

Clinical Care Pathways

Clinical Protocol

Hypertension

Executive Summary

Hypertension is common, underdiagnosed, poorly controlled, dangerous and expensive.

Almost half of all U.S. adults 20 years or older have high blood pressure. One in five adults with hypertension is unaware that they have the disease. Roughly three of four adults with high blood pressure have uncontrolled high blood pressure. Hypertension is a major contributing risk factor to other diseases including stroke, myocardial infarction, heart failure and chronic kidney disease. The annual cost of treating hypertension and associated conditions in the U.S. in 2019 was approximately \$219 billion.

Accurate monitoring of blood pressure is essential for correct diagnosis and appropriate treatment.

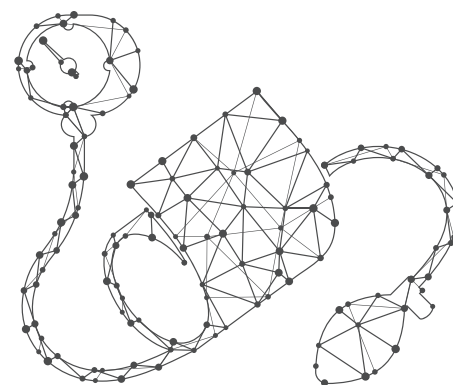
Blood pressure is a dynamic measurement. The ability to measure blood pressure accurately remains a major challenge. Accurately assessing blood pressure in the office is a key determinant to correctly identifying and treating hypertension.

Screen all adults for hypertension at every visit and at minimum annually.

AdventHealth Physician Network (AHPN) Board of Managers (BOM) has adopted the following definitions for normal, elevated blood pressure, and for stage 1 and stage 2 hypertension. Normotensive blood pressure is defined as less than 120 mmHg and less than 80 mmHg. Elevated blood pressure is defined as 120-139 mmHg systolic, or 80-89 mmHg diastolic. Stage 1 hypertension is defined as 140-159 mmHg systolic, or 90-99 mmHg diastolic. Stage 2 hypertension is defined as greater or equal to 160 mmHg systolic, or greater or equal to 100 mmHg diastolic.

The AHPN BOM has adopted the following elevated blood pressure and hypertension treatment protocols. Initiate non-pharmacological therapy for elevated blood pressure and reassess every six months. On a case-by-case basis, consider pharmacotherapy. Reassess blood pressure in six months. If still elevated, continue non-pharmacological therapy and consider pharmacotherapy on a case-by-case basis. Continue at minimum biannual assessments.

Continued on page 2



1 in 5

The number of people with hypertension are unaware they have the disease

\$219 B

The annual cost of treating hypertension and associated conditions in 2019

INSIDE

Introduction.....	2
Screening for Hypertension	2
Blood Pressure Monitoring	3
Diagnosing Hypertension	4
Diagnostic Workup.....	6

Classification of Hypertension Risk.....	8
Treatment	9
Hypertensive Urgency and Emergency.....	14
Hypertension Management Protocol Flow Diagram ..	16-19

Stratify patients with stage 1 hypertension to low and high-risk individuals. Initiate non-pharmacologic therapy for low-risk individuals and reassess in three to six months. If blood pressure is still high, add pharmacotherapy (one drug class). High risk individuals benefit from immediate treatment with non-pharmacological therapy and pharmacotherapy with one drug class.

Patients with stage 2 hypertension should be treated with non-pharmacological therapy and pharmacotherapy with two drug classes.

Introduction

Hypertension is common, underdiagnosed, poorly controlled, dangerous and expensive. It is one of the most common diagnoses in the U.S. and the most common diagnosis managed by primary care providers, with 56.8 million visits in 2019¹ and 1.3 million ED visits in 2021.² Almost half of all U.S. adults 20 years or older have high blood pressure (defined as with an elevated measured high blood pressure reading and/or taking antihypertensive medications).³

Hypertension prevalence rates vary by race, ethnicity, gender and education levels, disproportionately impacting non-Hispanic Black adults, men and adults with some college or less education level. More than half (58%) percent of non-Hispanic Black adults, 49% of non-Hispanic White adults, 45% of non-Hispanic Asian adults and 39% of Hispanic adults in the United States have high blood pressure.⁴ A higher percentage of men (50%) have high blood pressure than women (44%).⁵ More than half (50.5%) of individuals with a some

Screening for Hypertension

Guidelines differ as to the frequency blood pressure screening. JNC 8 guidelines recommend screening all normotensive adults (with BP less than 120/80) at every health care visit, but no less frequently than two years for normal blood pressure. The ACC/AHA 2017 guidelines recommend screening all normotensive, low risk (non-overweight, non-Black) adults 18-39 for high blood pressure every three

Appropriate hypertensive care, led by primary care providers, improves patient health, saves lives and is a cost-effective strategy to reduce low value health care-related spend.

Primary care providers are at the forefront of screening, diagnosing and correctly treating high blood pressure. By following national hypertension guidelines, primary care providers can improve patient quality of life, reduce morbidity and mortality and reduce low value spend.

college or less education level have high blood pressure as compared to 38.5% of all adults who graduated from college.⁶

Hypertension remains underdiagnosed and poorly controlled. One in five adults with high blood pressure is unaware that they have hypertension.⁷ About three in four adults with high blood pressure have uncontrolled high blood pressure.⁸ About 83% of non-Hispanic Black adults, 75% of non-Hispanic White adults, 82% of non-Hispanic Asian adults, and 83% of Hispanic adults with high blood pressure do not have it under control.⁹ Unfortunately, this has contributed to 685,875 U.S. deaths in 2022 alone.¹⁰

Hypertension is a major contributing risk factor to other diseases including stroke, myocardial infarction, heart failure and chronic kidney disease. Hypertension and associated conditions remain one of the costliest medical conditions in the U.S. The annual cost of treating hypertension and associated conditions in 2019 was approximately \$219 billion.¹¹

to five years and screening all others (higher risk adults 18-39 with normotensive blood pressure and all adults forty or older for high blood pressure) annually. Given the benefit of actively engaging with as many attributed members as possible, the AHPN BOM has recommended all AHPN primary care providers screen all adults for hypertension at every health care visit, and at a minimum, annually.

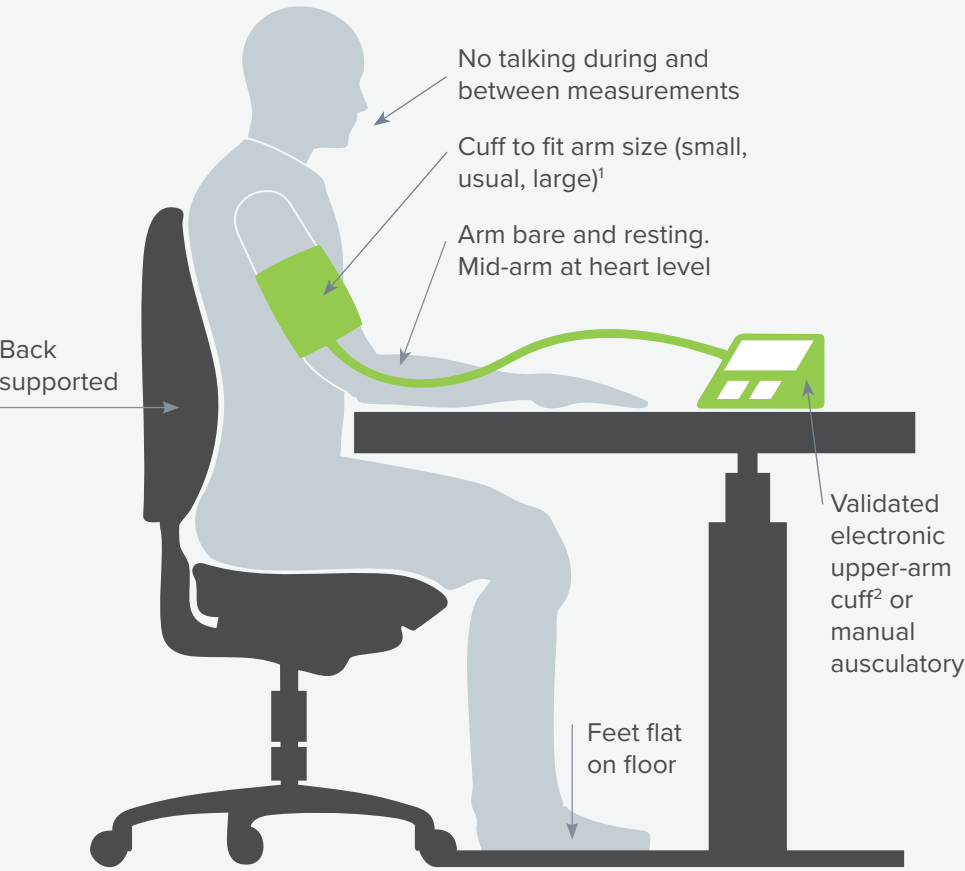
Blood Pressure Monitoring

Blood pressure is a dynamic measurement that measures the force of blood pushing against the walls of arteries as it is pumped by the heart across the body. Systolic blood pressure measures arterial pressure during ventricular contraction and diastolic blood pressure measures arterial pressure during ventricular relaxation. Blood pressure will normally vary based on when, where and how it is measured. Hypertension is defined as the persistent elevation of systolic and diastolic blood pressure reading.

The ability to measure blood pressure accurately remains a major challenge (Figure 1). Accurately assessing blood pressure in the office is a key determinant to correctly identifying hypertension. Pre-measurement preparation including allowing

the patient to rest quietly for three to five minutes in a seated position with their feet on the floor, ensuring the patient has not consumed caffeine, smoked or exercise for a minimum of 30 minutes prior to blood pressure reading, has an empty bladder and is not talking during the rest or measure periods is key to obtaining accurate blood pressure readings. Additionally, the use of a validated, calibrated and correctly sized and positioned blood pressure monitoring device, used by a trained individual, is essential for appropriate blood pressure readings. Blood pressure should be taken while the patient's arm is supported at heart level and with the patient sitting upright in a chair with back support. Blood pressure should ideally be recorded initially in both arms, with future

FIGURE 1 Accurately Measuring Blood Pressure



- ✓ Quiet room, comfortable temperature
- ✓ No smoking, coffee, exercise for 30 minutes
- ✓ Empty bladder
- ✓ Relax for three to five minutes
- ✓ Take three measurements at one-minute intervals
- ✓ Use the average of the last two measurements

¹ For manual auscultatory devices, the inflatable bladder of the cuff must cover 75-100% of the individual's arm circumference. For electronic devices, use cuffs according to device instructions.

² See validated electronic devices lists at www.stridebp.org.

readings being taken in the arm with the higher blood pressure readings. Blood pressure should be obtained three times with a measure interval of one minute between measurements, with the medical professional calculating the average of the last two measurements when identifying the patient's blood pressure readings. If the initial blood pressure reading is less than 130/85 mmHg, additional measurements are not required.

Out of office blood pressure measurements (taken by the patients at home or utilizing a 24-hour ambulatory blood pressure monitoring device) are

Diagnosing Hypertension

Guidelines agree that whenever possible, a diagnosis of hypertension should not be made based on a single reading. Additionally, consensus exists that in cases of lower risk individuals without evidence of hypertension mediated organ damage (HMOD) or who do not have stage 2 hypertension, that ideally blood pressure values should be checked over two to three separate visits at one-to four week intervals, and that office based elevated office base blood pressure readings should be confirmed with home or ambulatory based BP measurements, prior to a diagnosis of hypertension.

Guidelines differ, however, on the definitions of both normal and elevated blood pressure (Table 1). Focusing first on the definition of normal blood pressure, both the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure 2014 guideline (JNC 8), and the American College of Cardiology (ACC)/American Heart Association (AHA) 2017 Management of High Blood Pressure guideline define normal blood pressure as less than 120/80 mmHg.

often necessary for the accurate diagnosis and treatment of hypertension. Patients should follow a similar preparatory protocol to the one identified above for office-based blood pressure reading. Additionally, patients should record, or use a device that automatically records, all home blood pressure readings with date and time. Readings should be taken every morning for three to seven days.

Both ACC/AHA and ISH guidelines agree that office-based blood pressure reading of 140/90 mmHg corresponds to a home blood pressure reading of 135/85 mmHg.

The International Society of Hypertension (ISH) 2020 guideline, however, strikes a more nuanced tone, defining ideal blood pressure as less than 120/80 mmHg and normal blood pressure as less than 130/85 mmHg.

Guidelines also differ as to how to name above normal blood pressure that does not meet stage 1 hypertension criteria. The JNC uses the term “prehypertension,” the ACC/AHA guidelines call this “elevated blood pressure,” and the ISH uses “high-normal” terminology.

Similarly, stage 1 hypertension definitions vary amongst guidelines. JNC 8 defines stage 1 hypertension as a systolic blood pressure reading of 140 mmHg or as a diastolic blood pressure reading of 90 mmHg. The ACC/AHA guideline, however, defines stage 1 Hypertension as a systolic blood pressure reading of 130 mmHg or as a diastolic blood pressure reading of 80 mmHg. Both the 2019 British National Institute of Health and Care Excellence (NICE) and the 2020 International Society of Hypertension (ISH) guidelines agree that the blood

pressure value used to define stage 1 hypertension (termed Grage 1 hypertension in the NICE and ISH guideline) depends on the location where the blood pressure readings were taken. Both guidelines define stage 1 hypertension as an office based systolic blood pressure reading of 140 mmHg, an office based diastolic blood pressure reading of 90 mmHg, a home systolic home-based reading of 135 mmHg, or a home-based diastolic blood pressure reading of 85 mmHg. The NICE guideline, however,

adds the additional requirement that both office and home-based readings must be elevated for a diagnosis of stage 1 hypertension to be made.

The most recent guideline, the American Academy of Family Physicians (AAFP) 2020 guideline, in line with the JNC 8 and ISH guidelines, define stage 1 hypertension as a systolic blood pressure reading of 140 mmHg or a diastolic blood pressure reading of 90 mmHg.

TABLE 1 | Normotensive and Hypertensive Defining Blood Pressure Values by Guideline

	JNC (2003/2014)		ACC/AHA (2017)		NiCE (2019)		ISH (2020)		AAFP (2022)	
BP Category	SBP	DBP	SBP	DBP	SBP	DBP	SBP	DBP	SBP	DBP
Normal	<120	<80	<120	<80			<130°	<85°	Not Defined	
Office					<140	<90				
Home					<135	<85				
Elevated*	120-139	80-89	120-129	<80			130-139	85-89	Not Defined	
Hypertension, stage 1**	140-159	90-99	130-139	80-89					140-159	90-99
Office					140-159^	90-99^	140-159	90-99		
Home					135-159^	85-99^	135-159	85-99		
Hypertension, stage 2**	≥160	≥100	≥140	≥90	≥160	≥100	≥160	≥100	≥160	≥100

SBP: Systolic Blood Pressure

DBP: Diastolic Blood Pressure

° ISH guideline defines ideal blood pressure as less than 120/80 mm Hg and normal blood pressure as less than 130/85 mm Hg.

^ NICE guideline requires both a clinic blood pressure of 140/90 mmHg or higher and ABPM daytime average or HBPM average readings of 135/85 mmHg or higher for diagnosis of stage 1 hypertension.

* JNC uses “prehypertension” terminology; ISH uses “high-normal” terminology.

** NICE & ISH use “grade” vs. “stage” terminology. Both state that threshold of grade 1 blood pressure is dependent on location of blood pressure measurement.

After review of the above guidelines, the AHPN BOM approved the following definitions for normal and elevated blood pressure readings (Table 2).

Regardless of the location or blood pressure readings, consensus exists that prior to a diagnosis of hypertension, that the diagnosis of white-coat hypertension (where a person's blood pressure reading is higher in a clinical setting than it is when measured at home) should be considered. This condition is common, underlying 10-30% of patients with office based elevated blood pressure readings. The white coat hypertension diagnosis requires confirmation with repeated office and out of office blood pressure measurements. If confirmed, as some cases of white coat hypertension require treatment, it is important to stratify a patient’s hypertensive risk based on their total cardiovascular risk, other concurrent diseases and if there is evidence for hypertension mediated target organ damage.¹² If white blood pressure (a condition where blood pressure readings are elevated in a medical setting but normal at other times) is diagnosed, it is important to note that these patients blood pressures should be regularly monitored at home and at the office as some studies have shown increase prevalence of target organ damage including cardiovascular disease, stroke and increased mortality rates as compared with normotensive individuals.

Similarly to white coat hypertension, masked hypertension, or office-based blood pressure readings that are lower than the patient’s true out-of-office blood pressure readings should be

TABLE 2 | Normal and Elevated Blood Pressure Definitions

AHPN		
BP Category	SBP	DBP
Normal	<120	<80
Elevated	120-139	80-89
Hypertension, stage 1	140-159	90-99
Hypertension, stage 2	≥160	≥100

suspected when there is a discrepancy between home or ambulatory and office based blood pressure readings. This is important because masked hypertension is associated with a CVD and all-cause mortality risk that is twice as high as that seen in normotensive individuals.¹³ Both diagnostic assessment and subsequent monitoring of masked hypertension mirror that of white coat hypertension.

Diagnostic Workup

A diagnostic workup on diagnosis of hypertension is essential to both assessing for the possibility of HMOD and secondary hypertension. The history may include a review of the patient’s historical blood pressure values, current and historical antihypertensive treatment, an assessment of other diseases (e.g., cardiovascular disease, diabetes, dyslipidemia, chronic kidney disease), and a review of lifestyle and other personal risk factors (e.g., diet, physical activity level, smoking status, alcohol intake and mental health status). Family history of hypertension, premature cardiovascular disease or diabetes should also be assessed.

Recommended initial laboratory evaluation of hypertension includes an EKG, CMP (blood glucose level, serum, calcium, sodium and potassium, creatinine and GFR), TSH, urine microalbumin to creatinine ratio or urinalysis, hematocrit and lipid panel.^{14, 15} Additional diagnostic testing may be required on a case-by-case basis.

Routine laboratory evaluation of the hypertensive patient is appropriate every six to twelve months. Serum creatinine, eGFR and potassium levels should be checked at these visits. Consider more frequent testing in patients with concurrent CKD and as may be required on a case-by-case basis.

Secondary hypertension, or a specific, remediable cause of hypertension¹⁶ can be identified in approximately 10% of adult patients with hypertension. The ACC/AHA 2017 and 2020 ISH Guidelines recommend screening for secondary hypertension in adults with resistant hypertension, when hypertension is sudden, or noted in individuals under 30 years of age, especially in patients without other hypertensive risk factors. Secondary hypertension is commonly caused by obstructive sleep apnea, primary hyperaldosteronism,

renovascular disease, drug or alcohol-induced hypertension, and renal parenchymal disease. Uncommon causes of secondary hypertension are hyperthyroidism or hypothyroidism, pheochromocytoma, aortic coarctation and Cushing syndrome.¹⁷ Symptoms or signs suggestive of secondary hypertension are varied and may include muscle weakness, muscle cramps, and palpitations (suggesting hypokalemia and associated primary aldosteronism) unexplained sweating, palpitations, and frequent headaches (suggesting pheochromocytoma) and snoring, non-restorative sleep, and unexplained daytime sleepiness (suggesting obstructive sleep apnea).¹⁸

Several medications and herbs may increase blood pressure or reduce effectiveness of antihypertensive therapy (Table 3). While it is important to note that the effect of these medications and substances will vary between different individuals, a medication and supplements screening history for substances that may increase blood pressure readings or may antagonize effects of current antihypertensive medications should be regularly performed for all patients.

TABLE 3 | Drug and Substance Exacerbators and Inducers of Hypertension¹⁹

DRUG SUBSTANCE	POTENTIAL IMPACT*
Non-steroidal anti-inflammatory drugs (NSAIDs)	No difference or an increase of up to 3/1 mmHg with celecoxib 3/1 mmHg increase with nonselective NSAIDs No increase in blood pressure with aspirin NSAIDs can antagonize the effects of RAAS-inhibitors and beta blockers
Combined oral contraceptive pills	6/3 mmHg increase with high doses of estrogen (>50 mcg of estrogen and 1 to 4 mcg progestin)
Antidepressants	2/1 mmHg increase with SNRI (selective norepinephrine and serotonin reuptake inhibitors) Increased odds ratio of 3.19 of hypertension with tricyclic antidepressant use No increases in blood pressure with SSRI (selective serotonin reuptake inhibitors)
Acetaminophen	Increased relative risk of 1.34 of hypertension with almost daily acetaminophen use
Other Medications	Steroids antiretroviral therapy: inconsistent study findings for increased blood pressure. Sympathomimetics: pseudoephedrine, cocaine, amphetamines Anti-migraine serotonergics Recombinant human erythropoietin Calcineurin inhibitors Anti-angiogenesis and kinase inhibitors 11 β-hydroxysteroid dehydrogenase type 2 inhibitors.
Herbal and Other Substances	Alcohol, ma-huang, ginseng at high doses, liquorice, St. John’s wort, yohimbine

* Average increase in blood pressure or risk of hypertension. Individual responses are highly varied between individuals.

Classification of Hypertension Risk

Classification of the patient’s risk of developing cardiovascular disease (CVD) and HMOD (Table 4) is a developing topic. Although full consensus has not been reached, a thoughtful approach to understand the associated risk factors and presence of hypertensive mediated organ damage greatly aids in the stratification of urgency and aggressiveness of hypertension treatment. This approach is based on an assessment of patient’s current blood pressure status, other risk factors (age, gender, BMI, family history, smoking and alcohol status, presence of depression, social determinants of health) and additional known diseases (known coronary artery disease, heart failure, stroke, transient ischemic attack (TIA), peripheral vascular disease, atrial fibrillation or chronic kidney disease stage G3a A1 or higher).

HMOD refers to functional or structural damage in various organs caused by persistently elevated blood pressure. It represents a critical stage in the spectrum of hypertension, indicating end-organ involvement and increased cardiovascular

risk. A common theme in HMOD is hypertensive damage to vascular structures that supply blood to affected organs. The heart is an exception, where hypertension not only increases the likelihood of ischemic heart disease due to atherosclerosis but also triggers muscular remodeling of the cardiac wall, resulting in stiffness and ultimately heart failure with preserved ejection fraction (HFpEF). Other organ systems affected by persistent uncontrolled hypertension include the brain, where it significantly increases the risk of stroke, TIA, and vascular dementia due to small vessel disease. In the kidneys, hypertension raises the likelihood of chronic kidney disease. In the eyes, it leads to retinal and optic nerve damage, often resulting in permanent visual impairment or loss due to hypertensive retinopathy. In the penis, hypertension causes blood vessel damage and reduces arterial elasticity, impairing penile blood flow necessary for achieving and maintaining an erection. Additionally, hypertension accelerates atherosclerotic damage to vascular structures throughout the body, increasing the risk of peripheral arterial disease.

Treatment

Lifestyle modification is the foundation of all anti-hypertensive treatment. These include dietary changes, appropriate levels of physical activity, weight reduction if appropriate, smoking cessation, limiting alcohol and caffeine and a reduction in stress levels are all linked to a reduction in blood pressure or to a reduction in overall cardiovascular disease.

Diet plans such as a Dietary Approaches to Stop Hypertension (DASH) type diet that is low in salt (less than 2300 mg/day and ideally less than 1500 mg/day), saturated fats, cholesterol, processed foods, red and processed meats and high in fresh fruits, vegetables and whole grains are an essential step in hypertension prevention and management. Unless contraindicated by the presence of chronic kidney disease or use of medications that impair potassium excretion, a 3500-5000 mg intake of potassium per day (found in bananas, oranges, potatoes, spinach, sweet potatoes, and legumes) is also beneficial in hypertensive primary and second prevention. Limiting added sugars and concentrated sweeteners is also significantly helpful because of associated improvement in weight control and metabolic health. Adequate magnesium and calcium intake (found in nuts, seeds, leafy greens and low-fat dairy products) supports appropriate vascular tone and cardiac function. Alcohol moderation is also key to maintaining adequate blood pressure control. Light alcohol consumption (less than one standard drink per day) is associated with reduced cardiovascular disease and all-cause mortality. However, moderate, or excess intake (one or more standard drinks per day) increases the risks of hypertension and associated cardiovascular disease in a dose-dependent manner.²⁰ Reducing heavy intake to two drinks per day improves blood pressure; further reductions may not provide additional benefits.

All patients with elevated but non-hypertensive blood pressure should be treated with lifestyle modification and reassessed every three to six months for blood pressure changes that place them in the normotensive or hypertensive categories. Consideration for treatment with antihypertensive agents may be appropriate in this population on a case-by-case basis as determined by the presence

TABLE 5 | Individuals At Higher Risk of Hypertensive complications

Hypertensive Mediated Organ Damage (HMOD)

Left ventricular hypertrophy, heart failure, atrial fibrillation, myocardial infarction, peripheral arterial disease, arterially mediated erectile dysfunction, chronic kidney disease, hypertensive retinopathy or prior history of TIA or CVA.

Cognitive Impairment or Vascular Dementia

Diabetes Mellitus

Cardiovascular Risk Factors

Men older than 55 years and women older than 65 years, sedentary lifestyle, smoking, excess alcohol consumption, dyslipidemia, obesity, or family history of premature cardiovascular disease.

Blood Pressure Resistant to Treatment or Severe

TABLE 4 | Likelihood of Development of CVD Risk or HMOD

Presence and Number of Other Hypertension Associated Risk Factors, Associated Diseases and/or HMOD	Blood Pressure Reading			
	SBP	130-139	140-159	≥160
	DBP	85-89	90-99	≥100
None		Low	Low	Moderate to High
One or two		Low	Moderate	High
More than three		Low to Moderate	High	High
Presence of known HMOD, CKD stage G3a A1 or higher, diabetes mellitus or CVD		High	High	High

of underlying risk factors, associated diseases or the presence of HMOD.

Guidelines are in agreement that a trial of lifestyle modification only is appropriate for some patients with stage 1 hypertension. The ACC/AHA guideline utilizes an ASCVD risk score of less than 10 percent to differentiate between patients who may be trialed on lifestyle modification for three to six months prior to the addition of pharmacotherapy, versus patients that should be started on lifestyle modifications and concurrent pharmacotherapy on hypertension diagnosis.²¹ The ACC/AHA guideline further recommends that providers initially prescribe lifestyle modifications and blood pressure-lowering medication for patients with stage 1 hypertension and clinical CVD, kidney disease or hypertensive end-organ damage.

The 2020 ISH guideline similarly utilizes a hypertensive complication risk assessment to differentiate between grade 1 hypertension patients who may be trialed on lifestyle modification for three to six months prior to the addition of pharmacotherapy, versus patients that should be started on lifestyle modifications and concurrent pharmacotherapy on hypertension diagnosis. Table 5 identifies risk factors for consideration when identifying patients who are at higher risk for hypertensive complications.²²

Both the ACC/AHA and ISH guidelines are in agreement that a target BP reduction of at least 20/10 mmHg, ideally to values lower than grade/ stage 1 hypertension, and that this should occur within three months.²³ Additionally, both guidelines state that if pharmacotherapy is appropriate, that stage 1 hypertension patients should be initiated on one antihypertensive medication and reassessed monthly for hypertension normalization or additional actions.²⁴

All guidelines are further aligned that patients in grade/stage 2 hypertension should be immediately initiated on lifestyle modifications and concurrent pharmacotherapy consisting of two agents (each from a different antihypertensive medication class). These patients should be reassessed monthly for hypertension normalization or for additional actions.

Initial antihypertensive treatment should include an angiotensin-converting enzyme inhibitor (ACEi), an angiotensin receptor blocker (ARB), a long-acting dihydropyridine calcium channel blocker (LA-CCB) or a thiazide diuretic.²⁵ AHPN preferred antihypertensive medications recommended initial and maximal dose and recommended titration intervals are listed in Table 8.

The choice of the initiating (or not initiating) a specific drug class and medication is further dictated by patient’s preference, allergy profile, common medication side effects and a patient’s other comorbidities. For example, a patient with high blood pressure with concurrent G1-G4, A2-A3 chronic kidney disease should be initiated on an ACEi (preferred) or ARB. A second example is a patient with hypertension and stage C or D HFrEF (NYHA stage II-III). This patient should be initiated on HF appropriate beta blockers (even though beta blockers are typically not indicted as antihypertensive first line agents). Furthermore, an ACEi or ARB would not make sense in most patients within this sub-population, given they should ideally be placed on an ARNi (e.g., sacubitril-valsartan). Likewise, while non-dihydropyridine calcium channel blockers (diltiazem or verapamil) could be utilized as secondary anti-hypertensive agents, use of these medications is contraindicated in patients with hypertension and concurrent HFrEF as they have been shown to significantly increase risk for progression to heart failure exacerbation. Recommended drug classes for patients with concurrent HF and CKD, based on the ACC/AHA 2022 Guideline for Management of Heart Failure and KDIGO 2021 Blood pressure in CKD guidelines are noted in Table 6.

TABLE 6 | Hypertensive Agent of Choice with Other Comorbidities

CONCURRENT DIAGNOSIS	PREFERRED DRUG CLASS	SECOND LINE DRUG CLASS	CONTRAINDICATED
CKD (G1-G4, A2-A3)	ACEi	ARB	
HFrEF stage B	ACEi	ARB	Non-DHP CCB
	HF Specific Beta Blocker		
HFrEF stage C (NYHA I)	ACEi	ARB	
HFrEF stage C (NYHA II & III)	HF Specific Beta Blocker	ACEi* or ARB*	Non-DHP CCB. ACEi or ARB if on sacubitril-valsartan
HFrEF stage C (NYHA IV)	ACEi	ARB	Non-DHP CCB
	HF Specific Beta Blocker		
HFmrEF	ACEi	ARB	
	HF Specific Beta Blocker		
HFpEF	ARB	ACEi	

Non-DHP CCB: Non-dihydropyridine calcium channel blockers.
* only use ACEi or ARB if not using sacubitril-valsartan. An ACEi is preferred to ARB in the HFrEF population.

While ideal blood pressure is less than 120/80 mmHg, guidelines also differ as to high blood pressure targets based on age and comorbidities. A summary of recommended blood pressure goals is listed below (Table 7).²⁶

The AHPN BOM recommend a blood pressure target of < 140/90 mmHg with lower blood pressure target (< 130/85) on a case-by-case basis, balancing potential benefits of lower blood pressure readings against increased risk for medication side effects including orthostatic hypotension and syncopal events.

TABLE 7 | Hypertension Therapeutic Targets by Guideline, Age and Comorbidities

YEAR		PATIENT AGE	COMORBIDITY					
			CVD	Diabetes	Diabetes	HF	CKD°	COPD
2014	JNC	≥ 60	< 150/90 ■	≥ 140/90	< 140/90	< 150/90 ■	< 140/90 ■	< 150/90 ■
		< 60	< 140/90	≥ 140/90	< 140/90	< 140/90	< 140/90	< 140/90
2017	AHA/ACC	All Ages	< 130/80	≥ 130/80	< 130/80	< 130/80	< 130/80	< 130/80
2019	NICE	≥ 80	< 150/90	≥ 150/90	< 150/90*	< 150/90	< 150/90*	< 150/90
		< 80	< 140/90	≥ 140/90	< 140/90**	< 140/90	< 140/90**	< 140/90
2020	ISH	≥ 65	< 140/80	< 140/90	< 140/80	<130/80 but >120/70	< 140/80	< 140/80
		<65	< 130/80		< 130/80		< 130/80	< 130/80
2022	AAFP	All Ages	< 140/90***	≥ 140/90	< 140/90***	< 140/90***	< 140/90***	< 140/90***

° KDIGO 2021 BP management in CKD guidelines recommend SBP < 120.

■ In the general population aged ≥60 years, if pharmacologic treatment for high BP results in lower achieved SBP (e.g., <140 mmHg) and treatment is well tolerated and without adverse effects on health or quality of life, treatment does not need to be adjusted.

^ BP target of less than 130/80 mmHg is also reasonable.

* In CKD with albumin to creatinine ratio less than 70 mg/mmol modify target BP to < 140/90 mmHg. In CKD plus albumin to creatinine ratio of 70 mg/mmol or higher modify target BP to < 130/80 mmHg.

** In type 1 DM with albumin to creatinine ratio of 70 mg/mmol or higher or CKD with albumin to creatinine ratio of 70 mg/mmol or higher modify target BP to < 130/80 mmHg.

*** Consider BP target of less than 135/85 mmHg to lower risk for MI (AAFP weak recommendation).

Hypertensive Urgency and Emergency

Hypertensive urgencies and emergencies require immediate intervention. Both scenarios require dangerously elevated blood pressure readings (greater or equal to 180 mmHg systolic, or greater or equal to 120 mm of Hg diastolic). The difference between these is the absence (hypertensive urgency) or presence (hypertensive emergency) of acute organ damage such as stroke, heart attack, acute kidney injury or aortic dissection. Treatment for hypertensive urgency focuses a reduction of blood pressure over a number of hours to days with oral antihypertensive medications, often adjusting the patient’s existing regimen or initiating new oral therapy. In contrast, hypertensive emergency requires immediate hospitalization and rapid blood pressure reduction, typically using intravenous medications, with close monitoring of the patient to prevent further organ damage while avoiding overly rapid blood pressure reduction that could worsen organ perfusion. While this protocol is not intended to address appropriate treatment of hypertensive emergency, it is important that the primary care provider recognizes and appropriately manages this patient subpopulation.

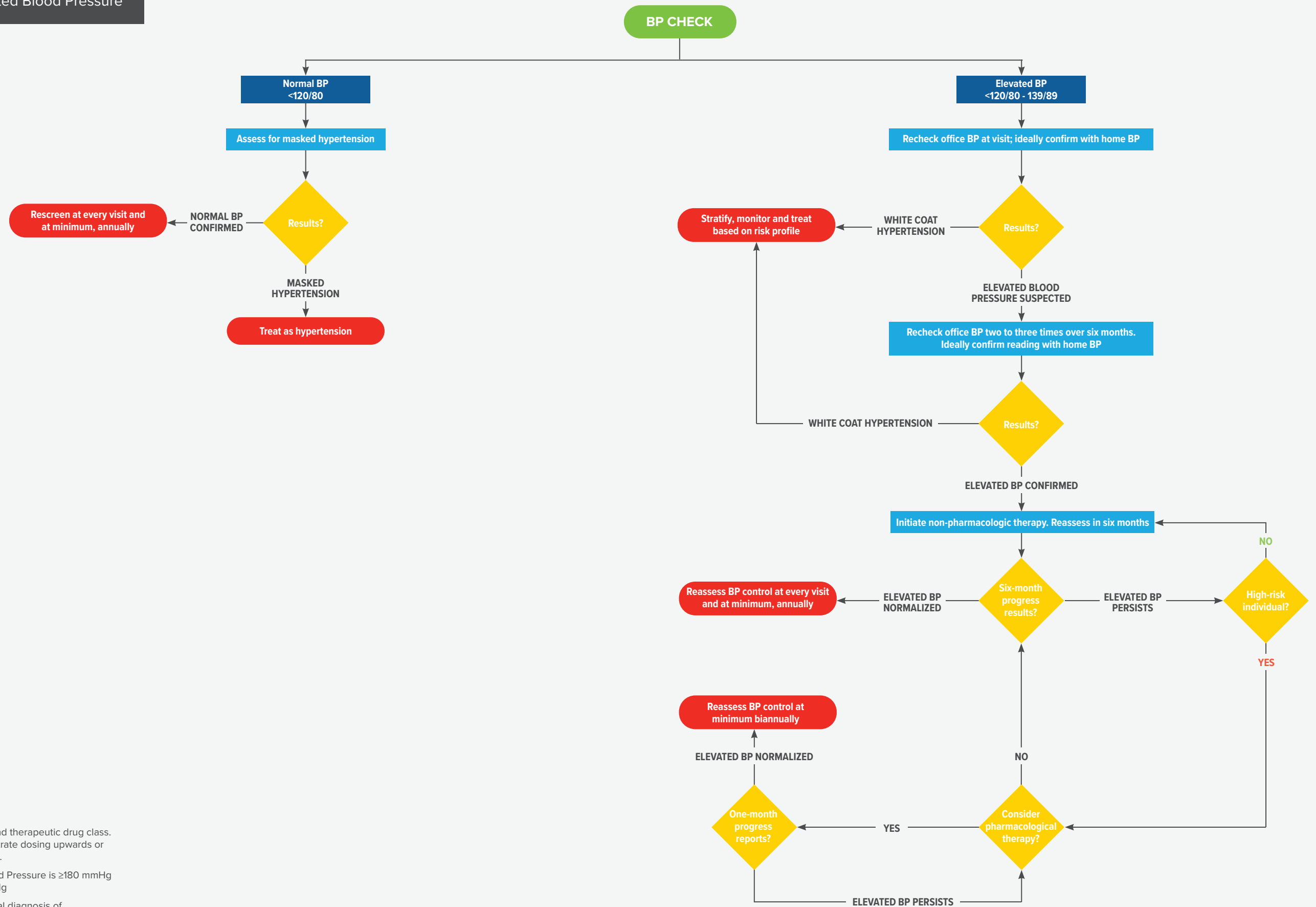
Hypertension Management Protocol Flow Diagrams

Primary care providers remain at the forefront of appropriately managing high blood pressure. Appropriate team-based hypertensive care, led by primary care providers, improves patient health, saves lives, and is a cost-effective strategy to reduce low-value health care-related spending. The following flow diagrams (Figures 2 and 3) summarize the AHPN hypertension management protocol.

TABLE 8 | AHPN Preferred Antihypertensive Medications

TYPE OF THERAPY	DRUG	ESTIMATED GLOBAL MONTHLY COST	INITIAL DOSE	MAX DOSE	TITRATION INTERVAL
		¢ = < \$10.00 \$ = \$20 - \$50 \$\$ = \$50.01 - \$100 \$\$\$ = \$100.01 - \$250 \$\$\$\$ = \$250.01 - \$500 \$\$\$\$\$ = ≥ \$500			
Long-acting dihydropyridine calcium channel blockers	Amlodipine	¢	2.5 mg - 5 mg daily	10 mg daily	evaluate response after ~2 to 4 weeks and titrate dose as needed
	Felodipine	¢	2.5 mg - 5 mg daily	10 mg daily	evaluate response after ~2 to 4 weeks and titrate dose as needed
	Isradipine	\$\$\$	2.5 mg twice daily	5 mg twice daily	evaluate response after ~2 to 4 weeks and titrate dose as needed
	Nifedipine XL				
	Brand Procardia XL	\$\$	30 mg - 60 mg daily	90 mg daily	evaluate response after ~2 to 4 weeks and titrate dose as needed
	Generic Nifedipine XL	\$	30 mg - 60 mg daily	90 mg daily	evaluate response after ~2 to 4 weeks and titrate dose as needed
	Nisoldipine				
	Brand Sular	\$\$\$	17 mg daily	34 mg daily	evaluate response after ~2 to 4 weeks and titrate dose as needed by 8.5 mg/dose
	Generic Nisoldipine ER	\$\$\$	20 mg daily	40 mg daily	evaluate response after ~2 to 4 weeks and titrate dose as needed by 10 mg/dose
Thiazide diuretics	Hydrochlorothiazide	¢	12.5 mg - 25 mg daily	50 mg daily	evaluate response after ~2 to 4 weeks and titrate dose as needed
Thiazide-like diuretics	Chlorthalidone	Not available	12.5 mg - 25 mg daily	25 mg daily	evaluate response after ~2 to 4 weeks and titrate dose as needed
	Indapamide	¢	1.25 mg - 2.5 mg daily	2.5 mg daily	evaluate response after ~2 to 4 weeks and titrate dose as needed
Angiotensin system inhibitors (ACEi)	Benazepril	¢	10 mg daily	40 mg per day in 1 or 2 divided doses	evaluate response after ~2 to 4 weeks and titrate dose (eg, increase the daily dose by doubling)
	Captopril	\$	6.25 mg - 25 mg 2 to 3 times daily	50 mg three times daily	evaluate response after ~1 week and titrate dose as needed
	Enalapril	¢	5 mg - 10 mg daily	40 mg per day in 1 or 2 divided doses	evaluate response after ~2 to 4 weeks and titrate dose (eg, increase the daily dose by doubling)
	Fosinopril	¢	10 mg daily	80 mg daily	evaluate response after ~2 to 4 weeks and titrate dose (eg, increase the daily dose by doubling)
	Lisinopril	¢	5 mg - 10 mg daily	40 mg daily	evaluate response after ~2 to 4 weeks and titrate dose (eg, increase the daily dose by doubling)
	Moexipril	¢	3.75 mg to 7.5 mg daily	30 mg per day in 1 or 2 divided doses	evaluate response after approximately 2 to 4 weeks and titrate dose in 1-step increments
	Perindopril	¢	4 mg daily	16 mg daily	evaluate response after ~2 to 4 weeks and titrate dose (eg, increase the daily dose by doubling)
	Quinapril	¢	10 mg - 20 mg daily	80 mg per day in 1 or 2 divided doses	evaluate response after ~2 to 4 weeks and titrate dose (eg, increase the daily dose by doubling)
	Ramipril	¢	2.5 mg daily	20 mg per day in 1 or 2 divided doses	evaluate response after ~2 to 4 weeks and titrate dose (eg, increase the daily dose by doubling)
	Trandolapril	¢	1 mg daily	4 mg daily	evaluate response after ~2 to 4 weeks and titrate dose (eg, increase the daily dose by doubling)
Angiotensin II receptor blockers (ARB)	Candesartan	\$	8 mg daily	32 mg daily	evaluate response after ~2 to 4 weeks and titrate dose (eg, increase the daily dose by doubling)
	Irbesartan	¢	150 mg daily	300 mg daily	evaluate response after ~2 to 4 weeks and titrate dose (eg, increase the daily dose by doubling)
	Losartan	¢	25 mg - 50 mg daily	100 mg per day in 1 to 2 divided doses	evaluate response after ~2 to 4 weeks and titrate dose (eg, increase the daily dose by doubling)
	Olmesartan	\$	20 mg daily	40 mg daily	evaluate response after ~2 to 4 weeks and titrate dose (eg, increase the daily dose by doubling)
	Telmisartan	¢	20 mg - 40 mg daily	80 mg daily	evaluate response after ~2 to 4 weeks and titrate dose (eg, increase the daily dose by doubling)
	Valsartan	¢	80 mg - 160 mg daily	320 mg daily	evaluate response after ~2 to 4 weeks and titrate dose (eg, increase the daily dose by doubling)

FIGURE 2 | AHPN Hypertension Management Protocol, Normal and Elevated Blood Pressure



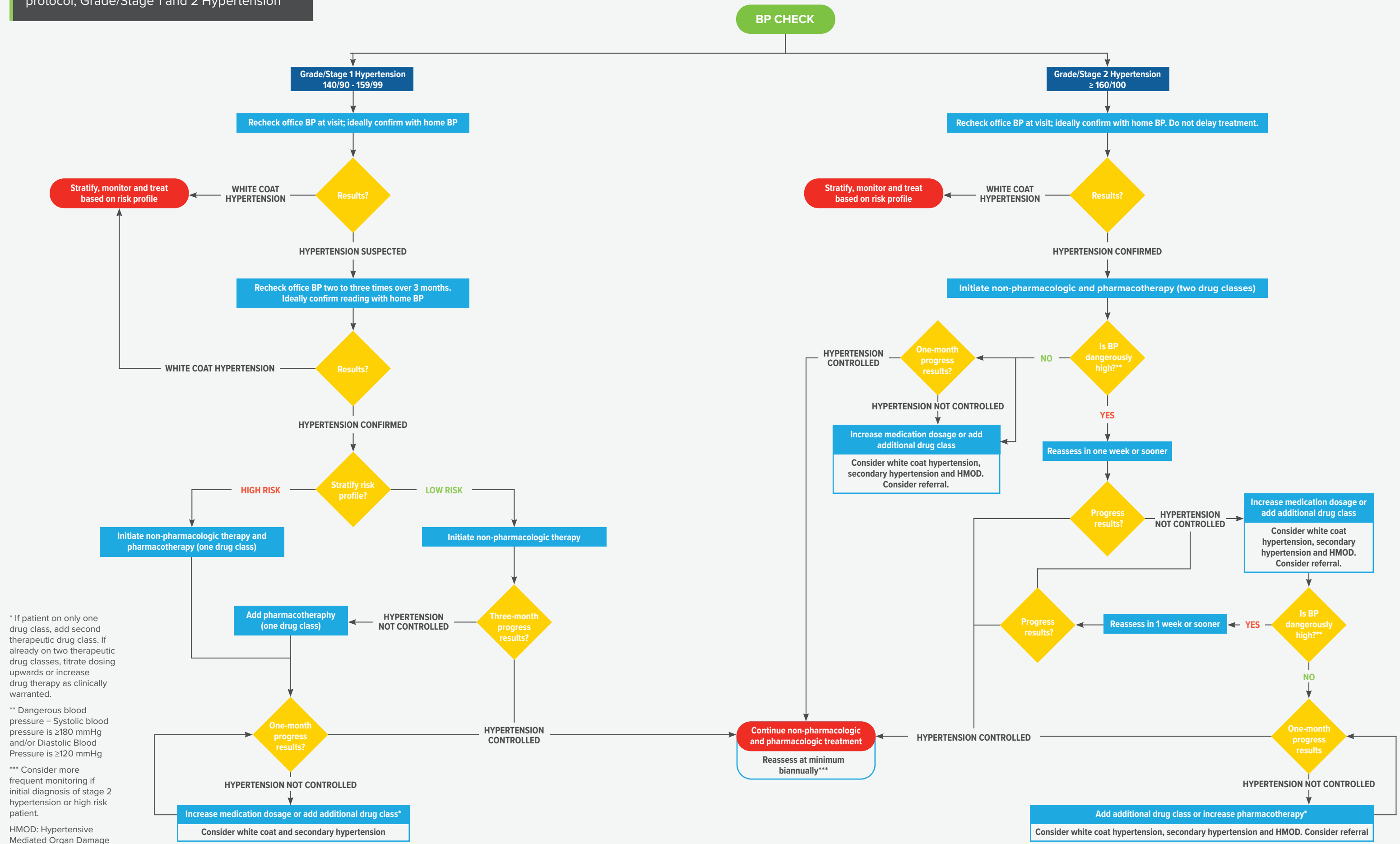
* If patient on only one drug class, add second therapeutic drug class. If already on two therapeutic drug classes, titrate dosing upwards or increase drug therapy as clinically warranted.

** Dangerous Blood Pressure = Systolic Blood Pressure is ≥ 180 mmHg and/or Diastolic Blood Pressure is ≥ 120 mmHg

*** Consider more frequent monitoring if initial diagnosis of stage 2 hypertension or high risk patient.

HMOD: Hypertensive Mediated Organ Damage

FIGURE 3 | AHPN Hypertension Management protocol, Grade/Stage 1 and 2 Hypertension



* If patient on only one drug class, add second therapeutic drug class. If already on two therapeutic drug classes, titrate dosing upwards or increase drug therapy as clinically warranted.

** Dangerous blood pressure = Systolic blood pressure is ≥180 mmHg and/or Diastolic Blood Pressure is ≥120 mmHg

*** Consider more frequent monitoring if initial diagnosis of stage 2 hypertension or high risk patient.

HMOD: Hypertensive Mediated Organ Damage

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