Mount Sinai Health Partners

Mount Sinai Ambulatory Care Pathway

Hypertension

Background

- This document is primarily intended to provide **guidance to support primary care providers and the collaborative team on Hypertension (HTN) management in adults.**
- The optimal care of patients with HTN involves proper measurement, lifestyle counseling, medication management**,** and screening and management of related co-morbidities.
- **The optimal HTN care team is multidisciplinary** and may include physicians, NPs, PAs, pharmacists, nutritionists, care managers, behavioral health providers and home health care professionals.
- **Reducing blood pressure may be accomplished** through proper diet, exercise and the use of more established and newer medication options.
- **New medications, while efficacious, are substantially more expensive.**

Table of Contents

This 2021 MSHS Hypertension Ambulatory Pathway is organized into the following sections:

Introduction

Multiple organizations including the **American College of Cardiology[1], the American College of Physicians/Academy of Family Physicians[2] and the European Society of Cardiology**[3] have published guidelines with differing definitions and workflows for the evaluation and treatment of hypertension (HTN). In addition the CMS Healthcare Effectiveness Data and Information Set (HEDIS) performance measure for controlling high blood pressure defines HTN as a blood pressure at or above 140/90[4]. Since this is the standard used by Medicare and our value based insurers we will continue to use this definition for charting, billing and performance review purposes. With that said, in their 2019 guideline the ACC/AHA emphasizes the critical importance of measuring atherosclerotic cardiovascular disease (ASCVD) risk for all patients with blood pressures at or above 130/80, regardless of stage and incorporating this risk assessment process into treatment goals to drive outcomes[5].

HTN is a major cause of morbidity and mortality. In the US 37 million adults are taking medication for hypertension and millions more are undiagnosed since elevated blood pressure rarely causes symptoms[6]. Among US adults taking antihypertensive medication, 53% have uncontrolled BP. Of US adults with hypertension, 20% were unaware they had the condition.The incidence of ASCVD and all cause mortality scales with blood pressure increases above 130/80 for those advised to start or already taking anti-hypertensive medications. Individuals with HTN face on average nearly $2,000 more in annual healthcare expenses than those without HTN.

Thus the need to screen our patients for hypertension and use evidence based guidelines to inform team based treatment strategies

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[1] Whelton PK, Carey, RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCMA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. J Am Coll Cardiol 2018;71:e127-248.

[2] Qaseem A, Wilt TJ, Rich R, et al. Pharmacologic Treatment of Hypertension in Adults Aged 60 Years or Older to Higher Versus Lower Blood Pressure Targets: A Clinical Practice Guideline From the American College of Physicians and the American Academy of Family Physicians Ann Intern Med. 2017;166:430-437.

[3] Williams B, Mancia G, spiering w et al. 2018 ESC/ESH Guidelines for the management of arterial hypertension: The Taks force for the management of arterial hypertension of the European Society of Cardiology (ESC) and the European Society of Hypertension. European Heart Journal, 2018;33:3021-3104.

[4] Controlling High Blood Pressure (CBP), National Center for Quality Assurance, Controlling High Blood Pressure - NCQA. Accessed April 14, 2021.

[5] Arnett DK, Blumenthal RS, Albert ma, et al 2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Circulation. 2019;140:e596–e646

[6] Centers for Disease Control and Prevention (CDC). Hypertension Cascade: Hypertension Prevalence, Treatment and Control Estimates Among US Adults Aged 18 Years and Older Applying the Criteria From the American College of Cardiology and American Heart Association's 2017 Hypertension Guideline—NHANES 2013–2016external icon. Atlanta, GA: US Department of Health and Human Services; 2019.

Ethnicity, Race and HTN[7]

Hypertension prevalence, treatment and control rates vary significantly according to ethnicity. Such differences are mainly attributed to genetic differences, but lifestyle and social determinants of health, i.e. food availability and substandard housinglikely affect health behaviors such as diet and stress levels – which appear to be major contributors.

Populations From African Descent

Black populations, whether residing in Africa, the Caribbean, United States, or Europe, develop hypertension and associated organ damage at younger ages, have a higher frequency of resistant and nighttime hypertension, and a higher risk of kidney disease, stroke, heart failure (HF), and mortality than other ethnic groups.

Populations From Asian Descent

East Asian populations have a greater likelihood of salt-sensitivity accompanied with mild obesity. When compared to Western populations, East Asian people present a higher prevalence of stroke (particularly hemorrhagic stroke) and non-ischemic HF. Morning hypertension and nighttime hypertension are also more common in Asian, compared with European populations.

South Asian populations originating from the Indian subcontinent have a particularly high risk for cardiovascular and metabolic diseases, including CAD and Type 2 DM. With large hypertensive populations residing in India and China, clinical trials in these populations are required to advise whether current treatment approaches are ideal.

For now management should include standard treatment until more evidence becomes available.

[7] Unger T, Borghi C, Charchar F, et al. 2020 International Society of Hypertension Global Hypertension Practice Guidelines. Hypertension. 2020;75:1334–1357.

Measurement[1,7]

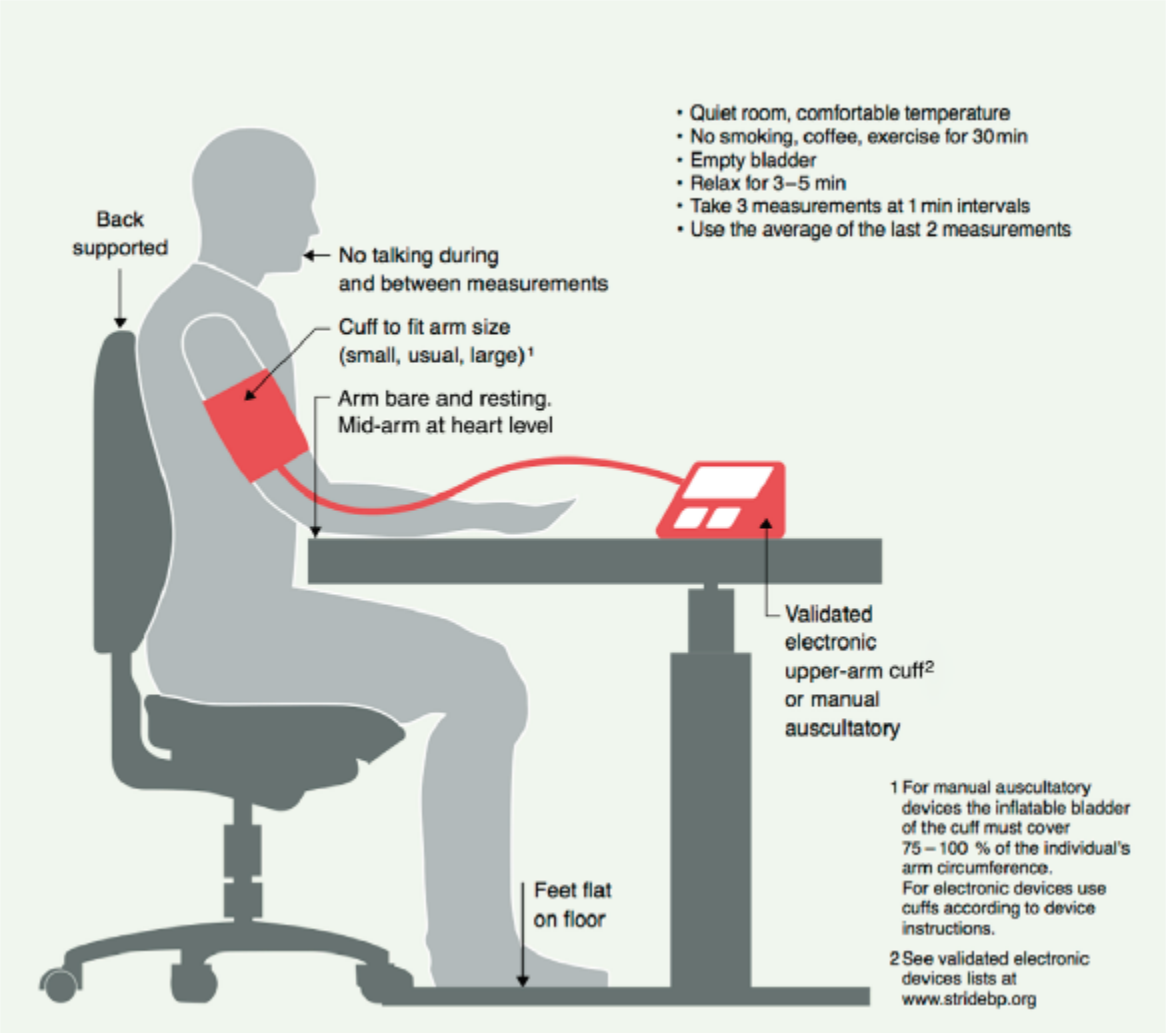

Figure 1: How to Measure Blood Pressure[7]

Initial Evaluation

Each practice should establish local protocols for measuring blood pressure that adhere to national recommendations. Measure BP in both arms, preferably simultaneously. If there is a consistent difference (>10 mmHg) between arms with repeated measurements, use the arm with the higher BP. If the difference is >20 mm Hg, consider further investigation.

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[1] Whelton PK, Carey, RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCMA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. J Am Coll Cardiol 2018;71:e127-248

[7] Unger T, Borghi C, Charchar F, et al. 2020 International Society of Hypertension Global Hypertension Practice Guidelines. Hypertension. 2020;75:1334–1357.

Standing Blood Pressure

Measure in treated hypertensives after 1 min and again after 3 min when there are symptoms suggesting postural hypotension and at the first visit in the elderly and people with diabetes

Out-of-Office Blood Pressure Measurement

Out-of-office BP measurements (by patients at home [HBPM] or with 24-hour ambulatory blood pressure monitoring [ABPM]) are more reproducible than office measurements, more closely associated with hypertension- induced organ damage and the risk of cardiovascular events and can identify both white coat and masked hypertension phenomena (see below).

Out-of-office BP measurement is often necessary for the accurate diagnosis and management of hypertension.

- **"White coat hypertension"** occurs when blood pressure levels in the office are significantly higher (SBP/DBP >20/10 mmHg) than readings obtained at home and is found in 15%-30% of patients with elevated BP readings in the office.
- **"Masked hypertension"** occurs when blood pressures in the office are within normal ranges, but high at home. This is found in 9%-30% of adults..
- In untreated or treated subjects with office BPs classified as high-normal BP systolic 130-139 mm Hg or diastolic 85-89 or grade 1 hypertension (systolic 140–159 mm Hg and/or diastolic 90–99 mm Hg), the BP level should be confirmed with repeated office visits or using HBPM or ABPM.
- While ABPM may be more accurate than HBPM, it is more cumbersome to use, particularly if repeated measurements are required over time.

Table 1: Blood Pressure Measurement Plan According to Office Blood Pressure Levels[7]

Office Blood Pressure Levels (mmHg)		
<130/85	130-159/85-99	>160/100
Remeasure within 3 years (1 year in those with other risk factors)	If possible, confirm with out-of-office blood pressure measurement (high possibility of white coat or masked hypertension). Alternatively, confirm with repeated office visits.	Confirm within a few days or weeks

[7] Unger T, Borghi C, Charchar F, et al. 2020 International Society of Hypertension Global Hypertension Practice Guidelines. Hypertension. 2020;75:1334–1357.

Table 2: Clinical Use of Home Blood Pressure (BP) Monitoring[7]

	Home Blood Pressure Monitoring
Condition	As for office blood pressure (see above)
Position	As for office BP (see above)
Device	Validated electronic (oscillometric) upper-arm cuff device (See approved devices at https://www.validatebp.org).[8]
Cuff	Size according to the individual's arm circumference
Measurement protocol	Before each visit to the health professional: • 3-7 day monitoring in the morning (before drug intake if treated) and the evening • Two measurements on each occasion after 5 min sitting rest and 1 min between measurements Long-term follow-up of treated hypertension: • 1-2 measurements per week or month
Interpretation	Average home blood pressure after excluding readings of the first day ≥135 or 85 mmHg indicates hypertension

Management Guidelines

- Provide recommendations for the frequency of home blood pressure monitoring (e.g., daily versus three times weekly).
- Acknowledge that individual BP readings may vary substantially
- Provide guidance for provider notification about high blood pressure readings (e.g. call primary care provider or team member if above 180/100 mmHg).
- Set office follow-up date with primary care provider or team member to review blood pressure monitor diary (e.g., 2-4 weeks)

Diagnosis[1,7]

The diagnosis of hypertension can be challenging and may require obtaining multiple blood pressure readings in the office and in the patient's home. **Hypertension can be diagnosed when a person's systolic blood pressure (SBP) in the office is ≥140 mm Hg and/or their diastolic blood pressure (DBP) is ≥ 90 mm Hg following repeated examination usually**

[8] American Medical Association (AMA) convened an Independent Review Committee, composed of members who are experts in the hypertension field, to assess whether a BP measurement device satisfied the Validated Device Listing Criteria, 2021

[1] Whelton PK, Carey, RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCMA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. J Am Coll Cardiol 2018;71:e127-248.
[7] Unger T, Borghi C, Charchar F, et al. 2020 International Society of Hypertension Global Hypertension Practice Guidelines. Hypertension. 2020;75:1334–1357.

over 2-3 office visits at 1-4 week intervals. Diagnosis can be made on a single visit if BP is ≥ 180/110 mm Hg and there is evidence of CVD.

High-normal BP is intended to identify individuals who could benefit from lifestyle interventions and who would receive pharmacological treatment, if compelling indications are present.

Isolated Systolic Hypertension, defined as a SBP ≥140 mm Hg with normal DBP, is common in young and in elderly people. In young adults, isolated systolic hypertension is the most common form of essential hypertension and in the elderly it reflects stiffening of the large arteries with an increase in pulse pressure (difference between SBP and DBP).

Table 3. Classification of Hypertension Based on Office Blood Pressure (BP) Measurement[7]

Category	Office Blood Pressure	Home Blood Pressure
Normal BP	<130 and <85	<135 and/or <85
High-normal BP	130-139 and/or 85-89	≥135 and/or >85
Grade 1 hypertension	140-159 and/or 90-99	
Grade 2 hypertension	≥160 and/or ≥100	

Key steps in the management of HTN include the following:

- Confirm the diagnosis
- Calculate the 10-year risk of a first atherosclerotic cardiovascular disease event using the race and sex-specific pooled cohort equations to better stratify atherosclerotic cardiovascular disease risk (e.g. http://tools.acc.org/ASCVD-Risk-Estimator-Plus/#!/calculate/estimate/).
  This risk tool is best validated among non-Hispanic whites and non-Hispanic blacks living in the United States and it may over- or under-estimate risk. For example, the presence of chronic kidney disease (CKD) markedly increases cardiovascular risk, but is not incorporated into this risk calculator. As a result, ASCVD risk is underestimated in patients with CKD. Clinicians may consider use of another risk prediction tool if validated in a population with similar characteristics to the evaluated patient.
- Evaluate for potential comorbid conditions and complications of HTN that may lower goal blood pressure to <130/80.
- Patients with high-normal BP and a 10-yr risk for ASCVD risk >10% can be treated with medical therapy while those with a risk <10% should be managed with non-pharmacological therapy.
- Engage patients in shared decision making based on co-morbidities and CV risk to set therapeutic goals. Patients should know their current cardiovascular risk and how it relates to decisions about their therapy
- Shared decision making occurs when practitioners engage patients in discussions about personalized ASCVD risk estimates and their implications on the perceived benefits of preventive strategies, including lifestyle habits, goals, and medical therapies. Collaborative decisions are more likely to address potential barriers to treatment options and increase long term adherence to medications and lifestyle modifications.

[7] Unger T, Borghi C, Charchar F, et al. 2020 International Society of Hypertension Global Hypertension Practice Guidelines. Hypertension. 2020;75:1334–1357.

- Follow-up visits should include most components of the initial comprehensive medical evaluation, including interval medical history, assessment of medication adherence, medication taking behavior and intolerance/side effects, physical examination and laboratory evaluation as appropriate, and assessment of risk for complications, self-management behaviors, nutrition, and psychosocial health

Risk Assessment[7]

History should include a full assessment for personal and family history of risk factors for CVD, current symptoms, medications or substances and lifestyles that can contribute to elevated blood pressure.

More than 50% of hypertensive patients have additional CVD risk factors, the most common additional risk factors are:

- Diabetes (15%–20%), lipid disorders (elevated LDL-C and triglycerides, 30%), overweight- obesity (40%), metabolic syndrome (40%), hyperuricemia (25%), peripheral arterial disease, CVA including lacunar infarcts as well as smoking, high alcohol intake, and sedentary lifestyle.
- The presence of one or more additional CVD risk factors proportionally increases the risk of coronary, cerebrovascular, and renal diseases in hypertensive patients.

Figure 2: Hypertension Diagnosis, Evaluation, and Treatment Algorithm[7]

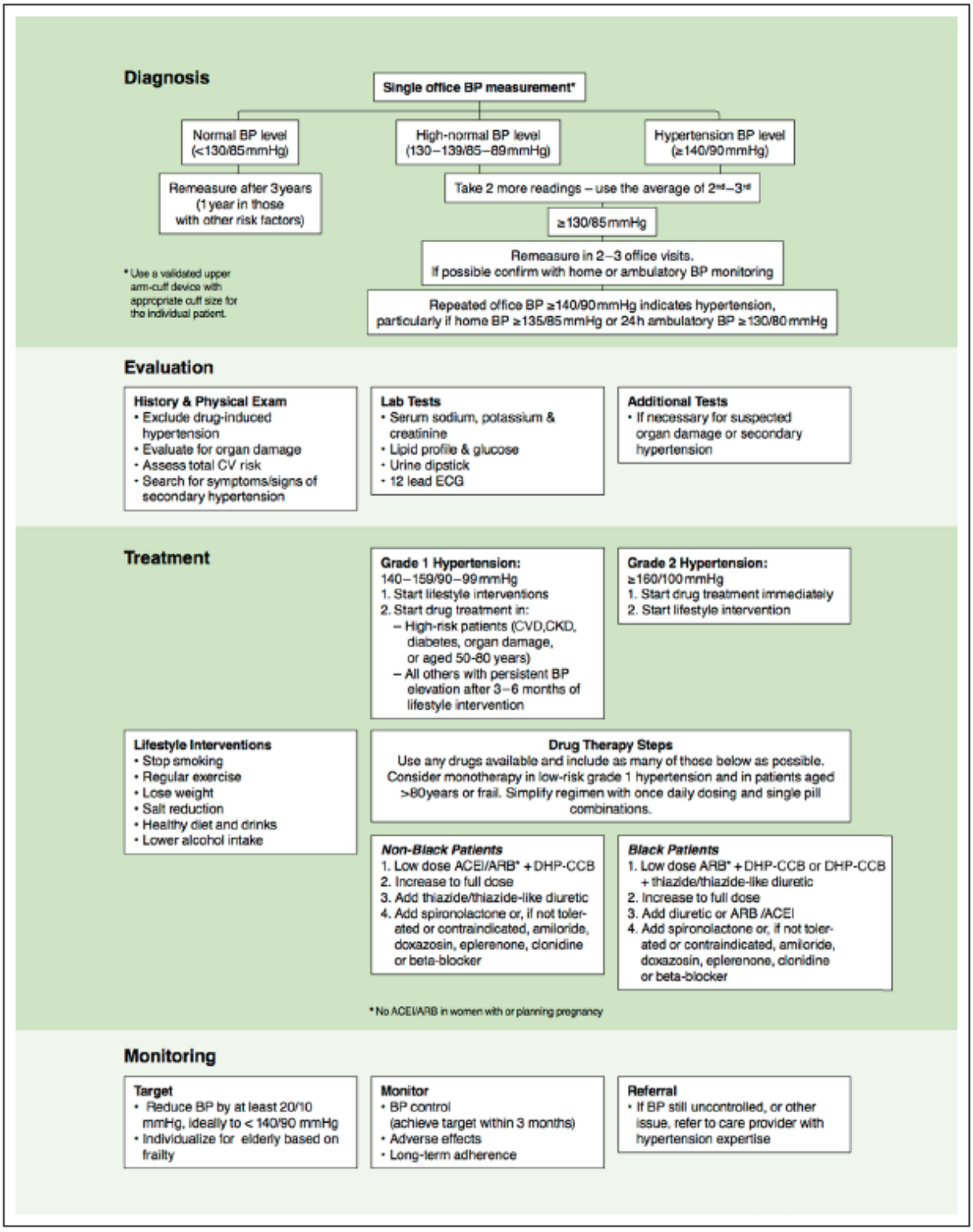

Figure 5. ISH 2020 ESSENTIAL recommendations (minimum standards of care).

Labs should include a basic metabolic panel (BMP), lipids, U/A and EKG. Additional investigations, when indicated, can be undertaken to assess and confirm suspicion of HTN

Mediated Organ Damage (HMOD), coexistent diseases and/or secondary hypertension. These include Fundoscopy,Transthoracic Echocardiography, Carotid Duplex Scans, and Kidney/Renal Artery imaging.

Elevated serum uric acid (UA) is common in patients with hypertension and patients with gout with a uric acid > 6mg/dl, should be treated with diet, urate influencing drugs (losartan, fibrates, atorvastatin) or urate lowering drugs.

Table 4. Simplified Classification of Hypertension Risk according to additional Risk Factors, Hypertension-Mediated Organ Damage (HMOD), and Previous Disease[7]

Other Risk Factors, HMOD, or Disease	High – Normal SBP 130-139 DBP 85-89	Grade 1 SBP 140–159 DBP 90–99	Grade 2 SBP ≥160 DBP ≥100
No other risk factors	Low	Low	Moderate / High
1 or 2 risk factors	Low	Moderate	High
≥3 risk factors	Low / Moderate	High	High
HMOD, CKD grade 3, diabetes mellitus, CVD	High	High	High

*Example based on 60 yr old male patient. Categories of risk will vary according to age and sex

Treatment[1,7]

The therapeutic strategy must include lifestyle modifications, BP control to target and effective treatment of other risk factors to optimize reduction of residual cardiovascular risk.
The combined treatment of hypertension, HMOD and additional cardiovascular risk factors reduces the rate of CVD beyond BP control alone.

Table 5: Lifestyle Modifications[7]

Salt reduction	There is strong evidence for a relationship between high salt intake and increased blood pressure. Reduce salt added when preparing foods, and at the table. Avoid or limit consumption of high salt foods such as soy sauce, fast foods, and processed foods including breads and cereals high in salt.
Healthy diet	Eating a diet that is rich in whole grains, fruits, vegetables, polyunsaturated fats, and dairy products, and reducing food

[7] Unger T, Borghi C, Charchar F, et al. 2020 International Society of Hypertension Global Hypertension Practice Guidelines. Hypertension. 2020;75:1334–1357.

[1] Whelton PK, Carey, RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCMA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. J Am Coll Cardiol 2018;71:e127-248.

	high in sugar, saturated fat, and trans fats, such as the DASH diet (www.dashforhealth.com). Increase intake of vegetables high in nitrates known to reduce BP, such as leafy vegetables and beetroot. Other beneficial foods and nutrients include those high in magnesium, calcium, and potassium, such as avocados, nuts, seeds, legumes, and tofu.
Healthy drinks	Moderate consumption of coffee, green and black tea. Other beverages that can be beneficial include hibiscus tea, pomegranate juice, beetroot juice, and cocoa.
Moderation of alcohol consumption	Positive linear association exists between alcohol consumption, blood pressure, the prevalence of hypertension, and CVD risk. The recommended daily limit for alcohol consumptions in 2 standard drinks for men and 1.5 for women (10 g alcohol/standard drink). Avoid binge drinking.
Weight reduction	Body weight control is indicated to avoid obesity. Particularly abdominal obesity should be managed. A waist-to-height ratio <0.5 is recommended for all populations.
Smoking cessation	Smoking is a major risk factor for CVD, COPD, and cancer. Smoking cessation and referral to smoking cessation programs are advised.
Regular physical activity	Studies suggest that regular aerobic and resistance exercise may be beneficial for both the prevention and treatment of hypertension. Moderate intensity aerobic exercise (walking, jogging, cycling, yoga, or swimming) for 30 minutes on 5-7 days per week or HIIT (high intensity interval training) which involves alternating short bursts of intense activity with subsequent recovery periods of lighter activity. Strength training can also help reduce blood pressure. Performance of resistance/strength exercises on 2-3 days per week.
Reduce stress and induce mindfulness	Chronic stress has been associated to high blood pressure later in life. Although more research is needed to determine the effects of chronic stress on blood pressure, randomized clinical trials examining the effects of transcendental meditation/mindfulness on blood pressure suggest that this practice lowers blood pressure. Stress should be reduced and mindfulness or meditation introduced into the daily routine.
Complementary, alternative, or traditional medicines	Large proportions of hypertensive patients use complementary, alternative, or traditional medicines (in regions such as Africa and China).) yet large-scale and appropriate clinical trials are required to evaluate the efficacy and safety of medicines. Thus, use of such treatment is not yet supported.
Reduce exposure to air pollution	Evidence from studies support a negative effect of air pollution on blood pressure in the long term.

Medication Management - Ideal characteristics of medication treatment include:

- Treatments should be evidence-based in relation to morbidity/mortality prevention.

- **Use once-daily regimen whenever possible, which provides 24-hour blood pressure control.**
- Treatment should be affordable and/or cost-effective relative to other agents.
- Treatments should be well-tolerated.
- For older adults (≥65 yr of age) with hypertension and a high burden of comorbidity and frailty/limited life expectancy, clinical judgment, patient preference,and a team-based approach to assess risk/benefit are reasonable for decisions regarding intensity of BP lowering and choice of antihypertensive drugs.
- There should be evidence of benefits of use of the medication in populations to which it is to be applied.

A reduction in BP of 20/10 mm Hg is associated with a 50% decrease in cardiovascular risk.

First-line pharmacological therapy is recommended as a single pill, combination pill or multiple pills, using a DHP-CCB + ARB/ACE or in Black patients, a thiazide-like diuretic + DHP-CCB or DHP-CCB + ARB. In Black patients, use ARB, not ACE, as angioedema is about 3 times more likely to occur with ACE inhibitors in these individuals.

Medication Adherence[1,7]

Evaluate at each visit and prior to escalation of antihypertensive treatment. Consider the following strategies to improve Medication Adherence

- Use once-daily dosing or single pill combinations (see Table 8)
- Empowerment-based counseling for self-management
- Providing adherence advice to patients, such as linking adherence to daily habits
- Home BP monitoring
- Reminder packaging of medications
- Electronic adherence aids such as mobile phones or short messages services
- Recognize and address comorbid behavioral health disorders
- Multidisciplinary healthcare team approach (i.e. pharmacists) to improve monitoring for adherence

Treatment Targets[1,7]

The treatment goal for most patients who are not at increased risk of atherosclerotic cardiovascular disase is <140/90 mmHg. Patients at increased ASCVD risk and/or have other

[1] Whelton PK, Carey, RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCMA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. J Am Coll Cardiol 2018;71:e127-248

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comorbid disorders appear to benefit from lower blood pressure targets, as indicated below. Treatment goals for patients should be individualized, taking into consideration the severity of comorbid disorders, estimated longevity, and risk of hypotension.

Table 6: Treatment Targets[1,7]

Target Blood Pressure	Risk Profiles and Comorbid Disorders
<140/90	ASCVD Risk <10%
<130/80	ASCVD Risk ≥10%
	Known CAD, prior stroke or TIA
	HFpEF
	HFrEF and achieved maximally tolerated doses of GDMT
	Diabetes mellitus
	Chronic kidney disease
	Chronic obstructive pulmonary disease

Table 7. Oral Anti Hypertensive Drugs[1]

Class	Drug	Usual Dose, Range (mg/day)	Daily Frequency	Comments
Primary Agents				
Thiazide or thiazide-like diuretics	Chlorthalidone	12.5-25	1	Chlorthalidone is preferred on the basis of prolonged half-life and proven trial reduction of CVD. Monitor for hyponatremia and hypokalemia, uric acid and calcium levels. Use with caution in patients with history of acute gout unless patient is on uric acid–lowering therapy.
	Hydrochlorothiazide	25-50	1	
	Indapamide	1.25-2.5	1	
	Metolazone	2.5-5	1	
ACE Inhibitors	Benazepril	10-40	1 or 2	Do not use in combination with ARBs or direct renin inhibitor. There is an increased risk of
	Captopril	12.5-150	2 or 3	
	Enalapril	5-40	1 or 2	

[1] Whelton PK, Carey, RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCMA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. J Am Coll Cardiol 2018;71:e127-248.

[7] Unger T, Borghi C, Charchar F, et al. 2020 International Society of Hypertension Global Hypertension Practice Guidelines. Hypertension. 2020;75:1334–1357.

	Fosinopril	10-40	1	hyperkalemia, especially in patients with CKD or in those on K+ supplements or K+-sparing drugs. There is a risk of acute renal failure in patients with severe bilateral renal artery stenosis. Do not use if patient has history of angioedema with ACE inhibitors. Avoid in pregnancy.
	Lisinopril	10-40	1	
	Moexipril	7.5-30	1 or 2	
	Perindopril	4-16	1	
	Quinapril	10-80	1 or 2	
	Ramipril	2.5-20	1 or 2	
	Trandolapril	1-4	1	
ARBs	Azilsartan	40-80	1	Do not use in combination with ACE inhibitors or direct renin inhibitor.There is an increased risk of hyperkalemia in CKD or in those on K+ supplements or K+-sparing drugs.There is a risk of acute renal failure in patients with severe bilateral renal artery stenosis.Do not use if patient has history of angioedema with ARBs. Patients with a history of angioedema with an ACE inhibitor can receive an ARB beginning 6 weeks after ACE inhibitor is discontinued.Avoid in pregnancy.
	Candesartan	8-32	1	
	Eprosartan	600-800	1 or 2	
	Irbesartan	150-300	1	
	Losartan	50-100	1 or 2	
	Olmesartan	20-40	1	
	Telmisartan	20-80	1	
	Valsartan	80-320	1	
CCB—dihydropyridines	Amlodipine	2.5-10	1	Avoid use in patients with HFrEF; amlodipine or felodipine may be used if required. They are associated with dose-related pedal edema, which is more common in women than men.
	Felodipine	2.5-10	1	
	Isradipine	5-10	2	
	Nicardipine SR	60-120	1	
	Nifedipine LA	30-90	1	
	Nisoldipine	17-34	1	
CCB—nondihydropyridines	Diltiazem ER	120-360	1	Avoid routine use with beta blockers due to increased risk of bradycardia and heart block. Do not use in patients with HFrEF. There are drug interactions with diltiazem and verapamil (CYP3A4 major substrate and moderate inhibitor).
	Verapamil IR	120-360	3	
	Verapamil SR	120-360	1 or 2	
	Verapamil-delayed onset ER	100-360	1 (evening)	
Secondary Agents				
Diuretics—loop	Bumetanide	0.5-2	2	These are preferred diuretics in patients with symptomatic HF. They are preferred over thiazides in patients with moderate-to-severe CKD (eg, GFR <30 mL/min).
	Furosemide	20-80	2	
	Torsemide	5-10	1	

Diuretics—potassium sparing	Amiloride	5-10	1 or 2	These monotherapy agents are minimally effective antihypertensives. Combination therapy of potassium-sparing diuretic with a thiazide can be considered in patients with hypokalemia on thiazide monotherapy. Avoid in patients with significant CKD (eg, GFR <45 mL/min).
	Triamterene	50-100	1 or 2	
Diuretics—aldosterone antagonists	Eplerenone	50-100	1 or 2	These are preferred agents in primary aldosteronism and resistant hypertension. Spironolactone is associated with greater risk of gynecomastia and impotence as compared with eplerenone. This is common add-on therapy in resistant hypertension. Avoid use with K+ supplements, other K+-sparing diuretics, or significant renal dysfunction. Eplerenone often requires twice-daily dosing for adequate BP lowering.
	Spironolactone	25-100	1	
Beta blockers—cardioselective	Atenolol	25-100	1	Beta blockers are not recommended as first-line agents unless the patient has IHD or HF. These are preferred in patients with bronchospastic airway disease requiring a beta blocker. Bisoprolol and metoprolol succinate are preferred in patients with HFrEF. Avoid abrupt cessation.
	Betaxolol	5-20	1	
	Bisoprolol	2.5-10	1	
	Metoprolol tartrate	100-200	2	
	Metoprolol succinate	50-200	1	
Beta blockers—cardioselective and vasodilatory	Nebivolol	5-40	1	Nebivolol induces nitric oxide–induced vasodilation. Avoid abrupt cessation.
Beta blockers—noncardioselective	Nadolol	40-120	1	Avoid in patients with reactive airways disease. Avoid abrupt cessation.
	Propranolol IR	80-180	2	
	Propranolol LA	80-160	1	
Beta blockers—intrinsic sympathomimetic activity	Acebutolol	200-800	2	Generally avoid, especially in patients with IHD or HF. Avoid abrupt cessation.
	Penbutolol	10-40	1	
	Pindolol	10-60	2	
Beta blockers—combined alpha- and beta-receptor	Carvedilol	12.5-50	2	Carvedilol is preferred in patients with HFrEF. Avoid abrupt cessation.
	Carvedilol phosphate	20-80	1	

	Labetalol	200-800	2	
Direct renin inhibitor	Aliskiren	150-300	1	Do not use in combination with ACE inhibitors or ARBs. Aliskiren is very long acting. There is an increased risk of hyperkalemia in CKD or in those on K+ supplements or K+-sparing drugs. Aliskiren may cause acute renal failure in patients with severe bilateral renal artery stenosis. Avoid in pregnancy.
Alpha-1 blockers	Doxazosin	1-8	1	These are associated with orthostatic hypotension, especially in older adults. They may be considered as second-line agent in patients with concomitant BPH.
	Prazosin	2-20	2 or 3	
	Terazosin	1-20	1 or 2	
Central alpha 1-agonist and other centrally acting drugs	Clonidine oral	0.1-0.8	2	These are generally reserved as last-line because of significant CNS adverse effects, especially in older adults. Avoid abrupt discontinuation of clonidine, which may induce hypertensive crisis; clonidine must be tapered to avoid rebound hypertension.
	Clonidine patch	0.1-0.3	1 weekly	
	Methyldopa	250-1,000	2	
	Guanfacine	0.5-2	1	
Direct vasodilators	Hydralazine	100-200	2 or 3	These are associated with sodium and water retention and reflex tachycardia; use with a diuretic and beta blocker. Hydralazine is associated with drug-induced lupus-like syndrome at higher doses. Minoxidil is associated with hirsutism and requires a loop diuretic. Minoxidil can induce pericardial effusion.
	Minoxidil	5-100	1-3	

*Dosages may vary from those listed in the FDA-approved labeling (available at https://dailymed.nlm.nih.gov/dailymed/). ACE indicates angiotensin-converting enzyme; ARB, angiotensin receptor blocker; BP, blood pressure; BPH, benign prostatic hyperplasia; CCB, calcium channel blocker; CKD, chronic kidney disease; CNS, central nervous system; CVD, cardiovascular disease; ER, extended release; GFR, glomerular filtration rate; HF, heart failure; HFrEF, heart failure with reduced ejection fraction; IHD, ischemic heart disease; IR, immediate release; LA, long-acting; and SR, sustained release.

Table 8: Single Pill Medication Combinations[9]

Medication Classes	Generic Name	Brand Name
ARB and Diuretic	Candesartan-HCTZ	Atacand-HCT
	Valsartan-HCTZ	Diovan-HCT
	Losartan-HCTZ	Hyzaar
	Olmesartan-HCTZ	Benicar-HCT
	Telmisartan-HCTZ	Micardis-HCT
	Irbesartan-HCTZ	Avalide
ACE and Diuretic	Quinapril-HCTZ	Accuretic
	Benazepril-HCTZ	Lotensin-HCT
	Enalapril-HCTZ	Vasorectic
	Fosinopril-HCTZ	Monopril-HCT
	Lisinopril-HCTZ	Prinizide, Zestoretic
CCB and ACE/ARB	Amlodipine-Benazepril	Lotrel
	Amlodipine-Valsartan	Exforge
	Amlodipine Olmesartan	Azor
	Amlodipine-Telmisartan	Twynsta
BB and Diuretics	Atenolol-Chlorthalidone	Tenorectic
	Bisoprolol-Chlorthalidone	Ziac
	Metoprolol succinate-HCTZ	Dutoprol
	Metoprolol tartrate-HCTZ	Lopressor HCT

*HCTZ-Hydrochlorothiazide

Resistant Hypertension[1,7]

Resistant hypertension is defined as seated office BP >140/90 mm Hg in a patient treated with three or more antihypertensive medications at optimal (or maximally tolerated) doses including a diuretic and after excluding pseudo-resistance (poor BP measurement technique, white coat effect, non-adherence and suboptimal choices in antihypertensive therapy) as well as substance/drug-induced hypertension and secondary hypertension. Resistant hypertension affects around 10% of hypertensive individuals and increases the risk of CAD, Chronic HF, CVA, EDRD and all-cause mortality. Approximately 50% of patients diagnosed with resistant hypertension have pseudo-resistance rather than true resistant hypertension.

[9] In Epocrates Essentials for Apple IOS Version 4.6. {Mobile application Software} Retrieved from www.epocrates.com, accessed 4/2021

[1] Whelton PK, Carey, RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCMA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. J Am Coll Cardiol 2018;71:e127-248.

[7] Unger T, Borghi C, Charchar F, et al. 2020 International Society of Hypertension Global Hypertension Practice Guidelines. Hypertension. 2020;75:1334–1357.

Treatment

Optimize lifestyle and medications. If GFR <30 or volume overload, initiate loop diuretics. **Add a low dose of spironolactone as the 4th line agent in those whose serum potassium is <4.5 mmol/L and whose eGFR is >45 ml/min to achieve BP targets.** If spironolactone is contraindicated or not tolerated, eplerenone, amiloride, doxazosin, clonidine, and beta-blockers are alternatives, or any available antihypertensive class not already in use. Giving one of the antihypertensive medications in the evening may improve control.

Secondary HTN[1,7]

A specific cause of secondary hypertension can be identified in 5%–10% of hypertensive patients. Early diagnosis of secondary hypertension and the institution of appropriate targeted treatment have the potential to cure hypertension in some patients or improve BP control/reduce the number of prescribed antihypertensive medications in others. **The most common types of secondary hypertension in adults are renal parenchymal disease, renovascular hypertension, primary aldosteronism, chronic sleep apnea, and substance/drug-induced.**

Consider screening for secondary hypertension in:

- Patients with early onset hypertension (<30 years of age) particularly in the absence of hypertension risk factors (obesity, metabolic syndrome, familial history etc.)
- Resistant hypertension
- Individuals with sudden deterioration in BP control
- Hypertensive urgency and emergency
- Those presenting with high probability of secondary hypertension based on strong clinical clues.

Primary Aldosteronism[10]

- **Screen if resistant HTN, hypokalemia (spontaneous or diuretic induced), incidental adrenal mass, CVA < 40 y/o, FHX early onset HTN or primary aldosteromism.**
- Protocol for Diagnosis
    - Correct hypokalemia if present and encourage liberal dietary sodium intake
    - Stop mineralocorticoid receptor antagonists (spironolactone, eplenerone), amiloride, triamterene, and potassium wasting diuretics ≥4 weeks prior to testing,
    - The discontinuation of all potentially confounding medications is not required for screening.

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[1] Whelton PK, Carey, RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCMA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. J Am Coll Cardiol 2018;71:e127-248.

[7] Unger T, Borghi C, Charchar F, et al. 2020 International Society of Hypertension Global Hypertension Practice Guidelines. Hypertension. 2020;75:1334–1357.

[10] Funder JW, Carey RM, Mantero F. The Management of Primary Aldosteronism: Case Detection, Diagnosis, and Treatment: An Endocrine Society Clinical Practice Guideline J Clin Endocrinol Metab, 2016;101:1889–1916

- Measure Aldosterone-Renin Ratio (ARR)
  - Obtain early morning specimen in ambulatory setting, after patient seated for >5 min
  - Measure Plasma Aldosterone (PAC, ng/dl) and Plasma Renin Activity (PRA, ng/ml/hr). Direct Renin Concentrations (DRC, ng/dl) can be used in place of PRA.
  - A PAC-PRA Ratio >30 or PAC-DRC >5.7 are highly suggestive of primary aldosteronism.
- In borderline cases, beta blockers cause false positive results. ACE, ARB, and CKD can cause false negative results.
- Confirmatory testing often required to demonstrate autonomous aldosterone secretion despite salt and fluid loading (saline infusion, fludrocortisone suppression, or dietary sodium loading tests). If spontaneous hypokalemia, PAC >20 ng/dl, and PRA undetectable, then confirmatory testing is not necessary.
- Further evaluation of confirmed cases with adrenal CT scan is indicated to determine disease subtype

Renovascular Disease

- Screen if HTN of abrupt onset or worsening, flash pulmonary edema, early onset HTN especially in women (Fibromuscular Dysplasia)
- Listen for abdominal bruits or bruits over other arteries
- Renal Duplex Ultrasound, MRA or CTA

Renal Parenchymal Disease

- Screen if history of lower urinary tract symptoms, recurrent UTIs, analgesic abuse, family history of polycystic kidneys, abnormalities on physical exam, or abnormal urine dipstick (hematuria, proteinuria).
- Obtain serum creatine to estimate GFR and urine to assess albumin-creatinine ratio (ACR).
- Obtain renal ultrasound if history, exam, or lab results warrant.

Obstructive Sleep Apnea

- Screen if risk factors for sleep apnea present, such as loud snoring, apneaic episodes, daytime sleepiness, morning headaches, obesity, crowded oropharyngeal airway, large neck size (men >17 in, women >16 in), history of heart failure.
- The STOP-BANG questionnaire and other structured screening tools may help identify higher risk patients
- In-laboratory polysomongraphy (PSG) or unattended home sleep apnea testing (HSAT) used for diagnosis

Dietary, Herbal, and Medications that Cause Hypertension

- Caffeine
- Nicotine (tobacco, vaping)
- Alcohol
- Herbals- Ephedra, MaHuang
- Medications (see Table 9)

Table 9: Common Medications That Cause Hypertension[1]

Medication Class	Examples of Specific Medications
Amphetamines	Amphetamines, dextroamphetamine, methylphenidate, dexmethylphenidate
Antidepressants	MAO inhibitors, SNRIs, tricyclic antidepressants
Atypical antipsychotics	Clozapine, olanzapine
Decongestants	Pseudophedrine, phenylephrine
Erythropoeisis Stimulatng Agents	Erythropoeitin
Immunosuppressants	Cyclosporine, tacrolimus
Oral contraceptives	Both estrogen and progesterone containing contraceptives can cause hypertension
Nonsteroidal anti-inflammatory drugs (NSAIDs)	Ibuprofen, naproxen, diclofenac
Systemic corticosteroids	Prednisone, methylprednisolone, dexamethasone, fludrocortisone
Angiogenesis inhibitors	Bevacizumab
Tyrosine kinase inhibitors	Sunitinib, sorafenib

Telehealth Visits[1]

- Telehealth has been demonstrated to improve blood pressure control.
- Both video and telephone-only visits can be utilized
- Proper patient education and preparation for these visits is necessary, including
    - Instructing patients to successfully use the technology
    - Previously ordered lab, imaging, and other tests should be performed ~1 week prior to the appointment
    - Results from home blood pressure monitoring should be uploading into EMR or faxed to office prior to the visit
    - Blood pressure, pulse, and weight should be recorded on the day of appointment
    - Current medications should be available to review during appointment
- **Providers should document the BP, pulse and weight recorded on day of visit in designated structured fields in EMR.**
- After Visit Summaries, patient education materials, orders, and referrals should be mailed to patient after visit

[1] Whelton PK, Carey, RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCMA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. J Am Coll Cardiol 2018;71:e127-248.

Clinical Integration Care Delivery Steps

- **Managing and empowering patients with HTN is a team sport**[1]
- Team-based care of hypertension has been shown to improve blood pressure control
- A **wide-variety of team members** can be involved in the diagnosis, lifestyle changes, medication management and disease management activities. Please see table A below for care delivery steps.
- Below are **potential team members and options** to integrate specialty care, primary care and advanced practice providers.

Table 10. Care Delivery Steps

Care Delivery Step	Possible Team Member(s)
Diagnosis and Severity Classification	Cardiologists, Nephrologists, PCP, Advanced Practice Provider (APP)
Initial Treatment (Lifestyle, Medications, Nutrition)	Cardiologists, Nephrologists, PCP, APP, Clinical Pharmacist
Maintenance Treatment (Medication Adjust/Adherence, Nutrition)	Cardiologists, Nephrologists, PCP, APP, Clinical Pharmacist
Self-Management (Weight monitoring/ Symptom response, Motivational Interviewing)	Cardiologists, Nephrologists, PCP, Clinical Pharmacist, Care Management (RN), Wellness Coach
Coordinate Specialty Treatment or Testing / Advanced Care	Care Management (SW, RN)
Behavioral Health- Screen and Refer/ Initiate Treatment	PCP, APP, Pharmacy, LCSW
Ambulatory Care Management / Home Care Services	Care Managers (RN, SW), Home Health Aide, Community Paramedicine
Tele-monitoring / Home Care Services	Cardiologists, Nephrologists, Clinical Pharmacist, Care Management (RN), Home Health Aide
Palliative Care- Screening	Cardiology, Nephrology, Geriatrics, or Palliative Care Specialist, PCP, APP, Pharmacist, Care Management (RN)

Referrals

Potential indications for referral for specialty care include

- Endocrinology

[1] Whelton PK, Carey, RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCMA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. J Am Coll Cardiol 2018;71:e127-248.

    - **Evaluation and treatment of endocrine causes of secondary hypertension**
    - Treatment of other poorly controlled endocrine disorders that impact HTN care (DM, hyper/hypothyroidism, hypogonadism)
- Cardiology
    - For **treatment of concomitant cardiac disease (CAD, HF, Afib)**
    - Assessment and treatment of renovascular hypertension, particularly non-atherosclerotic causes, such as fibromuscular dysplasia
- Nephrology
    - **Resistant hypertension**
    - To clarify the cause and treatment of comorbid CKD and assistance managing related complications

MSHS Disease Management Services

Clinical Pharmacy and Remote Patient Monitoring

- Pharmacists are a **key part of the care team for chronic disease management** including HTN, diabetes, heart failure, and COPD.[1,11]
- They are **credentialed providers that can prescribe and adjust medications** through the Collaborative Drug Treatment Model.
- Referrals to Pharmacists
    - Uncontrolled chronic diseases, such as: Hypertension, diabetes, heart failure, asthma, COPD, depression, behavioral health
    - Post Discharge
    - High utilizers
    - Polypharmacy, Medication Reconciliation and Medication Adherence

Remote Patient Monitoring (RPM)

- MSHP's "Connected Hearts Program" available across all employed primary care sites
- Enrolled patient receive bluetooth-enabled blood pressure monitoring devices and weight scales, as well as cellular-enable data hubs, provided at no cost to patients.
- Home blood pressure values are encrypted and uploaded into Epic flowsheets
- Pharmacists receive and respond to out-of-range alerts and adjust medications in collaboration with PCP.
- Patients who benefit from enrollment include those with:
    - Poorly controlled hypertension
    - Comorbid disorders that warrant more intensified monitoring and treatment
    - Limit access to office visits
    - Interest and ability to participate in self-mangement

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[1] Whelton PK, Carey, RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCMA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. J Am Coll Cardiol 2018;71:e127-248.

[11] Practice Advisory on Collaborative Drug Therapy Management, American Academy off Managed care pharmacy, https://www.amcp.org/sites/default/files/2019-03/Practice%20Advisory%20on%20CDTM%202.2012_0.pdf. Accessed November 1, 2020

- Patients can be referred using the “Referral to Condition Management Department” order in Epic.
- Medicare and Medicare Advantage Plans cover this service. In absence of secondary insurance, patients are responsible for the 20% coinsurance ($8-20/month). Healthfirst Medicaid and some commercial plans also cover this program.

Certified Diabetes Education Disease Management Team (Wellness coaches)

- Certified Diabetes Educators (CDEs) practice at the top of their license. CDEs are embedded in primary and specialty offices to **help manage patients with both a diagnoses of Diabetes and HTN.**
- Patients receive customized education and strategies to achieve an optimal quality of life. CDE engagement includes:
    - Assessing and educating patients and caregivers on their health conditions,
    - Cohesive collaboration with the medical team to integrate evidenced- based care into patient’s plan of care, ongoing monitoring, real time support and follow up by the medical team,
    - Seamless communication amongst the medical team, and specialty care consultations for high risk patients,
- Oversight and training by a Medical Director and outcomes evaluation.

Care Coordination in HTN at MSHS[12]

- The medical complexity inherent in many patients with HTN requires the involvement of multiple clinicians across many care settings.
- Interdisciplinary, team-based care may be the most effective approach to complex patients
- Mount Sinai Health Partners Care Management social workers and nurses partner with patients, family caregivers, and providers to identify and address known risk factors that can impact patients’ health.
- **Care Management interventions include**:
    - A comprehensive assessment of the patient’s understanding of and ability to manage their illness, including a psychosocial assessment.
    - Development of a comprehensive care plan to set goals to optimize health and quality of life
- **Referral Criteria** may include those with:
    - Multiple no-shows, unexplained non-adherence to medications, testing or treatment
    - Demonstrated difficulty managing symptoms and/or disease processes (including those newly diagnosed)
    - Frequent admissions or ED visits that may be preventable with additional support
    - Complex family dynamics that deplete the provider
    - Difficulty accessing needed community-based care and a high “worry score”, patients you as the provider are most worried about from visit to visit
- **How to refer to Care Management**
    - **Use the MSHP Care Management Referral in Epic (order #391414).**

[12] Information developed and provided by the Mount Sinai Care Management Department

- **Email mshpcmreferral@mountsinai.org or call 212-241-7228.**
- Providers who refer patients can expect:
  - Prompt and efficient processing of your referral
  - Communication about referral processing and assignment through the Epic Inbasket
  - Follow-up from clinical staff within one week of assignment

Behavioral Health[13,14]

- Individuals with chronic conditions are 2-5 times more likely to have anxiety and depressive disorders compared with the general population
- Patients with chronic medical illness and a co-morbid psychiatric diagnosis have poorer quality of life, increased functional disability, and increased mortality to name a few.
- Patients should be screened annually for depression using the PHQ-2/PHQ-9, treated by local PCP or referred to psychiatric services as needed through their current care pathways utilized by their PCP.

[13] Information developed and provided by the Mount Sinai Department of Psychiatry.
[14] Ratcliff, Chelsea & Fletcher, Terri & Petersen, Nancy & Sansgiry, Shubhada & Kauth, Michael & Kunik, Mark & Stanley, Melinda & Cully, Jeffrey. (2017). Recognition of anxiety, depression, and PTSD in patients with COPD and CHF: Who gets missed?. General Hospital Psychiatry. 47. 10.1016