingham study. *Stroke* 1991;22:312-18. (Class B)

Wong D, 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* 2007;167:2431-36. (Class D)

World Health Organization/International Society of Hypertension. 1999 World Health Organization-International Society of Hypertension guidelines for the management of hypertension. *J Hypertens* 1999;17:151-83. (Class R)

World Hypertension League. Physical exercise in the management of hypertension: a consensus statement by the World Hypertension League. *J Hypertens* 1991;9:283-87. (Class R)

References

Wright Jr JT, Harris-Haywood S, Pressel S, et al. Clinical outcomes by race in hypertensive patients with and without the metabolic syndrome: antihypertensive and lipid-lowering treatment to prevent heart attack trial (ALLHAT). *Arch Intern Med* 2008;168:207-17. (Class A)

Yakovlevitch M, Black HR. Resistant hypertension in a tertiary care clinic. *Arch Intern Med* 1991;151:1786-92. (Class D)

Yusuf S, Hawken S, Óunpuu S, et al. Obesity and the risk of myocardial infarction in 27,000 participants from 52 countries: a case-control study. *Lancet* 2005;366:1640-49. (Class C)

Conclusion Grading Worksheet A – Annotation #7 (Goal Blood Pressure for Patients with Cardiovascular Disease)

Work Group's Conclusion: Goal office blood pressures should be less than 140/90 mmHg for adults with uncomplicated hypertension (in the absence of comorbidities).

Conclusion Grade: II

Work Group's Conclusion: Patients with comorbid conditions including diabetes or chronic kidney disease, should have a goal office blood pressure of less than 130/80 mmHg.

Conclusion Grade: II

Work Group's Conclusion: Patients with coronary artery disease should have a goal office blood pressure less than 130/80 mmHg.

Conclusion Grade: II

Author/ Year	Design Type	Class	Quality +, –, ø	Population Studied/Sample Size	Primary Outcome Measure(s)/Results (e.g., p-value, confidence interval, relative risk, odds ratio, likelihood ratio, number needed to treat)	Authors' Conclusions/*Work Group's Comments (italicized)*
Nissen et al., 2004 (CAMEL OT Study)	Randomized controlled trial (RCT)	A	+	-- 1991 pts with angiographically documented (> 20% stenosis) coronary artery disease (CAD) with diastolic BP < 100 mm Hg who were randomized to the following groups: (1) Amlodipine (n=663, mean age 57.3 yrs, 76.3% men) (2) Placebo (n=655, mean age 57.2 yrs, 73.0% men) (3) Enalapril (n=673, mean age 58.5 yrs, 71.9% men) -- 274 patient substudy using intravascular ultrasound (IVUS) noting nominal change in atheroma volume -- Primary outcome was incidence of adverse CV events (cardiovascular death, nonfatal MI, resuscitated cardiac arrest, coronary revascularization procedures, hospitalization for angina or CHF, stroke, TIA, incident peripheral vascular disease)	-- Mean BP at baseline (systolic/diastolic mm Hg): Placebo: 128.9/77.6 Enalapril: 128.9/77.2 Amlodipine: 129.5/77.7 -- Mean BP change at end of 24-month follow-up (systolic/diastolic mm Hg): Placebo: increase 0.7/0.6 Enalapril: reduced 4.8/2.5 Amlodipine: reduced 4.9/2.4 ($p < 0.001$ for both compared to placebo) -- CV events occurred in 23.1% of placebo pts and 16.6% of amlodipine pts, hazard ratio (HR) 0.69, p=0.003; compared to placebo, the amlodipine group had fewer coronary revascularizations (p=0.03), hospitalizations for angina (p=0.002) and resuscitated cardiac arrests (p=0.04) -- CV events occurred in 20.1% of enalapril pts, with non-significant HRs compared to amlodipine and placebo; however, amlodipine did have fewer angina hospitalizations compared with enalapril pts (HR 0.59, p=0.003); no comparisons of enalapril to placebo showed significant differences -- IVUS results (24 months follow-up): Placebo: 1.3% increase Enalapril: 0.8% increase Amlodipine: 0.5% increase (all comparisons non-significant) -- When only pts with systolic BP > mean systolic BP were selected, amlodipine vs. placebo IVUS change became significant (less increase in amlodipine, p=0.02) -- Adverse events: overall well tolerated; amlodipine was discontinued in 87 pts, enalapril discontinued in 102 pts, and placebo discontinued in 71 pts -- Number needed to treat for amlodipine to prevent 1 CV event over 2 years was 16 pts (compared to placebo)	-- Blood pressure reduction may have contributed to decreased CV events; amlodipine showed significant decreases in CV events compared to placebo; enalapril did not reach significance in any comparison, although non-significant trends were observed favoring enalapril compared to placebo -- Blood pressure reduction may have contributed to differences in CV events between groups; lack of significance of differences between enalapril and the placebo group may also have been driven in part due to lack of anti-anginal activity of enalapril -- Effectiveness of blood pressure lowering medications (especially amlodipine in this study) in decreasing CV events in these pts with generally "normal" blood pressures may suggest that present goals for BP lowering in established CAD may be too high (but need further confirmatory trials) -- Higher blood pressures may lead to increases in atheroma progression on IVUS

Author/ Year	Design Type	Class	Quality +,–,0	Population Studied/Sample Size	Primary Outcome Measure(s)/Results (e.g., p-value, confidence interval, relative risk, odds ratio, likelihood ratio, number needed to treat)	Authors' Conclusions/ *Work Group's Comments (italicized)*
Prospective Studies Collaboration, 2002	Meta-analysis	M	+	-- Meta-analysis of data from 61 prospective observational studies including a total of 958,074 adults (12.7 million person-years of risk) with no known vascular disease (age 40-89 years old, subdivided into 5 decades) -- Primary risk factors were age and systolic and diastolic BP in relation to deaths from vascular disease -- Blood lipids, diabetes, weight, alcohol use, and smoking at baseline also assessed; however, controlling for these factors did not significantly alter the hazard ratios for BP effects -- Time-dependent correction for regression dilution was used to relate mortality during each decade of age at death to estimated usual BP at the start of that decade	-- About 56,000 deaths from vascular causes (12,000 from stroke, 34,000 from ischemic heart disease, and 10,000 from other vascular causes) -- About 66,000 deaths occurred from other causes -- Within each decade of age at death, the risk of vascular death associated with the difference in usual BP is reduced down to 115 mm Hg systolic and 75 mm Hg diastolic, below which there is little evidence of further risk reduction -- At ages 40-69 years, each 20 mm Hg reduction in systolic BP (corresponding to about 10 mm Hg diastolic reduction) is associated with > 2-fold difference in stroke death rate, and about a 2-fold difference in ischemic heart disease deaths and deaths from other vascular causes (lower death rates with lower BP) -- At ages 80-89 years, these proportional differences in vascular mortality are about half as strong as for ages 40-49 years (although still significant), but annual absolute differences in risk are greater in old age -- Similar age-related associations were found in men and women -- For predicting vascular mortality based on a single BP measurement, the average of the systolic and diastolic values are slightly more important than either alone	-- Throughout middle and old age, BP is strongly associated with vascular death rate (and overall death rate to a lesser extent), without evidence for a threshold down to a BP value of at least 115/75 mm Hg -- Although the study did not include patients with prevalent vascular disease (to avoid reverse causality where the disease itself may strongly affect the BP values), it may be beneficial for those who are at high risk because of prevalent disease (or age or other risk factors) to lower blood pressure even if they are currently in the "normal" range

Author/ Year	Design Type	Class	Quality +,–,ø	Population Studied/Sample Size	Primary Outcome Measure(s)/Results (e.g., p-value, confidence interval, relative risk, odds ratio, likelihood ratio, number needed to treat)	Authors' Conclusions/ *Work Group's Comments (italicized)*
Chobanian et al., 2003	Clinical Guideline	R	ø	-- Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-7)	JNC-7 Recommendations: -- In persons older than 50 years, systolic BP of > 140 mm Hg is a much more important cardiovascular disease (CVS) risk factor than diastolic BP -- Starting at BP 115/75, the CVD risk doubles with each increment of systolic/diastolic BP of 20/10 mm Hg -- Systolic BP of 120-139 or a diastolic BP of 80-85 is considered "prehypertensive" and deserves intervention at the level of lifestyle modifications to prevent CVD -- Most pts with hypertension will require 2 or more drugs to achieve goal of < 140/90 mm Hg or less than < 130/80 mm Hg for pts with diabetes or chronic kidney disease -- If BP > 20/10 mm Hg above goal, initiating treatment with 2 pharmacological agents should be considered (generally including a thiazide diuretic) -- Pts need to be motivated to adhere to treatment, and thus having a positive therapeutic relationship and trust in the provider are important toward reaching BP goals	-- Effective BP control can be obtained in most patients with hypertension, but most will need 2 or more antihypertensive drugs to achieve goals as well as lifestyle modifications (weight reduction in overweight pts, dietary modifications and sodium restriction, increase in physical activity, moderation of alcohol consumption, smoking cessation) -- For hypertensive diabetic and chronic renal disease patients, goal is to slow loss of renal function and prevent CVD, thus needing more aggressive BP treatment to < 130/80 mm Hg

This section provides resources, strategies and measurement specifications for use in closing the gap between current clinical practice and the recommendations set forth in the guideline.

The subdivisions of this section are:

- Priority Aims and Suggested Measures
  - Measurement Specifications
- Key Implementation Recommendations
- Knowledge Resources
- Resources Available

Priority Aims and Suggested Measures

1. Increase the percentage of adult patients in blood pressure control.

   Possible measures of accomplishing this aim:

   a. Percentage of adult patients with a blood pressure documented at every clinic visit.

   b. Percentage of adult patients who have a blood pressure reading less than 140/90 mmHg at their clinic visit. *(MN Community Measurement)*

   c. Percentage of adult patients with a diagnosis of diabetes, who have a blood pressure reading of less than130/80 mmHg at their clinic visit. *(Annotation #7)*

   d. Percentage of adult patients with a diagnosis of chronic kidney disease who have a blood pressure reading of less than 130/80 mmHg at their clinic visit. *(Annotation #7)*

   e. Percentage of adult patients with a diagnosis of coronary artery disease who have a blood pressure reading of less than 130/80 mmHg at their clinic visit. *(Annotation #7) (See ICSI Stable Coronary Artery Disease guideline.)*

2. Improve the assessment of adult patients with hypertension.

   Possible measures of accomplishing this aim:

   a. Percentage of paramedical staff with documented initial and annual education in the correct technique for blood pressure measurement. *(Appendix A)*

   b. Percentage of adult patients with a home blood pressure monitoring device with documentation in their medical record of initial education by staff in the correct technique for blood pressure measurement and monitoring. *(Annotation #2)*

3. Increase the percentage of adult patients with hypertension who receive patient education, with a focus on the use of non-pharmacological treatments.

   Possible measures of accomplishing this aim:

   a. Percentage of adult patients presenting in clinic within the last month for whom patient education about modifiable risk factors has been documented in the medical record.

   b. Percentage of adult patients presenting in clinic within the last month reporting a discussion about modifiable risk factors.

(See Appendix C, "Recommended Education Messages.")

4. Increase the percentage of adult patients not in blood pressure control who have a care plan.

   Possible measures of accomplishing this aims:

   a. Percentage of adult patients with a diagnosis of hypertension, with a blood pressure reading of greater than 140/90 mmHg who have a care plan documented in their medical record.

   b. Percentage of adult patients with a diagnosis of diabetes with a blood pressure reading of greater than 130/80 mmHg who have a care plan documented in their medical record. *(See ICSI Diagnosis and Management of Type 2 Diabetes Mellitus in Adults guideline.)*

   c. Percentage of adult patients with a diagnosis of chronic kidney disease with a blood pressure reading of greater than 130/80 mmHg who have a care plan documented in their medical record.

   d. Percentage of adult patients with a diagnosis of coronary artery disease, with a blood pressure reading of greater than 130/80 mmHg who have a care plan documented in their medical record. *(Annotation #7) (See ICSI Stable Coronary Artery Disease guideline.)*

5. Increase the percentage of adult patients not at blood pressure goal who have a change in subsequent therapy.

   Possible measures of accomplishing this aim:

   a. Percentage of adult patients on medication and not at blood pressure goal with a documented change in therapy (e.g., increase in dose of initial drug, change to a drug from another class or addition of a second drug from another class). *(Annotation #8)*

   b. Percentage of adult patients with three consecutive elevated blood pressure measures who have a change in blood pressure medication started within three months.

Measurement Specifications

Possible Success Measure #1b

Percentage of adult patients who have blood pressure less than 140/90 mmHg at their clinic visit.

Data of Interest

$$\frac{\text{\# of patients with a diagnosis of hypertension who had a blood pressure reading at their last visit less than 140 mmHg systolic and less than 90 mmHg diastolic}}{\text{\# of patients age 18 years and older who have a diagnosis of hypertension}}$$

Population Definition

Adult patients 18 years and older who have had an office visit within the previous 12 months having the following ICD-9 codes: 401.0, 401.1 and/or 401.9.

Method of Data Collection

Medical groups may generate a list of patients meeting the inclusion criteria. This list would be newly created not less than every 6 to 12 months to remain current. Data may be collected by medical record review. Identify the blood pressure at the most recent office visit.

- Calculate the average of two or more systolic blood pressure and diastolic blood pressure readings taken at the most recent office visit to determine level of control.
- Go to the previous office visit if the most recent office visit was for sigmoidoscopy, injuries or a visit at which local anesthesia such as lidocaine was given for a procedure.
- The mean of two or more systolic and the mean of two or more diastolic readings taken at the selected visit would be calculated. The mean systolic blood pressure and mean diastolic blood pressure may then be used to determine whether the patient has a blood pressure less than 140/90 mmHg.
- After review in one month, all eligible patients would return to the pool of eligible patients from which the following month's sample of charts would be randomly drawn.

Time Frame for Data Collection

Randomly selected cases may be reviewed monthly.

Notes

Blood pressure should be less than 140 mmHg systolic and less than 90 mmHg diastolic while concurrently controlling other modifiable cardiovascular risk factors. These levels were achieved in the major clinical trials that demonstrated efficacy in treating Stage 1 and Stage 2 hypertension. Further reduction to a goal of 130/80 mmHg or lower is reasonable, especially in individuals with chronic kidney disease, coronary artery disease or diabetes to preserve renal function and maximally protect against vascular complications.

The population of patients included in the sample and the blood pressure level would be adjusted for those with an underlying disease (diabetes, coronary artery disease or chronic kidney disease, less than 130/80 mmHg).

Possible Success Measure #5a

Percentage of adult patients with hypertension, presenting in clinic within the last month, for whom patient education about modifiable risk factors has been documented in the medical record.

Population Definition

Patients age 18 years and older who have had a clinic visit within the past month having primary, secondary or tertiary ICD-9 codes 401.0, 401.1 and/or 401.9.

Data of Interest

$$\frac{\text{\# of records with documentation of discussion of modifiable risk factors}}{\text{\# of patients with hypertension whose medical records are reviewed}}$$

Numerator/Denominator Definitions:

Numerator: Hypertension is defined as ICD-9 codes of 401.0, 401.1 and/or 401.9. Documented is defined as any evidence in the medical record that a clinician discussed modifiable risk factors that include weight reduction and maintenance, moderation of dietary sodium, moderation of alcohol intake, adequate physical activity, the DASH eating plan, tobacco avoidance and drug therapy.

Denominator: Hypertension is defined as ICD-9 codes of 401.0, 401.1 and/or 401.9.

Method of Data Collection

Medical groups may generate a list of patients meeting the inclusion criteria. This list would be newly created not less than every 6 to 12 months to remain current. Data may be collected by medical record review. Determine the presence of documentation of a discussion about modifiable risk factors at the clinic visit within the past month.

Time Frame for Data Collection

Randomly selected cases may be reviewed monthly.

Notes

Clinical studies show that the blood-pressure-lowering effects of lifestyle modifications can be equivalent to drug monotherapy. Behavior change strategies should include nutrition, exercise and smoking cessation services. Some patient education should occur and be documented at every visit.

Key Implementation Recommendations

The following system changes were identified by the guideline work group as key strategies for health care systems to incorporate in support of implementation of this guideline.

1. Develop systems that provide for staff education on proper blood pressure measurement. (See Appendix A, "Standards for Blood Pressure Measurement.") Based on surveys that show the variability of blood pressure measurement, training sessions should be arranged by your medical facility (review the steps in Appendix A and the rationale that accompanies the document). Accurate, reproducible blood pressure measurement is important to correctly classify blood pressure. Inconsistencies may result from using defective equipment and not standardizing the technique. The education and training standards found in Appendix A are consistent with American Heart Association and National Heart, Lung, and Blood Institute recommendations.
2. Develop systems for providing patient education on hypertension management. (See Appendix C, "Recommended Education Messages.") The appendix contains educational messages that will support goals of patient education and self-involvement in ongoing hypertension management. Major components of the education are:
   - basic information about "What is blood pressure?", what the blood pressure numbers mean, and how high blood pressure affects your life;
   - lifestyle modifications;
   - pharmacologic therapy;
   - ongoing management.

Knowledge Products and Resources

Criteria for Selecting Resources

The following resources were selected by the Hypertension Diagnosis and Treatment guideline work group as additional resources for providers and/or patients. The following criteria were considered in selecting these resources.

- The site contains information specific to the topic of the guideline.
- The content is supported by evidence-based research.
- The content includes the source/author and contact information.
- The content clearly states revision dates or the date the information was published.
- The content is clear about potential biases, noting conflict of interest and/or disclaimers as appropriate.

Resources Available to ICSI Members Only

ICSI has a wide variety of knowledge resources that are ***only*** available to ICSI members (these are indicated with an asterisk in far left-hand column of the Resources Available table). In addition to the resources listed in the table, ICSI members have access to a broad range of materials including tool kits on CQI processes and Rapid Cycling that can be helpful. To obtain copies of these or other Knowledge Resources, go to http://www.icsi.org/improvement_resources. To access these materials on the Web site, you must be logged in as an ICSI member.

The resources in the table on the next page that are not reserved for ICSI members are available to the public free-of-charge.

Resources Available

*	Author/Organization	Title/Description	Audience	Web sites/Order Information
	Allina Press	What You Should Know about High Blood Pressure (hypertension brochure) #31483	Patients and Families	To order, call 612-775-9614
	American Heart Association (AHA)	Web site with excellent resources for patient education and general heart health resources. Understanding and Controlling Your High Blood Pressure and Exercise and Your Heart.	Patients and Families	http://www.americanheart.org
	Mayo Health Oasis	Web site with excellent resources for patient education resources, particularly using search terms "hypertension," "blood pressure" and "home monitoring."	Patients and Families	http://www.mayoclinic.com
	National Heart, Lung, and Blood Institute (NHLBI)	Web site with excellent resources for patient education. Includes an online catalog of materials. - Facts about Heart Disease and Women: Preventing and Controlling High Blood Pressure (brochure #97-3655) - Facts about Lowering Blood Pressure (brochure # 5232) - Facts about the DASH Diet (booklet #03-4082) - Your Guide to Lowering Blood Pressure (booklet #03-5232)	Patients and Families	http://www.nhlbi.nih.gov (Select Health Information and Publications, then select Heart/ Vascular Diseases.)
	National Kidney Foundation	The National Kidney Foundation, Inc. (NKF) is a major voluntary health organization dedicated to preventing kidney disease, improving the health and well-being of individuals and families affected by kidney disease.	Health Care Professionals	http://www.kidney.org/kidney-disease/
*	Park Nicollet Health Services	Patient Education: Hypertension, Understanding brochure	Patients and Families	http://www.americanheart.org

* Available to ICSI members only.