INSTITUTE FOR CLINICAL SYSTEMS IMPROVEMENT

Health Care Guideline

Hypertension Diagnosis and Treatment

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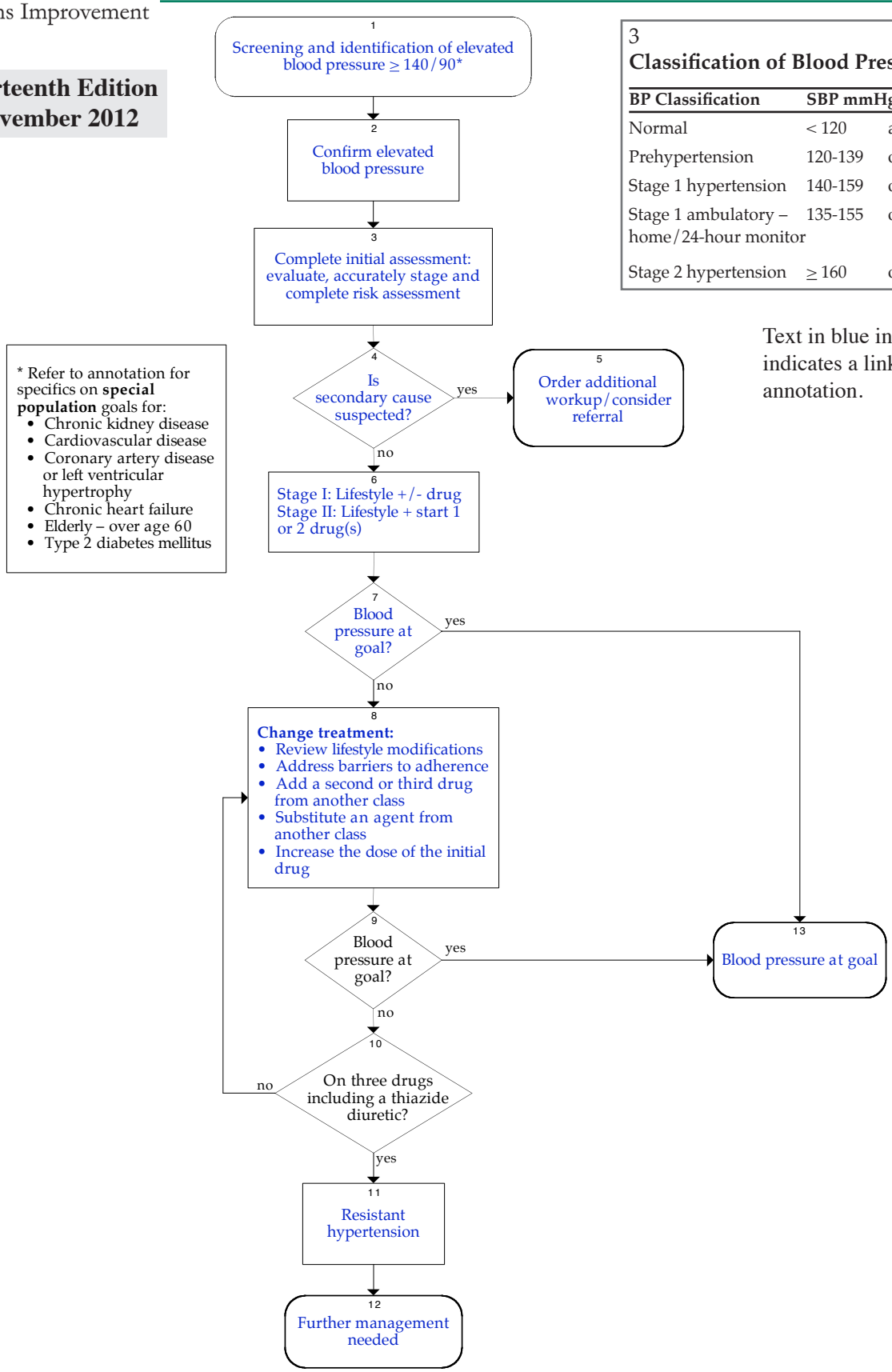
Health Care Guideline:
Hypertension Diagnosis and Treatment



3
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 1 ambulatory – home/24-hour monitor	135-155	or	85-95
Stage 2 hypertension	≥ 160	or	≥ 100

Text in blue in this algorithm indicates a linked corresponding annotation.

* Refer to annotation for specifics on **special population** goals for:
- Chronic kidney disease
- Cardiovascular disease
- Coronary artery disease or left ventricular hypertrophy
- Chronic heart failure
- Elderly – over age 60
- Type 2 diabetes mellitus

Return to Table of Contents

Table of Contents

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Evidence Grading

Literature Search

A consistent and defined process is used for literature search and review for the development and revision of ICSI guidelines. The literature search was divided into two stages to identify systematic reviews, (stage I) and randomized controlled trials, meta-analysis and other literature (stage II). Literature search terms used for this revision are below and include literature from January 2010 through May 2012.

GRADE Methodology

Following a review of several evidence rating and recommendation writing systems, ICSI has made a decision to transition to the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system.

GRADE has advantages over other systems including the current system used by ICSI. Advantages include:

- developed by a widely representative group of international guideline developers;
- explicit and comprehensive criteria for downgrading and upgrading quality of evidence ratings;
- clear separation between quality of evidence and strength of recommendations that includes a transparent process of moving from evidence evaluation to recommendations;
- clear, pragmatic interpretations of strong versus weak recommendations for clinicians, patients and policy-makers;
- explicit acknowledgement of values and preferences; and
- explicit evaluation of the importance of outcomes of alternative management strategies.

This document is in transition to the GRADE methodology

Transition steps incorporating GRADE methodology for this document include the following:

- Priority placed upon available Systematic Reviews in literature searches.
- All existing Class A (RCTs) studies have been considered as high quality evidence unless specified differently by a work group member.
- All existing Class B, C and D studies have been considered as low quality evidence unless specified differently by a work group member.
- All existing Class M and R studies are identified by study design versus assigning a quality of evidence. Refer to Crosswalk between ICSI Evidence Grading System and GRADE.
- All new literature considered by the work group for this revision has been assessed using GRADE methodology.

Return to Table of Contents

Crosswalk between ICSI Evidence Grading System and GRADE

ICSI GRADE System	Previous ICSI System	
High, if no limitation	**Class A:**	Randomized, controlled trial
Low	**Class B:**	[observational] Cohort study
	Class C:	[observational] Non-randomized trial with concurrent or historical controls
Low		Case-control study
Low		Population-based descriptive study
***Low**		Study of sensitivity and specificity of a diagnostic test
* Following individual study review, may be elevated to Moderate or High depending upon study design		
	Class D:	[observational]
Low		Cross-sectional study Case series Case report
Meta-analysis	**Class M:**	Meta-analysis
Systematic Review		Systematic review
Decision Analysis		Decision analysis
Cost-Effectiveness Analysis		Cost-effectiveness analysis
Low	**Class R:**	Consensus statement
Low		Consensus report
Low		Narrative review
Guideline	**Class R:**	Guideline
Low	**Class X:**	Medical opinion

Evidence Definitions:

High Quality Evidence = Further research is very unlikely to change our confidence in the estimate of effect.

Moderate Quality Evidence = Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low Quality Evidence = Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate or any estimate of effect is very uncertain.

In addition to evidence that is graded and used to formulate recommendations, additional pieces of literature will be used to inform the reader of other topics of interest. This literature is not given an evidence grade and is instead identified as a **Reference** throughout the document.

Return to Table of Contents

Foreword

Introduction

Approximately 30% of the adult population in the United States has hypertension. The majority of people over 65 years of age carry this diagnosis. Therefore, approximately 66.9 million people in the United States carry the diagnosis of hypertension. It is estimated that this number will rise as the number of patients who are over the age of 65, as well as the number of patients who are obese, continue to increase.

Hypertension is the most common reason for adult office visits other than pregnancy and has the highest use of prescription drugs. Despite the number of resources used to treat this disease, only about 50% of hypertensives have their blood pressure under control using the definition of blood pressure less than 140/90 *(National Health and Nutritional Examination Survey[NHANES] 2005-2008)*.

Poor adherence to lifestyle changes and medication contribute to this poor outcome. Lifestyle changes such as a low-sodium diet, weight loss, increased exercise and limiting alcohol abuse are difficult when there are no symptoms of the disease until secondary problems arise. It is also difficult to continue medications when drug-related side effects arise when the disease itself is asymptomatic. Inadequate access to medical care for chronic disease as well as the cost of medication contribute to poor control of blood pressure.

The cost of inadequate treatment of hypertension is significant. Hypertension is a leading contributor to vascular disease such as stroke and myocardial infarction as well as chronic kidney disease and congestive heart failure. These diseases lead to significant medical costs as well as lost productivity in the work force.

The African American population in the U.S. has a higher incidence of hypertension, with an increased risk of stroke, myocardial infarction and kidney disease. Particular attention to treating hypertension in high-risk populations such as African Americans, the elderly and people with chronic kidney disease should have significant benefit.

In the current iteration of this guideline, we have focused on the importance of clinic blood pressure measurement for diagnosis and treatment, effective approaches to pharmacologic therapy, and more uniform goals of less than 140/90 in special populations.

Return to Table of Contents

Scope and Target Population

Adults age 18 years or older, excluding pregnancy.

Return to Table of Contents

Aims

1. Increase the percentage of hypertensive patients age 18 years and older whose blood pressure is under control. *(Annotation #7)*
2. Improve the assessment of hypertensive patients age 18 years and older. *(Annotation #2)*
3. Increase the percentage of hypertensive patients age 18 years and older who receive patient education, with a focus on the use of non-pharmacological treatments. *(Appendix C)*
4. Increase the percentage of patients age 18 years and older with uncontrolled hypertension who have a plan of care. *(Annotations #3, 6, 7)*
5. Increase the percentage of hypertensive patients age 18 years and older not at a blood pressure goal who have a change in subsequent pharmacological therapy. *(Annotation #8)*

Return to Table of Contents

Clinical Highlights

- Confirmation of hypertension is based on the initial visit, plus one or more follow-up visits with at least two blood pressure measures at each visit. *(Annotation #2; Aim #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; Aim #2)*
- A thiazide-type diuretic should be considered as initial therapy in most patients with uncomplicated hypertension. (*Annotation #6; Aim #1)*
- Physician reluctance to initiate and intensify treatment is a major obstacle to achieving treatment goals. *(Annotations #8, 11; Aims #3, 4)*
- 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; Aim #2)*
- Fewer than 50% of patients with hypertension will be controlled with a single drug. *(Annotation #8; Aims #1, 4, 5)*

Return to Table of Contents

Implementation Recommendation Highlights

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.

- 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.
- 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 message are:
  - basic information about what blood pressure is, what the blood pressure numbers mean, and how high blood pressure affects your life;
  - lifestyle modifications;
  - pharmacologic therapy; and
  - ongoing management.
- Consider the use of motivational interviewing as a method for addressing behavior change. Motivational interviewing is defined as a client-centered, directive counseling style for eliciting behavior change by helping patients to explore and resolve ambivalence. Rather than telling a client what changes to make, the interviewer elicits "change talk" from them, taking into account an individual's priorities and values.

Return to Table of Contents

Related ICSI Scientific Documents

Guidelines

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

Return to Table of Contents

Definition

Clinician – All health care professionals whose practice is based on interaction with and/or treatment of a patient.

Return to Table of Contents

Algorithm Annotations

1. Screening and Identification of Elevated Blood Pressure Greater Than or Equal to 140/90

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. The standards for blood pressure measurement can be found in Appendix A.

Special Populations

Existing guidelines recommend lower blood pressure goals for certain groups. The Hypertension Diagnosis and Treatment work group has concluded that a goal of less than 140/90 mmHg is acceptable.

A review of seven trials (22,089 participants) comparing patients randomized to lower or to standard blood pressure targets (140-160/90-100 mmHg) found that lower targets did not reduce mortality, myocardial infarction, stroke, congestive heart failure or end-stage renal disease *(Arguedas, 2009 [Meta-analysis])*. The results in subgroups with diabetes or chronic kidney disease were consistent with the overall results (i.e., no benefit). Subsequently, the results of the ACCORD trial in diabetic patients were published and will be detailed in the section related to blood pressure goals in diabetic patients *(ACCORD Study Group, 2010 [High Quality Evidence])*. The discussion below weighs evidence from trials with other interventions that may have resulted in different blood pressure levels in the treatment arms (e.g., active drug versus placebo), observational studies and expert opinion.

Chronic Kidney Disease (CKD)

Hypertension is a major risk factor for as well as a consequence of chronic kidney disease and end-stage renal disease (ESRD).

Current JNC 7 and NKF/DOQI recommendations call for treatment of blood pressure to < 130/80 in patients with chronic kidney disease. However, no single, adequately powered intent-to-treat randomized control trial has shown a benefit of this blood pressure goal in chronic kidney disease *(Appel, 2010 [High Quality Evidence]; Lewis, 2010 [Systematic Review]; Arguedas, 2009 [Meta-analysis])* and meta-analysis of available trials shows a relative risk of end-stage renal disease of 1.01 for lower versus standard blood pressure goals *(Lewis, 2010 [Systematic Review])*.

In the Modification of Diet in Renal Disease study, 585 individuals with chronic kidney disease (mean eGFR 39 ml/min/1.73 m2) were randomized to a low blood pressure (mean arterial pressure [MAP] 92 mmHg, corresponding to < 125/75 mmHg) or usual care condition (mean arterial pressure 107 mmHg, corresponding to < 140/90 mmHg). At completion of the study (mean 2.2 years of follow-up), the rate of progression of kidney disease did not differ between blood pressure groups; however, the low blood pressure goal (achieved blood pressure 126/77 versus 134/81 mmHg) slowed the decline in GFR in a subgroup of 156 patients with proteinuria (> 1 g/24 hours) *(Klahr, 1994 [High Quality Evidence])*. A registry follow-up of all individuals in the Modification of Diet in Renal Disease study 6.2 years later suggested that individuals originally randomized to the low blood pressure target had a decreased incidence of end-stage kidney disease (62%), compared to those in the usual care group (70%) *(Sarnak, 2005 [Low Quality Evidence])*. In the African American Study of Kidney Disease and Hypertension (African-American Study of Kidney Disease), 1,094 African Americans with chronic kidney disease (GFR 20-75 mL/min/1.73 m2) were randomized to a low mean arterial pressure goal (< 92 mmHg) or to a usual mean arterial pressure goal (< 107 mmHg). Those achieving a blood pressure of 128/78 experienced renal deterioration at the same rate as those achieving a blood pressure of 141/85 *(Wright, 2002 [High Quality Evidence])*. There was no difference in cardiovascular events by blood pressure group *(Norris, 2006 [High Quality Evidence])*. In a long-term follow-up of the

Return to Algorithm *Return to Table of Contents*

cohort, a lower risk of renal deterioration was seen in participants with baseline proteinuria (equivalent to albuminuria > 300 mg/24 hours) initially assigned to the lower blood pressure goal, although no significant benefit of the lower blood pressure goal was seen overall *(Appel, 2010 [High Quality Evidence])*.

Hence, prior recommendations by some other groups (JNC-7) for lower blood pressure goals in all patients with chronic kidney disease are based on expert opinion and not fully supported by available prospective clinical trials.

The above studies do support a lower blood pressure goal (< 130/80) in patients with nephrotic level of proteinuria and perhaps in those with moderate proteinuria. The benefit of more aggressive antihypertensive treatment appears to be for preventing renal but not necessarily cardiovascular endpoints. Treatment goals should be considered on an individual patient basis based on clinical judgment and patient preference.

Cardiovascular Disease

A reappraisal of evidence from randomized trials in patients with chronic heart disease or previous stroke does not show consistent evidence that cardiovascular disease risk is further reduced by more intensive lowering of blood pressure *(Zanchetti, 2009 [Low Quality Evidence])*. This evidence is not definitive, i.e., limitations include few trials designed to evaluate specific blood pressure goals, small differences in achieved blood pressure in many trials, and the use of active agents and corresponding placebo on top of multiple antihypertensive and other cardiovascular therapies. American Heart Association/American College of Cardiology guidelines published in 2007 called for goal office blood pressures less than 130/80 mmHg in patients with coronary disease, carotid disease, peripheral artery disease, abdominal aortic aneurysm or a 10-year Framingham risk score of > 10% *(Rosendorff, 2007 [Low Quality Evidence])*. These recommendations are based on expert opinion and limited clinical evidence. A subgroup analysis of 6,400 participants of the International Verapamil SR-Trandolapril Study (INVEST) who had diabetes and coronary artery disease assessed the relationship between the degree of blood pressure control and adverse cardiovascular outcomes *(Cooper-DeHoff, 2010 [Systematic Review])*. Tight control defined as systolic blood pressure to < 130 mmHg was not associated with fewer adverse cardiovascular outcomes compared to usual control (< 140-130 mmHg).

Based on current evidence, pursuing blood pressure goals lower than < 140/90 should be considered on an individual patient basis based on clinical judgment and patient preference.

Coronary Artery Disease or Left Ventricular Hypertrophy

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. In a recently published secondary analysis of patients 80 years of age or older with hypertension and stable coronary artery disease and treated with either verapamil or atenolol-based therapy, a J-shaped phenomenon was observed in terms of increased risk of all-cause death, non-fatal myocardial infarction, or non-fatal stroke *(Denardo, 2010 [Meta-analysis])*. The systolic and diastolic blood pressure levels below which these event rates were increased were ≤ 140 or ≤ 70 mmHg, respectively. As a result, it would appear prudent to avoid lowering blood pressure to ≤ 140/70 mmHg in very elderly (75 and older) patients with coronary artery disease or left ventricular hypertrophy. In elderly patients with isolated systolic hypertension, some authors recommend against lowering the diastolic blood pressure below 55-60 mmHg *(Fagard, 2007 [High Quality Evidence]; Messerli, 2006 [Meta-analysis])*. This may require compromise of the goal level of systolic blood pressure achieved.

Chronic Heart Failure

There is a strong relationship between hypertension and developing heart failure, and numerous studies have demonstrated reduced incidence of heart failure with antihypertensive therapy *(Hunt, 2009 [Guideline])*.

American Heart Association/American College of Cardiology guidelines call for goal office blood pressures less than 120/80 mmHg for patients with a history of heart failure *(Rosendorff, 2007 [Low Quality Evidence])*. In heart failure with decreased systolic function in particular, many of the medications for which there is demonstrated benefit also lower blood pressure, and low normal or slightly hypotensive values are often seen during optimal therapy. However, there are no intent to treat randomized clinical trials to support lower blood pressure goals in patients with either systolic or diastolic chronic heart failure. Hence, these recommendations are based on expert opinion and limited clinical evidence.

Systolic heart failure therapy should not be interrupted for low normal blood pressure readings. Whether therapy should specifically be titrated to a lower goal than < 140/90 mmHg should be considered on an individual patient basis based on clinical judgment, target drug dosing and patient preference.

Elderly – Over Age 60

Multiple randomized placebo controlled clinical trials have demonstrated benefit of the treatment of hypertension in people over 60 with systolic blood pressure > 160 mmHg *(Beckett, 2008 [High Quality Evidence]; Liu, 1998 [Low Quality Evidence]; Staessen, 1997 [High Quality Evidence]; MRC Working Party, 1992 [High Quality Evidence]; SHEP Cooperative Research Group, 1991 [High Quality Evidence]; Amery, 1985 [High Quality Evidence])*. There does not appear to be an upper age limit to this benefit, extending well beyond 80 years of age *(Beckett, 2008 [High Quality Evidence])*. Based on the achieved systolic blood pressure levels in placebo-controlled randomized trials of treatment for isolated systolic hypertension with initial systolic blood pressure > 160 mmHg, the evidence supports the safety and benefit of lowering systolic blood pressure into the 140s in patients over age 60 *(Beckett, 2008 [High Quality Evidence]; SHEP Cooperative Research Group, 1991 [High Quality Evidence])*. However, no randomized control trial has recruited exclusively elderly patients with isolated Stage 1 systolic hypertension (140-159 mmHg), and therefore there is weaker evidence of the benefit or safety of initiating treatment or titrating therapy for systolic blood pressure levels below 160 mmHg. A recent large Chinese trial (N=9,711) included 3,179 patients over age 65 *(Zhang, 2011 [High Quality Evidence])*. All participants had blood pressure 140-180/90-100 mm Hg while taking a low-dose diuretic. Using low-dose felodopine or placebo as initial therapy, a mean blood pressure of 138/83 was achieved in the intervention group, compared with 142/85 in the comparison group. In the subgroup over age 65, mean achieved blood pressure in the two groups was 140/81 and 146/84, respectively. The primary outcome of time to first stroke was significantly decreased by 27% overall (p=0.002), and by 44% (p<0.001) in the subgroup over age 65. Other key outcomes (coronary events, cardiovascular mortality and total mortality) were also significantly reduced overall and in the elderly. This new evidence from a subgroup of a randomized trial provides moderate support for broad benefits from treating the elderly to a mean systolic blood pressure of 140 mm Hg. Treating to lower systolic goals should be considered on the basis of clinical judgment and patient preference. In older patients with isolated systolic hypertension, a blood pressure goal of less than 150 may be acceptable, particularly if the patient tolerates treatment poorly or is already on two-three medications including a diuretic. Only one randomized placebo-controlled trial that demonstrated benefit in the elderly had an explicit goal blood pressure, which was < 150/80 mmHg in the intervention group *(Beckett, 2008 [High Quality Evidence])*.

Type 2 Diabetes Mellitus

The HOT, ADVANCE and ACCORD trials are all large randomized clinical trials that allow comparison of more-stringent versus less-stringent blood pressure levels on major cardiovascular outcomes in type 2 diabetes *(ACCORD Study Group, The, 2010 [High Quality Evidence]; ADVANCE Collaborative Group, 2008 [High Quality Evidence]; Hansson, 1998 [High Quality Evidence])*. The ADVANCE trial found that those in the intensive group, with mean systolic blood pressure 135 mmHg, had lower total mortality and cardiovascular mortality, relative to those treated to higher systolic blood pressure levels. The ACCORD trial found no difference in major cardiovascular outcomes between a more-intensive blood pressure intervention targeting systolic blood pressure < 120 mmHg compared to a standard intervention targeting systolic

blood pressure between 130 and 139 mmHg. The more-intensive blood pressure regimen was associated with no benefit on pre-specified composite outcome measures, but a small reduction in the rate of stroke was observed. However, those treated to systolic blood pressure < 120 mmHg had greater medication use and more serious adverse events *(ACCORD Study Group, The, 2010 [High Quality Evidence])*.

The above studies support a systolic blood pressure goal < 140 mmHg for people with type 2 diabetes.

Only the HOT trial specifically targeted diastolic blood pressure. In the HOT trial, targeting a lower diastolic blood pressure was associated with fewer cardiovascular events in subjects with type 2 diabetes. The average achieved diastolic blood pressure values in the three HOT intervention arms ranged from 81 to 85 mmHg. Based on results from the ADVANCE and ACCORD trials, it appears likely that achieved systolic blood pressure values in the mid-130 range will usually be associated with diastolic blood pressure values well below 80 mmHg. Therefore, to simplify clinical guidelines across various conditions, and to simplify quality measures, the work group recommends a diastolic blood pressure goal of less than 90 mmHg.

The work group will continue to review the blood pressure goal to consider any new evidence and the recommendations of other national practice guidelines (e.g., ADA and JNC8) that are expected to announce revisions. The general recommendation of blood pressure < 140/90 does not preclude setting individual patient goals lower than that based on patient characteristics, comorbidities, risks or the preference of an informed patient.

Return to Algorithm *Return to Table of Contents*

2. Confirm Elevated Blood Pressure

Recommendations:

- All elevated blood pressure readings should be confirmed *(High Quality Evidence, Strong Recommendation)*.
- A standardized blood pressure measurement process is important for correctly identifying hypertensive patients *(Moderate Quality Evidence, Strong Recommendation)*.
- A combination of office and out-of-office blood pressure measurement should be used to confirm the diagnosis of hypertension *(Moderate Quality Evidence, Strong Recommendation)*.
- 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 should be based on a combination of one or more follow-up visits with at least two blood pressure readings at each visit and out-of-office blood pressure measurements or 24-hour ambulatory blood pressure monitoring. Unconfirmed hypertension should be coded with ICD-9 code 796.2.

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 clinician visits.

(Pickering, 2005 [Guideline]; Hajjar, 2003 [Low Quality Evidence])

Return to Algorithm *Return to Table of Contents*

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."

Automated blood pressure measurement, measured using a standardized technique, can be used as a substitute for standardized blood pressure measurement and may reduce white-coat effect and other errors seen with casual clinic blood pressure measurement *(Myers, 2011 [High Quality Evidence])*.

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 diagnosis and monitoring *(Hodgkinson, 2011 [Systematic Review]; Pickering, 2008 [Guideline])*. 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 [Low Quality Evidence])*. 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 two to three readings while rested in the seated position, both in the morning and at night for one week prior to a clinic visit *(Pickering, 2008 [Guideline])*. 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 [Low Quality Evidence])*. The general home blood pressure goal with treatment is less than 135/85 mmHg. Refer to the Implementation Tools and Resources Table for additional blood pressure monitoring information.

24-Hour Blood Pressure Measurement

Twenty-four hour ambulatory blood pressure monitoring can be used to confirm the diagnosis of hypertension and is more accurate than office blood pressure measurement for this purpose *(Hodgkinson, 2011 [Systematic Review])*. Ambulatory blood pressure monitoring predicts subsequent cardiovascular events and target organ damage more reliably than office blood pressure measurements.

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 [Low Quality Evidence])*.

Ambulatory blood pressure monitoring 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 [Low Quality Evidence])*. This diagnosis can also be reliably established in patients with elevated office readings who lack target organ damage by 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, masked hypertension, hypotensive symptoms, episodic hypertension and suspected autonomic dysfunction.

Ambulatory blood pressure monitoring may be inaccurate with atrial fibrillation.

Return to Algorithm *Return to Table of Contents*

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. (Guideline)

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.

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 non-fatal cardiovascular events, and treatment has been shown to reduce cardiovascular morbidity and mortality *(Chobanian, 2003 [Guideline]; World Health Organization/International Society of Hypertension, 1999 [Guideline]; Liu, 1998 [Low Quality Evidence]; Staessen, 1997 [High Quality Evidence]; SHEP Cooperative Research Group, 1991 [High Quality Evidence])*.

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 [Guideline])*.

Return to Algorithm *Return to Table of Contents*

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, "Stage I: Lifestyle +/- Drug/Stage II: Lifestyle + Start One or Two Drug(s)").

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. (Guideline)

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 under reported.

Return to Algorithm *Return to Table of Contents*

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

Recommendations:

- 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 [Low Quality Evidence])*. See Appendix B, "10-Year Cardiovascular Disease Risk Calculator (Risk Assessment)." This method of risk assessment makes clear the need not only to control blood pressure but also to prevent target organ damage and control all cardiovascular risk factors to maximize risk reduction.

Return to Algorithm *Return to Table of Contents*

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. (Guideline)

  When systolic and diastolic pressure falls 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 *(Aw, 2005 [Meta-analysis]; Priya, 2000 [Low Quality Evidence])*. 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.

Return to Algorithm *Return to Table of Contents*

- **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 *(Yusuf, 2005 [Low Quality Evidence]; Baik, 2000 [Low Quality Evidence]; Lean, 1998 [Low Quality Evidence])*. See the 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, papilledema) 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 or A1c, hematocrit, serum sodium, potassium, creatinine (estimated or measured glomerular filtration rate), calcium and lipid profile (total cholesterol, high-density 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 [Guideline])*.

  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 clinician based on clinical findings. These may include but are not limited to complete blood count, chest x-ray, uric acid and TSH.

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

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

Return to Algorithm *Return to Table of Contents*

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. (Guideline)

† 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, "10-Year Cardiovascular Disease Risk Calculator (Risk Assessment)."

Return to Algorithm *Return to Table of Contents*

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. Keep in mind that some lifestyle risk factors like obesity and excessive alcohol use may also contribute to hypertension and treatment resistance but are not usually classified as secondary causes.

Return to Algorithm *Return to Table of Contents*

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:

Diagnosis	Signs/Symptoms	Options for Further Evaluation
Chronic kidney disease/obstructive uropathy	Variable, may be absent	Estimated GFR, urinalysis
Renovascular hypertension	Unexplained hypertension in younger women, abdominal bruit	Consult with specialist
Sleep apnea	Excessive daytime sleepiness, obesity	History, sleep study
Primary aldosteronism	Unprovoked hypokalemia	Plasma rennin/aldosterone ratio 24-hour urine aldosterone
Drug-induced (prescription, over-the-counter, supplements or illicit drugs)	Variable	History, urine toxin screen
Aortic coarctation	Unequal blood pressure in right and left arms, delayed or absent femoral pulses	Aortic imaging, consult local experts for preferred test
Cushing syndrome	Striae, moon facies, buffalo hump, truncal obesity	Dexamethasone suppression test, 24-hour urine free cortisol
Pheochromocytoma	Palpitations and other paroxysmal symptoms	24-hour urine metanephrines and normetanephrines, plasma-free metanephrines
Thyroid/parathyroid disease	Variable/ hypercalcemia	TSH, serum PTH

Care should be taken to ensure 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.

Return to Algorithm *Return to Table of Contents*

5. Order Additional Workup/Consider Referral

If screening tests for secondary hypertension are positive, consider appropriate referral for additional workup and treatment.

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

Return to Algorithm *Return to Table of Contents*

6. Stage I: Lifestyle +/- Drug/Stage II: Lifestyle + Start One or Two Drug(s)

Recommendation:

- It is strongly recommended that hypertensive patients be initially treated with and periodically reassessed for adherence to healthy lifestyle habits for both prevention and treatment of hypertension *(High Quality Evidence, Strong Recommendation)*.

Clinical studies show that the blood-pressure-lowering effects of lifestyle modifications can be equivalent to drug monotherapy *(Elmer, 2006 [High Quality Evidence])*. 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.

Implementing team-based care including pharmacists and nurses should be considered an effective way to improve blood pressure control in hypertensive patients.

Six lifestyle behaviors – not smoking, limiting the use of alcohol, obtaining adequate physical activity, limiting sodium intake, having a diet that emphasizes fruits and vegetables and maintaining a normal weight – are associated with a decade or more of increased life expectancy. Individuals who adopt this lifestyle, at any age, have significantly lower risk of developing hypertension and subsequent heart failure.

Limit sodium

Reducing sodium intake in the control diet group increased blood pressure control 2.3-fold. We recommend a daily intake of less than 1,500 mg of sodium for most persons *(Svetkey, 2004 [Low Quality Evidence])*.

Increase vegetables and minimize animal-based fats (DASH diet)

Among subjects with hypertension baseline, the DASH diet increased blood pressure control twofold over control (63% vs. 32%; 95% confidence interval, 1.4–2.9) *(Svetky, 2004 [Low Quality Evidence])*. Compared to those consuming the least amounts of fruit daily (15.6 grams/day), those consuming the most (222.7 grams/day) had a 45% lower risk of hypertension *(Utsugi, 2008 [Low Quality Evidence])*. The age-adjusted prevalence of self-reported hypertension was significantly different between the four diet groups, ranging from 15.0% in male meat eaters to 5.8% in male vegans, and from 12.1% in female meat eaters to 7.7% in female vegans, with fish eaters and vegetarians having similar and intermediate prevalences. Mean systolic and diastolic blood pressures were significantly different between the four diet groups, with meat eaters having the highest values and vegans the lowest values *(Appleby, 2002 [Low Quality Evidence])*.

Weight Reduction and Management

In multivariable analyses, every 1-kg/m2 increase in body mass index was associated with an 11% (95% confidence interval [CI], 9 to 13) increase in heart failure risk. Compared with lean participants, overweight participants had a 49% (95% CI, 32 to 69) and obese participants had a 180% (95% CI, 124 to 250) increase in heart failure risk *(Kenchaiah, 2009 [Low Quality Evidence])*, with increasing body mass index a significant predictor of hypertension *(Chirinos, 2009 [Low Quality Evidence])*. LeBlanc, et al. showed that behaviorally based treatment resulted in 3-kg (6.6-lb.) greater weight loss in intervention than controls *(LeBlanc, 2011 [])*. Among patients with severe obesity, a lifestyle intervention involving diet combined with physical activity resulted in clinically significant weight loss and favorable changes in cardiometabolic risk factors *(Goodpaster, 2010 [High Quality Evidence])*.

Exercise

To promote and maintain health, all healthy adults aged 18 to 65 years of age need moderate-intensity aerobic (endurance) physical activity for a minimum of 30 minutes on five days each week or vigorous-intensity aerobic physical activity for a minimum of 20 minutes on three days each week. [I (A)] Combinations of moderate- and vigorous-intensity activity can be performed to meet this recommendation. [IIa (B)] For example, a person can meet the recommendation by walking briskly for 30 minutes twice during the week and then jogging for 20 minutes on two other days. Moderate-intensity aerobic activity, which is generally equivalent to a brisk walk and noticeably accelerates the heart rate, can be accumulated toward the 30-minute minimum by performing bouts each lasting 10 or more minutes. [I (B)] Vigorous-intensity activity is exemplified by jogging and causes rapid breathing and a substantial increase in heart rate. In addition, every adult should perform activities that maintain or increase muscular strength and endurance a minimum of two days each week [IIa (A)] *(Haskell, 2007 [Low Quality Evidence])*.

Fitness is a strong and independent predictor of all-cause and cardiovascular disease mortality, but exercise is often overlooked from a clinical perspective *(Lee, 2010 [Low Quality Evidence]; Hamer, 2007 [Meta-analysis])*. Barriers to implementation are myriad. Meeting the challenge of an implementation of effective lifestyle change at the community level requires a system for the identification of at-risk populations, an optimization of the knowledge base and practices of health care clinicians, and a piloting of targeted biobehavioral intervention programs *(Dagogo-Jack, 2010 [Low Quality Evidence])*. Exercise in medicine is a non-profit initiative launched by the American College of Sports Medicine (ACSM) and the American Medical Association (AMA), and provides operationalized approaches for the multifaceted manners needed to facilitate behavioral change (http://www.exerciseismedicine.org).

Moderation of alcohol intake

Limit alcohol use to one serving per day for women, two per day for men, with a maximum of five per week for women and nine per week for men. Overall, interventions to reduce alcohol consumption caused small but statistically significant reductions in both systolic (3.4 mmHg, 95%CI: 0.9 to 6.0) and diastolic (3.4 mmHg, 95%CI: 1.5 to 5.4) blood pressure. Thirty percent (95%CI: 21% to 39%) of patients receiving a structured intervention to reduce alcohol consumption were likely to achieve a reduction of at least 10 mmHg in systolic blood pressure *(Djoussé, 2007 [Meta-analysis])*.

No smoking

13.6/1,000 person-years develop preventable heart failure *(Kalogeropoulos, 2009 [Low Quality Evidence])*.

Review of non-prescription and supplement use

Over-the-counter medications and supplements can cause increases in blood pressure. Use of caffeine pills, NSAIDs, cold medicine (such as pseudoephedrine, phenylephrine) and herbal supplements such as bitter orange, ephedra (ma-nuang), ginseng, guarana, licorice and St. John's wort should be evaluated in patients with hypertension.

Please see the ICSI guideline Healthy Lifestyles for additional information on smoking cessation, exercise, nutrition and alcohol moderation.

Drug Therapy

A thiazide-type diuretic should be considered as initial therapy in most patients with uncomplicated hypertension *(High Quality Evidence, Strong Recommendation)*.

- For patients with Stage 2 hypertension, consider initial therapy with two drugs including a diuretic paired with one of the other recommended first-line drugs.

Return to Algorithm *Return to Table of Contents*

A thiazide-type diuretic should be considered as initial therapy in most patients with uncomplicated hypertension *(Appel, 2002 [Low Quality Evidence])*. Because thiazide-type diuretics have been shown to be as good as 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 [Guideline])*. However, studies support the use of specific alternative drugs as initial therapy in the presence of specific co-existing diseases. Diuretics are generally inexpensive *(Psaty, 2003 [Meta-analysis]; ALLHAT Officers, Coordinators for the ALLHAT Collaborative Research Group, The, 2002 [High Quality Evidence])*. Thiazide-type diuretics are especially useful for patient's 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 *(Wright Jr, 2008 [High Quality Evidence]; ALLHAT Officers, Coordinators for the ALLHAT Collaborative Research Group, The, 2000 [High Quality Evidence])*. 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 [Meta-analysis])*. Studies have demonstrated the cost effectiveness in older patients of selecting drugs using evidence-based guidelines *(Fischer, 2004 [Cost-Effectiveness Analysis])*. In patients for whom diuretics are contraindicated or poorly tolerated, use of an ACE inhibitor, angiotensin receptor blocker, beta-blocker or calcium channel blocker is appropriate. 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 considerations when selecting initial drug therapy include age, race, cost, drug interactions, side effects and quality of life issues. In general, diuretics and calcium channel blockers appear to be more effective as an initial treatment of hypertension in African Americans. 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 [Low Quality Evidence])*.

Other classes of drugs should be reserved for special situations or as additive therapy. 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 *(Jafar, 2003 [Meta-analysis]; Agodoa, 2001 [High Quality Evidence]; Brenner, 2001 [High Quality Evidence]; Jafar, 2001 [Meta-analysis])*. 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 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 [High Quality Evidence])*. 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 [Systematic Review])*. 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.

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 [Meta-analysis])*. 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.

Return to Algorithm *Return to Table of Contents*

Long-acting dihydopyridine calcium channel blockers 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 channel blockers. 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 [High Quality Evidence])*. 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. Although limited scientific evidence supports the use of combination therapy as initial drug treatment for hypertension, several observations favor such an approach *(Gradman, 2010 [Low Quality Evidence])*. Hypertension results from the effects of multiple pressor mechanisms, and drug monotherapy usually targets only one of these. Moreover, drug therapy targeted to only one mechanism often triggers counter-regulatory effects that limit overall response. Because combination therapy targets more than one pressor mechanism and limits counter-regulatory effects, blood pressure response is greater and control is achieved quicker than with drug monotherapy. In addition, many drugs have dose-related side effects. Lower doses of two drugs may be better tolerated than higher doses of a single agent. Studies also show that the blood-pressure-lowering effect of combining drugs is predicted on the basis of additive effects, and the overall response of using two drugs is five times greater than the effect of doubling the dose of a single agent *(Wald, 2009 [Meta-analysis])*. In addition, a correlation between time taken to achieve blood pressure control and clinical outcome has been observed. One study involving primary care clinics in Canada compared treatment using their current national guidelines with a treatment algorithm that directed initial therapy with a low-dose diuretic/ACE inhibitor or diuretic/ARB combination with subsequent up-titration of the combination as needed to control blood pressure *(Feldman, 2009 [High Quality Evidence])*. After six months, control rates were significantly higher with the combination algorithm compared to the national guidelines approach, which directed treatment with drug monotherapy and subsequent dose up-titration of the initial drug. Current guidelines *(Chobanian, 2003 [Guideline])* suggest use of two drugs as initial therapy when blood pressure is ≥ 20/10 mmHg above the goal, which consists of all patients with Stage 2 hypertension. Most effective two-drug combinations include a diuretic paired with one of the other recommended first-line drugs. A recent study demonstrated superior efficacy of an ACE inhibitor/dihydropyridine calcium antagonist combination compared to a diuretic/ACE-inhibitor combination *(Jamerson, 2008 [High Quality Evidence])*. More routine use of initial therapy with combinations of drugs may improve control rates and reduce morbidity and mortality from hypertension. Single pill combinations can be used initially or to simplify the drug program after titration of individual component drugs.

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

Return to Algorithm *Return to Table of Contents*

Class	Drug	Usual Dose for Hypertension, mg	Common Side Effects
Thiazide Diuretic	Chlorthalidone HCTZ	12.5-25 daily 12.5-25 daily	Hypokalemia, hyponatremia, gout
ACEI	Lisinopril Benazepril	10-40 daily 10-40 daily	Cough, hyperkalemia, angioedema
ARB	Losartan Irbesartan	50-100 daily 150-300 daily	Hyperkalemia
CCB dihydropyridine	Amlodipine Felodipine	2.5-10 daily 2.5-10 daily	Edema
CCB Non-DHP	Diltiazem ER Verapamil ER	120-360 daily 120-360 daily	Edema, CHF, heart block, constipation
Beta-blockers	Metopropol tartrate	25-100 twice daily	CHF, heart block Dizziness
Alpha-blockers	Doxazosin	1-8 daily	Orthostatic dizziness, edema, CHF
Adrenergic	Guanfacine Clonidine	1-4 daily 0.1-0.4 twice daily	Rebound with withdrawal, dry mouth, sedation

The above are generic medications and dose ranges commonly used in the treatment of hypertension. This is not meant to be a comprehensive list. Please note that dosages for other conditions such as heart failure may differ from those used in hypertension.

Return to Algorithm *Return to Table of Contents*

7. Blood Pressure at Goal?

Goal office blood pressures should be less than 140/90 mmHg for adults with uncomplicated hypertension (in the absence of comorbidities). Goal blood pressures measured out of the office setting should be less than 135 mmHg systolic and less than 85 mmHg diastolic.

Return to Algorithm *Return to Table of Contents*

8. Change Treatment

If the patient has been prescribed one or more antihypertensive agents and acceptable response has not been achieved, several issues should be addressed or revisited prior to adding or changing drug therapy. 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 [Low Quality Evidence])*. 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 [Systematic Review])*. Asking open-ended/non-judgmental questions about treatment regimens can lead to a good discussion between the clinician 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

Return to Algorithm *Return to Table of Contents*

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 [Systematic Review]),* 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 clinician follow-up, and actively involve family members and significant others *(Haynes, 2002 [Low Quality Evidence])*. Since there is not a simple test to accurately measure adherence, there are some practical methods that can be used for all patients at every visit: 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.

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 [Low Quality Evidence])*. Combination antihypertensive medications may also improve adherence by decreasing pill burden.

If medication adherence appears to be a non-factor and the patient is still not meeting blood pressure goals, standardized instruction in self-blood-pressure measurement will allow assessment of "white-coat" syndrome. Clinicians should also consider interfering substances that can adversely affect blood pressure including non-steroidal anti-inflammatory drugs, 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.

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.

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

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

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 thiazide 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.
- Fewer than 50% of patients with hypertension will be controlled with a single drug.
- The use of combination agents can be effective.

When choosing between adding agents and increasing the dose of current therapies, consider the dose response curve of the agent. Within the usual prescribed dose range, the blood pressure response curve is

Return to Algorithm *Return to Table of Contents*

fairly flat for most classes of antihypertensive medications (thiazide diuretic, ACE inhibitors, angiotensin receptor blockers and beta-blockers). If a patient is taking a mid-range dose and is > 5-10 mmHg above systolic or diastolic goal, adding a second agent is more likely to be effective than increasing dose. Calcium channel blockers, alpha-blockers and direct vasodilators have a more linear dose response curve. Greater reductions in blood pressure can be achieved with dose adjustments of these agents; however, side effects are also dose dependent.

For most patients, two or more drugs in combination may be needed to reach hypertension goals.

Systolic blood pressure control for adults with cardiovascular comorbidities is poor *(Wong, 2007 [Low Quality Evidence])*. 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 2 diabetes *(ADVANCE Collaborative Group, 2007 [High Quality Evidence])*.

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

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

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.

Return to Algorithm *Return to Table of Contents*

11. Resistant Hypertension

Resistant hypertension is present 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. 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 *(Calhoun, 2008 [Guideline]; Taler, 2002 [High Quality Evidence]; Yakovlevitch, 1991 [Low Quality Evidence])*.

Differential diagnosis includes the following:

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).
- 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.

Return to Algorithm *Return to Table of Contents*

- 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. Twenty-four hour blood pressure monitoring or accurate out-of-clinic blood pressure measurement should be obtained in all patients with resistant hypertension.

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
- Illicit drug use

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, contraceptives, estrogen, cyclosporine, erythropoietin, corticosteroids, natural licorice and herbal compounds (ephedra, ma-huang).

Over-the-counter medication use:

- Over-the-counter medications and supplements can cause increases in blood pressure. Use of caffeine pills, NSAIDs, cold medicine (such as pseudoephedrine, phenylephrine, and herbal supplements such as bitter orange, ephedra (ma-nuang), ginseng, guarana, licorice and St. John's wort should be evaluated in patients with hypertension.

Secondary causes:

- More common secondary causes include chronic kidney disease, primary aldosteronism and renovascular hypertension. Uncommon causes include pheochromocytoma, Cushing's syndrome and aortic coarctation.

Secondary medical diagnoses that can contribute include obesity and obstructive sleep apnea.

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 may be necessary for effective volume control. Furosemide is short acting and should be given twice daily. Torsemide is a longer acting loop diuretic that can be used once daily. The drug regimen should also include near maximal doses of two of the following additional classes of drugs:

- ACE inhibitor
- Calcium channel blocker
- Angiotensin receptor blocker
- Beta-adrenergic-blocker or other anti-adrenergic agent
- Direct vasodilator

Return to Algorithm *Return to Table of Contents*

12. Further Management Needed

Consider hypertension consultation if a patient's blood pressure is not controlled on three to four medications, including a thiazide diuretic, or if secondary hypertension is suspected.

Return to Algorithm *Return to Table of Contents*

13. Blood Pressure at Goal

Recommendations:

- On follow-up visits, history and physical examination should be directed toward detection of hypertensive target organ damage *(Moderate Quality Evidence, Strong Recommendation)*.
- In patients with office blood pressure at goal who demonstrate progressive target organ disease, home monitoring may be beneficial *(Low Quality Evidence, Weak Recommendation)*.

Once blood pressure is at goal and stable, the patient should be seen at a minimum once a year by the clinician 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 [Guideline])*. 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 clinicians 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 in or withdrawal from antihypertensive drug therapy following a prolonged interval of excellent blood pressure control *(Nelson, 2001 [Systematic Review])*.

On follow-up visits, history and physical examination should be directed to target organ damage (cardiac exam, neck/renal bruits, lung exam, chest and shortness of breath), laboratory tests related to medication safety and assessment of overall cardiovascular risk.

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

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

Return to Algorithm *Return to Table of Contents*

The Aims and Measures section is intended to provide protocol users with a menu of measures for multiple purposes that may include the following:

- population health improvement measures,
- quality improvement measures for delivery systems,
- measures from regulatory organizations such as the Joint Commission,
- measures that are currently required for public reporting,
- measures that are part of Center for Medicare Services Physician Quality Reporting initiative, and
- other measures from local and national organizations aimed at measuring population health and improvement of care delivery.

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

The subdivisions of this section are:

- Aims and Measures
- Implementation Recommendations
- Implementation Tools and Resources
- Implementation Tools and Resources Table

Aims and Measures

Refer to Appendix E, "Accountability Measures for Hypertension Treatment in Adults," for additional measurement information.

1. Increase the percentage of hypertensive patients age 18 years and older whose blood pressure is under control. *(Annotation #7)*

   Measures for accomplishing this aim:

   a. Percentage of hypertensive patients with a blood pressure reading at clinician visit.

   b. Percentage of uncomplicated hypertensive adult patients age 18 to 60 years with a blood pressure reading of less than 140/90 mmHg.

   c. Percentage of patients over age 60 years with isolated systolic hypertension on drug therapy with a blood pressure reading of less than 150 mmHg systolic.

   d. Percentage of type 2 diabetes patients with a blood pressure reading of less than 140/85 mmHg.

2. Improve the assessment of hypertensive patients age 18 years and older. *(Annotation #2)*

   Measure for accomplishing this aim:

   a. Percentage of hypertensive patients with a home blood pressure monitoring device who have been educated in the correct technique for blood pressure measurement and monitoring.

3. Increase the percentage of hypertensive patients age 18 years and older who receive patient education, with a focus on the use of non-pharmacological treatments. (See Appendix C, "Recommended Education Messages.")

   Measure for accomplishing this aim:

   a. Percentage of hypertensive patients who receive education on the usage of non-pharmacological treatments.

4. Increase the percentage of patients age 18 years and older with uncontrolled hypertension who have a plan of care. *(Annotations #3, 6, 7)*

   Measures for accomplishing these aims:

   a. Percentage of uncomplicated hypertensive patients age 18 through 60 years with a blood pressure reading of greater than 140/90 mmHg who have a plan of care.

   b. Percentage of type 2 diabetes patients with a blood pressure reading of greater than 140/85 mmHg who have a plan of care.

   c. Percentage of patients over age 60 years with isolated systolic hypertension on drug therapy with a blood pressure reading greater than 150 mmHg who have a plan of care.

5. Increase the percentage of hypertensive patients age 18 years and older not at a blood pressure goal who have a change in subsequent pharmacological therapy. *(Annotation #8)*

   Measure for accomplishing this aim:

   a. Percentage of uncomplicated hypertensive patients age 18 through 60 years with blood pressure greater than 140/90 mmHg and on medication who have a change in pharmacological 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).

Return to Table of Contents

Measurement Specifications

Measurement #1a

Percentage of hypertensive patients age 18 years and older with a blood pressure reading at clinician visit.

Population Definition

Patients age 18 years and older with an office visit within the previous 12 months and with any of the following hypertension ICD-9 diagnosis codes: 401.0, 401.1 and/or 401.9.

Data of Interest

$$\frac{\text{\# of patients who had a blood pressure reading at clinician visit}}{\text{\# of patients who have hypertension}}$$

Numerator/Denominator Definitions

Numerator: Number of patients age 18 years and older and with hypertension who have a blood pressure reading at clinician visit.

Denominator: Number of patients age 18 years and older and with hypertension.

Hypertension ICD-9 Codes: 401.0, 401.1 and/or 401.9.

Method/Source of Data Collection

Medical groups may generate a full list of patients from EMR or registry meeting the inclusion criteria: age 18 years and older and hypertension ICD-9 Codes: 401.0, 401.1 and/or 401.9. Identify whether the blood pressure reading was done at the most recent clinician visit.

Time Frame Pertaining to Data Collection

Monthly.

Notes

This is a process measure, and improvement is associated with a higher score.

Return to Table of Contents

Measurement #1b

Percentage of uncomplicated hypertensive adult patients age 18 to 60 years with a blood pressure reading of less than 140/90 mmHg.

Population Definition

Adult patients age 18 to 60 years who have had an office visit within the previous 12 months and with any of the following hypertension ICD-9 codes: 401.0, 401.1 and/or 401.9.

Data of Interest

$$\frac{\text{\# of patients with a blood pressure reading of less than 140/90 mmHg}}{\text{\# of patients with hypertension}}$$

Numerator/Denominator Definitions

Numerator: Number of adult patients age 18 to 60 years with uncomplicated hypertension who had a blood pressure reading of less than 140/90 mmHg.

Denominator: Number of adult patients age 18 to 60 years with uncomplicated hypertension.

Hypertension ICD-9 Codes: 401.0, 401.1 and/or 401.9.

Method/Source of Data Collection

Medical groups may generate a full list of patients from EMR or registry meeting the inclusion criteria: adult age 18 to 60 years and hypertension ICD-9 codes: 401.0, 401.1 and/or 401.9. Identify whether the blood pressure was done at the most recent office visit.

Notes:

- Identify the blood pressure at the most recent office visit.
- If more than one reading was performed 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.
- Refer 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 should 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.

Time Frame for Data Collection

Monthly.

Notes

This is an outcome measure, and improvement is associated with a higher score.

Return to Table of Contents

Measurement #1c

Percentage of patients over age 60 years with isolated systolic hypertension on drug therapy with a blood pressure reading of less than 150 mmHg systolic.

Population Definition

Patients over age 60 years who have had an office visit within the previous 12 months and diagnosed with isolated hypertension and on drug therapy.

Data of Interest

$$\frac{\text{\# of patients with a blood pressure reading of less than 150 mmHg systolic}}{\text{\# of patients isolated hypertension and on drug therapy}}$$

Numerator/Denominator Definitions

Numerator: Number of patients over age 60 years with isolated systolic hypertension on drug therapy with a blood pressure reading of less than 150 mmHg systolic.

Denominator: Number of patients over age 60 years with isolated systolic hypertension on drug therapy.

Method/Source of Data Collection

Medical groups may generate a full list of patients from EMR or registry meeting population definition criteria. Groups can generate either the full list of patients or randomly select a sample of patients' charts. Of those patients meeting the population definition criteria, identify those who had a blood pressure reading of 150 mmHg systolic at the most recent office visit.

Notes:

- Identify the systolic blood pressure at the most recent office visit.
- If more than one reading was performed at the most recent office visit, calculate the average of two or more systolic blood pressure readings taken at the most recent office visit to determine level of control.
- Refer 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 taken at the selected visit should be calculated. The mean systolic blood pressure may then be used to determine whether the patient has a blood pressure less than 150 mmHg systolic.

Time Frame for Data Collection

Monthly.

Notes

This is an outcome measure, and improvement is associated with a higher score.

Return to Table of Contents

Measurement #1d

Percentage of type 2 diabetes patients with a blood pressure reading of less than 140/85 mmHg.

Population Definition

Patients age 18 years and older who have had an office visit within the previous 12 months and type 2 diabetes diagnosis.

Data of Interest

$$\frac{\text{\# of patients with a blood pressure reading of less than 140/85 mmHg}}{\text{\# of patients with type 2 diabetes}}$$

Numerator/Denominator Definitions

Numerator: Number of patients age 18 years and older and with diagnosis of type 2 diabetes who had a blood pressure reading of less than 140/85 mmHg.

Denominator: Number of patients age 18 and older with type 2 diabetes.

Method/Source of Data Collection

Medical groups may generate a full list of patients from EMR or registry meeting the inclusion criteria: age 18 and older, and type 2 diabetes diagnosis. Of those patients meeting the inclusion criteria, identify those who had a blood pressure reading of 140/85 mmHg at the most recent office visit.

Notes:

- Identify the blood pressure at the most recent office visit.
- If more than one reading was performed 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.
- Refer 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 should 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 140/85 mmHg.

Time Frame Pertaining to Data Collection

Monthly.

Notes

This is an outcome measure, and improvement is associated with a higher score.

Return to Table of Contents

Measurement #2a

Percentage of hypertensive patients with a home blood pressure monitoring device who have been educated in the correct technique for blood pressure measurement and monitoring.

Population Definition

Patients age 18 years and older who have had an office visit within the previous 12 months and hypertension diagnosis with any of the following ICD-9 codes: 401.0, 401.1 and/or 401.9.

Data of Interest

$$\frac{\text{\# of patients who have been educated in the correct technique}}{\text{\# of patients with a home blood pressure monitoring device}}$$

Numerator/Denominator Definitions

Numerator: Number of patients age 18 years and older and with hypertension who have been educated in the correct technique for blood pressure measurement and monitoring.

Denominator: Number of patients age 18 years and older and hypertension who have a home blood pressure monitoring device.

Method/Source of Data Collection

Medical groups may generate a full list of patients from EMR or registry meeting the inclusion criteria: age 18 years and older and hypertension diagnosis with any of the following ICD-9 Codes: 401.0, 401.1 and/or 401.9. Of those patients meeting the inclusion criteria, identify those who have a home blood pressure monitoring device and whether education was provided on the correct technique for blood pressure measurement and monitoring.

Time Frame Pertaining to Data Collection

Monthly.

Notes

This is a process measure, and improvement is associated with a higher score.

Return to Table of Contents

Measurement #3a

Percentage of hypertensive patients who receive education on the usage of non-pharmacological treatments.

Population Definition

Patients age 18 years and older who have had an office visit within the previous 12 months and hypertension diagnosis with any of the following ICD-9 codes: 401.0, 401.1 and/or 401.9.

Data of Interest

$$\frac{\text{\# of patients who have received education on the use of non-pharmacological treatments}}{\text{\# of patients with hypertension}}$$

Numerator/Denominator Definitions

Numerator: Number of patients age 18 years and older and with hypertension who have received education on the use of non-pharmacological treatments.

Denominator: Number of patients age 18 years and older and with hypertension.

Method/Source of Data Collection

Medical groups may generate a full list of patients from EMR or registry meeting the inclusion criteria: age 18 years and older and hypertension diagnosis with any of the following ICD-9 Codes: 401.0, 401.1 and/or 401.9. Of those patients meeting the inclusion criteria, identify those who have received education on the use of non-pharmacological treatments.

Time Frame Pertaining to Data Collection

Monthly.

Notes

This is a process measure, and improvement is associated with a higher score.

Return to Table of Contents

Measurement #4a

Percentage of uncomplicated hypertensive patients age 18 through 60 years with a blood pressure reading of greater than 140/90 mmHg who have a plan of care.

Population Definition

Patients age 18 through 60 years who have had an office visit within the previous 12 months and hypertension diagnosis with any of the following ICD-9 codes: 401.0, 401.1 and/or 401.9.

Data of Interest

$$\frac{\text{\# of patients who have a plan of care}}{\text{\# of patients with hypertension and blood pressure greater than 140/90 mmHg}}$$

Numerator/Denominator Definitions

Numerator: Number of patients age 18 through 60 years and with uncomplicated hypertension, and blood pressure greater than 140/90 mmHg who have a plan of care.

Denominator: Number of uncomplicated hypertension patients age 18 through 60 years and blood pressure greater than 140/90 mmHg.

Method/Source of Data Collection

Medical groups may generate a full list of patients from EMR or registry meeting the inclusion criteria: age 18 years and older and hypertension diagnosis with any of the following ICD-9 codes: 401.0, 401.1 and/or 401.9 and blood pressure greater than 140/90 mmHg. Of those patients meeting the inclusion criteria, identify those who have a plan of care.

Time Frame Pertaining to Data Collection

Monthly.

Notes

This is a process measure, and improvement is associated with a higher score.

Return to Table of Contents

Measurement #4b

Percentage of type 2 diabetes patients with a blood pressure reading of greater than 140/85 mmHg who have a plan of care.

Population Definition

Patients age 18 years and older who have had an office visit within the previous 12 months and type 2 diabetes diagnosis.

Data of Interest

$$\frac{\text{\# of patients who have a plan of care}}{\text{\# of patients with type 2 diabetes and blood pressure greater than 140/85 mmHg}}$$

Numerator/Denominator Definitions

Numerator: Number of patients age 18 years and older and with type 2 diabetes, and blood pressure greater than 140/85 mmHg who have a plan of care.

Denominator: Number of type 2 diabetes patients age 18 years and older and blood pressure greater than 140/85 mmHg.

Method/Source of Data Collection

Medical groups may generate a full list of patients from EMR or registry meeting the inclusion criteria: age 18 years and older and type 2 diabetes diagnosis and blood pressure greater than 140/85 mmHg. Of those patients meeting the inclusion criteria, identify those who have a plan of care.

Time Frame Pertaining to Data Collection

Monthly.

Notes

This is a process measure, and improvement is associated with a higher score.

Return to Table of Contents

Measurement #4c

Percentage of patients over age 60 years with isolated systolic hypertension on drug therapy with a blood pressure reading greater than 150 mmHg systolic who have a plan of care.

Population Definition

Patients over age 60 years who have had an office visit within the previous 12 months and diagnosed with isolated systolic hypertension on drug therapy and blood pressure reading greater than 150 mmHg systolic.

Data of Interest

$$\frac{\text{\# of patients who have a plan of care}}{\text{\# of patients with isolated systolic hypertension on drug therapy and a blood pressure reading greater than 150 mmHg systolic}}$$

Numerator/Denominator Definitions

Numerator: Number of patients over age 60 years with isolated systolic hypertension on drug therapy with a blood pressure reading greater than 150 mmHg systolic who have a plan of care.

Denominator: Number of patients over age 60 years with isolated systolic hypertension on drug therapy with a blood pressure reading greater than 150 mmHg systolic.

Method/Source of Data Collection

Medical groups may generate a full list of patients over age 60 years from EMR or registry meeting population definition criteria. Of those patients meeting the population definition criteria, identify those who had a plan of care.

Time Frame Pertaining to Data Collection

Monthly.

Notes

This is a process measure, and improvement is associated with a higher score.

Return to Table of Contents

Measurement #5a

Percentage of uncomplicated hypertensive patients age 18 through 60 years with blood pressure greater than 140/90 mmHg and on medication who have a change in pharmacological 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).

Population Definition

Patients age 18 through 60 years and hypertensive diagnosis ICD-9 codes 401.0, 401.1 and/or 401.9 who have had a clinic visit within the past month.

Data of Interest

$$\frac{\text{\# of patients who have a change in pharmacological therapy}}{\text{\# of hypertension patients with blood pressure greater than 140/90 mmHg and on medication}}$$

Numerator/Denominator Definitions

Numerator: Number of uncomplicated hypertensive patients age 18 through 60 years and blood pressure greater than 140/90 mmHg and on hypertension medication who have a change in pharmacological therapy. Change in pharmacological therapy may include increase in dose of initial drug, change to a drug from another class or addition of a second drug from another class.

Denominator: Number of uncomplicated hypertensive patients with blood pressure greater than 140/90 mmHg and on hypertension medication.

Hypertension ICD-9 codes of 401.0, 401.1 and/or 401.9.

Method of Data Collection

Medical groups may generate a full list of patients from EMR or registry meeting the inclusion criteria: age 18 through 60 years and any of the following hypertension ICD-9 diagnoses: 401.0, 401.1 and/or 401.9, and blood pressure greater than 140/90 mmHg and on hypertension medication. From the review, determine if the patients meeting the criteria had a change in pharmacological therapy. Change in pharmacological therapy may include increase in dose of initial drug, change to a drug from another class or addition of a second drug from another class.

Time Frame for Data Collection

Monthly.

Notes

This is a process measure, and improvement is associated with a higher score.

Return to Table of Contents

Implementation Recommendations

Prior to implementation, it is important to consider current organizational infrastructure that address the following:

- System and process design
- Training and education
- Culture and the need to shift values, beliefs and behaviors of the organization.

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:

- 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.
- 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 message are:
  - basic information about what blood pressure is, what the blood pressure numbers mean, and how high blood pressure affects your life;
  - lifestyle modifications;
  - pharmacologic therapy; and
  - ongoing management.
- Consider the use of motivational interviewing as a method for addressing behavior change. Motivational interviewing is defined as a client-centered, directive counseling style for eliciting behavior change by helping patients to explore and resolve ambivalence. Rather than telling a client what changes to make, the interviewer elicits "change talk" from them, taking into account an individual's priorities and values.

Return to Table of Contents

Implementation Tools and Resources

Criteria for Selecting Resources

The following tools and resources specific to the topic of the guideline were selected by the work group. Each item was reviewed thoroughly by at least one work group member. It is expected that users of these tools will establish the proper copyright prior to their use. The types of criteria the work group used are:

- The content supports the clinical and the implementation recommendations.
- Where possible, the content is supported by evidence-based research.
- The author, source and revision dates for the content are included where possible.
- The content is clear about potential biases and when appropriate conflicts of interests and/or disclaimers are noted where appropriate.

Return to Table of Contents

Implementation Tools and Resources Table

Author/Organization	Title/Description	Audience	Web sites/Order Information
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.heart.org
Consumer Reports	Web site gives ratings and recommendations to different models of blood pressure monitors.	Patients and Families	http://www.consumerreports.org
Mayo Clinic	Blood pressure monitor information Video to use an automatic monitor	Patients and Families	http://www.mayoclinic.com/health/high-blood-pressure/HI00016 http://www.mayoclinic.com/health/how-to-measure-blood-pressure/MM00785
National Heart, Lung, and Blood Institute (NHLBI)	Web site with excellent resources for patient education. - Facts about Heart Disease and Women: Preventing and Controlling High Blood Pressure - Facts about High Blood Pressure - Facts about DASH Eating Plan	Patients and Families	http://www.nhlbi.nih.gov
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/
U.S. Department of Health and Human Services	Web site for patients on healthy living and health news.	Patients and Families	http://www.healthfinder.gov
U.S. National Library of Medicine and National Institutes of Health	Health information Web site.	Patients and Families	http://www.nlm.nih.gov/medlineplus/

Return to Table of Contents

The subdivisions of this section are:

- References
- Appendices

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Links are provided for those new references added to this edition (author name is highlighted in blue).

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Return to Table of Contents

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Return to Table of Contents

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.)*

Return to Table of Contents

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.

Return to Table of Contents

Appendix B – 10-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 **hp2010.nhlbi.net/atpiii.calculator.asp**

Return to Table of Contents

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 Clinician Visits

Basic Information

- Discuss:
  - What is blood pressure?
  - What do the numbers mean?
  - Factors affecting blood pressure, e.g., over-the-counter medications
  - How high blood pressure affects health
  - How to perform out-of-office blood pressure readings

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 (http://www.dashdiet.org)
- 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 blood pressure and behavioral improvement.

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

Return to Table of Contents

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

Return to Table of Contents

Initial Pertinent Labs	**Routine 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.)	• 12-lead ECG • Urinalysis • Fasting blood glucose or A1c • Hematocrit • Serum sodium • Potassium • Creatinine (estimate glomerular filtration rate) • Calcium • Lipid profile (total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol and triglycerides)

Return to Table of Contents

BACK

Appendix E – Accountability Measures for Hypertension Treatment in Adults

BACKGROUND

Several organizations (e.g., NCQA, NQF and CMS) now use or are considering the use of accountability measures related to the care of adults with hypertension. Use of such measures is expected to encourage timely use of evidence-based care recommendations to better control hypertension and ultimately reduce the likelihood of major complications such as congestive heart failure, renal disease, stroke and myocardial infarctions *(Chassin, 2010 [X])*.

USES OF ACCOUNTABILITY MEASURES

Measurement for accountability is conceptually different from measurement for improvement or measurement for research *(Solberg, 1997 [Low Quality Evidence])*. Most accountability measures are used for the following purposes: (a) public reporting of medical group, clinic or clinician performance to patients or to payers, with the goal of providing positive publicity (and ultimately more patients) and remuneration to those whose patients have better hypertension control; and/or (b) pay-for-performance programs that increase the income of clinicians whose patients have better hypertension control.

BENEFITS OF USING HYPERTENSION ACCOUNTABILITY MEASURES

Over 20% of U.S. adults have hypertension, which if uncontrolled increases risk of major cardiovascular events. A moderate amount of evidence (none from randomized studies) suggests that use of accountability measures may lead to higher rates of hypertension control. No studies have carefully assessed possible untoward unintended consequences related to use of accountability measures such as over treatment of some patients, hospitalizations related to greater use of antihypertensive agents, or loss of clinicians from care systems that serve patients whose hypertension is more difficult to control due to low health literacy, social disadvantage or non-adherence.

CONSTRAINTS ON THE USE OF HYPERTENSION ACCOUNTABILITY MEASURES

Several factors constrain the assumption that accountability measures accurately reflect the quality of care provided. These factors include the following:

- Hypertension control depends in part upon changes in lifestyle, including reduction of sodium intake, weight loss, regular exercise, reduction of alcohol use and stress reduction. Adopting these lifestyles is often beyond the control of clinical clinicians. Clinicians who serve patients with lower health literacy or educational levels, or those with higher rates of alcohol use, mental illness, obesity or stress may, as a group, be less able to achieve hypertension control than clinicians who serve more educated, less socially disadvantaged populations of patients. Use of unadjusted accountability measures linked to economic incentives may have the unintended consequence of driving competent clinicians out of care settings that serve more socially disadvantaged patients. A technical response to this problem is to adjust ratings for the proportion of socially disadvantaged patients at a given care delivery setting.
- Most chronic disease clinical guidelines recommend individualizing therapy, based on the balance of the benefits and the risks of therapy for a given patient. Although hypertension medications are generally regarded as safe, diuretics and ACE/ARB agents are among the five leading causes of drug-related hospitalization in the United States.
- When a patient has multiple chronic conditions, or has a severe or life-threatening condition that circumscribes life expectancy, the benefits of hypertension control may diminish, while the risks

Return to Table of Contents

of hypertension control may increase. Deviation from recommended blood pressure targets is often appropriate under these circumstances.

- All evidence-based recommendations are not of equal benefit to all patients. For example, the benefits related to hypertension control are greatest, on average, for those with Stage 2 hypertension, and the incremental benefits of blood pressure lowering diminish as blood pressure levels approach recommended goals. Accountability measures that specify a threshold (such as blood pressure < 140/90 mmHg) may tempt clinical clinicians to focus on those closest to goal, rather than on those furthest from goal who may never achieve goal but may still benefit the most from lowering blood pressure.

TECHNICAL CONSIDERATIONS IN SELECTING BLOOD PRESSURE CONTROL LEVELS FOR ACCOUNTABILITY MEASURES

1. Because accountability measures, especially when linked to financial incentives, may have substantial effects on clinician behavior, it is important to select accountability measures that are very well supported by strong, consistent evidence of benefit across wide groups of patients based on multiple well-designed randomized clinical trials. In essence, accountability measures should be based only on the strongest levels of evidence, and not be based on controversial or inconsistent data, epidemiological data alone or expert opinion.

2. When accountability measures are based on clinical trial results, the mean or median achieved blood pressure level in the group with superior results is NOT an appropriate threshold clinical goal for an accountability measure. Half the subjects in any group are at or above the median value for that group. Thus, if an intervention group with median systolic blood pressure of 135 mmHg did better than a comparison group that achieved a mean systolic blood pressure of 145 mmHg, the recommended threshold value for an accountability measure would most appropriately be around < 140 mmHg, not < 135 mmHg. It is not defensible to recommend as a community standard of care a clinical metric that could only be achieved by half of the eligible and consented patients receiving free, highly structured care from expert clinicians within clinical trial clinics.

3. A technical response to heterogeneity of distribution of socially disadvantaged patients across care settings is to statistically adjust accountability measures for the proportion of socially disadvantaged patients at a given care delivery setting.

SUMMARY: POLICY CONSIDERATIONS

Accountability measures that are linked to public reporting or financial incentives for clinicians may be an effective method for influencing clinical decision-making and improving chronic disease care. For this reason, it is critically important to select accountability measures that are consistently and strongly supported by randomized clinical trial data, and to apply these measures only to the subsets of patients most likely to achieve benefits. Even with such carefully considered constraints, there is a real danger that overly stringent accountability measures could lead to over treatment of hypertension in some patients, or other unintended consequences. To minimize the risks, while retaining the potential benefits of accountability measurement, conservative thresholds are indicated, and adjustment of accountability measures for social disadvantage is strongly encouraged.

The consensus recommendation of the guideline group for use of accountability measures for hypertension treatment is summarized below:

1. In general, it would not be appropriate to recommend blood pressure accountability targets lower than a standard of < 140/90 mmHg for adults with hypertension. This level of control is supported by numerous randomized clinical trials. Use of this level for accountability measures would still

Return to Table of Contents

allow clinicians to treat individual patients to lower goals whenever it is determined to be appropriate, while minimizing the risks of incentivizing clinicians to over treat those who are frail, elderly, or have multiple chronic diseases.

2. Whether classification of blood pressure control in an individual patient should be adjusted for the number of antihypertensive drugs being used in attempting to achieve control is a matter to consider for accountability measures. For example, if a patient is on three or four antihypertensive medications but has blood pressure somewhat over 140/90 mmHg, the quality of care is not likely to be deficient – the lack of control may be more related to severity of disease or to non-adherence. Thus, an alternative accountability measure might be this: (a) blood pressure < 140/90 mmHg, OR ELSE (b) treatment in the last year with two or more blood pressure medications. Use of this accountability measure would allow clinical clinicians to treat individual patients to lower goals whenever this might be appropriate, while minimizing the risks of incentivizing clinicians to over treat those who are frail, elderly, or have multiple chronic diseases. In addition, this accountability measure would not penalize clinicians caring for a disproportionate share of patients who are non-adherent, or who express a strong personal preference for less-intensive hypertension treatment than clinicians may recommend. We do not, at this time, recommend that accountability measures apply to those age 65 and over.

3. Statistical adjustment of accountability measures for the proportion of socially disadvantaged patients at a given care setting is recommended, to avoid the erroneous conclusion that clinicians serving socially disadvantaged patient populations provide uniformly poorer care than clinicians serving less disadvantaged patient populations.

Return to Table of Contents BACK

ICSI has long had a policy of transparency in declaring potential conflicting and competing interests of all individuals who participate in the development, revision and approval of ICSI guidelines and protocols.

In 2010, the ICSI Conflict of Interest Review Committee was established by the Board of Directors to review all disclosures and make recommendations to the board when steps should be taken to mitigate potential conflicts of interest, including recommendations regarding removal of work group members. This committee has adopted the Institute of Medicine Conflict of Interest standards as outlined in the report, Clinical Practice Guidelines We Can Trust (2011).

Where there are work group members with identified potential conflicts, these are disclosed and discussed at the initial work group meeting. These members are expected to recuse themselves from related discussions or authorship of related recommendations, as directed by the Conflict of Interest committee or requested by the work group.

The complete ICSI policy regarding Conflicts of Interest is available at http://bit.ly/ICSICOI.

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ICSI facilitates and coordinates the guideline development and revision process. ICSI, member medical groups and sponsoring health plans review and provide feedback but do not have editorial control over the work group. All recommendations are based on the work group's independent evaluation of the evidence.

Return to Table of Contents

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Return to Table of Contents

All ICSI documents are available for review during the revision process by member medical groups and sponsors. In addition, all members commit to reviewing specific documents each year. This comprehensive review provides information to the work group for such issues as content update, improving clarity of recommendations, implementation suggestions and more. The specific reviewer comments and the work group responses are available to ICSI members at http://bit.ly/Hypertension1112.

The ICSI Patient Advisory Council meets regularly to respond to any scientific document review requests put forth by ICSI facilitators and work groups. Patient advisors who serve on the council consistently share their experiences and perspectives in either a comprehensive or partial review of a document, and engaging in discussion and answering questions. In alignment with the Institute of Medicine's triple aims, ICSI and its member groups are committed to improving the patient experience when developing health care recommendations.

Return to Table of Contents

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Return to Table of Contents

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Return to Table of Contents

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ICSI Document Development and Revision Process

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Since 1993, the Institute for Clinical Systems Improvement (ICSI) has developed more than 60 evidence-based health care documents that support best practices for the prevention, diagnosis, treatment or management of a given symptom, disease or condition for patients.

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The information contained in this ICSI Health Care Guideline is intended primarily for health professionals and other expert audiences.

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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.

Document Development and Revision Process

The development process is based on a number of long-proven approaches and is continually being revised based on changing community standards. The ICSI staff, in consultation with the work group and a medical librarian, conduct a literature search to identify systematic reviews, randomized clinical trials, meta-analysis, other guidelines, regulatory statements and other pertinent literature. This literature is evaluated based on the GRADE methodology by work group members. When needed, an outside methodologist is consulted.

The work group uses this information to develop or revise clinical flows and algorithms, write recommendations, and identify gaps in the literature. The work group gives consideration to the importance of many issues as they develop the guideline. These considerations include the systems of care in our community and how resources vary, the balance between benefits and harms of interventions, patient and community values, the autonomy of clinicians and patients and more. All decisions made by the work group are done using a consensus process.

ICSI's medical group members and sponsors review each guideline as part of the revision process. They provide comment on the scientific content, recommendations, implementation strategies and barriers to implementation. This feedback is used by and responded to by the work group as part of their revision work. Final review and approval of the guideline is done by ICSI's Committee on Evidence-Based Practice. This committee is made up of practicing clinicians and nurses, drawn from ICSI member medical groups.

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These are provided to assist medical groups and others to implement the recommendations in the guidelines. Where possible, implementation strategies are included that have been formally evaluated and tested. Measures are included that may be used for quality improvement as well as for outcome reporting. When available, regulatory or publicly reported measures are included.

Document Revision Cycle

Scientific documents are revised every 12-24 months as indicated by changes in clinical practice and literature. ICSI staff monitors major peer-reviewed journals every month for the guidelines for which they are responsible. Work group members are also asked to provide any pertinent literature through check-ins with the work group midcycle and annually to determine if there have been changes in the evidence significant enough to warrant document revision earlier than scheduled. This process complements the exhaustive literature search that is done on the subject prior to development of the first version of a guideline.

Return to Table of Contents