Hypertension: Diagnosis and Management – Adult – Ambulatory Clinical Practice Guideline

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Introduction

The global prevalence of hypertension was estimated to be 1.13 billion in 2015 (based on office blood pressures.)[1] Hypertension now affects over 40% of the U.S. adult population[3] and is the most common diagnosis at outpatient office visits. Hypertension is also a leading risk factor that contributes to heart failure, heart attack, stroke, and chronic kidney disease. From 2005 to 2015, the death rates attributable to high blood pressure increased 10.5%, and the actual number of deaths attributable to high blood pressure rose 37.5%.[2] In 2015, it was the primary or contributing cause of death for more than 427,000 Americans [2] .

This guideline outlines the preferred hypertension management approach for most patients. It is not intended to replace a clinician's judgment or to establish a protocol for all patients. Although guidelines in general may be used to inform regulatory or payer decisions, the intent is to improve quality of care and align with patients' interests.

Hypertension management, in accordance with guideline recommendations, is effective only when followed by both practitioners and patients. Adherence to recommendations can be enhanced by shared decision-making between clinicians and patients, with patient engagement in selecting interventions based on individual values, preferences, and associated conditions and comorbidities.

Scope

Intended User(s): Physicians, Advanced Practice Providers, Registered Nurses, Pharmacists

Objective(s): To provide recommendations that reduce the incidence of stroke, myocardial infarction, congestive heart failure, and kidney failure by identifying and treating hypertension.

Target Population: Adults age 18 years or older

Clinical Questions Considered:

- What is the threshold for a new hypertension diagnosis?
- When is pharmacotherapy indicated for the treatment of hypertension?
- Which medications are considered first-line agents for treating hypertension?

Definitions

Blood pressure (BP) is categorized into 4 levels as outlined in **Table 1**.

Table 1. Categories of blood pressure[3]

BP Category	Systolic BP		Diastolic BP
Normal	<120 mm Hg	*and*	< 80 mm Hg
Elevated	120-129 mm Hg	*and*	< 80 mm Hg
Hypertension			
Stage 1	130-139 mm Hg	*or*	80-89 mm Hg
Stage 2	≥140 mm Hg	*or*	≥90 mm Hg

Recommendations

Blood Pressure Measurement

Proper methods are recommended for accurate measurement and documentation of BP. *(ACC-AHA Class I, Level C-EO)*

Clinic blood pressure measurements obtained using proper technique with manual and/or validated automated devices are acceptable, however automated devices are preferable.[4] *(UW Health Moderate quality evidence, C recommendation)*

Establishing the diagnosis

The diagnosis of hypertension requires the average of ≥2 blood pressure measurements on ≥2 office visits. *(ACC-AHA Class I, Level A)*

Clinic blood pressures can be highly variable. Out-of-office blood pressure measurements (home blood pressure monitoring [HBPM] with or without 24-hour ambulatory blood pressure monitoring [ABPM]) are recommended to confirm the diagnosis of hypertension. *(ACC-AHA Class I, Level A)* Out-of-office blood pressure measurements are also recommended for titration of blood pressure medication, in conjunction with telehealth counseling or other clinical interventions. *(ACC-AHA Class I, Level A)* For additional information on blood pressure measuring, refer to **Appendix A**.

Patients may also have white coat hypertension or masked hypertension (see **Table 2**).

White coat hypertension - characterized by elevated office BP but normal readings when measured outside the office with either 24-hour ambulatory blood pressure monitoring (ABPM) or home blood pressure monitoring (HBPM).[3]

Masked hypertension - characterized by normal office BP readings but out-of-office (ABPM/HBPM) readings that are consistently above normal. [3]

Table 2. When to screen for white coat hypertension or masked hypertension[3]

Screen for white coat hypertension	Screen for masked hypertension
• In adults with an untreated SBP greater than 130 mm Hg but less than 160 mm Hg or DBP greater than 80 mm Hg but less than 100 mm Hg *(ACC-AHA Class IIa, Level B-NR)* • In adults on multiple-drug therapies for hypertension and office BPs within 10 mm Hg above goal *(ACC-AHA Class IIb, Level C-LD)*	• In adults with untreated office BPs that are consistently between 120 mm Hg and 129 mm Hg for SBP or between 75 mm Hg and 79 mm Hg for DBP *(ACC-AHA Class IIa, Level B-NR)* • It may be reasonable to screen for masked uncontrolled hypertension with HBPM in adults being treated for hypertension and office readings at goal, in the presence of target organ damage or increased overall CVD risk. *(ACC-AHA Class IIb, Level C-EO)*

Patient Hypertension Evaluation

Assess lifestyle, identify modifiable and non-modifiable risk factors for hypertension and other cardiovascular disease (CVD) risk factors, and evaluate for target organ damage using personal history, physical examination and selective testing (**Table 3**).[3,5]

Table 3. Hypertensive Target Organ Damage[3,6]

- Heart disease (left ventricular hypertrophy, heart failure, coronary artery disease, atrial fibrillation)
- Chronic kidney disease
- Stroke/Transient Ischemic Attack
- Peripheral arterial disease
- Retinopathy

For new onset or uncontrolled hypertension in adults, screening for specific form(s) of secondary hypertension is recommended when the clinical indications and physical examination findings are present (see **Tables 4** and **5**). *(ACC-AHA Class I, Level C-EO)* [3] It is also important to evaluate for the presence of target organ damage (see **Table 3**).

Table 4. When to Evaluate for Secondary Hypertension[3]

- Drug-resistant/induced hypertension
- Abrupt onset of hypertension
- Onset of hypertension at age <30 years
- Exacerbation of previously controlled hypertension
- Unprovoked or excessive hypokalemia
- Disproportionate target organ damage for degree of hypertension
- Accelerated/malignant hypertension
- Onset of diastolic hypertension in older adults (≥65 years)

Table 5. Secondary Causes of Hypertension[3]

- Renovascular disease/renal artery stenosis
- Primary aldosteronism
- Obstructive sleep apnea
- Drug- or alcohol-induced
- Pheochromocytoma/paraganglioma
- Cushing's syndrome
- Aortic coarctation
- Thyroid or parathyroid disease
- Congenital adrenal hyperplasia
- Acromegaly
- Alcohol abuse
- Illicit stimulants (amphetamines, methamphetamines, cocaine)
- Chronic kidney disease (CKD)
- Medications (stimulants, estrogen, corticosteroids, erythropoietin alfa, mineralocorticosteroids, cyclosporine, tacrolimus, NSAIDS, herbals, OTC decongestants, triptans, bupropion, SNRIs, others)

Screening for Hypertension

The U.S. Preventive Services Task Force (USPSTF) recommends screening for high blood pressure in adults aged 18 years or older without known hypertension and to obtain measurements outside of the clinical setting for diagnostic confirmation. [7] *(USPSTF Grade A)*

Annual blood pressure screening is recommended for adults aged ≥40 years old and for all adults with an increased risk for high blood pressure (see risk factors above).[7] *(UW Health Moderate quality evidence, S recommendation)* Patients aged 18-39 years with normal blood pressure (< 120/80 mmHg)**[3]**, and no other cardiovascular disease risk factors, should be rescreened every 3-5 years.[7] *(USPSTF Grade A)*

Table 6. Time Interval for Blood Pressure Screening

Patient	Interval
• Patients 18-39 years with blood pressure <130/85 mm Hg and no other cardiovascular disease risk factors	Every 3-5 years
• Patients ≥ 40 years • Any adult age with increased risk for high blood pressure (see Table 3)	Annual blood pressure screening

Treatment and Management

As the relationship between blood pressure and risk of CVD events is continuous and independent of other risk factors, the benefits of blood pressure treatment are highest at higher levels and diminish at lower blood pressures.[8,9]

For patients with confirmed hypertension, assess the 10-year risk for heart disease and stroke using the atherosclerotic cardiovascular disease (ASCVD) risk calculator to guide patient discussions and treatment decisions.[3] ASCVD is defined as first coronary heart disease death, non-fatal MI or fatal or non-fatal stroke.[3] A patient's ASCVD Risk Estimate can be calculated with the ACC-AHA Pooled Cohort equation (http://tools.acc.org/ASCVD-Risk-Estimator-Plus/#!/calculate/estimate/) or the HealthDecision tool found in UW HealthLink.

Treatment Goals

For adults with confirmed hypertension, without additional target organ damage or other CVD risk factors, a goal blood pressure target of less than 130/80 mmHg may be reasonable.[3] *(ACC-AHA Class I, Level B-NR for systolic BP; ACC-AHA Class I, Level C-EO for diastolic BP)*

For adults with confirmed hypertension and known cardiovascular disease or a 10-year ASCVD event risk of ≥10%, a blood pressure goal of less than 130/80 is recommended.[3] *(ACC-AHA Class I, Level B-R for systolic BP; ACC-AHA Class I, Level C-EO for diastolic BP)*

Less intensive target blood pressures may be considered in patients[10] *(UW Health High quality evidence, C recommendation)*:

- With a one-minute standing SBP <110 mmHg
- With a history of orthostatic hypotension
- Who are intolerant to their current medications
- With a history of falls and/or frailty
- Who have difficulty with medication adherence including alcohol abuse, psychiatric disease

Response to treatment (non-pharmacologic and/or pharmacologic) should be monitored using home blood pressure measurements. [3,11-14] *(UW Health High quality evidence, S recommendation)*

Non-pharmacologic Interventions

All patients should be encouraged to make lifestyle modifications (see **Table 7**).[3,5,15] (*ACC-AHA Class I hypertension, Class IIa normotension; Level A)* Lifestyle modifications can be quite effective and may mitigate the need for antihypertensive pharmacotherapy. Lifestyle changes should be reinforced at every patient encounter, even after antihypertensive medication initiation.[3]

Table 7. Non-pharmacologic Interventions to Lower Blood Pressure[3]

Lifestyle modification	Recommendation*	Comments	Approximate reduction in SBP (hypertensive, normotensive)
Weight loss *(ACC-AHA Class I, Level A)*	Aim for ideal body weight; at least 1 kg reduction in body weight for overweight adults	Weight loss can lower BP, increase the efficacy of antihypertensive medications, and improve CVD risk factors such as diabetes mellitus and dyslipidemia. For every 1 kg of weight lost, BP may decrease by 1 mm Hg.	-5 mm Hg, -2/3 mmHg
Healthy diet *(ACC-AHA Class I, Level A)*	DASH diet	A diet rich in fruits, vegetables, whole grains, low-fat dairy products with a reduced content of saturated and total fat. The DASH diet is not recommended in patients with end-stage kidney disease.	-11 mm Hg, -3 mmHg
Reduced intake of dietary sodium *(ACC-AHA Class I, Level A)*	Optimal goal is < 1500 mg/day, but start with an initial goal of 1000 mg/day reduction and no more than 2300 mg sodium/day	More than 40% of sodium in American diet comes from only 10 types of food (i.e., breads and rolls, pizza, sandwiches, cold cuts and cured meats, canned soup, chips). Eat less processed foods and dine out less	-5/6 mm Hg, -2/3 mmHg
Enhance intake of dietary potassium *(ACC-AHA Class I, Level A)*	3500-5000 mg/day, preferably by diet rich in potassium	Foods high in potassium include certain fruits (i.e., bananas, oranges, cantaloupe, grapefruit), leafy green vegetables (e.g., broccoli, kale, spinach), sweet potatoes, mushrooms. Increased dietary potassium is not recommended in patients with end-stage kidney disease.	-4/5 mm Hg, -2 mmHg
Physical activity *(ACC-AHA Class I, Level A)*	30-45 minutes of moderately intense physical activity most days of the week	Exercise contributes to weight loss and reduces the risks of CVD and overall mortality. Patients at high risk should have an exercise stress test prior to starting a new program. Medically supervised exercise programs should be advised if BP response to exercise is a concern (call UW Preventive Cardiology Program 263-7420 for information about monitored exercise sessions).	-5/8 mm Hg, -2/4 mmHg
Moderate Alcohol consumption *(ACC-AHA Class I, Level A)*	Reduce or eliminate alcohol intake	Alcohol is a risk factor for hypertension, contributes excess calories, can reduce efficacy of antihypertensive medications, and increases the risk of stroke. Men should have no more than 2, and women no more than 1, alcoholic drink(s) daily. Examples of one drink are 12 oz. of beer, 4 oz. of wine, or 1 oz. of spirits.	-4 mm Hg, -3 mmHg
Tobacco and secondhand smoke *(ACC-AHA Class I, Level A)*	Smoking cessation and avoidance of secondhand smoke	Tobacco and its by-products increase CVD risk[3] and may make antihypertensive medications less effective. Each cigarette causes an increase in blood pressure. The CVD benefits of smoking cessation are evident in one year.	

Pharmacotherapy
Prior to initiating or if considering antihypertensive therapy for primary prevention of ASCVD, a patient-health care provider discussion should focus on the patient's estimated 10-year ASCVD risk, management of other ASCVD risk factors, expected ASCVD event reduction, potential drug interactions, adverse drug effects, and costs.

When to initiate antihypertensive medication
Antihypertensive medication is recommended for the following[3] (see Figure 1):

- for secondary prevention of recurrent CVD events in patients with clinical CVD and an average SBP ≥ 130 mmHg or an average DBP ≥ 80 mmHg *(ACC-AHA Class I, Level A for systolic BP; ACC-AHA Class I, Level C-EO for diastolic BP)*
- for primary prevention in adults with an estimated 10-year ASCVD risk ≥10% and an average SBP ≥130 mmHg or an average DBP ≥ 80 mmHg *(ACC-AHA Class I, Level A for systolic BP; ACC-AHA Class I, Level C-EO for diastolic BP)*
- for primary prevention of CVD in adults with no history of CVD, an estimated 10-year ASCVD risk <10% and an average SBP ≥140 mmHg or an average DBP ≥ 90 mmHg *(ACC-AHA Class I, Level C-LD)*

For patients with stage 2 hypertension and an average BP more than 20/10 mm Hg above their BP target, initiation of antihypertensive drug therapy with 2 first-line agents of different classes, either as separate agents or in a fixed-dose combination, is recommended. (*ACC-AHA Class I, Level C-EO)*

The choice of medication should be influenced by patient age, ethnicity/race, and other clinical characteristics such as comorbidities or pregnancy status. (Refer to **Tables 8** and **9**)

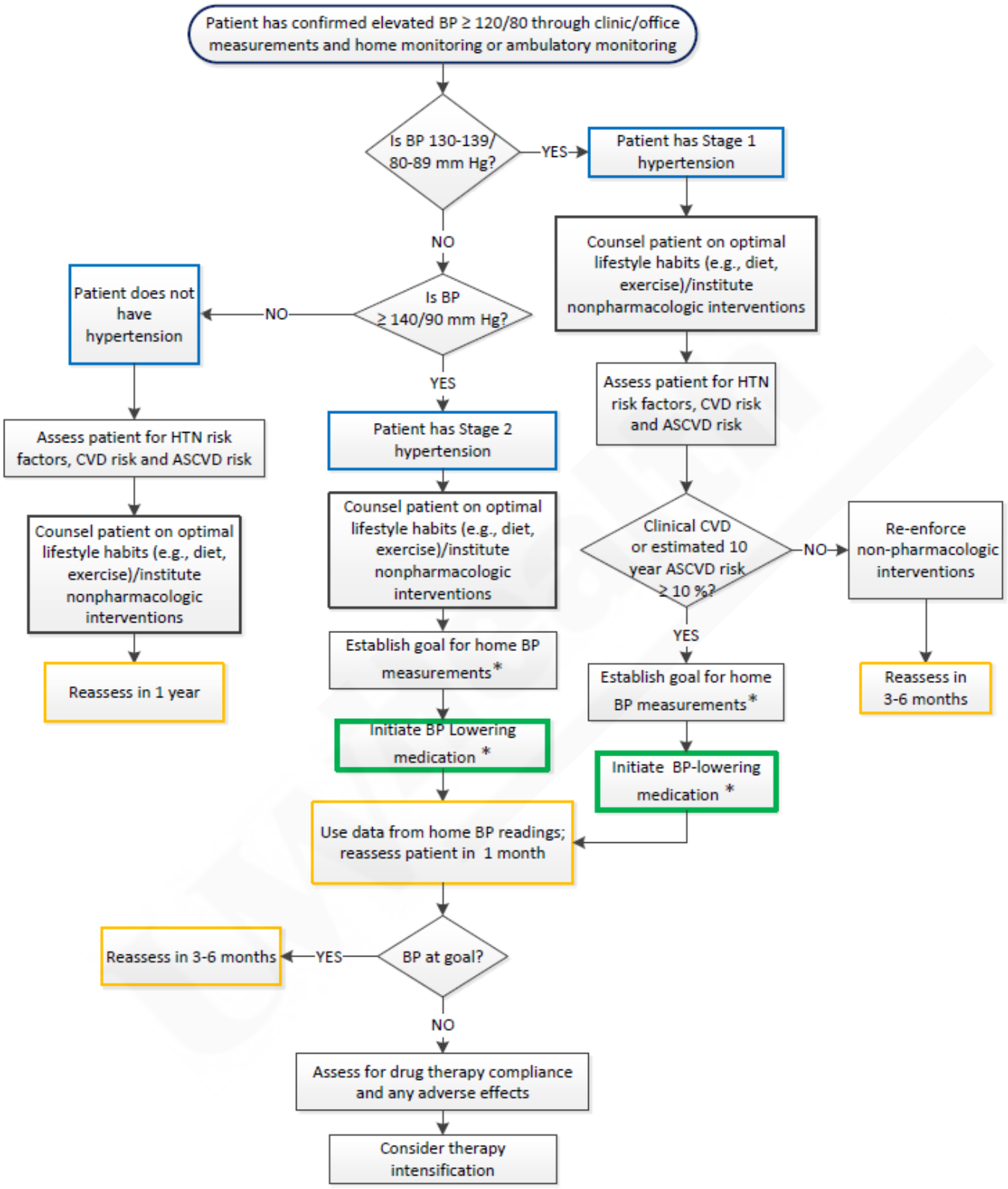
Monitoring for Side Effects
Patients on pharmacotherapy should be monitored for possible side effects of medication to help assure patient compliance.[3]

Creatinine and potassium levels should be checked *(ACC-AHA Class I, Level B-R for renal/electrolyte monitoring)* 1-2 weeks after medication initiation, at each dose change, and every 12 months thereafter in patients on diuretics, ACE-Is, ARBs, or spironolactone *(UW Health Moderate quality evidence, strong recommendation for frequency)*.[5,16,17] More frequent monitoring may be needed if symptoms suggest renal or electrolyte disorders.

For patients using a diuretic antihypertensive medication (including aldosterone antagonists), serum sodium should be checked at initiation, 1-2 weeks after each dose change, and as needed to evaluate for hyponatremia *(ACC-AHA Class I, Level B-R for hyponatremia monitoring)*.

Additional serial laboratory monitoring (e.g., BUN, fasting lipid panel, fasting glucose) can be considered for individual patients, but are no longer recommended based on a diagnosis of hypertension alone.

Figure 1. Hypertension Assessment and Treatment Algorithm[3]



* *Prior to initiating or if considering antihypertensive therapy for primary prevention of ASCVD, a patient-health care provider discussion should focus on the patient's estimated 10-year ASCVD risk, management of other ASCVD risk factors, expected ASCVD event reduction, potential drug interactions, adverse drug effects, and costs.*

Table 8 - Treatment of Hypertension With and Without Co-Morbidities[5,7,18,19]

	Patient Type	First Drug	Add Second Drug if Needed to Achieve a BP < 140/90 mmHg	If Third Drug is Needed to Achieve a BP < 140/90 mmHg
Hypertension is primary condition being treated and/or no co-morbidities	Black patients (African ancestry): All ages	CCB[a] or thiazide-like diuretic	ARB[b] or ACE inhibitor (If ARB or ACE inhibitor unavailable, may use CCB or diuretic if not already using)	Combination of CCB + ACE inhibitor or ARB + thiazide-like diuretic
	White and other non-black patients: < 60 years	ARB[b] or ACE inhibitor	CCB[a] or thiazide-like diuretic	Combination of CCB + ACE inhibitor or ARB + thiazide-like diuretic
	White and other non-black patients: ≥ 60 years	CCB[a] or thiazide-like diuretic (ACE inhibitors or ARBs also effective)	ARB[b] or ACE inhibitor (for CCB or thiazide-like diuretic if ACE inhibitor or ARB used first)	Combination of CCB + ACE inhibitor or ARB + thiazide-like diuretic
Hypertension is associated with other co-morbidities	Diabetes mellitus	ARB or ACE inhibitor Note: In black patients, it is acceptable to start with a CCB or thiazide/like	CCB or thiazide-like diuretic Note: In black patients, if starting with a CCB or thiazide-like diuretic, add an ARB or ACE inhibitor	The alternative second drug (thiazide-like diuretic or CCB)
	Chronic kidney disease	ARB or ACE inhibitor	CCB or thiazide-like diuretic [c]	The alternative second drug (thiazide-like diuretic or CCB)
	Clinical coronary artery disease[d]	β-blocker plus ARB or ACE inhibitor	CCB or thiazide-like diuretic	The alternative second drug (thiazide-like diuretic or CCB)
	Stroke history	ARB or ACE inhibitor	Thiazide-like diuretic or CCB	The alternative second drug (CCB or thiazide-like diuretic)
	Heart failure	Refer to UW Health Chronic Left Ventricular Systolic Heart Failure: Management guideline		

Abbreviations: ACE = angiotensin-converting enzyme; ARB = angiotensin receptor blocker; BP = blood pressure; CCB = calcium channel blocker; eGFR = estimated glomerular filtration rate

[a] CCBs are generally preferred, but thiazide/thiazide-like diuretics like chlorthalidone may cost less.
[b] ARBs can be considered because ACE inhibitors can cause cough and angioedema, although ACE inhibitors may cost less.
[c] If eGFR < 40 mL/min, a loop diuretic (e.g., furosemide or torsemide) may be needed.
[d] Note: If history of myocardial infarction, a β-blocker and ARB/or ACE inhibitor are indicated regardless of blood pressure.

Table 9. Select Antihypertensive medications [3,20-23]

Drug class	Drug	Usual Dose (mg)	Doses per day	Max Daily Dose (mg)	Comments
THIAZIDE AND THIAZIDE-LIKE DIURETICS	Chlorthalidone	12.5-25	1	25	• Chlorthalidone is preferred over hydrochlorothiazide [22,23] because it is longer acting and more potent; however, more careful monitoring for electrolyte and renal disturbances is needed. • Monitor for electrolyte imbalances • Use with caution in patients with history of acute gout • Thiazides are sulfonamides and may share cross-reactivity with other members of this chemical group (low risk)
	Hydrochlorothiazide (HCTZ)	12.5-25	1	25	
	Indapamide	1.25-2.5	1	5	
	Metolazone	2.5-5	1	5	
ACE INHIBITORS (ACE-I)	Benazepril	10-40	1-2	40	• **DO NOT use in combination with ARBs or direct renin inhibitor** • Avoid in pregnancy; counsel women of child-bearing potential on risks of pregnancy • Dry cough can develop at any time during usage • Monitor for hyperkalemia, especially in patients with CKD, using K^+ supplements or K^+ sparing drugs • Can cause acute renal failure, particularly in patients with bilateral renal artery stenosis • Angioedema is rare but serious reaction; do not use if history of angioedema with ACE-I • Consider lower starting dose when receiving concomitant diuretics or in volume depleted state.
	Captopril	12.5-50	2-3	150	
	Enalapril	5-40	1-2	40	
	Fosinopril	10-40	1	80	
	Lisinopril	10-40	1	40	
	Perindopril	4-8	1	16	
	Quinapril	10-80	1-2	80	
	Ramipril	2.5-10	1-2	20	
	Trandolapril	1-4	1	4	
ANGIOTENSIN II RECEPTOR BLOCKERS (ARB)	Azilsartan	40-80	1	80	• **DO NOT use in combination with ACE-Is or direct renin inhibitor** • Avoid in pregnancy; counsel women of child-bearing potential on risks of pregnancy • Monitor for hyperkalemia, especially in patients with CKD, using K^+ supplements or K^+ sparing drugs • Can cause acute renal failure, particularly in patients with bilateral renal artery stenosis • Can be used if history of angioedema with ACE-I, starting 6 weeks after ACE-I is discontinued • Consider lower starting dose when receiving concomitant diuretics or in volume depleted state
	Candesartan	8-32	1	32	
	Irbesartan	150-300	1	300	
	Losartan	50	1-2	100	
	Olmesartan	20-40	1	40	
	Telmisartan	20-80	1	80	
	Valsartan	80-320	1	320	

Select Antihypertensive medications (continued) [3,20-23]

Class	Drug	Usual Dose (mg)	Doses per day	Max Daily Dose (mg)	Comments
CALCIUM CHANNEL BLOCKER – DIHYDROPYRIDINE	Amlodipine	2.5-10	1	10	• **Do not use immediate-release/short acting nifedipine.** • More effective than non-dihydropyridines in controlling blood pressure • Associated with dose-related peripheral edema, which is more common in women than men • Be aware of interaction between amlodipine and simvastatin • Avoid use in patients with heart failure or heart failure w/reduced ejection fraction (HFrEF)amlodipine or felodipine may be used if required
	Felodipine ER	2.5-10	1	10	
	Nifedipine ER	30-90	1	120	
CALCIUM CHANNEL BLOCKER – NON-DIHYDROPYRIDINE	Diltiazem SR	60-120	2	360	• Avoid use with beta-blockers due to increased risk for bradycardia and heart block • Do not use in patients with HFrEF • Be aware of many drug interactions (CYP3A4 major substrate and moderate inhibitor); avoid use with simvastatin • May cause constipation
	Diltiazem ER	120-360	1	480	
	Verapamil IR	40-80	3	480	
	Verapamil SR	120-240	1-2	480	
	Verapamil ER	100-480	1	480	
LOOP DIURETICS	Bumetanide	0.25-2	2	4	• Monitor electrolytes (e.g., hypokalemia) • Preferred over thiazides in patients with CKD (i.e., GFR <30 mL/min) • Preferred diuretic in patients with symptomatic heart failure
	Furosemide	10-40	2	80	
	Torsemide	5-10	1	10	
ALDOSTERONE ANTAGONIST DIURETICS	Spironolactone	12.5-50	1-2	100	• Preferred agents in primary aldosteronism and resistant hypertension. Low dose spironolactone (12.5-25 mg daily) can be very effective as a 3rd or 4th line agent, especially in overweight patients and patients with hypokalemia • Monitor electrolytes (e.g., hyperkalemia) especially with spironolactone • Avoid use with K+ supplements, other K+ sparing diuretics, or significant renal dysfunction • Spironolactone is associated with greater risk of gynecomastia and impotence compared to eplerenone • Eplerenone often requires twice-daily dosing for adequate BP lowering
	Eplerenone	25-50	1-2	100	

Antihypertensive Medications (continued)

Class	Drug	Usual Dose (mg)	Doses per day	Max Daily Dose (mg)	Comments
BETA BLOCKERS – CARDIOSELECTIVE	Atenolol	25-100	1	100	• Only recommended for hypertension if there is a compelling indication (e.g., coronary artery disease, LV systolic dysfunction, atrial fibrillation rate control, etc.) • Combined alpha-beta-blockers (i.e., carvedilol, labetalol) are much more effective and less likely to cause metabolic disturbances than high dose pure beta-blockers (e.g., atenolol and metoprolol) • Can worsen insulin resistance and dyslipidemia in susceptible individuals, such as those with diabetes mellitus or the metabolic syndrome • Use with caution in patients with diabetes mellitus because of potential to mask hypoglycemia • Bisoprolol, metoprolol succinate, and carvedilol are preferred in patients with HFrEF • Labetalol may be used in pregnancy • Avoid abrupt cessation
	Bisoprolol	2.5-10	1	10	
	Metoprolol tartrate	50-100	2	200	
	Metoprolol succinate	50-200	1	200	
BETA-BLOCKERS-COMBINED α- AND β-RECEPTOR	Carvedilol	6.25-25	2	50	
	Labetalol	100-400	2	800	
BETA-BLOCKERS – NON-CARDIOSELECTIVE	Nadolol	40-120	1	120	
	Propranolol IR	40-80	2	640	
	Propranolol LA	80-160	1	640	

Disclaimer

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

Methodology

Development Process

Each guideline is reviewed and updated a minimum of every 3 years. All guidelines are developed using the guiding principles, standard processes, and styling outlined in the UW Health Clinical Practice Guideline Resource Guide. This includes expectations for workgroup composition and recruitment strategies, disclosure and management of conflict of interest for participating workgroup members, literature review techniques, evidence grading resources, required approval bodies, and suggestions for communication and implementation.

Methods Used to Collect the Evidence:

The following criteria were used by the guideline author(s) and workgroup members to conduct electronic database searches in the collection of evidence for review.

Literature Sources:

- Electronic database search (e.g., PubMed)
- Databases of systematic reviews (e.g., Cochrane Library)
- Hand-searching journals, external guidelines, and conference publications

Time Period: July 2018 to December 2018

The following is a list of various search terms that were used individually or in combination with each other for literature searches on PubMed: hypertension, SPRINT, ACC, AHA

Methods to Select the Evidence:

Literary sources were selected with the following criteria in thought: English language, subject age (i.e., >18 years), publication in a MEDLINE core clinical journal and strength of expert opinion (e.g., international or national guideline).

Methods Used to Formulate the Recommendations:

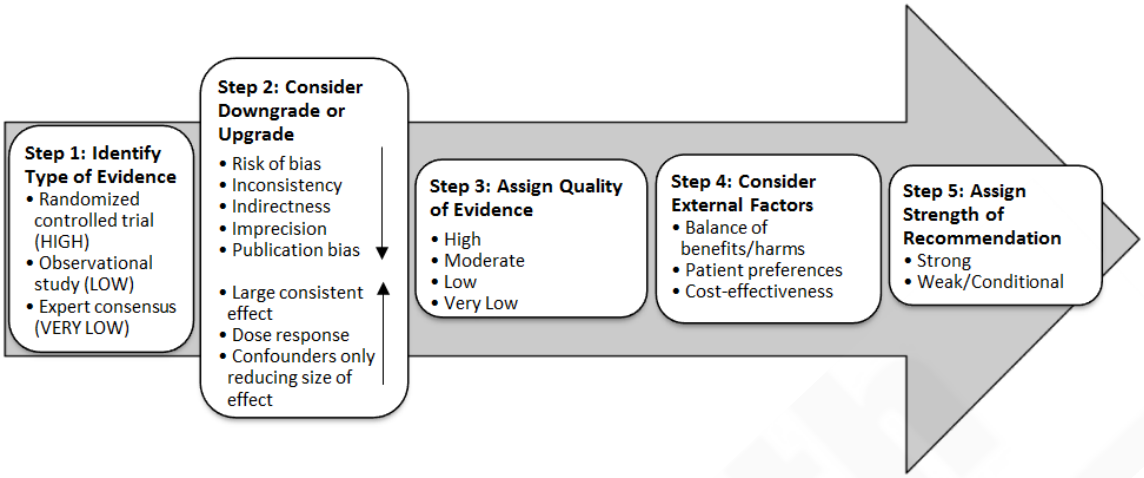
The workgroup members agreed to adopt recommendations developed by external organizations and/or created recommendations internally via a consensus process using discussion of the literature and expert experience/opinion. If issues or controversies arose where consensus could not be reached, the topic was escalated appropriately per the guiding principles outlined in the UW Health Clinical Practice Guideline Resource Guide.

Methods Used to Assess the Quality of the Evidence/Strength of the Recommendations:

Recommendations developed by external organizations maintained the evidence grade assigned within the original source document and were adopted for use at UW Health.

Internally developed recommendations, or those adopted from external sources without an assigned evidence grade, were evaluated by the guideline workgroup using an algorithm adapted from the Grading of Recommendations Assessment, Development and Evaluation (GRADE) methodology (see **Figure 1**).

Figure 1. GRADE Methodology adapted by UW Health



Rating Scheme for the Strength of the Evidence/Recommendations:

GRADE Ranking of Evidence

High	We are confident that the effect in the study reflects the actual effect.
Moderate	We are quite confident that the effect in the study is close to the true effect, but it is also possible it is substantially different.
Low	The true effect may differ significantly from the estimate.
Very Low	The true effect is likely to be substantially different from the estimated effect.

GRADE Ratings for Recommendations For or Against Practice

Strong (S)	Generally should be performed (i.e., the net benefit of the treatment is clear, patient values and circumstances are unlikely to affect the decision.)
Conditional (C)	May be reasonable to perform (i.e., may be conditional upon patient values and preferences, the resources available, or the setting in which the intervention will be implemented.)

ACC/AHA Grading Scheme

SIZE OF TREATMENT EFFECT

ESTIMATE OF CERTAINTY (PRECISION) OF TREATMENT EFFECT	CLASS I *Benefit >>> Risk* Procedure/Treatment **SHOULD** be performed/ administered	CLASS IIa *Benefit >> Risk* *Additional studies with focused objectives needed* **IT IS REASONABLE** to perform procedure/administer treatment	CLASS IIb *Benefit ≥ Risk* *Additional studies with broad objectives needed; additional registry data would be helpful* Procedure/Treatment **MAY BE CONSIDERED**	CLASS III *No Benefit* or CLASS III *Harm* Procedure/Test / Treatment COR III: No benefit — Not Helpful / No Proven Benefit COR III: Harm — Excess Cost w/o Benefit or Harmful / Harmful to Patients
LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	■ Recommendation that procedure or treatment is useful/effective ■ Sufficient evidence from multiple randomized trials or meta-analyses	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from multiple randomized trials or meta-analyses	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Sufficient evidence from multiple randomized trials or meta-analyses
LEVEL B Limited populations evaluated* Data derived from a single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is useful/effective ■ Evidence from single randomized trial or nonrandomized studies	■ Recommendation in favor of treatment or procedure being useful/effective ■ Some conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation's usefulness/efficacy less well established ■ Greater conflicting evidence from single randomized trial or nonrandomized studies	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Evidence from single randomized trial or nonrandomized studies
LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies, or standard of care	■ Recommendation that procedure or treatment is useful/effective ■ Only expert opinion, case studies, or standard of care	■ Recommendation in favor of treatment or procedure being useful/effective ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation's usefulness/efficacy less well established ■ Only diverging expert opinion, case studies, or standard of care	■ Recommendation that procedure or treatment is not useful/effective and may be harmful ■ Only expert opinion, case studies, or standard of care
Suggested phrases for writing recommendations	should is recommended is indicated is useful/effective/beneficial	is reasonable can be useful/effective/beneficial is probably recommended or indicated	may/might be considered may/might be reasonable usefulness/effectiveness is unknown/unclear/uncertain or not well established	COR III: No Benefit: is not recommended; is not indicated; should not be performed/ administered/ other; is not useful/ beneficial/ effective COR III: Harm: potentially harmful; causes harm; associated with excess morbidity/mortality; should not be performed/ administered/ other
Comparative effectiveness phrases†	treatment/strategy A is recommended/indicated in preference to treatment B treatment A should be chosen over treatment B	treatment/strategy A is probably recommended/indicated in preference to treatment B it is reasonable to choose treatment A over treatment B		

Recognition of Potential Health Care Disparities: Hypertension is more prevalent in certain race/ethnicities, especially non-Hispanic blacks, who have the highest age-adjusted prevalence not only in the US but the world. Certain racial groups/ethnicities (non-Hispanic blacks and Hispanic adults) are also known to have poorer control of their hypertension compared to non-Hispanic whites.[24-26]

Collateral Tools & Resources

The following collateral tools and resources support staff execution and performance of the evidence-based guideline recommendations in everyday clinical practice.

Metrics

WCHQ (2015)

1. CKD Screening- % of patients age 18-85 years with either diabetes or hypertension (excluding those with CKD and ESRD) who had an eGFR test during the last year.
2. Blood Pressure Control in CKD Stages I, II, III- % age 18-85 years with a diagnosis of CKD in stage I, II, or III (excluding those with CKD in stages IV or V or with ESRD) whose most recent blood pressure reading within the last year is controlled to a rate of < 140/90 mmgHg.
3. Blood Pressure Control in CKD Stages IV, V- % age 18-85 years with a diagnosis of CKD in stage IV or V (excluding ESRD) whose most recent blood pressure reading within the last year is controlled to a rate of < 140/90 mmHg.
4. Blood Pressure Control in Diabetes- % age 18-75 years whose most recent blood pressure reading within the last year is controlled to a rate of < 140/90 mmHg.
5. Blood Pressure Control in IVD- % age 18-75 years with a diagnosis of IVD whose most recent blood pressure reading within the last year is controlled to a rate of < 140/90 mmHg.
6. High Blood Pressure- % age 18-85 years who have a diagnosis of essential hypertension and whose blood pressure was adequately controlled based on JNC 8 goals: < 140/90 mmHg for patients less than 60 years of age or patients of any age with a diagnosis of diabetes and/or chronic kidney disease; < 150/90 for patients 60 years of age and older without diabetes or chronic kidney disease.

ACO-MSSP (2016)

1. %of patients age 18-85 years who had a diagnosis of hypertension and whose blood pressure was adequately controlled (< 140/90 mmHg) during the measurement period.

Best Practice Alerts (BPA)

Name [####]

eConsults

UWOP ECONSULT TO CARDIOLOGY- HYPERTENSION [5626]

Order Sets & Smart Sets

Advanced Hypertension [5068]; Blood Pressure (Allied Health Visit) [5055]; HTN [5094]; Kidney- Hypertension Clinic [3285

Patient Resources

1. Health Facts For You #379- Heart Health: The DASH Diet
2. Health Facts For You #4462- High Blood Pressure
3. Health Facts For You #7761- Hypertension Medicines- ACE Inhibitors
4. Health Facts For You #7762- Hypertension Medicines- ARBs (Angiotensin Receptor Blockers)
5. Health Facts For You #7765- Hypertension Medicines- Beta-Blockers
6. Health Facts For You #7764- Hypertension Medicines- Calcium Channel Blockers
7. Health Facts For You #7763- Hypertension Medicines- Diuretics
8. Health Facts For You #7684- Taking Your Blood Pressure at Home
9. Health Facts For You #523- Heart Health: Resources for Heart- Healthy Living
10. Health Facts For You #6246- The Benefits of Exercise
11. Health Facts For You #5117- Potassium Sparing Diuretics
12. Health Facts For You #4678- Loop Diuretics (oral)
13. Health Facts For You #5041- Thiazide Diuretics (oral)
14. Health Facts For You #5817- Your Risk of Heart and Vascular Disease
15. Healthwise- Blood Pressure Test: Home
16. Healthwise- Blood Pressure: Elevated

17. Healthwise- Diet: DASH
18. Healthwise- Hypertension
19. Healthwise- Hypertension: General Info
20. Healthwise- Hypertension: Acute
21. Health Information- Angiotensin II Receptor Blockers (ARBs) for High Blood Pressure
22. Health Information- Angiotensin-Converting Enzyme (ACE) Inhibitors for High Blood Pressure
23. Health Information- Antihypertensive Medications, Deciding About
24. Health Information- Automated Ambulatory Blood Pressure Monitoring
25. Health Information- Beta-Blockers for High Blood Pressure
26. Health Information- Blood Pressure Screening
27. Health Information- Blood Pressure Monitoring at Home
28. Health Information- Blood Pressure Numbers: When to Get Help
29. Health Information- Calcium Channel Blockers for High Blood Pressure
30. Health Information- DASH Diet Sample Menu
31. Health Information- Direct Renin Inhibitors for High Blood Pressure
32. Health Information- Diuretics for High Blood Pressure
33. Health Information- High Blood Pressure: Should I Take Medicine?
34. Health Information- High Blood Pressure in African Americans
35. Health Information- High Blood Pressure Treatment Guidelines
36. Health Information- Home Blood Pressure Test
37. Health Information- Hypertension (High Blood Pressure)
38. Health Information- Hypertension: Checking your blood pressure at home
39. Health Information- Hypertension: Taking medicines properly
40. Health Information- Hypertension: Using the DASH diet
41. Health Information- Other Medicines for High Blood Pressure
42. Health Information- Prehypertension
43. Health Information- Secondary High Blood Pressure

Protocols
Hypertension Lab Ordering – Adult [78]; Antihypertensive Medication Titration [99]
Primary Care Expanded Antihypertensive Medication Management - Adult - Ambulatory [164]
Prescription Renewal Delegation Protocol- UW Health - Adult/Pediatric - Ambulatory [186]

Reporting Workbench Reports
Multi-condition Report

Smart Texts
Home BP Monitoring [34557]; Goal BP [34550]; Buy Home BP Cuff [34555]; BP Check [34546]

Appendix A. Blood Pressure Measurement

It is important to consider all blood pressure measurements in the clinical context of the patient to avoid over- or under-diagnosis of hypertension (e.g., elevated measurement expected during acute injury such as a broken wrist or low blood pressure in the setting of dehydration).

Blood Pressure Measurement in the Office/Clinic Setting[1,3]

Step 1: Properly prepare the patient	• Have the patient relaxed, seated comfortably in a quiet environment for 5 minutes before beginning BP measurements • Make sure patient avoids caffeine, exercise and smoking for at least 30 minutes before the measurement
Step 2: Use the proper technique for BP measurements	• Support the patient's arm (e.g., resting on a desk) • Use correct cuff size and position cuff at level of the heart
Step 3: Take the proper measurements needed for diagnosis and treatment of elevated BP	• At first visit, record BP in both arms. Use the arm with higher value as the reference. • If using auscultatory methods, deflate cuff pressure 2 mm Hg per second and listen for Korotkoff sounds to identify SBP and DBP respectively. • Consider measuring BP 1 minute and 3 minutes after standing from a seated position in all patients at the first measurement to exclude orthostatic hypotension.
Step 4: Properly document acute BP readings	• Record SBP and DBP. If using auscultatory technique, record SBP and DBP as onset of first and disappearance of all Korotkoff sounds, respectively, and with the nearest even number.
Step 5: Average the readings	• Use an average of ≥2 readings obtained on ≥2 occasions to estimate an individual's level of BP
Step 6: Provide BP readings to patient	• Provide patients the systolic/diastolic BP readings both verbally and in writing

Out-of-clinic blood pressure readings may be obtained via ambulatory blood pressure monitoring (ABPM) or extended home blood pressure monitoring (HBPM).[7,27,28]

ABPM provides the average of BP readings over a defined period, usually 24 hours.[1] The USPSTF found convincing evidence that ABPM is the best method for diagnosing hypertension, and considers it to be the reference standard for confirming the diagnosis.[7] Alternatively, good quality evidence suggests that confirmation of hypertension with HBPM may be acceptable.[7]

Following a medication change, patients should obtain blood pressure readings twice a day for 1-2 weeks and report back to provider. Patients who are at goal BP should check BP 1-2 weeks prior to their clinic visit and bring readings/log to clinic for review.[3]

To accurately record BP at home, patients should avoid smoking, caffeine or exercise within 30 minutes before BP measurement. In addition, patients should have at least 5 minutes of quiet rest before BP measurement. Patient should measure blood pressure twice a day (in the morning before medication and in the evening before supper), taking at least 2 readings that are 1 minute apart.

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