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Foundations of Cardiometabolic Health Certification Course

Certified Cardiometabolic Health Professional (CCHP)

Hypertension in Racial/Ethnic Populations

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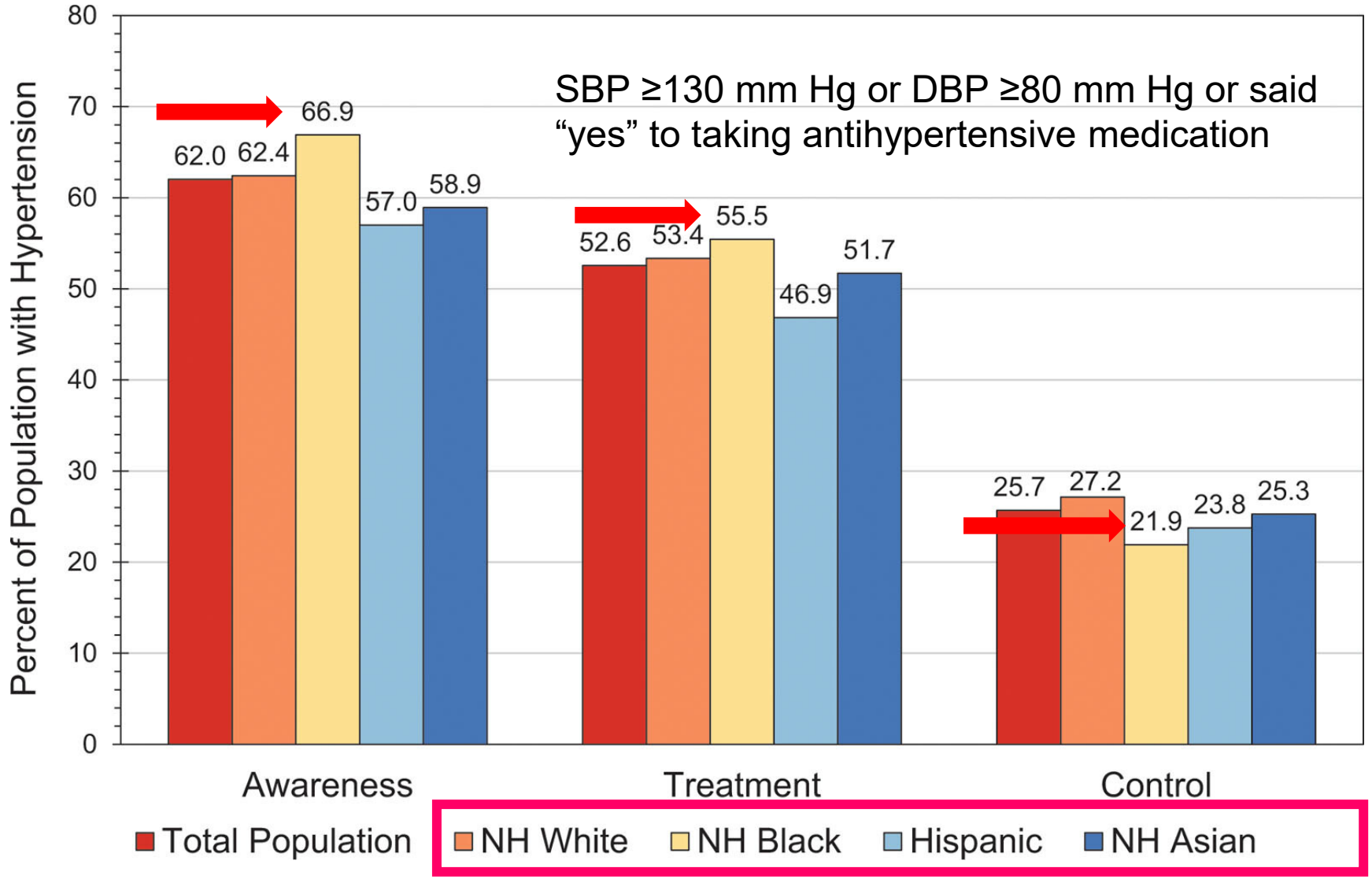
Unique Aspects of BP in U.S. Black Populations

- Premature onset
- Increased target organ damage, including LVH ,HF, CKD/ESRD, and retinopathy
- HTN prevalence among the highest in the world
- Black individuals develop HTN at earlier age and average BPs much higher

Flack JM et al for ISHIB Hypertension. 2010;56:780-800.
Ferdinand KC, Ferdinand DP. Expert Rev Cardiovasc Ther. 2008;10:1357-1366.

Extent of Awareness, Treatment and control of High Blood Pressure by Race/ethnicity, United States (NHANES, 2017-2020)



2023 AHA Heart Disease and Stroke Statistics. Circulation 2023; 147: e93-e621, DOI: 10.1161/CIR.0000000000001123

Self-Reported Antihypertensive Medication†
Prevalence of Hypertension Based on 2 SBP/DBP Thresholds*†

	SBP/DBP ≥130/80 mm Hg		SBP/DBP ≥140/90 mm Hg	
	Men	Women	by Race-ethnicity§	
Non-Hispanic White Adults	47%	41%	31%	30%
Non-Hispanic Black Adults	**59%**	**56%**	**42%**	**46%**
Non-Hispanic Asian Adults	45%	36%	29%	27%
Hispanic Adults	44%	42%	27%	32%

*130/80 and 140/90 mm Hg in 9623 participants (≥20 years of age) in NHANES 2011–2014. †BP cutpoints for definition of hypertension in the present guideline. ‡BP cutpoints for definition of hypertension in JNC 7.
§Adjusted to the 2010 age-sex distribution of the U.S. adult population.

What is the prevalence of HTN among non-Hispanic adults based on ≥ 130/80?

a) 59% Non-Hispanic Black adult – men
b) 60% Non-Hispanic Asian adult – women
c) 55% Hispanic adult – men
d) 35% Non-Hispanic White adult - women

cdc.gov NHANES 2011–2014

What is the prevalence of HTN among non-Hispanic adults based on ≥ 130/80?

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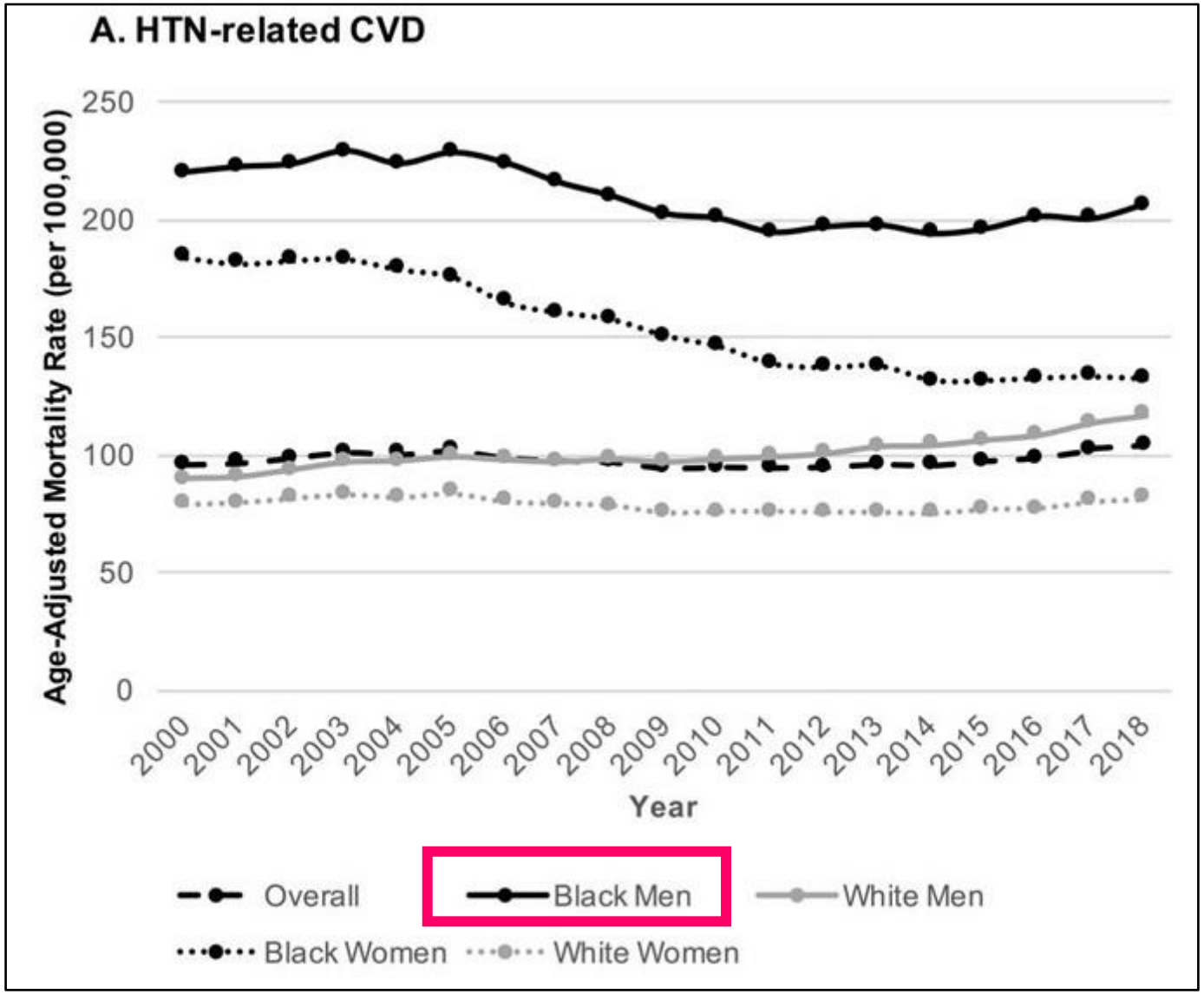
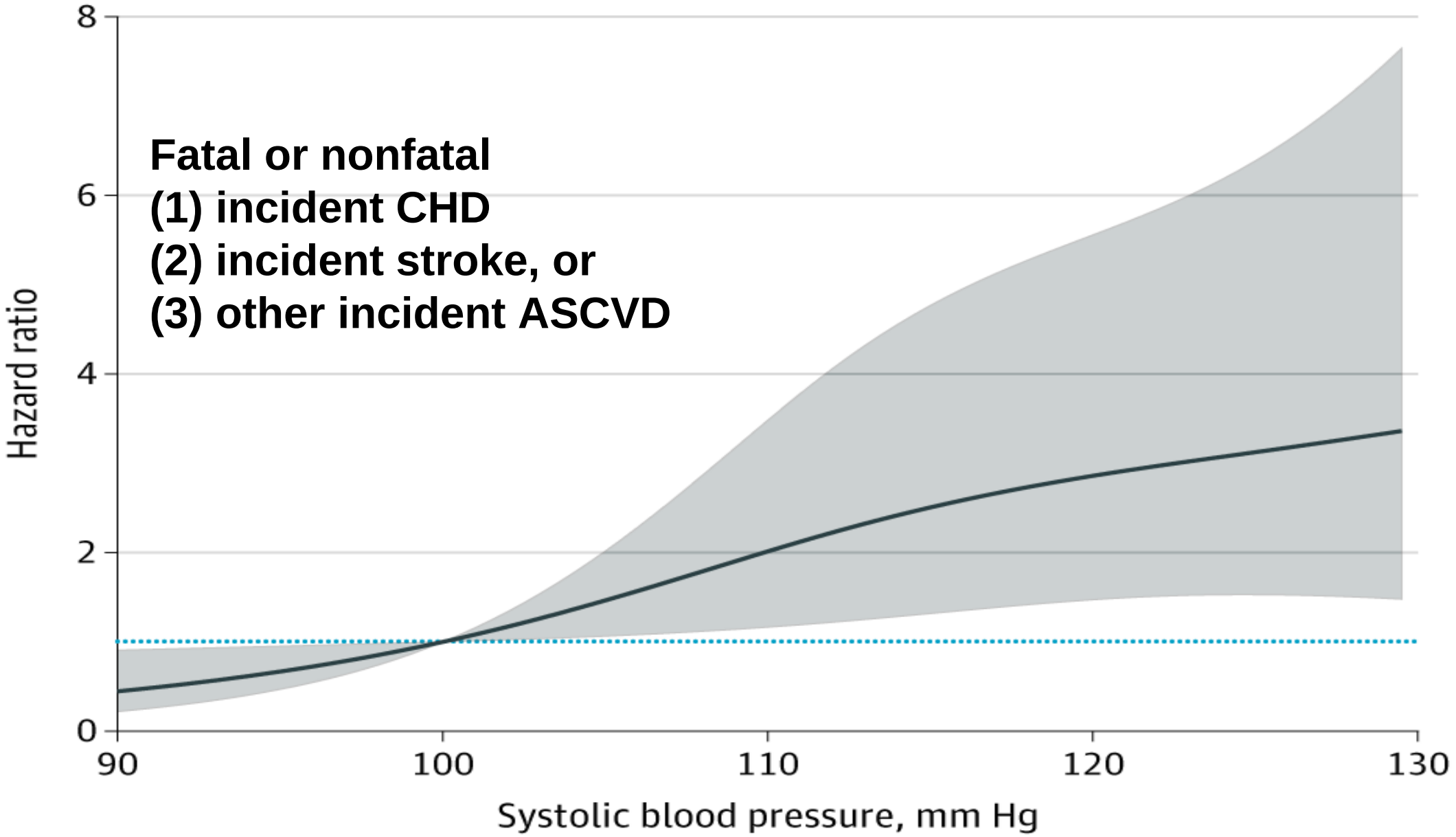
cdc.gov NHANES 2011–2014

Age-adjusted U.S. HTN-related CVD Death Rates, by Race/Ethnicity: 2000–2018



Rethy, L, et al. Hypertension 2020; 76.3: e23-e25

Adjusted Hazard of Incident ASCVD by SBP



Adjusted for age, sex, race/ethnicity, DBP, TC, HDL-C, fasting glucose, BMI, income, education, ever smoking, and preDM

June 10, 2020. doi:10.1001/jamacardio.2020.1731

Controlled BP defined as SBP <140 mm Hg and DBP <90 mm Hg. Treatment defined by self-reported antihypertensive medication use

Research

JAMA | Original Investigation

Trends in Blood Pressure Control Among US Adults With Hypertension, 1999-2000 to 2017-2018

Paul Muntner, PhD; Shakia T. Hardy, PhD; Lawrence J. Fine, MD; Byron C. Jaeger, PhD; Gregory Wozniak, PhD; Emily B. Levitan, ScD; Lisandro D. Colantonio, MD, PhD

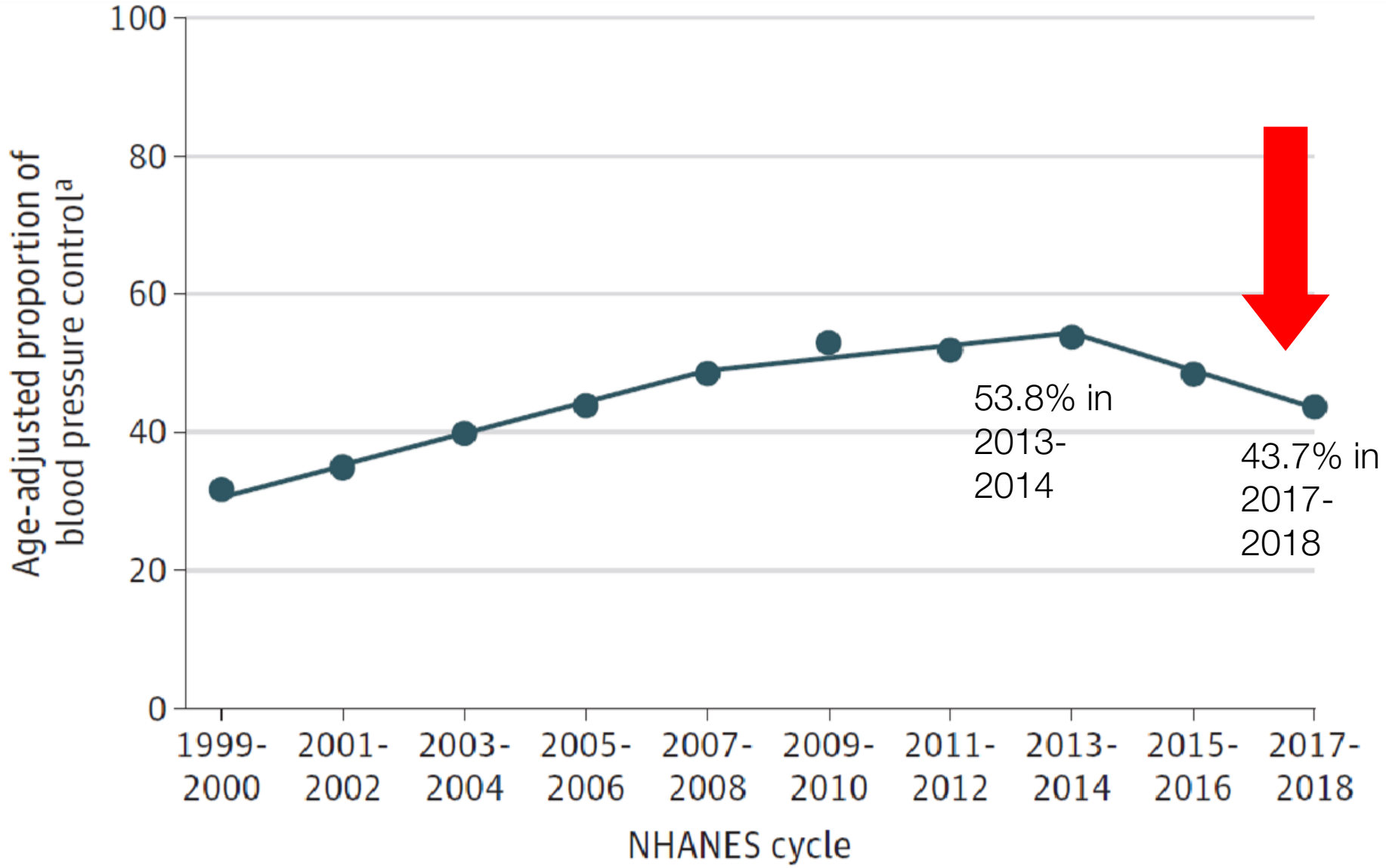
IMPORTANCE Controlling blood pressure (BP) reduces the risk for cardiovascular disease.

OBJECTIVE To determine whether BP control among US adults with hypertension changed from 1999-2000 through 2017-2018.

Editorial
Related article
Supplemental content

JAMA. doi:10.1001/jama.2020.14545 Published online September 9, 2020

Blood Pressure Control Among All Adults with Hypertension



Muntner P, et al. JAMA. 2020;324(12):1190.

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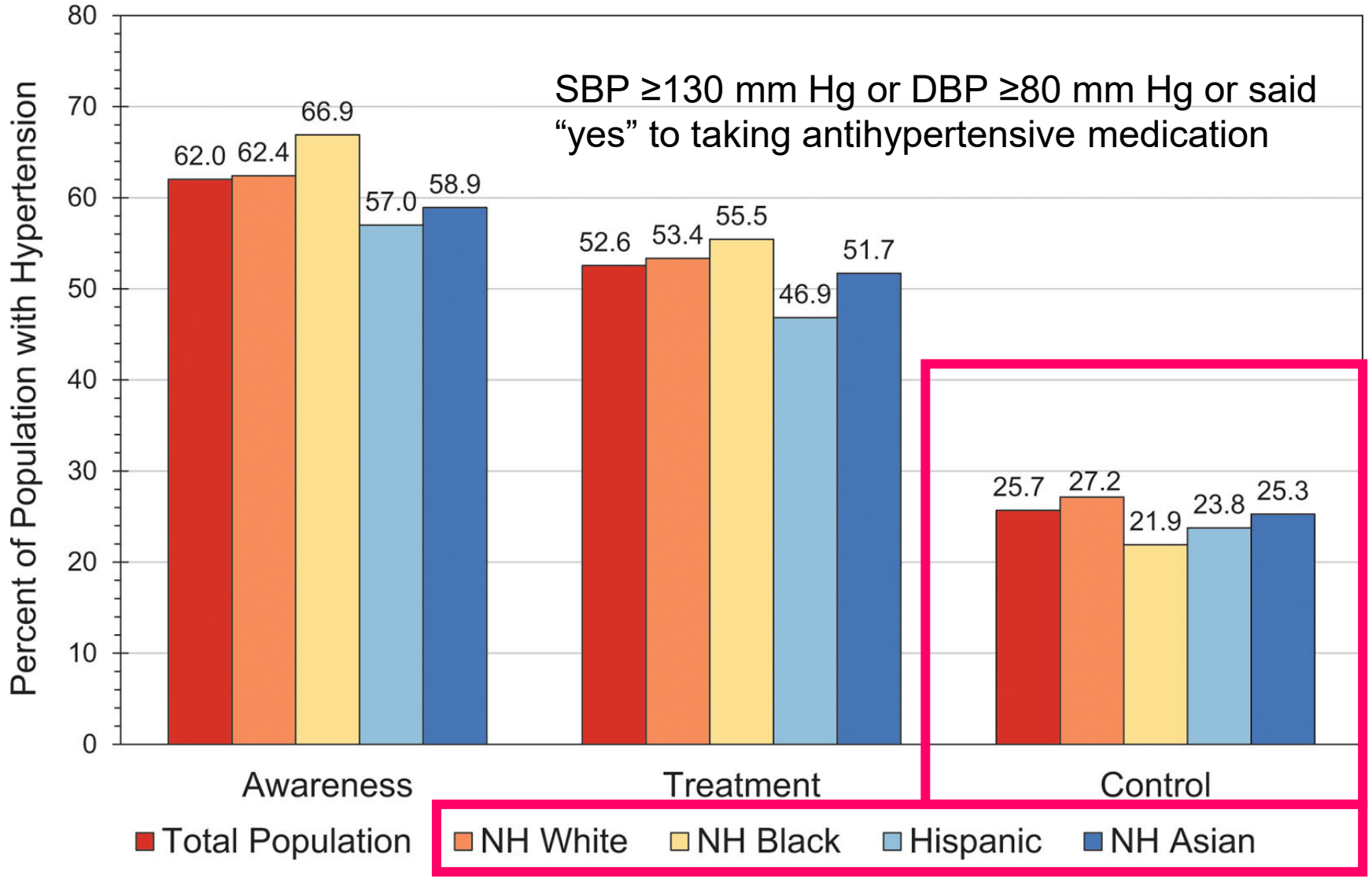


2023 AHA Heart Disease and Stroke Statistics. Circulation 2023; 147: e93-e621, DOI: 10.1161/CIR.0000000000001123

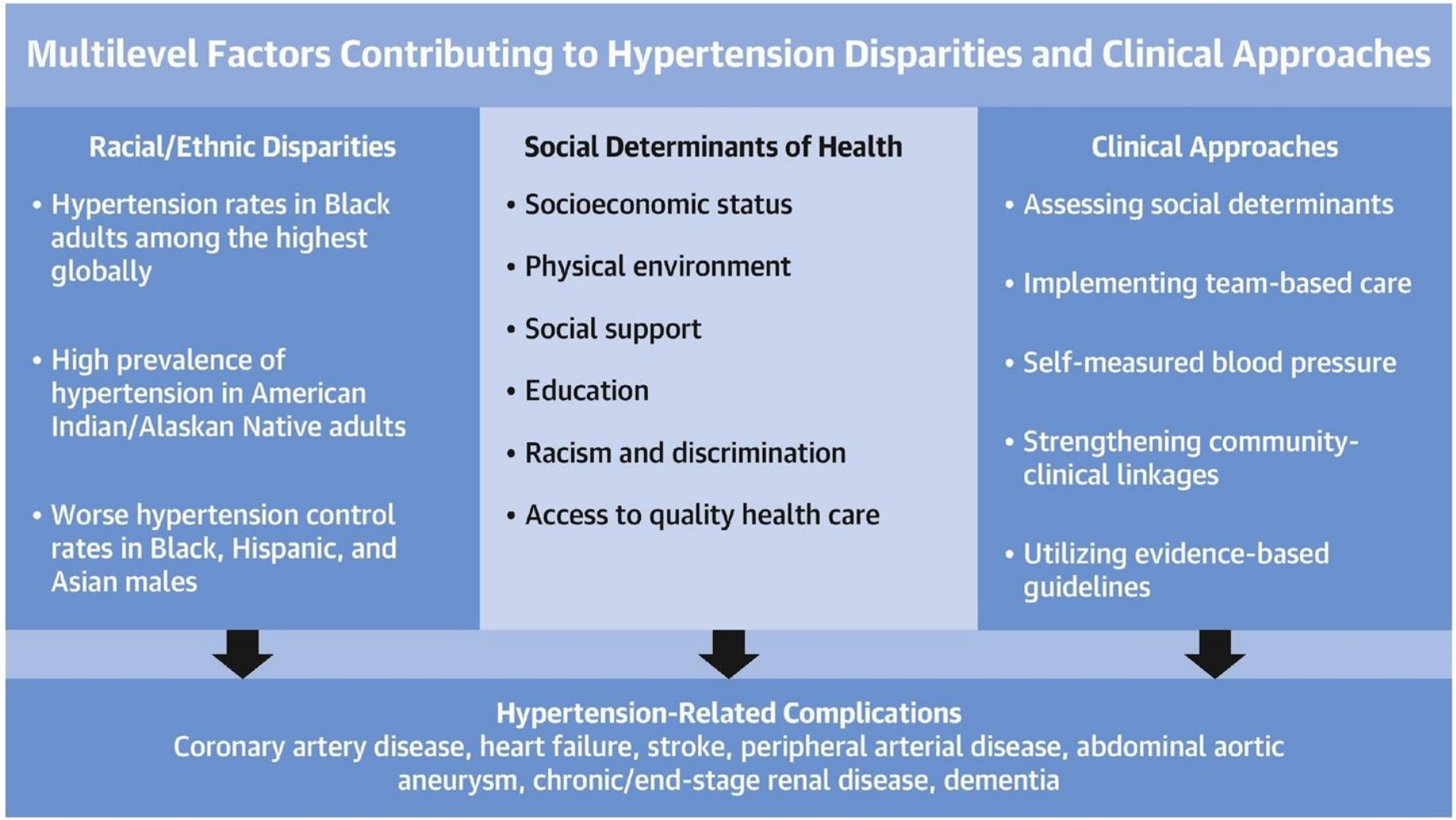
Subgroup Analyses for BP Control

- BP control less:
- Black vs. White adults (aPR = 0.88; 95% CI, 0.81-0.96)
- Age <45 yrs. or >75 yrs.

- BP control more likely:
  - Private insurance vs. without (aPR = 1.4; 95% CI, 1.08-1.8)
  - Usual health care vs. without (aPR = 1.48; 95% CI, 1.13-1.94)
  - Health care visit in past yr. vs. without (aPR = 5.23; 95% CI, 2.88 9.49)

Muntner P, et al. JAMA. 2020;324(12):1190.

CENTRAL ILLUSTRATION: Multilevel Factors Contributing to Hypertension Disparities and Clinical Considerations



Ogunniyi, M.O. et al. J Am Coll Cardiol. 2021;78(24):2460-2470.

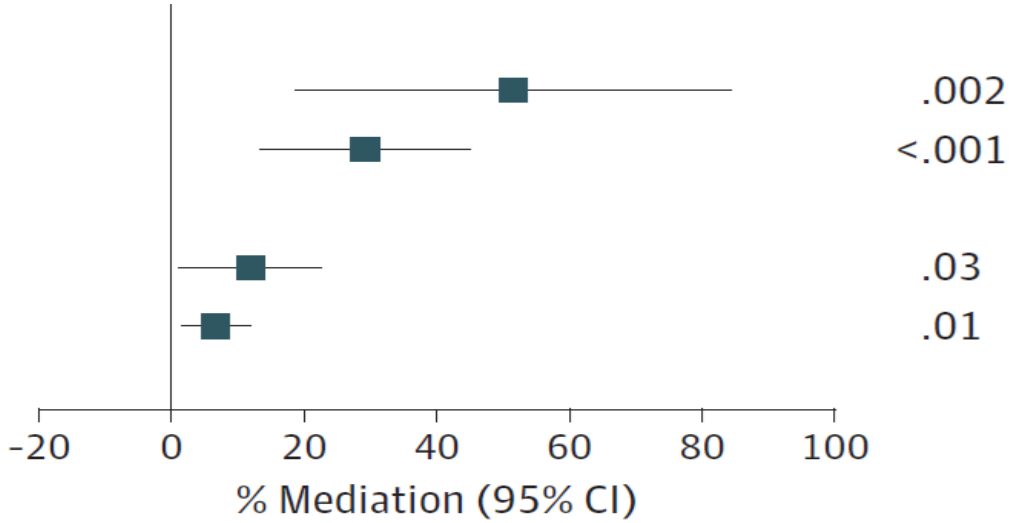
The Southern Diet: REGARDS Study

- **High Southern diet intake: largest mediator of HTN difference blacks vs. whites for both men and women.**
- Fried foods, organ meats, processed meats, eggs/egg dishes, added fats, high-fat dairy foods, sugar-sweetened beverages, and bread.
- Other research, associated increased risk of incident stroke,CHD,ESRD, and CKD,sepsis, cancer mortality, and cognitive decline.

JAMA. 2018;320(13):1338-1348

Association of Clinical and Social Factors With Excess Hypertension Risk in Black Compared With White US Adults

High Southern diet score[g]		
Men	51.6 (18.8 to 84.4)	.002
Women	29.2 (13.4 to 44.9)	<.001
High ratio of sodium to potassium[h]		
Men	12.3 (1.1 to 22.8)	.03
Women	6.8 (1.6 to 11.9)	.01



CONCLUSIONS AND RELEVANCE In a mediation analysis comparing incident hypertension among black adults vs white adults in the United States, key factors statistically mediating the racial difference for both men and women included Southern diet score, dietary ratio of sodium to potassium, and education level. Among women, waist circumference and body mass index also were key factors.

Racial and Ethnic Differences in Treatment

COR	LOE	Recommendations for Race and Ethnicity
I	B-R	In black adults with HTN but without HF or CKD, including those with DM, initial anti-HTN treatment should include a thiazide-type diuretic or CCB.

Whelton PK, Carey RM, Aronow WS, et al. Hypertension. 2018;71(6):1269-1324

Racial and Ethnic Differences in Treatment

COR	LOE	Recommendations for Race and Ethnicity
I	C-LD	Two or more antihypertensive medications are recommended to achieve a BP target of less than 130/80 mm Hg in most adults with hypertension, especially in black adults with hypertension.

Whelton PK, Carey RM, Aronow WS, et al. Hypertension. 2018;71(6):1269-1324

Pooled Estimates of Decrement in BP With Antihypertensive Treatments

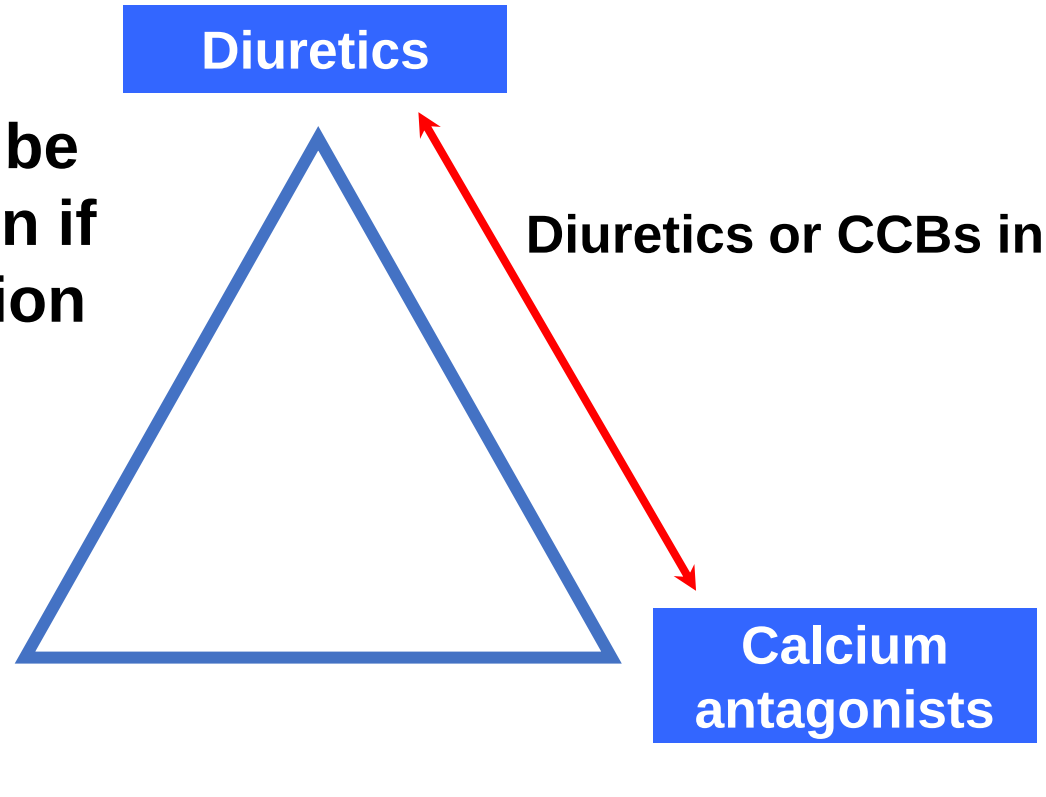
Drug Category	Mean SBP/DBP Reduction* White Adults	Black Adults	White-Black Difference
Diuretics	11.5/9.1	15.0/10.7	–3.5/–1.5
CCBs	15.3/12.6	16.9/13.3	–2.4/–0.6
β-Blockers	11.7/11.3	5.9/9.5	6.0/2.9
ACEIs	12.8/11.4	8.5/8.0	4.6/3.0

White-black difference in response between groups, with negative values indicate greater response in Black adults and positive values indicate greater response in White adults. SBP/DBP

Brewster LM, et al Ann Intern Med 2004; 141:614-627

Initial Choices of Medications

β-blockers should be included in regimen if compelling indication for a β-blocker



* Recommended for CKD
Combining ACEI with ARB discouraged

James PA, et al. JAMA. 2014;311(5):507-520

Keys to Effective Blood Pressure Control in Adults With Hypertension

1. Agree (patient and provider) on blood pressure target
2. Use fixed-dose combinations
3. Substitute long-acting chlorthalidone for hydrochlorothiazide (alternatively indapamide)
4. Use long-acting amlodipine as first-line calcium channel blocker
5. Monthly visits until blood pressure target achieved
6. Replace prescription of 30 d with 90-d refills, if allowed
7. Use telehealth strategies to augment office-based management
8. Enhance connectivity between patient, provider, and electronic health record for better feedback and communication
9. Screen for social determinants of health and consideration of obstacles to care
10. Use multidisciplinary team-based care to enhance lifestyle and medication adherence and to solve social issues

Carey RM, Wright JT Jr, Taler SJ, Whelton PK. Circ Res. 2021 Apr 2;128(7):827-846.

Supporting Adherence in Hypertensive African-American Women

Patient education

- On managing hypertension
- On managing medication side effects

Early screening for depression in hypertensive African Americans

- Development of culturally sensitive hypertension educational material
- Formation of support groups for promoting adherence

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Pharmacologic Agents in the Treatment of Hypertension

Keith C. Ferdinand, MD, FACC, FAHA, FASPC, FNLA
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Drug Classes Used to Treat Hypertension

- Thiazide and Loop Diuretics
- Calcium Channel Blockers
- Angiotensin-converting Enzyme Inhibitors
- Angiotensin Receptor Blockers
- Renin Inhibitors
- Aldosterone Blockers and Potassium Sparing Diuretics
- Beta-adrenergic Blockers
- Alpha 1 Adrenoreceptor Antagonists
- Direct-acting Vasodilators
- Central Sympatholytic Drugs

Primary Agents

Thiazide or thiazide-type 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 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	12.5–150	2 or 3	
	Enalapril	5–40	1 or 2	
	Fosinopril	10–40	1	
	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	

Whelton PK, Carey RM, Aronow WS, et al. Hypertension. 2018;71(6). doi:10.1161/hyp.0000000000000065

Primary Agents

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 HF*r*EF; 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	2	
	Nifedipine LA	30–90	1	
	Nisoldipine	17–34	1	

Whelton PK, Carey RM, Aronow WS, et al. Hypertension. 2018;71(6). doi:10.1161/hyp.0000000000000065

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	Felodipine	2.5–10	1	
	Isradipine	5–10	2	
	Nicardipine SR	60–120	2	
	Nifedipine LA	30–90	1	
	Nisoldipine	17–34	1	
CCB—nondihydropyridines	Diltiazem ER	120–360	1	Avoid routine use with beta blockers because of increased risk of bradycardia and heart block.Do not use in patients with HF*r*EF.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	100–300	1 (in the evening)	

Whelton PK, Carey RM, Aronow WS, et al. *Hypertension*. 2018;71(6). doi:10.1161/hyp.0000000000000065

Secondary Agents

Alpha-1 blockers	Doxazosin	1–16	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$_2$-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	250–1000	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	

Whelton PK, Carey RM, Aronow WS, et al. Hypertension. 2018;71(6). doi:10.1161/hyp.0000000000000065

Secondary Agents

Beta blockers—cardioselective	Atenolol	25–100	2	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 HF*r*EF.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	80–160	2	
	Propranolol LA	80–160	1	

Whelton PK, Carey RM, Aronow WS, et al. Hypertension. 2018;71(6). doi:10.1161/hyp.0000000000000065

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 are monotherapy agents and minimally effective antihypertensive agents.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	

Whelton PK, Carey RM, Aronow WS, et al. Hypertension. 2018;71(6). doi:10.1161/hyp.0000000000000065

Secondary Agents

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 HF*r*EF.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.

Whelton PK, Carey RM, Aronow WS, et al. Hypertension. 2018;71(6). doi:10.1161/hyp.0000000000000065

β-blockers for HTN & CVD

- Pharmacologic properties of b-blockers: a heterogeneous class
- HTN patients and b-blockers - newly diagnosed; elderly; African Americans; DM and MetS
- Heart failure; atrial fibrillation
- Chronic CAD; peri-operative use

2.1.2. β-Blockers

- A heterogeneous class of antihypertensive drugs with differing effects on resistance vessels, cardiac conduction and contractility.
- Remains standard of care with angina pectoris, MI, and LV dysfunction with or without symptoms of HF unless contraindicated.
- Carvedilol, metoprolol, and bisoprolol have been shown to improve outcomes in patients with HF .

Pharmacologic Properties of Relatively Selective β-blockers

Drug	β1-blockade potency ratio	β1/β2 selectivity	ISA	Lipophilicity	MSA	Half-life (h)
Acebutolol	**0.3**	**+**	**+**	**Moderate**	**+**	**3-4**
Atenolol	**1.0**	**+**	**0**	**Low**	**0**	**6-9**
Bisoprolol	**10.0**	**++**	**0**	**Moderate**	**0**	**9-12**
Metoprolol-succinate/ tartrate	**1.0**	**++**	**0**	**High**	**0**	**3-4**

Mason RP et al. J Cardiovasc Pharmacol. 2009;54:123-128. Poirier L et al. Can J Cardiol. 2012;28:334-340

Pharmacologic Properties of Vasodilating β -blockers

Drug	β1-blockade potency ratio	β1/β2 selectivity	ISA	Lipophilicity	MSA	Half-life (h)	Other
Selective beta-1 agonists							
Nebivolol	10.0	+++	0	High	0	8-27	Endothelium-dependent, nitric oxide-mediated vasodilaton
Alpha1-adrenergic and beta-adrenergic antagonists							
Labetalol	0.3	+	0	Low	0	3-4	Alpha1-adrenergic blocking activity; direct beta-2 vasodilatory activity
Carvedilol	10.0	0	0	Moderate	++	7-10	Alpha1-adrenergic blocking activity; vasodilation

Mason RP et al. J Cardiovasc Pharmacol. 2009;54:123-128. Poirier L et al. *Can J Cardiol.* 2012;28:334-340