



# Hypertension in Primary Care



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# Learning Objectives

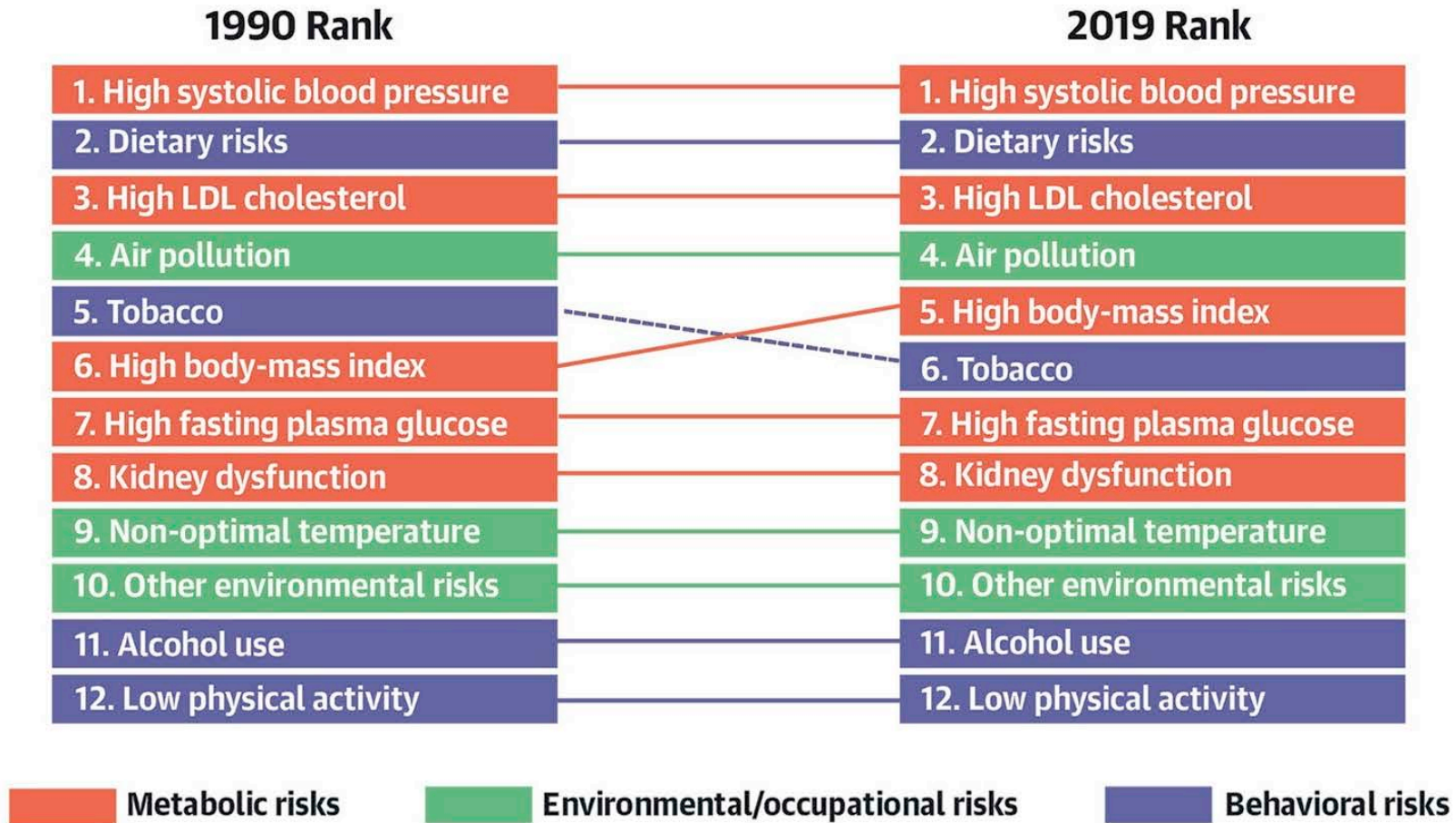
- Diagnose hypertension (HTN) using current guidelines and proper measurement.
- Counsel patients about **lifestyle** and **pharmacotherapy** options to manage HTN.
- Summarize secondary causes of HTN, and when HTN should be managed by a specialist.

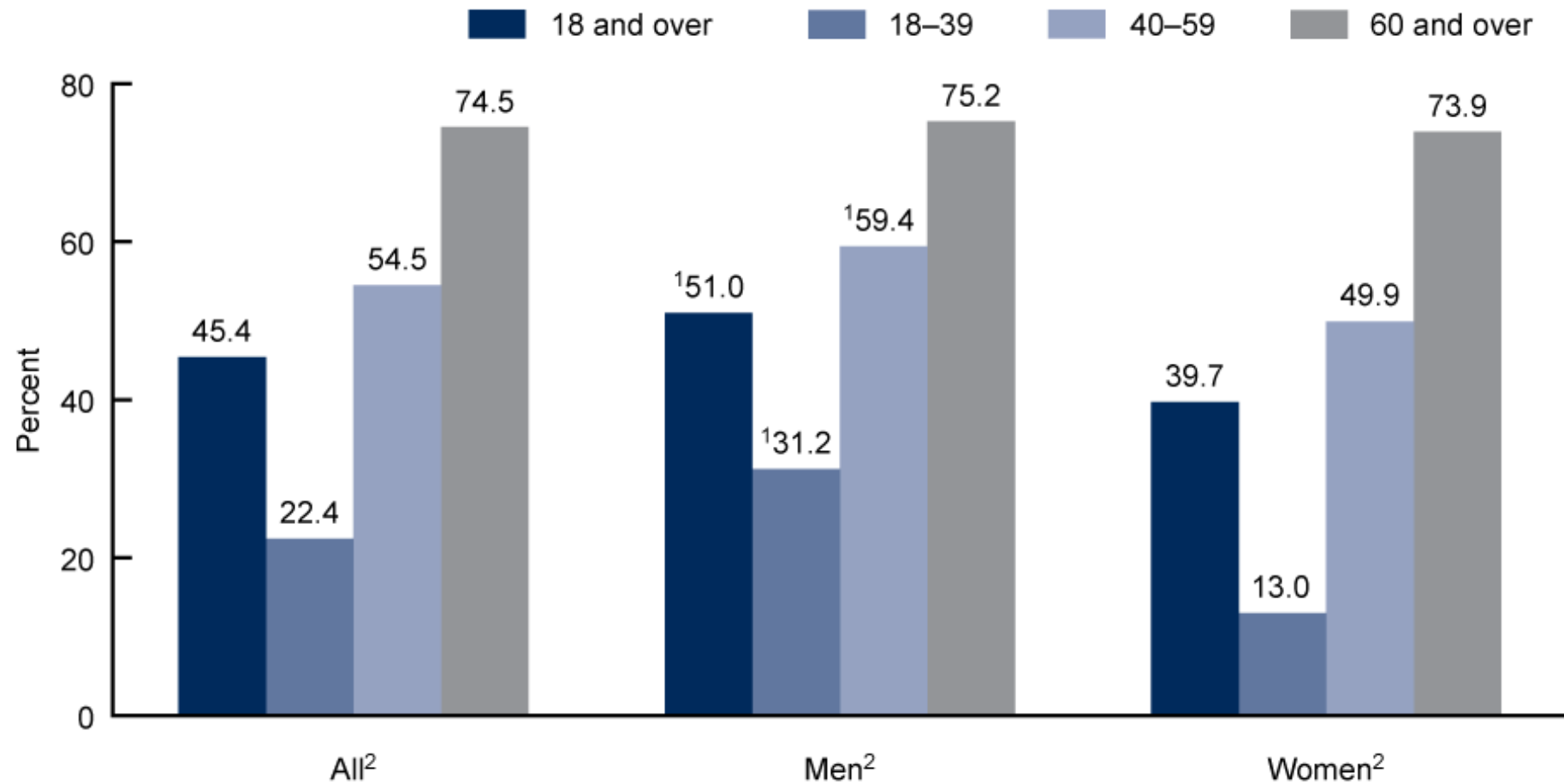
# Global analysis of HTN

- The number of adults aged 30–79 years with hypertension has increased from 650 million to 1.28 billion (1990-2019).
- About 580 million people with hypertension (**41% of women and 51% of men**) are NOT diagnosed with HTN.
- With known hypertension, **fewer than 1 in 4 women and 1 in 5 men are controlled.**



# CVD Burden Attributable to Modifiable Risk Factors





2017-18 NHANES data, BP ≥ 130/80 for U.S.

# USPSTF

Population	Recommendation	Grade
Adults 18 years or older without known hypertension	The USPSTF recommends screening for hypertension in adults 18 years or older with office blood pressure measurement (OBPM). The USPSTF recommends obtaining blood pressure measurements outside of the clinical setting for diagnostic confirmation before starting treatment.	<b>A</b>

# USPSTF

Population	Recommendation	Grade
Children and adolescents	The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for high blood pressure in children and adolescents.	I

The [American Academy of Pediatrics](#) recommends obtaining a blood pressure reading at well child checks **beginning at age 3 years old**.



<b>Guideline Differences</b>	<b>2017 ACC/AHA</b>	<b>2023 ESH</b>
<b>Hypertension Definition</b>	≥ 130/80	≥ 140/90
Normal BP Ranges (mmHg)	Normal: < 120/80 Elevated: 120-129/<80	Optimal: < 120/80 Normal: 120-129/80-84 High-Normal: 130-139/85-89
Hypertensive BP Ranges (mmHg)	Hypertension Stage 1: 130-139/80-89 Hypertension Stage 2: ≥ 140/90	Hypertension Grade 1: 140-159/90-99 Hypertension Grade 2: 160-179/100-109 Hypertension Grade 3: ≥ 180/110

# Diagnosing HTN in Adults





	Standard office BP Measurement	Automated Office BP	Ambulatory BPM	Home BPM
Measurement parameter(s)	Resting office BP	Resting office BP	Dynamic day BP (responses to exercise, meals, drugs); BP pattern (Nocturnal ↑, nocturnal BP dipping, early AM BP surge)	Resting home BP
Detects White Coat HTN	No	No	Yes	Yes
Detects Masked HTN	No	No	+++	++
Sensitivity for est. CVD event risk	+	+	+++	++



# 7 SIMPLE TIPS TO GET AN ACCURATE BLOOD PRESSURE READING

The common positioning errors can result in inaccurate blood pressure measurement. Figures shown are estimates of how improper positioning can potentially impact blood pressure readings.

Sources:

1. Pickering, et al. Recommendations for Blood Pressure Measurement in Humans and Experimental Animals Part 1: Blood Pressure Measurement in Humans. *Circulation*. 2005;111: 697-716.
2. Handler J. The importance of accurate blood pressure measurement. *The Permanente Journal*/Summer 2009/Volume 13 No. 3 51

This 7 simple tips to get an accurate blood pressure reading was adapted with permission of the American Medical Association and The Johns Hopkins University. The original copyrighted content can be found at [www.ama-assn.org/ama-johns-hopkins-blood-pressure-resources](http://www.ama-assn.org/ama-johns-hopkins-blood-pressure-resources).

## Follow these steps for an accurate blood pressure measurement

### 1. PREPARE

Avoid caffeine, smoking and exercise for 30 minutes before measuring your blood pressure.

Wait at least 30 minutes after a meal.

If you're on blood pressure medication, measure your BP *before* you take your medication.

Empty your bladder beforehand.

Find a quiet space where you can sit comfortably without distraction.

### 2. POSITION



### 3. MEASURE

Rest for five minutes while in position before starting.

Take two or three measurements, one minute apart, twice daily for seven days.

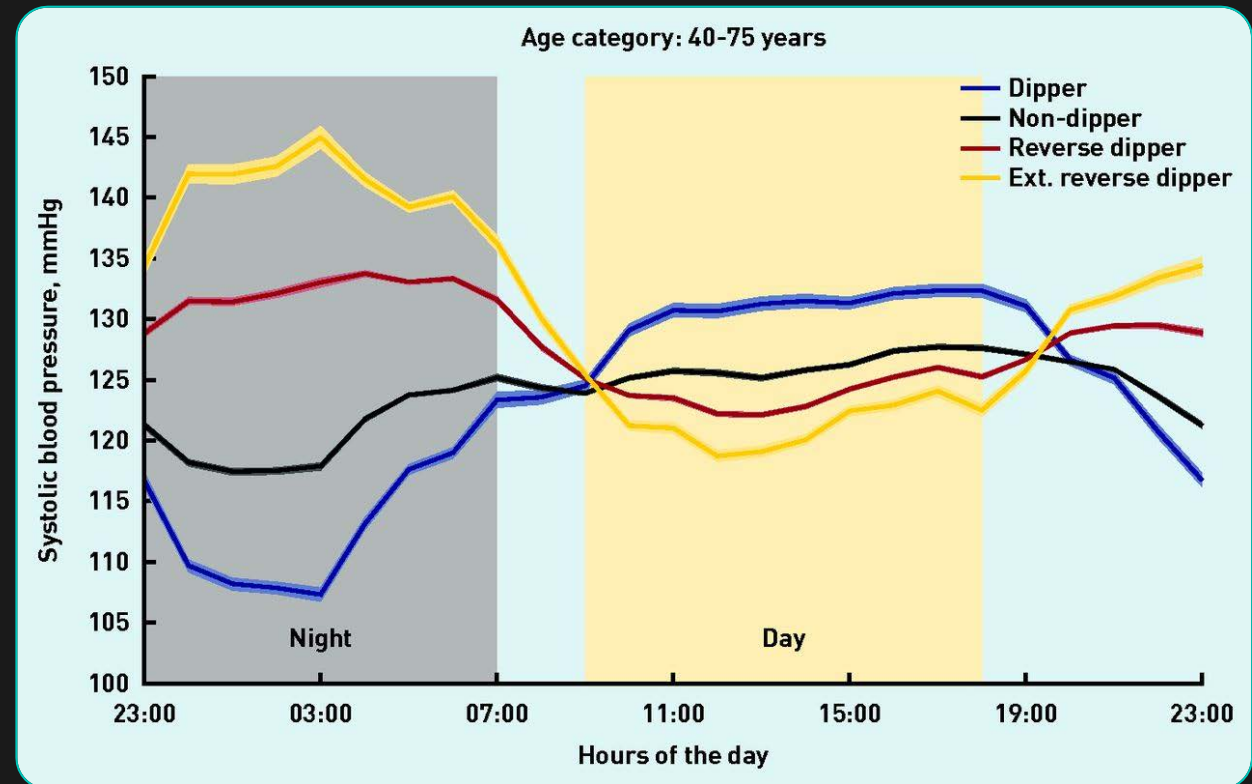
Keep your body relaxed and in position during measurements.

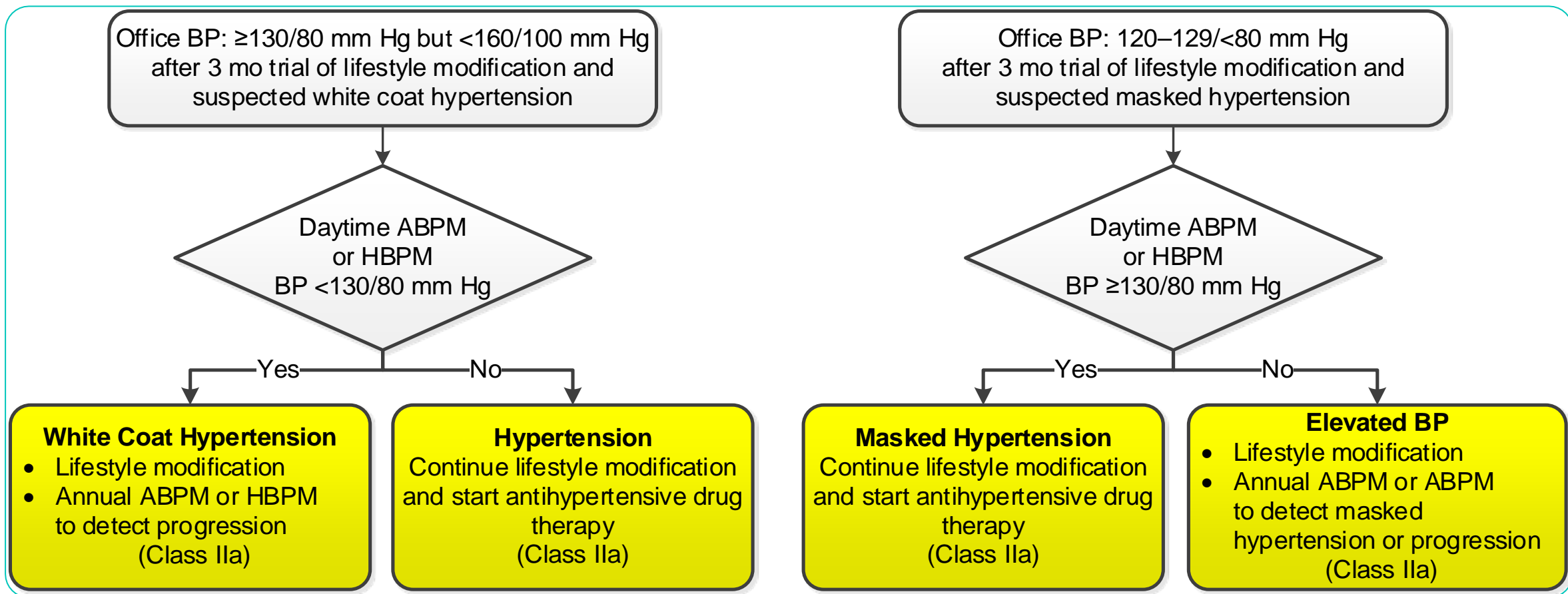
Sit quietly with no distractions during measurements—avoid conversations, TV, phones and other devices.

Record your measurements when finished.

# BP Readings at Night

- Normal BP ‘dipper pattern’, due to a reduction in sympathetic tone & increase in vagal activity.
- Prevalence of reverse dipping has been reported to be **between 3% and 39%**.
- **Reverse dippers** were found to be older, associated with obstructive sleep apnea, and were at higher risk of death.





# Detection of White Coat or Masked Hypertension

# Tests for Primary Hypertension

<b>Basic testing</b>	Fasting blood glucose
	Complete blood count
	Lipid profile/ ASCVD risk score
	Serum creatinine with eGFR
	Serum sodium, potassium
	Serum calcium (Vit D, PTH, renal function)
	Thyroid-stimulating hormone
	Urinalysis
	Electrocardiogram
<b>Optional testing</b>	Echocardiogram (LVH)
	Urinary albumin to creatinine ratio (or urine microalbumin)



# Question

Which one of the following lifestyle interventions has the greatest effect on blood pressure?

- A. Dietary Approaches to Stop Hypertension (DASH) diet.
- B. Moderate-intensity exercise.
- C. Reduced alcohol intake.
- D. Tobacco cessation.

# Question

Which one of the following lifestyle interventions has the greatest effect on blood pressure?

- A. Dietary Approaches to Stop Hypertension (DASH) diet.**
- B. Moderate-intensity exercise.
- C. Reduced alcohol intake.
- D. Tobacco cessation.

○ Aim to eat :

- Fruits
- Vegetables
- Whole grains
- Low-fat dairy products
- Skinless poultry and fish
- Nuts and legumes
- Non-tropical vegetable oils

○ Limit:

- Saturated and trans fats
- Alcoholic beverages
- Sodium
- Fatty meats
- Items with added sugar such as sugar-sweetened beverages

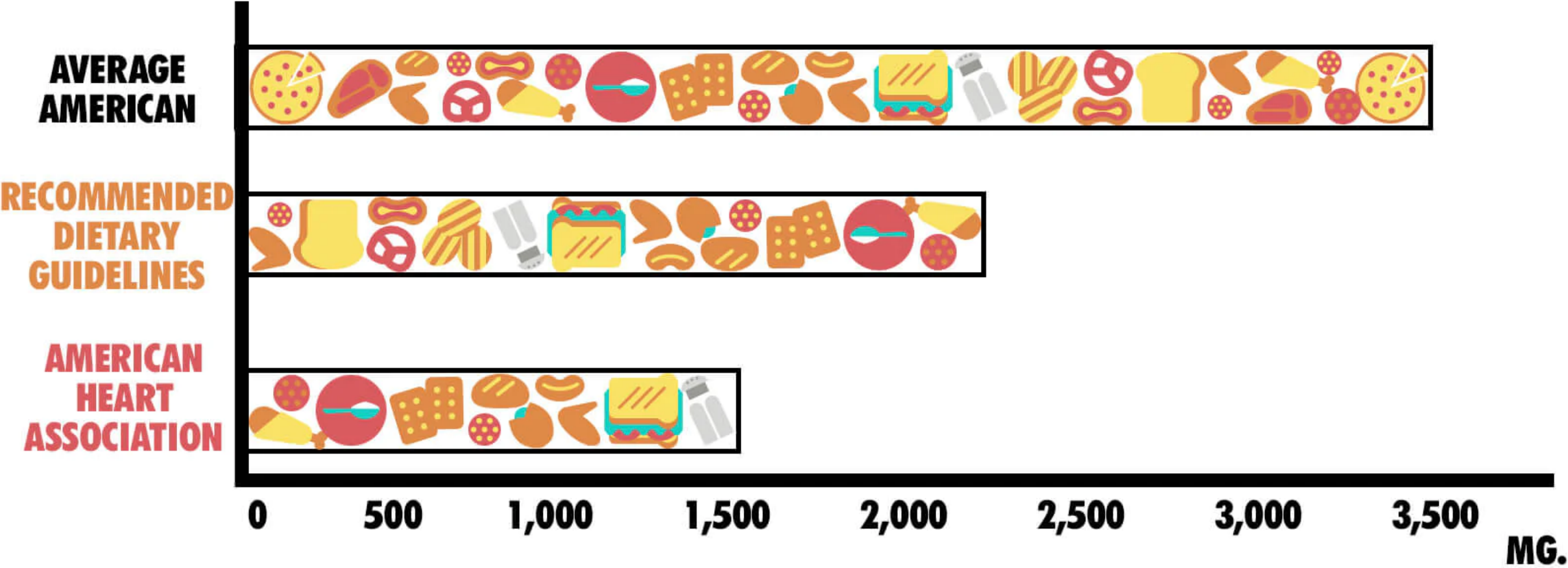


# THE DASH DIET



Dietary Approaches to Stop Hypertension

# RECOMMENDED DAILY SODIUM INTAKE



# CDC: American Sodium Intake

More than 40% of the sodium we eat each day comes from just 10 types of foods.

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Breads and rolls

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Pizza

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Sandwiches

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Cold cuts and cured meats

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Soups

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Burritos and tacos

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Savory snacks (Chips, popcorn, pretzels)

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Chicken

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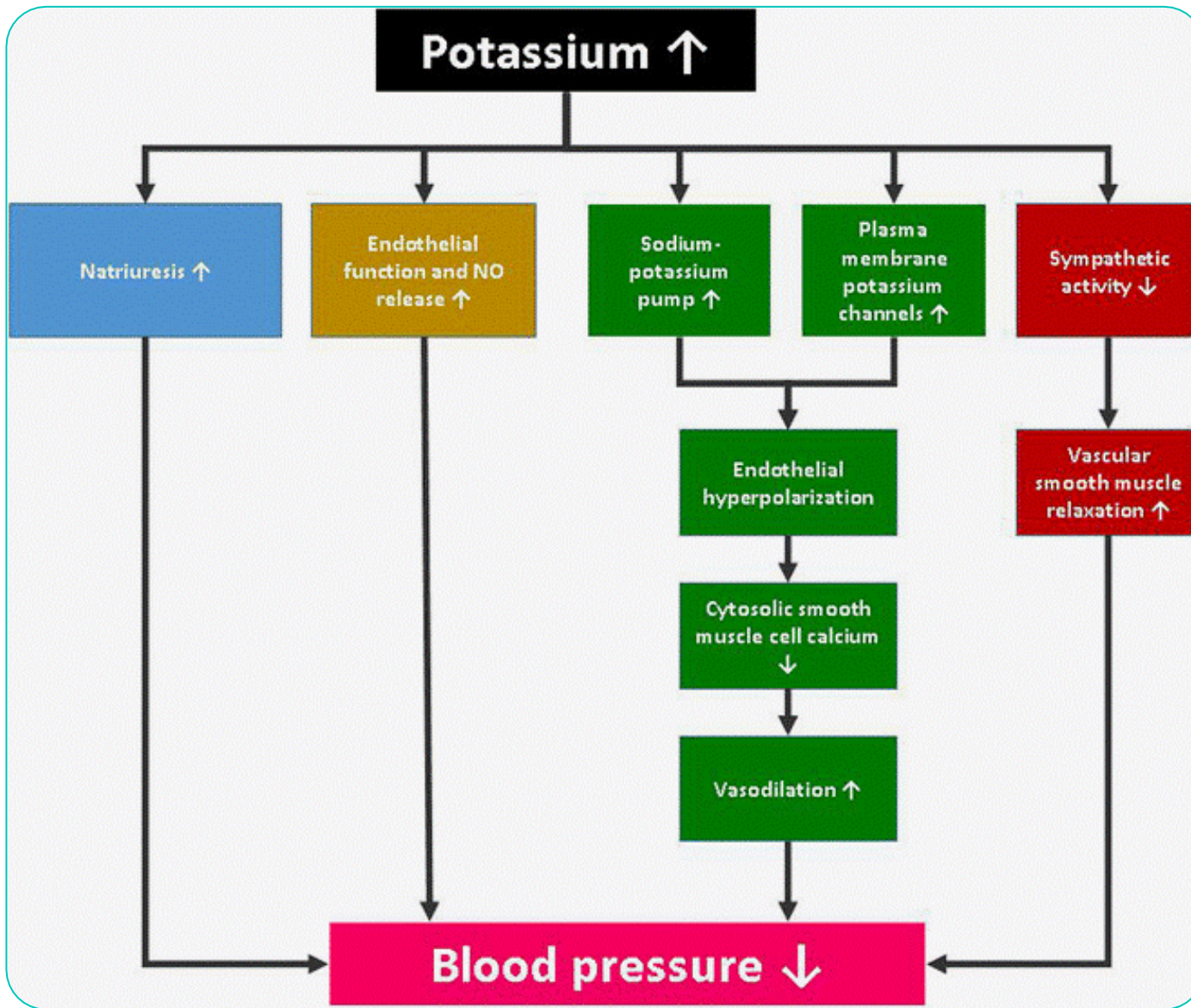
Cheese

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Eggs and omelets

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# Potassium Intake

- Avocado
- Spinach/ Greens
- Yogurt/ Milk
- Oranges
- Bananas
- Sweet potatoes
- Tomatoes
- Beans
- Acorn squash
- Salmon

# Best Proven Nonpharmacological Interventions for Prevention and Treatment of Hypertension

	Nonpharmacological Intervention	Dose	Approximate Impact on SBP	
			Hypertension	Normotension
Weight loss	Weight/body fat	Best goal is ideal body weight but aim for at least a 1-kg reduction in body weight if overweight. <b>Expect about 1 mm Hg for every 1-kg reduction in body weight.</b>	-5 mm Hg	-2/3 mm Hg
Healthy diet	<b>DASH dietary pattern</b>	Consume a diet rich in fruits, vegetables, whole grains, and low-fat dairy products, with reduced content of saturated and total fat.	-11 mm Hg	-3 mm Hg
Reduced intake of dietary sodium	Dietary sodium	Optimal goal is <1500 mg/d but aim for at least a 1000-mg/day reduction in most adults.	-5/6 mm Hg	-2/3 mm Hg
Enhanced intake of dietary potassium	Dietary potassium	Aim for 3500–5000 mg/d, preferably by consumption of a diet rich in potassium.	-4/5 mm Hg	-2 mm Hg

2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults



# Best Proven Nonpharmacological Interventions for Prevention and Treatment of Hypertension (cont.)

	Nonpharmacological Intervention	Dose	Approximate Impact on SBP	
			Hypertension	Normotension
Physical activity	Aerobic	<ul style="list-style-type: none"> <li>• 90–150 min/wk</li> <li>• 65%–75% heart rate reserve</li> </ul>	-5/8 mm Hg	-2/4 mm Hg
	Dynamic resistance	<ul style="list-style-type: none"> <li>• 90–150 min/wk</li> <li>• 50%–80% 1 rep maximum</li> <li>• 6 exercises, 3 sets/exercise, 10 repetitions/set</li> </ul>	-4 mm Hg	-2 mm Hg
	Isometric resistance	<ul style="list-style-type: none"> <li>• 4 × 2 min (hand grip), 1 min rest between exercises, 30%–40% maximum voluntary contraction, 3 sessions/wk</li> <li>• 8–10 wk</li> </ul>	-5 mm Hg	-4 mm Hg
Moderation in alcohol intake	Alcohol consumption	In individuals who drink alcohol, reduce alcohol <sup>†</sup> to: <ul style="list-style-type: none"> <li>• Men: ≤2 drinks daily</li> <li>• Women: ≤1 drink daily</li> </ul>	-4 mm Hg	-3 mm

2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults



## LIFESTYLE MEDICINE FOCUSES ON 6 AREAS TO IMPROVE HEALTH



# Meds that can increase BP

- Anticonvulsants (Carbamazepine)
- Antidepressants (SSRI's, SNRI's, TCA's)
- Antiemetics (Metoclopramide, Prochlorperazine)
- Antipsychotics (Clozapine, Thioridazine)
- Contraceptives
- Testosterone
- Antineoplastic agents
- Glucocorticoids & Mineralocorticoids
- Herbal Supplements marketed for weight loss and athletic enhancement
- Amphetamines (ex. Adderall, phentermine)
- Decongestants
- Nonsteroidal anti-inflammatory drugs

BP Category	SBP		DBP
Normal	<120 mm Hg	and	<80 mm Hg
Elevated	120–129 mm Hg	and	<80 mm Hg
<b>Hypertension</b>			
Stage 1	130–139 mm Hg	or	80–89 mm Hg
Stage 2	≥140 mm Hg	or	≥90 mm Hg

## Categories of BP in Adults (2017 ACC/AHA/et al.)

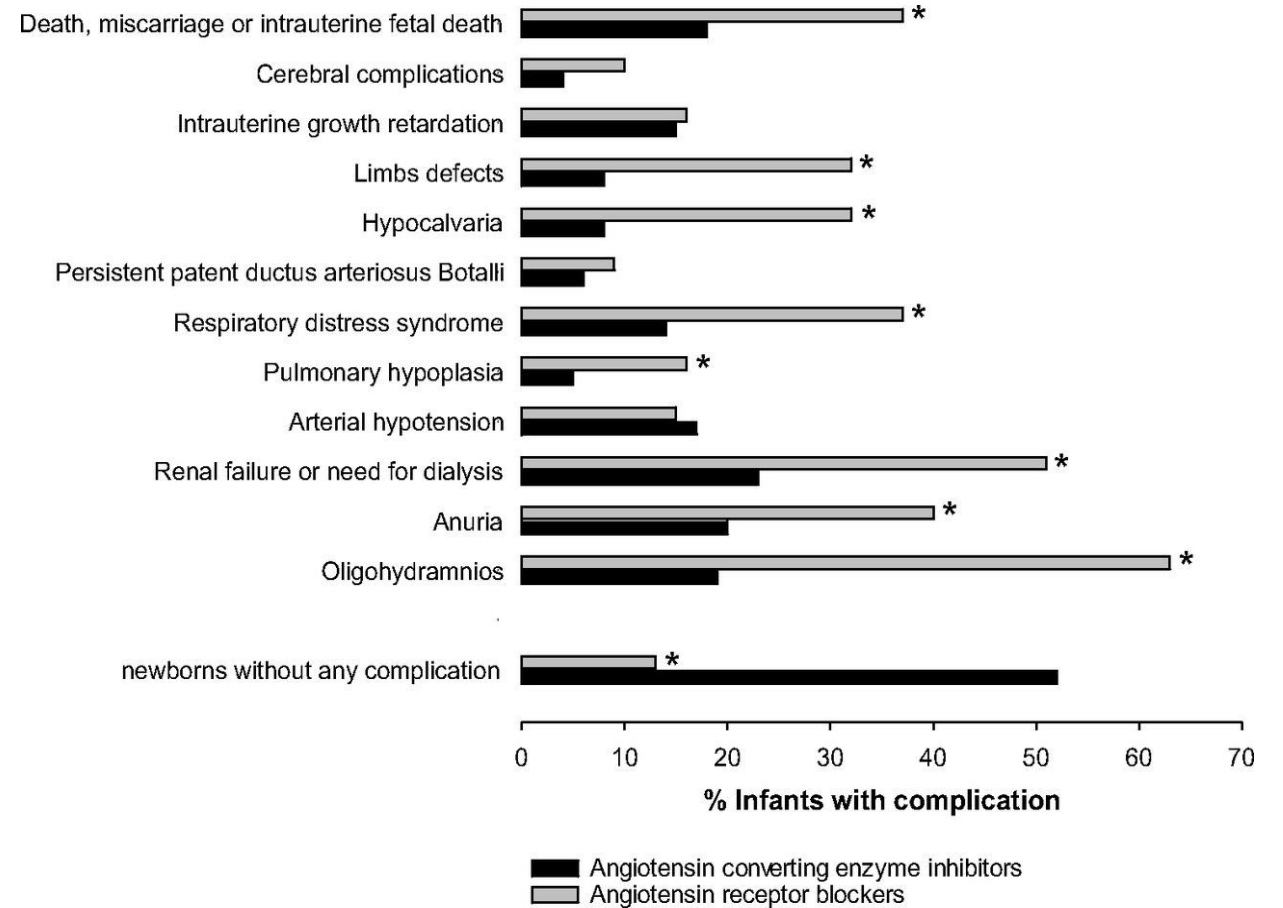
# First Line BP Meds

- Initial first-line therapy for stage 1 hypertension includes:  
ACE inhibitors or ARBs, CCB's, or thiazide diuretics.
  - NOT beta blockers
- Two first-line drugs of different classes are recommended with Stage 2 hypertension (>140/90).
- In African American adults with hypertension but without HF or CKD, initial treatment should be a CCB or a thiazide-type diuretic.

# ACE-I and ARBs

- Cough (5-20% of pts on ACE), angioedema
- Do NOT use an ACE with an ARB
- ACE inhibitors and ARBs increase the risk of **hyperkalemia** in CKD and with K<sup>+</sup>-sparing drugs.
- OK to use in CKD, but if the increase in creatinine (or the decrease in GFR) is >30%, think about **renal artery stenosis**

# ACE-I and ARBs in Pregnancy





Losartan – about \$15

Valsartan – about \$17

Candesartan – about \$66

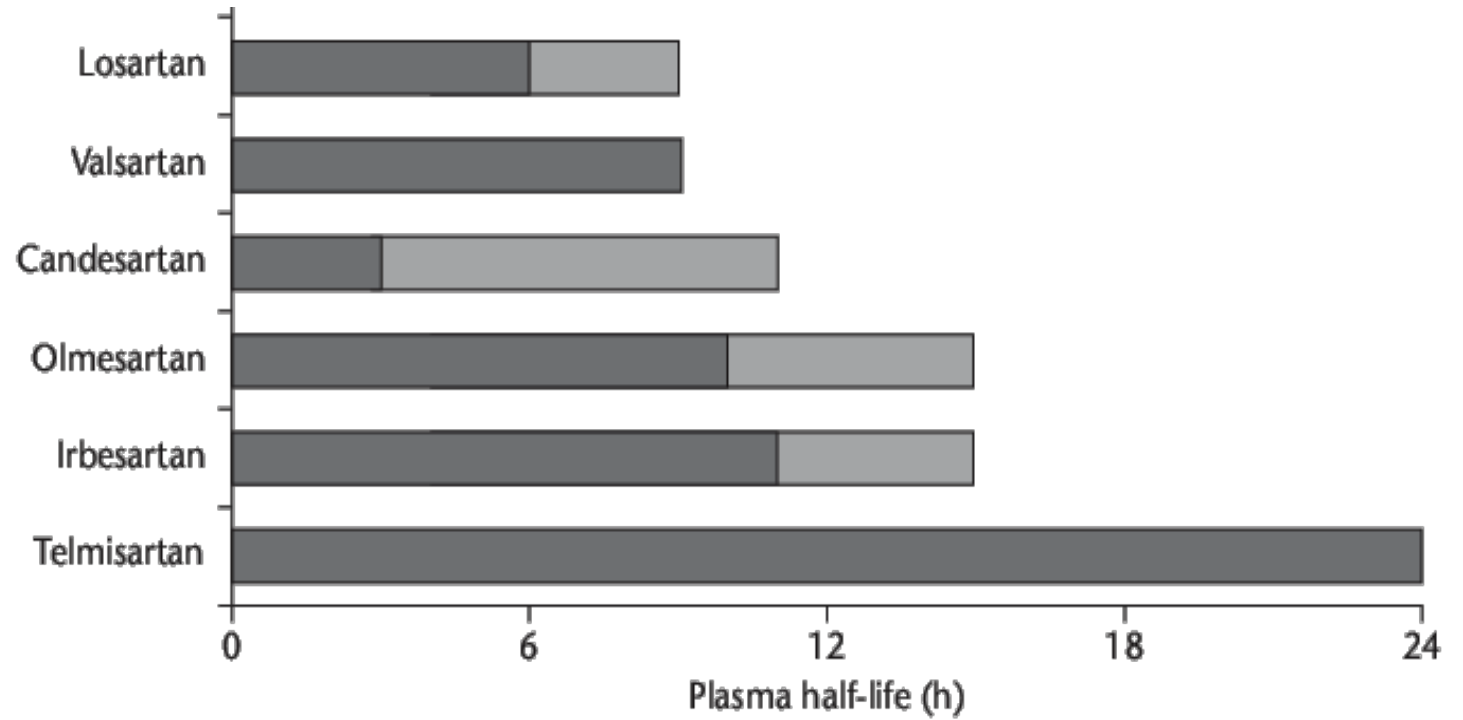
**Telmisartan** – about \$16

**Irbesartan** – about \$31

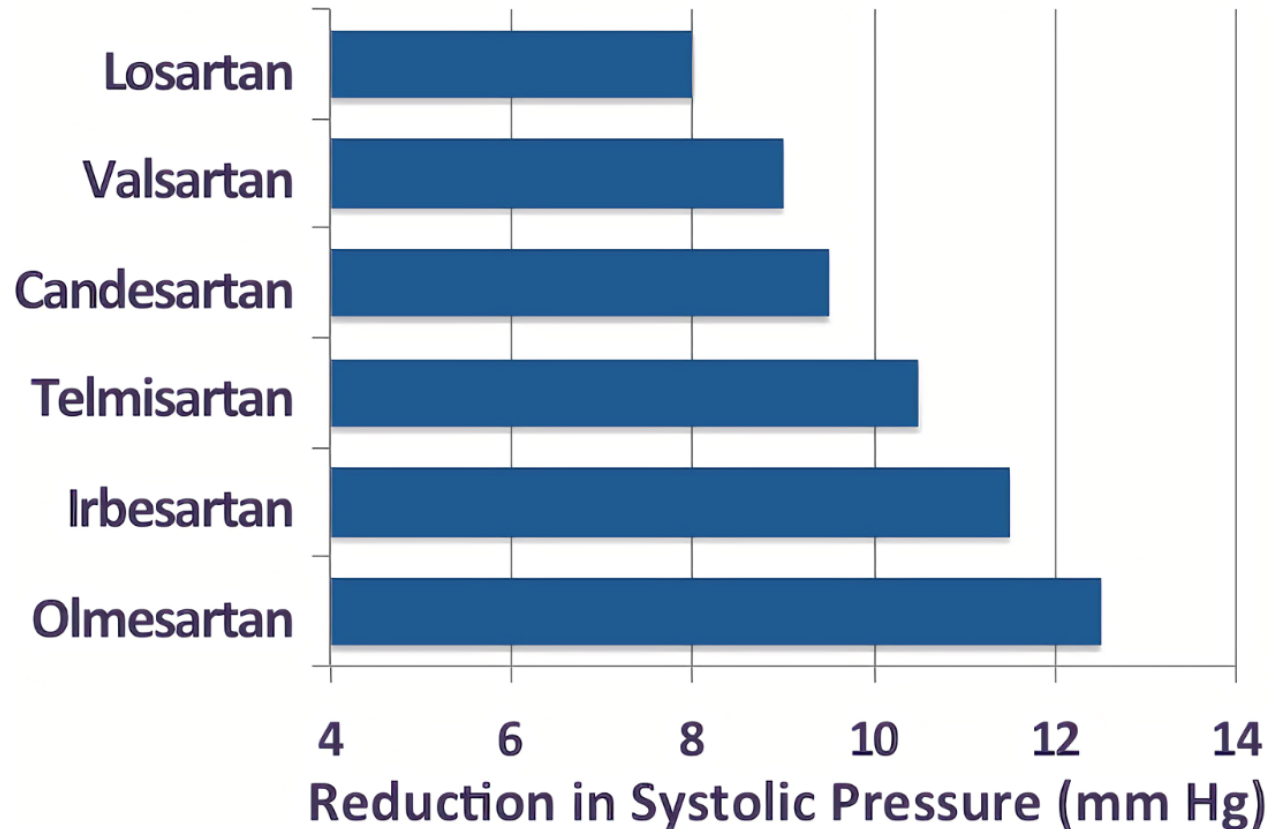
**Olmесartan** – about \$17

Azilsartan – about \$177

**GoodRx**



## Reduction in Systolic Pressure By ARB



Losartan – about \$15

Valsartan – about \$17

Candesartan – about \$66

**Telmisartan** – about \$16

**Irbesartan** – about \$31

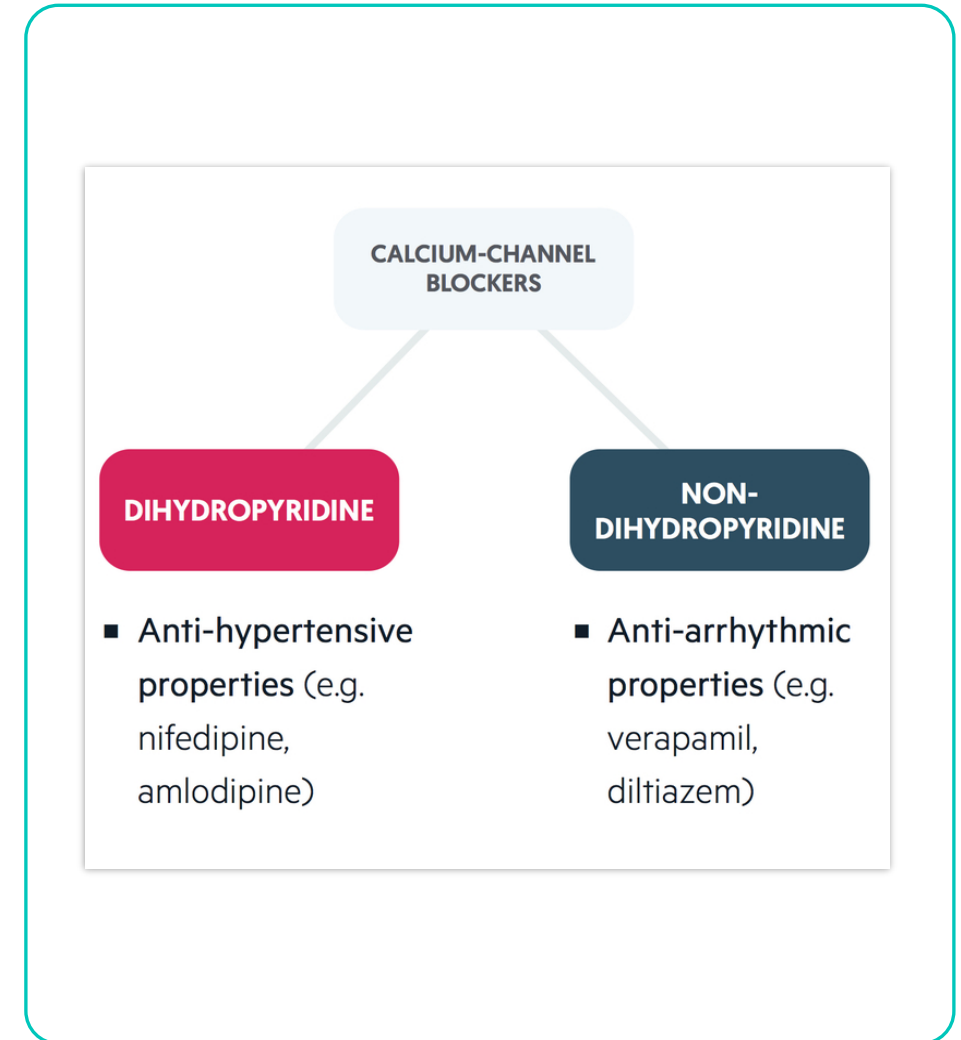
**Olmesartan** – about \$17

Azilsartan – about \$177

**GoodRx**


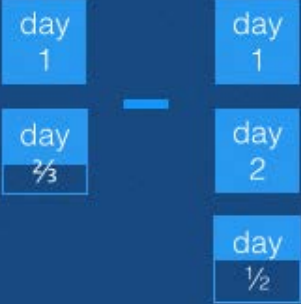
# CCB's

- Dihydropyridines can cause edema, lightheadedness (vasodilation)
- Non-dihydropyridine CCBs are associated with bradycardia, heart block, decreased contractility - **avoid in HFrEF**
- Both types can cause gingival hyperplasia (rare)

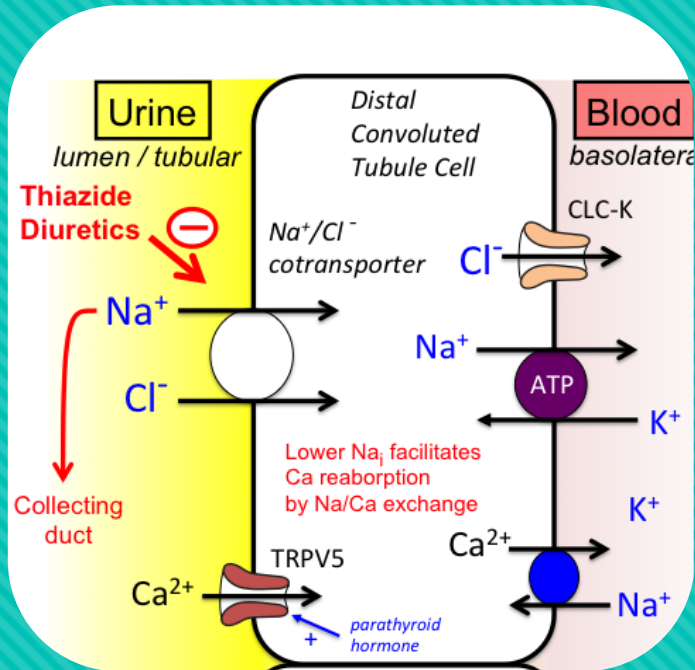


# Thiazide Diuretics

Chlorthalidone is preferred due to long half-life and proven reduction of CVD risk.

Hydrochlorothiazide	Chlorthalidone (Hygroton)
Usual dose 12.5 to 50 mg qDay	Usual dose 12.5 to 50 mg qDay
half life 2.5 hours	half life 40-60 hours
	
Most popular thiazide drug combos	The drug in AllHat

# Thiazides



Sulfa drug

Hypokalemia

Hypercalcemia

- Consider with calcium renal stones (lowers urine Ca<sup>+</sup>)

Hyperuricemia

Hyperglycemia (debatable)

# Combination Therapy

Drug	GoodRx Cost
Lisinopril/ HCTZ	About \$13
Amlodipine/ Benazepril	About \$26
Amlodipine/ Olmesartan	About \$24
Amlodipine/ Telmisartan	About \$45

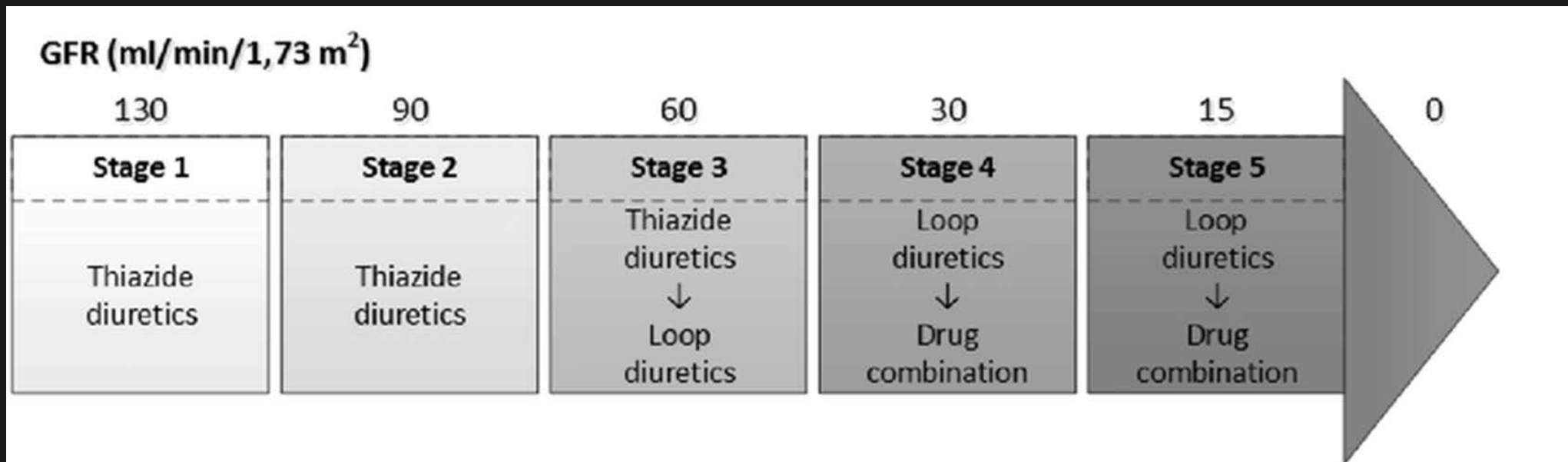
- Targets multiple causes of HTN
- Less dose-dependent side effects
- Improved compliance

# HTN Meds with CKD

- BP goal should be **<130/80 mm Hg**.
- In those with stage 3 or higher CKD or stage 1 or 2 CKD with albuminuria (>300 mg/g urine alb-to-creat ratio), treat with an **ACE inhibitor or ARB**.
  - Tolerable increase in creatinine (or decrease in the GFR) is less than 30%
- When adjusting meds, **check BMP** 1-2 weeks later.

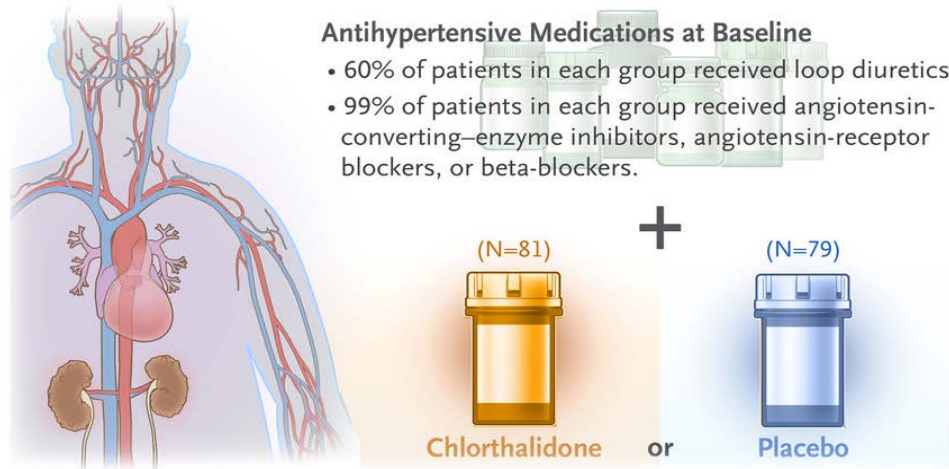


# Thiazides and CKD



## Chlorthalidone for Hypertension in Advanced Chronic Kidney Disease

Agarwal R et al. DOI: 10.1056/NEJMoa2110730



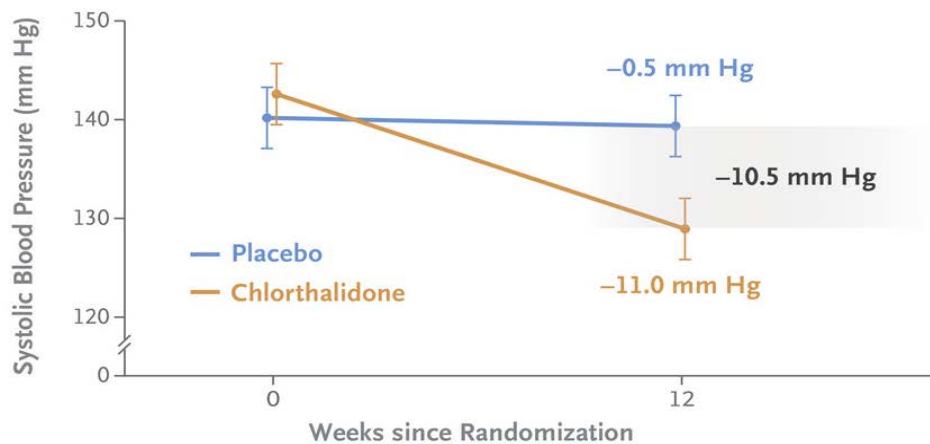
**CLICK trial (NEJM 2021): stage 4 chronic kidney disease and poorly controlled hypertension**

Most patients with CKD will require diuretic therapy to attain goal BP.

- Chlorthalidone, HCTZ
- Loop diuretic

### Adjusted Change in 24-Hour Ambulatory Systolic Blood Pressure from Baseline to 12 Weeks

Mean difference, -10.5 mm Hg; 95% CI, -14.6 to -6.4; P<0.001



\*In the absence of heart failure, potassium-sparing diuretics (like eplerenone and spironolactone) **should be AVOIDED** in patients with **moderate to severe CKD**, as it may impact K<sup>+</sup> and renal function.

# HTN Meds with Heart Failure pEF

- BP goal should be <130/80 mm Hg.
- In HFpEF with symptoms of volume overload, diuretics should be used
  - Loop diuretic
  - eplerone, spironolactone (MRA)
  - then consider other GDMT to help lower BP
    - SGLT-2 (esp. with MRA → less diuretic needed, lowers K+)
    - sacubitril-valsartan, or ACE-I/ ARBs

# HTN Meds with Heart Failure rEF

- GDMT Pillars: ARNI (or ACE or ARB), BB, MRA, SGLT-2
- Bisoprolol, metoprolol succinate, and carvedilol (not in asthma) are preferred BB
- Mineralocorticoid receptor antagonist (eplerenone, spironolactone)
  - Eplerenone has less gynecomastia and less ED (but more expensive)
  - \*Monitor potassium, keep K+ less than 5.5
- Loop diuretics for volume mgmt and when GFR is <30 ml/min.
  - Furosemide, Torsemide, Bumetanide

# HTN Meds with Other Disease States

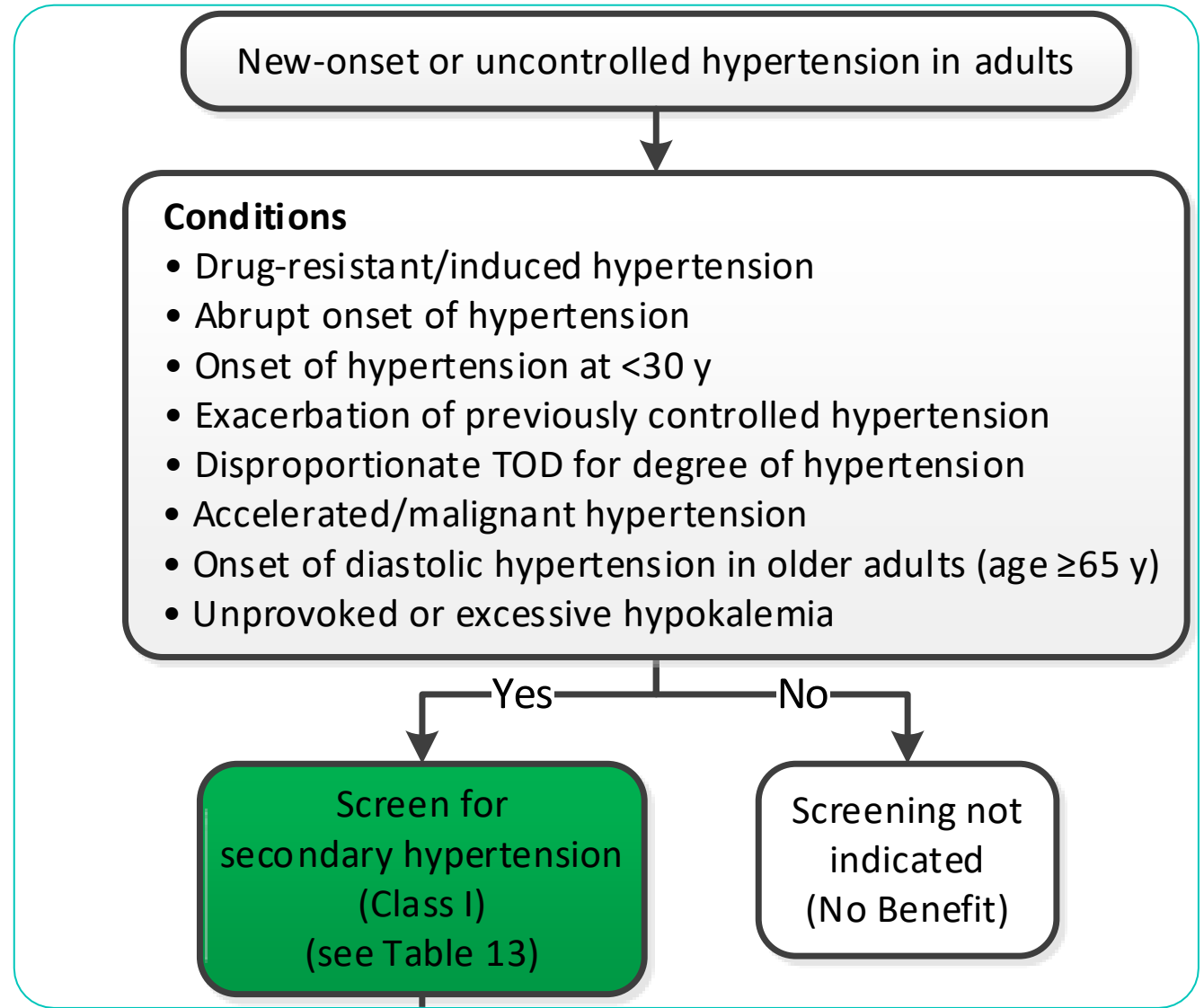
- In patients with **diabetes**, the benefit of ACE inhibitors and ARBs over other drugs is limited to patients with diabetes and **albuminuria**.
- In patients with **atrial fibrillation**, consider beta blocker or non-dihydropyridine calcium channel blocker (like verapamil or diltiazem) for rate control.
  - It may be more difficult to get accurate BP readings.
- Beta blockers are indicated in patients who have had a **myocardial infarction** (MI) in the previous three years.

# Drug Resistant Hypertension

BP that remains uncontrolled above goal despite the concurrent use of 3 antihypertensive drugs of different classes (commonly calcium channel blocker, ACE/ ARB, and diuretic).

Pseudo-resistance (i.e., error in BP measurement, white coat effect, or suboptimal adherence to the antihypertensive drug regimen) must be excluded.

# Screening for Secondary Hypertension

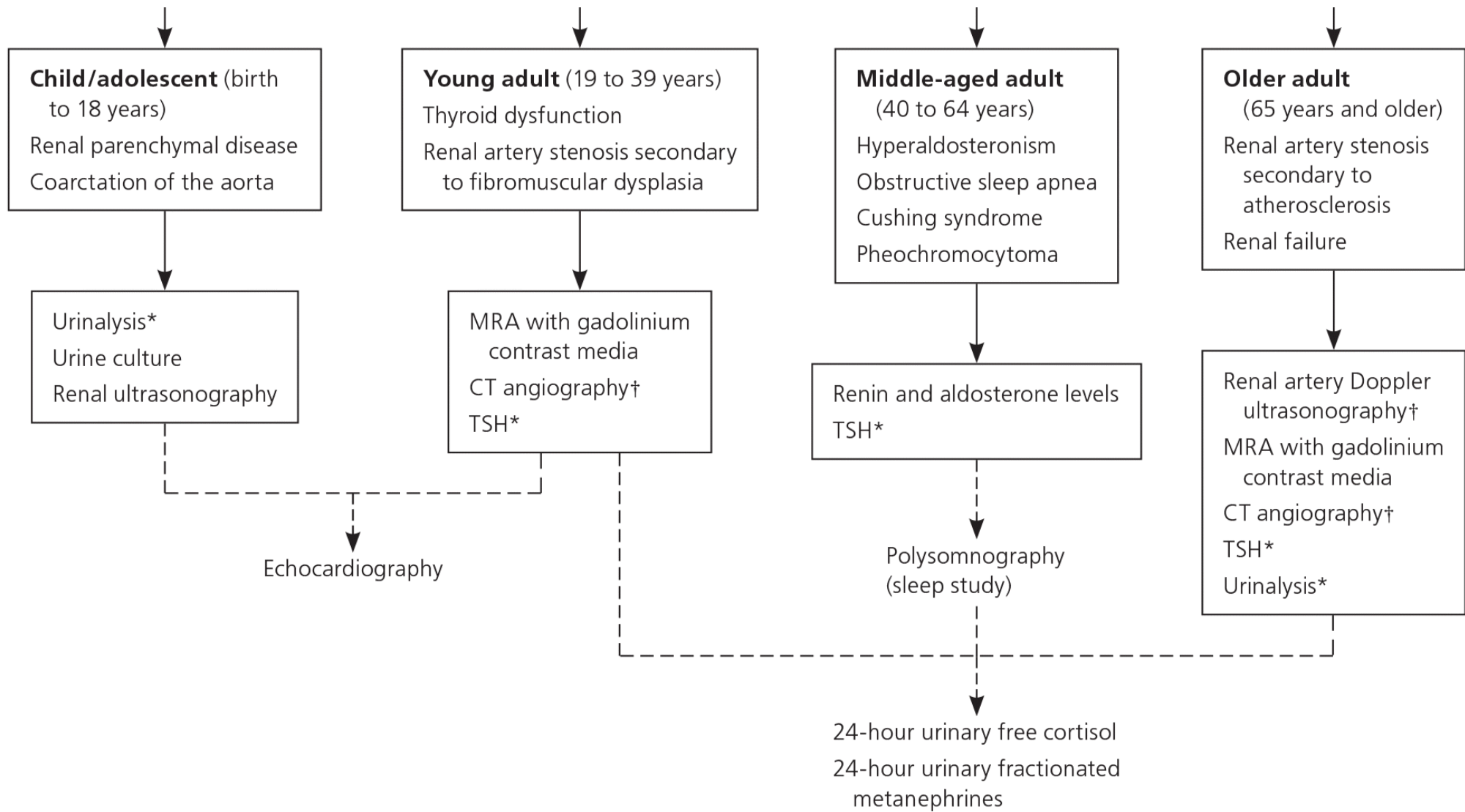


*TOD = target organ damage*



# Causes of Secondary Hypertension

Common causes
Renal parenchymal disease
Renovascular disease
Primary aldosteronism
Obstructive sleep apnea
Drug or alcohol induced
Uncommon causes
Pheochromocytoma/paraganglioma
Cushing's syndrome
Hypothyroidism
Hyperthyroidism
Aortic coarctation (undiagnosed or repaired)
Primary hyperparathyroidism
Congenital adrenal hyperplasia
Mineralocorticoid excess syndromes other than primary aldosteronism
Acromegaly



# Primary Aldosteronism

- Primary hyperaldosteronism is estimated to occur in approximately 8% of all patients with HTN and up to 20% with resistant HTN.
- Most common cause (2/3) is idiopathic bilateral adrenal hyperplasia, remaining (1/3) are unilateral Conn syndrome – adrenal tumor.
- Screening is recommended with HTN and any of the following:
  - resistant hypertension
  - Hypokalemia (often NOT present, <37%)
  - incidentally discovered adrenal mass
  - family history of early-onset hypertension
  - stroke at a young age (<40 years)

# Primary Hyperaldosteronism

Screening Test	Widely Accepted Cutoff
Aldosterone-renin ratio ( <i>ng/dL per ng/mL/hour</i> )	$\geq 30$
Plasma aldosterone concentration ( <i>ng/dL</i> )	$\geq 15$

\*Renin suppressed with Primary  
\*Renin increased with Secondary

## Medications to Hold Before Primary Aldosteronism Testing\*

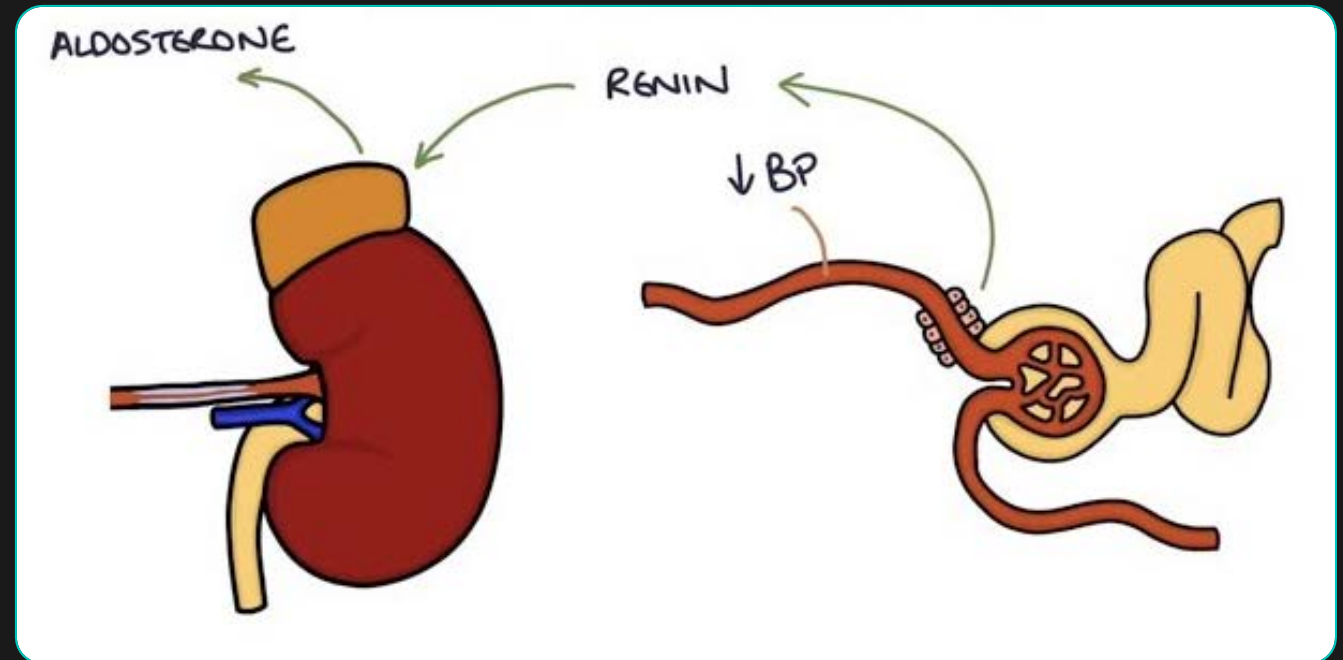
Medications	Hold priority	Duration of hold (weeks)
Mineralocorticoid receptor antagonists†	Mandatory	4
Angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, beta blockers, diuretics, dihydropyridine calcium channel blockers	Optional	2 to 4
Alpha blockers, nondihydropyridine calcium channel blockers, vasodilators	Continue	—

**Note:** Because of interference with the renin-angiotensin-aldosterone system, certain antihypertensive medications may alter renin and angiotensin levels.

\*—Based on the 2016 Endocrine Society Guidelines.

# Secondary Hyperaldosteronism

- \*Renin suppressed with Primary
- \*Renin increased with Secondary
- Renovascular HTN (stenosis)
- CHF
- Cirrhosis (low protein)
- Nephrotic syndrome (low protein)
- Diuretic use



# Other Meds to Consider

- **Spironolactone or eplerenone** is preferred for the treatment of primary aldosteronism and in resistant hypertension.
- **Alpha-1 blockers** are associated with orthostatic hypotension; this drug class may be considered in men with symptoms of benign prostatic hyperplasia.
- Beyond what was discussed, consider referral...



# Obstructive Sleep Apnea

- OSA is highly prevalent in hypertensive patients, of whom 30% to 50% will have comorbid OSA. This is especially true with resistant hypertension, **up to 80% may have OSA**.
- Studies have shown **two- to three-fold greater mortality rates**, most notably in women with severe untreated OSA.
- **Spironolactone** in a small RCT reduced the severity of OSA and lowered BP in patients with resistant HTN (it may reduce parapharyngeal edema).

# Key Practice Points

Coach patients and staff to measure BP accurately (Target BP)

**DASH diet** is a powerful lifestyle tool

Know when to look for **secondary causes**, and when to refer

Primary hyperaldosteronism and OSA are common contributors

Hesitate before prescribing **losartan QD**, think about half life

**Chlorthalidone** is the preferred thiazide

Be mindful of BP meds for CKD, high aldosterone, HF, and pregnancy



Questions?

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