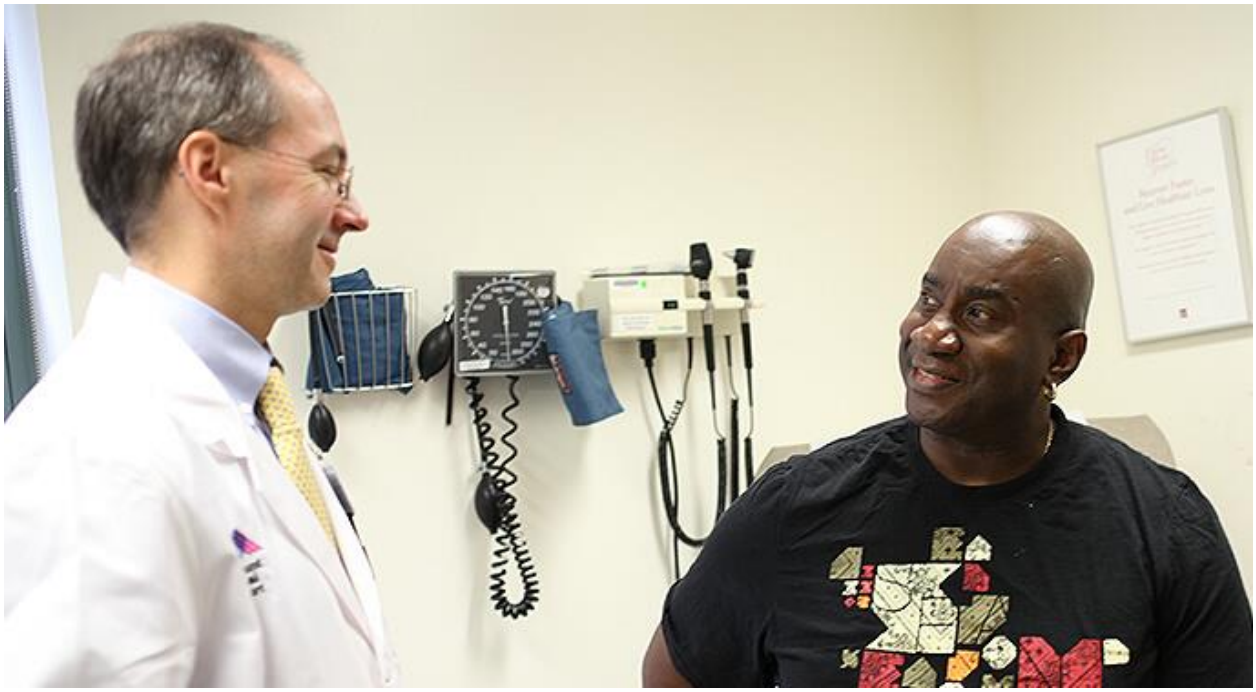
Mount Sinai

Ambulatory Care Pathway



Hypertension

Revised April 2023

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 blood pressure measurement, lifestyle counseling, medication management**,** and screening and management of related co-morbidities.

- **The optimal HTN care team is multidisciplinary** and may include primary physicians and subspecialists, MAs, NPs, PAs, pharmacists, registered dietitians, care managers, behavioral health providers and home health care professionals.

    - Valuable blood pressure (BP) data may come from care providers who aren't managing BP control; BP should be recorded by all care providers whenever it is measured

- **Reducing blood pressure may be accomplished** through diet, exercise and the use of pharmacotherapy including single-pill combinations (i.e amlodipine-telmisartan)

    - Single-pill combinations should be used as the first line of pharmacological treatment whenever available when untreated BP is >140/90 as they are associated with better adherence and persistence than multi-pill regimens

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Introduction

Hypertension (HTN) is a major cause of morbidity and mortality and the #1 modifiable risk factor for the development of cardiovascular disease (CVD). In the US, approximately 37 million adults are taking medication for HTN and millions more are undiagnosed since elevated blood pressure rarely causes symptoms[1]. Among US adults taking antihypertensive medication, 53% remain uncontrolled. Individuals with HTN face on average nearly $2,000 more in annual healthcare expenses than those without HTN.[2]

While there is some debate among professional organizations as to the definitions and workflows for the evaluation and treatment of HTN, we use the CMS Healthcare Effectiveness Data and Information Set (HEDIS) performance measure definition throughout this document.This is the standard for control used by Medicare and our value-based insurers.[3]

For the purposes of this care pathway as well as all Mount Sinai Health System charting, billing, and performance reviews, defines **uncontrolled hypertension** as **blood pressure at or above 140/90 for adults age 18-85**.[4]

The incidence of atherosclerotic cardiovascular disease (ASCVD) and all-cause mortality scales with blood pressure increases above 130/80. It is, therefore, critical to measure ASCVD risk for all patients with blood pressures at or above 130/80, and incorporate this risk assessment process into treatment goals.[5]

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High Risk Populations & Care Inequities

Hypertension prevalence, diagnosis, treatment, and control rates vary significantly by race and ethnicity. Social determinants of health have been shown to have an impact on hypertension outcomes, with minority groups having higher rates of hypertension and lower rates of control.

Black Americans, Hispanic Americans, and Asian Americans have lower rates of BP control than White Americans, despite some similarities in prevalence, awareness, and treatment among these groups. Black adults, however, and Black women especially, have the highest prevalence of hypertension of any race/ethnicity group.[6]

Health care providers have a duty to consider all risk factors for patients and take a holistic approach to understanding their patient's health, including differential access to care, social determinants of health, and their downstream consequences.

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Measurement[7]

Ensure both your staff and patients who self-measure at home understand how to accurately measure blood pressure and are using a validated device.[8] Home blood pressure monitoring may be necessary for accurate diagnosis and effective management.

Initial Evaluation

Follow the below guidelines from the American Heart Association for accurate blood pressure measurement.[9]

Preparation

- Patient should refrain from smoking, coffee, and exercise 30 minutes prior to taking the reading
- Empty the bladder prior to taking the reading
- Use a validated electronic/oscillometic upper-arm cuff (preferred) or manual auscultatory[10]
    - Select the appropriate cuff to fit arm size (small, usual, large)

Taking the Reading

- Sit in a quiet room at a comfortable temperature
- Relax for 3-5 minutes
- Make sure the back is supported and feet are flat on the floor
- Arm should be bare and resting with the mid-arm at the heart level
- Take 3 measurements at 1 minute intervals
    - No talking during and between measurements
    - Use the average of the last 2 measurements

Measure BP in both arms. 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.

Standing/Orthostatic Blood Pressure

Measure in treated hypertensive patients after 1 minute of the initial reading and again after 3 minutes of the initial reading if the patient:

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- Has symptoms suggesting postural hypotension
- Is seeing you for the first time and is ≥ 65 years old

Out-of-Office Blood Pressure Measurement

Out-of-office BP measurement is often necessary for the accurate diagnosis and management of hypertension. Home BP measurements are more reproducible, more closely associated with hypertension-induced organ damage and the risk of cardiovascular events, and can identify both white coat hypertension and masked hypertension.

Phenomenon	Definition	Prevalence
White coat hypertension	In-office BP readings are significantly higher than at-home readings (SBP/DBP >20/10 mmHg)	15-30% of patients with elevated BP readings in the office
Masked hypertension	At-home readings are high but in-office readings are within normal ranges	9-30% of adults

Confirm Stage 1 and Stage 2 readings in patients not taking antihypertensive medications with repeated office visits or using home blood pressure monitoring (HBPM) or ambulatory blood pressure monitoring (ABPM). Out of office measurements to confirm diagnosis are recommended for all patients when able.

Home Blood Pressure Monitoring[11]	
Device	Validated electronic (oscillometric) upper-arm cuff device
Cuff	Size according to the individual's arm circumference

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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
Interpretation	Average home blood pressure ≥135 or 85 mmHg indicates Stage 2 hypertension.* Exclude readings from the first day of home measurement. **Note: This is equivalent to an office BP reading of 140/90*

Patient Guidelines

- Instruct patient how often to self-measure their blood pressure at home (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)

Summary

- Home blood pressure measurement may be necessary for an accurate diagnosis and successful management as those readings are more reproducible and can identify white coat hypertension and masked hypertension
- Ensure patients understand how to correctly measure their blood pressure, how often to do so, and when to contact you about high readings

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Diagnosis[12]

Diagnose hypertension when the patient meets the following criteria:

Category[7]	Office Blood Pressure	Home Blood Pressure
Normal BP	<120 and <80	<120 and/or <80
Elevated	120-129 and 80-89	120-129 and/or <80
Stage 1 hypertension	130-139 and/or 80-89	130-139 and/or 80-89
Stage 2 hypertension	≥140 and/or ≥90	≥135 and/or >85

Note: Home BP of 135/85 is equivalent to office BP of 140/90

Isolated Systolic Hypertension, defined as a SBP ≥140 mm Hg with normal DBP, is common in elderly people. in the elderly it reflects stiffening of the large arteries with an increase in pulse pressure (difference between SBP and DBP).[13]

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Managing Hypertension

Once you have confirmed the diagnosis, order any necessary labs and assess the patient's 10-year risk level for ASCVD.

Labwork

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 Hypertension 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 and urate influencing drugs (losartan, fibrates, atorvastatin) or urate lowering drugs.

Perform Risk Assessment

History should include a full assessment for personal and family history of CVD risk factors, current symptoms, medications or substances, and lifestyle factors 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.

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Calculate the 10-year risk of a first atherosclerotic cardiovascular disease event using ACC's ASCVD Risk Estimator Plus to better stratify ACSVD risk. Epic users can use the dotphrase **.ASCVRISK**.

This risk tool is best validated among non-Hispanic white patients and non-Hispanic black patients 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.

Patients with Stage 1 hypertension and a 10-year ASCVD risk >10% can be treated with pharmacotherapy while those with Stage 1 hypertension and a 10-year ASCVD risk <10% should be managed with non-pharmacological therapy.

Summary

- Once you've confirmed the diagnosis, assess the patient's 10-year ASCVD risk
- History should include a full assessment for personal and family history of CVD risk factors
- Patients with Stage 1 hypertension and a 10-year ASCVD risk >10% can be treated with pharmacotherapy.
- Patients with Stage 1 hypertension and a 10-year ASCVD risk <10% should be managed with non-pharmacological therapy.

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Hypertension Diagnosis, Evaluation, and Treatment Algorithm[14]

Diagnosis

Single office BP measurement

- Normal BP level: (120/80 mmHg) or Elevated BP: (120-129/ <80)
  - Remeasure after 3 years (1 year in those with other risk factors)
- Stage 1 Hypertension BP level: (130-139/80 mmHg)
- Stage 2 Hypertension BP level: (≥140/90 mmHg)

Take 2 more readings. Use the average of the second and third.

≥ 130/85 mmHg

Remeasure in 2-3 office visits. If possible confirm with home BP monitoring.

Repeated office BP ≥130/80 mmHg indicates hypertension

* Use a validated upper arm cuff device with appropriate cuff size for the individual patient

Evaluation

History & Physical Exam
- Exclude drug-induced hypertension
- Evaluate for organ damage
- Assess total CV risk
- Search for symptoms/signs of secondary hypertension

Lab Tests
- Serum sodium, potassium, & creatinine
- Lipid profile & glucose
- Urine dipstick
- 12 lead ECG

Additional Tests
If necessary for suspected organ damage or secondary hypertension

Treatment

LIFESTYLE INTERVENTIONS
- Stop smoking
- Regular exercise
- Lose weight
- Salt reduction
- Healthy diet and drinks
- Lower alcohol intake

Stage 1 Hypertension: ≥ 130/80 mmHg

Stage 2 Hypertension: ≥ 140/90 mmHg

Drug Therapy Steps
- Use any drugs available and include as many of those below as possible.
- Consider monotherapy in low-risk grade 1 hypertension and in patients aged >80 years or frail. Simplify regimen with once daily dosing and single pill combinations.

Monitoring

Target
- Reduce BP by at least 20/10 mmHg, ideally to <140/90 mmHg
- Individualize for elderly based on frailty

Monitor
- BP control (achieve target within 3 months)
- Adverse effects
- Long-term adherence

Referral
- If BP still uncontrolled, or other issue, refer to care provider with hypertension expertise

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Treatment[15]

Reduction in SBP by 10mmHg reduces CVD risk by 20-30% and both lifestyle changes and medications can be key features of the treatment plan.[16]

Engage patients in shared decision making based on co-morbidities and CV risk to set therapeutic goals by including patients in discussions about personalized ASCVD risk estimates and their implications on preventive strategies, goals, and medical therapies.

Patients should know their current cardiovascular risk and how it relates to decisions about their therapy. Collaborative decisions are more likely to address potential barriers to treatment options and increase long term adherence to medications and lifestyle modifications.

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

Non-Pharmacological Treatment

Counsel patients on appropriate lifestyle modifications such as diet, exercise, and smoking cessation.[17] Find a printable version of this chart to share with patients on the Condition Management Hub.

Reduce salt intake	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.

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Consume a healthy and balanced diet	Eat a diet that is rich in whole grains, fruits, vegetables, polyunsaturated fats, and dairy products, and reducing food high in sugar, saturated fat, and trans fats, such as the DASH diet. 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.
Consume coffee, green and black tea, and alcohol in moderation	Consume alcohol, coffee, and green and black tea in moderation.[18] The recommended daily limit for alcohol consumption is 2 standard drinks for men and 1.5 for women (10 g alcohol/standard drink). Avoid binge drinking. Hibiscus tea, pomegranate juice, beetroot juice, and cocoa may be beneficial.[19]
Maintain a healthy body weight	Your blood pressure rises as your body weight increases, and losing excess weight can help lower your blood pressure.
Quit smoking	Smoking is a major risk factor for CVD, COPD, and cancer. Smoking cessation programs are available for patients who need additional support to quit smoking.

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Exercise regularly	Aim for 30 minutes of moderate intensity aerobic exercise (walking, jogging, cycling, yoga, or swimming) or HIIT (high intensity interval training) 5-7 days per week. Strength training 2-3 days per week can also help reduce blood pressure.
Reduce stress and induce mindfulness	Chronic stress has been associated with high blood pressure later in life. Evidence suggests that transcendental meditation/mindfulness lowers blood pressure. Reduce stress where possible and introduce daily mindfulness or meditation.
Complementary, alternative, or traditional medicines	Some patients choose to seek complementary, alternative, or traditional medicines yet efficacy is not yet well understood.
Reduce exposure to air pollution	Evidence from studies support a negative effect of air pollution on blood pressure in the long term.[20]

Pharmacological Treatment

Medication regimens should be:

- Evidence-based in relation to morbidity/mortality prevention

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- **Long-acting and once-daily long-acting** whenever possible to provide 24-hour blood pressure control
- A single-pill formulation when possible
- Affordable and/or cost-effective relative to other agents.
- Well-tolerated with minimal side effects
- Demonstrative of benefits of use in the relevant population

For older adults (≥ 65 years 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/benefits are reasonable for decisions regarding intensity of BP lowering and choice of antihypertensive drugs.

Single-pill combinations should be used as the first line of pharmacological treatment for stage 2 hypertension whenever available as they are associated with better adherence and persistence than multi-pill regimens.[21]

Medication Adherence[22]

Evaluate adherence at each visit and prior to escalation of antihypertensive treatment. Consider the following strategies to improve medication adherence:

- Prescribe once-daily dosing or single pill combinations
- Incorporate medications into daily habits, such as brushing teeth or feeding a pet
- Home BP monitoring
- Reminder packaging of medications, i.e. blister packaging or a pillbox
- 90-day fills of medications with refills if appropriate
- Home delivery of medications from local pharmacy or use of a mail-order pharmacy
- 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

Telehealth Visits[23]

- Telehealth has been demonstrated to improve blood pressure control with self-monitoring

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- Both video and telephone-only visits can be utilized

- Proper patient education and preparation for these visits is necessary
    - Ensure patients understand how to use the telehealth technology
    - Order labs, imaging, and other tests should to be performed about 1 week prior to the appointment
    - Current medications should be available to review during appointment

- **Providers should document the BP and any other vital signs recorded by the patient recorded on day of visit in designated structured fields in EMR, even if the patient submitted via MyChart**

- After Visit Summaries, patient education materials, orders, and referrals should be sent to patient after visit via mail or secure portal messaging

Treatment Targets[24]

Treatment goals for patients should be individualized, taking into consideration the severity of comorbid disorders, estimated longevity, and risk of hypotension.

- The treatment goal for most patients on antihypertensive medications is <130/80 mmHg

- For those not at increased risk of CVD (ASCVD <10%), it is reasonable to target <140/90mmHg with lifestyle intervention alone

    - If pharmacotherpay is intiated in this group, the treatment target is typically <130/80mmHg

- Patients at increased ASCVD risk and/or those who have other comorbid disorders appear to benefit from lower blood pressure targets, as indicated below

Target Blood Pressure	Risk Profiles and Comorbid Disorders
<140/90	• ASCVD Risk <10%

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<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 • COPD

Single Pill Combination Tablets	Dosing Ranges
ACE Inhibitor or ARB + Diuretic	
Losartan-HCTZ*	50-12.5 mg, 100-12.5 mg, 100-25 mg
Lisinopril-HCTZ*	10-12.5 mg, 20-12.5 mg, 20-25 mg
Olmesartan-HCTZ	20-12.5 mg, 40-12.5 mg, 40-25 mg
Valsartan-HCTZ*	80-12.5 mg, 160-12.5 mg, 160-25 mg, 320-12.5 mg, 320-25 mg
Azilsartan-Chlorthalidone	40- 12.5 mg, 40-25 mg
Benazepril-HCTZ*	10-12.5 mg, 20-12.5 mg, 20-25 mg
Candesartan-HCTZ	16-12.5 mg, 32-12.5 mg, 32-25 mg
Captopril-HCTZ*	25-15 mg, 25-25 mg, 50-15 mg, 50-25 mg
Enalapril-HCTZ*	5-12.5 mg, 10-25 mg
Fosinopril-HCTZ	10-12.5 mg, 20-12.5 mg
Irbesartan-HCTZ	150-12.5 mg, 300-12.5 mg
Telmisartan-HCTZ	40-12.5 mg, 80-12.5 mg, 80-25 mg
ACE Inhibitor or ARB + CCB	
Amlodipine-Benazepril*	2.5-10 mg, 5-10 mg, 5-20 mg, 5-40 mg, 10-20 mg, 10-20 mg, 10-40 mg
Amlodipine-Olmesartan	5-20 mg, 5-40 mg, 10-20 mg, 10-40 mg

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Amlodipine-Valsartan*	5-160 mg, 5-320 mg, 10-160 mg, 10-320 mg
Telmisartan-Amlodipine	40-5 mg, 40-10 mg, 80-5 mg, 80-10 mg
Direct Renin Inhibitor + Diuretic	
Aliskerin-HCTZ	150-12.5 mg, 150-25 mg, 300-12.5 mg, 300-25 mg
Beta Blocker + Diuretic	
Atenolol-Chlorthalidone*	50-25mg, 100-25mg
Bisoprolol-HCTZ*	2.5-6.25 mg, 5-6.25mg, 10-6.25 mg
Metoprolol Tartrate-HCTZ	50-25mg, 100-25mg, 100-50mg
K-Sparing Diuretic + Thiazide Diuretic	
Triamterene-HCTZ*	Capsules: 37.5-25mg Tablets: 37.5-25mg, 75-50mg
Amiloride-HCTZ*	5-50mg
Spironolactone-HCTZ*	25-25mg
Triple Combinations *Note: no longer on Medicaid formulary for 2023 and are not covered*	
Olmesartan-Amlodipine-HCTZ	20-5-12.5mg, 40-5-12.5, 40-5-25mg, 40-10-12.5mg, 40-10-25mg
Valsartan-Amlodipine-HCTZ	5-160-12.5mg, 5-160-25mg, 10-160-12.5mg, 10-160-25mg, 10-320-25mg

** Prior Authorization not required per Medicaid NYRx*

Oral Anti-Hypertensive Drugs[25]				
Class	Drug	Dosing Range (mg/day)	Frequency	Comments
Primary Agents				
Thiazide or thiazide-like diuretics	Chlorthalidone	12.5–25mg	Once daily	Chlorthalidone is preferred on the basis of prolonged half-life

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	Hydrochlorothiazide	25–50mg		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.
	Indapamide	1.25–2.5mg		
	Metolazone	2.5–5mg		
ACE Inhibitors	Benazepril	10–40mg	1 or 2x daily	Do not use in combination with ARBs or direct renin inhibitor. There is an increased risk of 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.
	Captopril	12.5–150mg	2 or 3x daily	
	Enalapril	5–40mg	1 or 2x daily	
	Fosinopril	10–40mg	Once daily	
	Lisinopril	10–40mg	Once daily	
	Moexipril	7.5–30mg	1 or 2x daily	
	Perindopril	4–16mg	Once daily	
	Quinapril	10–80mg	1 or 2x daily	
	Ramipril	2.5–20mg	1 or 2x daily	
	Trandolapril	1–4mg	Once daily	
ARBs	Azilsartan	40–80mg	Once daily	Do not use in combination with ACE

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	Candesartan	8–32mg	Once daily	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.
	Eprosartan	600–800mg	1 or 2x daily	
	Irbesartan	150–300mg	Once daily	
	Losartan	50–100mg	1 or 2x daily	
	Olmesartan	20–40mg	Once daily	
	Telmisartan	20–80mg	Once daily	
	Valsartan	80–320mg	Once daily	
CCB—dihydropyridines	Amlodipine	2.5–10mg	Once daily	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	2.5–10mg	Once daily	
Secondary Agents				

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Diuretics—loop	Bumetanide	0.5–2mg	2x daily	These are preferred diuretics in patients with symptomatic HF. They may be preferred over thiazides in patients with moderate-to-severe CKD (eg, GFR <30 mL/min).
	Furosemide	20–80mg	2x daily	
	Torsemide	5–10mg	Once daily	
Diuretics—potassium sparing	Amiloride	5–10mg	1 or 2x daily	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	50–100mg	1 or 2x daily	
Diuretics—aldosterone antagonists	Eplerenone	50–100mg	1 or 2x daily	These are preferred agents in primary aldosteronism and resistant hypertension. Spironolactone is associated with greater risk of gynecomastia and impotence as compared with eplerenone.

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	Spironolactone	25–100mg	Once daily	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.
Beta blockers—cardioselective	Atenolol	25–100mg	Once daily	Beta blockers are not recommended as first-line agents unless the patient has CAD or HF or there is another indication for beta blocker use (migraine prevention, essential tremor). 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	5–20mg	Once daily	
	Bisoprolol	2.5–10mg	Once daily	
	Metoprolol tartrate	100–200mg	2x daily	
	Metoprolol succinate	50–200mg	Once daily	
Beta blockers—cardioselective and vasodilatory	Nebivolol	5–40mg	Once daily	Nebivolol induces nitric oxide–induced vasodilation.

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				Avoid abrupt cessation.
Beta blockers—noncardioselective	Nadolol	40–120mg	Once daily	Avoid in patients with reactive airways disease. Avoid abrupt cessation.
	Propranolol IR	80–180mg	2x daily	
	Propranolol LA	80–160mg	Once daily	
Beta blockers—intrinsic sympathomimetic activity	Acebutolol	200–800mg	2x daily	Generally avoid, especially in patients with IHD/CAD or HF. Avoid abrupt cessation.
	Penbutolol	10–40mg	Once daily	
	Pindolol	10–60mg	2x daily	
Beta blockers—combined alpha- and beta-receptor	Carvedilol	12.5–50mg	2x daily	Carvedilol is preferred in patients with HFrEF. Avoid abrupt cessation.
	Carvedilol phosphate	20–80mg	Once daily	
	Labetalol	200–800mg	2x daily	
Direct renin inhibitor	Aliskiren	150–300mg	Once daily	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.

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Alpha-1 blockers	Doxazosin	1–8mg	Once daily	These are associated with orthostatic hypotension, especially in older adults. They may be considered as second-line agent in patients with concomitant BPH.
	Prazosin	2–20mg	2 or 3x daily	
	Terazosin	1–20mg	1 or 2x daily	
Central alpha 1-agonist and other centrally acting drugs	Clonidine oral	0.1–0.8mg	2x daily	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	0.1–0.3mg	1 weekly	
	Methyldopa	250–1000mg	2x daily	
	Guanfacine	0.5–2mg	Once daily	
Direct vasodilators	Hydralazine	100–200mg	2 or 3x daily	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. *Hydralazine is not a preferred medication*

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				unless all other options have been exhausted.
	Minoxidil	5-100mg	1-3x daily	Minoxidil is associated with hirsutism and requires a loop diuretic for controlling fluid retention associated with the medication. Minoxidil can induce pericardial effusion, and has associated adverse effects of tachycardia and hirsutism. Therefore, Minoxidil should be reserved as a last line option

*Dosages may vary from those listed in the FDA-approved labeling
(available at https://dailymed.nlm.nih.gov/dailymed/)

ACE	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

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ER	extended release
GFR	glomerular filtration rate
HF	heart failure
HFrEF	heart failure with reduced ejection fraction
IR	immediate release
LA	long-acting
SR	sustained release

Summary

- Reduction in SBP by 10mmHg reduces CVD risk by 20-30% and both lifestyle changes and medications can be key features of the treatment plan
- Engage patients in shared decision making to address potential barriers to treatment options and increase long term adherence to medications and lifestyle modifications
- Use single pill formulations when possible; once daily medication regimens are preferred
- Evaluate medication adherence at each visit and prior to escalation of antihypertensive treatment

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Secondary HTN[26]

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 causes of secondary hypertension in adults are renal parenchymal disease, renovascular hypertension, primary aldosteronism, chronic sleep apnea, and substance/drug-induced. A specific cause of secondary hypertension can be identified in 5%–10% of hypertensive patients.

When to screen for secondary hypertension

- Patients with early onset hypertension (<30 years of age), particularly in the absence of hypertension risk factors (obesity, metabolic syndrome, familial history etc.)
- 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[27]

When to screen for primary aldosteronism

- Resistant HTN
- Hypokalemia (spontaneous or diuretic induced)
- Incidental adrenal mass
- CVA < 40 y/o
- Family history of early onset HTN or primary aldosteromism[28]

Protocol for diagnosis

Prior to Labs

- Correct hypokalemia if present
- 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
- Measure Aldosterone-Renin Ratio (ARR)

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- 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

Interpreting Labs and Further Evaluation

- A PAC-PRA Ratio >30 or PAC-DRC >5.7 are highly suggestive of primary aldosteronism

- 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

Caution

- In borderline cases, beta blockers cause false positive results
- ACE, ARB, and CKD can cause false negative results

Renovascular Disease

When to screen

- HTN of abrupt onset or worsening
- Flash pulmonary edema
- Early onset HTN especially in women (fibromuscular dysplasia)

Diagnosis

- Listen for abdominal bruits or bruits over other arteries
- Renal Duplex Ultrasound, MRA or CTA

Renal Parenchymal Disease

When to screen

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- Screen all patients with hypertension

Diagnosis

- Obtain serum creatine to estimate GFR and urine to assess albumin-creatinine ratio (ACR)
- Obtain renal ultrasound if history, exam, or lab results warrant further diagnositics

Obstructive Sleep Apnea

When to screen

- 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

Diagnosis

- 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) can be used for diagnosis

Dietary and lifestyle habits, herbals, and medications that cause hypertension

- Caffeine
- Nicotine (tobacco, vaping)
- Alcohol
- Herbals such as ephedra/ma huang
- Medications (see table on next page)

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Medication Class[29]	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	• Estrogen-based • Progesterone-based

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Nonsteroidal anti-inflammatory drugs (NSAIDs)	• Ibuprofen • Naproxen • Diclofenac
Systemic corticosteroids	• Prednisone • Methylprednisolone • Dexamethasone • Fludrocortisone
Angiogenesis inhibitors	• Bevacizumab
Tyrosine kinase inhibitors	• Sunitinib • Sorafenib

Summary

- Screen for secondary hypertension when appropriate
- In addition to medical conditions such as primary aldosteronism, chronic sleep apnea, and renal parenchymal disease, diet and lifestyle and medications and herbals can also cause secondary hypertension

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Resistant Hypertension[30]

Diagnosis

Diagnose resistant hypertension in patients with seated office BP >140/90 mm Hg AND:

- Treated with three antihypertensive medications at optimal (or maximally tolerated) doses including a diuretic
- Pseudo-resistance (poor BP measurement technique, white coat effect, non-adherence and suboptimal choices in antihypertensive therapy) has been ruled out
- Substance/drug-induced hypertension has been ruled out
- Secondary hypertension has been ruled out

Caution

Approximately 50% of patients diagnosed with resistant hypertension have pseudo-resistance rather than true resistant hypertension. Patients with resistant hypertension should be evaluated for secondary causes.

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 if

- Serum potassium is <4.5 mmol/L
- eGFR is >45 ml/min

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.

Summary

- Patients with resistant hypertension should be evaluated for secondary causes

Clinical Integration Care Delivery Steps

Team-based care of hypertension has been shown to improve blood pressure control and a wide variety of team members can work together for diagnosis, lifestyle changes, medication management and disease management.[31]

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

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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)

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Consider a referral for evaluation and treatment of:	
Cardiology	• Concomitant cardiac disease (CAD, HF, Afib) • Renovascular hypertension, particularly non-atherosclerotic causes, such as fibromuscular dysplasia
Endocrinology	• Endocrine causes of secondary hypertension • Other poorly controlled endocrine disorders that impact HTN care (DM, hyper/hypothyroidism, hypogonadism)
Nephrology	• Resistant hypertension • Comorbid CKD and related complications

Mount Sinai Health System employed providers should consider an e-consult if available

Clinical Pharmacy

Pharmacists are a key part of the care team for chronic disease management including HTN, diabetes, heart failure, and COPD.[32]

They are **credentialed providers that can prescribe and adjust medications** through the Collaborative Drug Treatment Model.

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Refer to pharmacy for assistance managing

- 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 Remote Patient Monitoring is available across all Mount Sinai primary care sites. 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.

Enrolled patient receive bluetooth-enabled blood pressure monitoring as well as cellular-enabled data hubs. 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.

Consider RPM for patients with

- Poorly controlled hypertension
- Comorbid disorders that warrant more intensified monitoring and treatment
- White coat hypertension
- Limit access to office visits
- Interest and ability to participate in self-mangement

Patients can be referred using the
"Referral to Condition Management Department" order in Epic

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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 diabetic patients with 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 Management

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

When to consider a care management referral

- Multiple no-shows
- Unexplained non-adherence to medications, testing, or treatment

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- 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
- Patients you are most worried about from visit to visit

How to refer to care management

- Use the MSHP Care Management Referral in Epic (**order #391414**)
- 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[33]

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 comorbid psychiatric diagnosis have poorer quality of life, increased functional disability, and increased mortality.

- Screen patients **annually** for depression using the PHQ2/PHQ9
- PCPs can treat and manage or refer to behavioral health services as needed

Summary

- Team-based care has been shown to improve blood pressure control
- The health system offers disease management resources such as clinical phamacists, remote patient monitoring, and care management to help you manage patients with hypertension
- Screen patients annually for depression using the PHQ2/PHQ9

[1] 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 2013–2016. Atlanta, GA: US Department of Health and Human Services; 2019.
[2] Kirkland, E. B., Heincelman, M., Bishu, K. G., Schumann, S. O., Schreiner, A., Axon, R. N., Mauldin, P. D., & Moran, W. P. (2018). Trends in healthcare expenditures among US adults with hypertension: National Estimates, 2003–2014. Journal of the American Heart Association, 7(11). https://doi.org/10.1161/jaha.118.008731
[3] See guidelines from the American College of Cardiology, the American College of Physicians/Academy of Family Physicians, and the European Society of Cardiology.
[4] https://qpp.cms.gov/docs/QPP_quality_measure_specifications/Web-Interface-Measures/2022_Measure_HTN2_CMSWebInterface_v6.0.pdf
[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
[6] Aggarwal R, Chiu N, Wadhera A, et al. Racial/Ethnic Disparities in Hypertension Prevalence, Awareness, Treatment, and Control in the United States, 2013 to 2018. Hypertension. 2021;78:1719–1726. https://doi.org/10.1161/HYPERTENSIONAHA.121.17570
[7] Unger T, Borghi C, Charchar F, et al. 2020 International Society of Hypertension Global Hypertension Practice Guidelines. Hypertension. 2020;75:1334–1357; 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
[8] Validatebp.org
[9] Patient-friendly handouts are available in English, Spanish, and Chinese at https://www.heart.org/en/health-topics/high-blood-pressure/understanding-blood-pressure-readings/monitoring-your-blood-pressure-at-home
[10] 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.
[11] Unger et al. Global Hypertension Practice Guidelines.
[12] Unger et al. Global Hypertension Practice Guidelines; Whelton PK at al. ACC/AHA Task Force on Clinical Practice Guidelines 2018.
[13] Basile, J. (2002). Hypertension in the elderly: A review of the importance of systolic blood pressure elevation. Journal of Clinical Hypertension, 4(2), 108-119. doi: 10.1111/j.1524-6175.2001.00903.x
[14] Unger et al. Global Hypertension Practice Guidelines.
[15] Unger et al. Global Hypertension Practice Guidelines; Whelton PK at al. ACC/AHA Task Force on Clinical Practice Guidelines 2018.
[16] Carey RM, Moran AE, Whelton PK. Treatment of Hypertension: A Review. *JAMA.* 2022;328(18):1849–1861. doi:10.1001/jama.2022.19590
[17] Unger et al. Global Hypertension Practice Guidelines.
[18] A positive linear association exists between alcohol consumption, blood pressure, the prevalence of hypertension, and CVD risk.
[19] Bonilla Ocampo, D., Paipilla, A., Marín, E., Vargas-Molina, S., Petro, J., & Pérez-Idárraga, A. (2018). Dietary nitrate from beetroot juice for hypertension: A systematic review. Biomolecules, 8(4), 134. https://doi.org/10.3390/biom8040134
[20] Ghaznavi, R., Ahmadi, A., Shirani, M., & Kheirmand, M. (2020). The effect of pollution on hypertension and on the total risk score in hypertensives. E-Journal of Cardiology Practice, 22.
[21] Hripcsak, G., Suchard, M. A., Shea, S., Chen, R., You, S. C., Pratt, N., ... & Ross, J. S. (2020). Comparison of cardiovascular and safety outcomes of chlorthalidone vs hydrochlorothiazide to treat hypertension. Hypertension, 76(2), 524-531. doi: 10.1161/HYPERTENSIONAHA.120.15781.

Return to TOC

[22] Unger et al. Global Hypertension Practice Guidelines; Whelton PK at al. ACC/AHA Task Force on Clinical Practice Guidelines 2018.
[23] Whelton PK at al. ACC/AHA Task Force on Clinical Practice Guidelines 2018.
[24] Unger et al. Global Hypertension Practice Guidelines; Whelton PK at al. ACC/AHA Task Force on Clinical Practice Guidelines 2018.
[25] Whelton PK at al. ACC/AHA Task Force on Clinical Practice Guidelines 2018.
[26] Unger et al. Global Hypertension Practice Guidelines; Whelton PK at al. ACC/AHA Task Force on Clinical Practice Guidelines 2018.
[27] 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
[28] Cohen, J. B., Cohen, D. L., Herman, D. S., Verbalis, J. G., & Renna, N. F. (2021). Testing for primary aldosteronism and mineralocorticoid receptor antagonist use among US veterans: A retrospective cohort study. Annals of Internal Medicine, 174(5), 656-663. doi: 10.7326/M20-4873.
[29] Whelton PK at al. ACC/AHA Task Force on Clinical Practice Guidelines 2018.
[30] Unger et al. Global Hypertension Practice Guidelines; Whelton PK at al. ACC/AHA Task Force on Clinical Practice Guidelines 2018.
[31] Whelton PK at al. ACC/AHA Task Force on Clinical Practice Guidelines 2018.
[32] 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; Whelton PK at al. ACC/AHA Task Force on Clinical Practice Guidelines 2018.
[33] 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

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