Challenging Cases in Complex Hypertension

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Disclosure

Consultant: Eli Lilly (SURPASS-CVOT); Idorsia – Hypertension; Medtronic; Novo Nordisk; ReCor (Renal Denervation); UpToDate (Hypertension Section)

Research Grant: Ablative Solutions; Eli Lilly (TRIUMPH); ReCor (Radiance I and II)

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Case 1

- 54-year-old AA male new to your practice
- BP recently measured at 162/94 mm Hg in the local Emergency Room where he presented for sinus problems.
- Subsequent measurements at home by a friend with hypertension were "high" over the last week, both in the am and pm.
- Office BP today is 158/96 mmHg, an average of 3 measurements taken properly (seated, back supported, etc.)
- Examination remarkable only for AV nicking, a sustained apical impulse and an S4, without a murmur, normal pulses.
- BMP normal, eGFR 76 cc/min, urine negative for protein, A1C 5.1%
- EKG remarkable for LVH.

Case 1

- On further questioning you learn that the patient has a long history of hypertension and was treated starting 20 years ago but he stopped his 2 BP-lowering medications about 10 years ago.
- Up until that time he had been on a reduced salt diet, exercised, ate a healthy diet and watched his weight.
- He is employed, owns his own home, and is happily married.
- He is now 10 pounds heavier than 10 years ago at 180 pounds, 5' 10", BMI 25.8
- He states he does not drink or smoke, can go on a reduced salt diet, and will start exercising.
- He has bought a BP measuring device which he brought to the office.

Case 1 - Question 1

The Most Likely Diagnosis in This Patient Is:

A. Essential Hypertension
B. Apparent Resistant Hypertension
C. Resistant Hypertension
D. Secondary Hypertension
E. None of the above

THE VAST MAJORITY OF HYPERTENSION SEEN IN CLINICAL PRACTICE IS PRIMARY OR ESSENTIAL HYPERTENSION

- Pathogenesis of hypertension is complex:
  - Poly-genetic (multiple-genes) and environmental factors interact to cause hypertension.
  - Obesity, insulin resistance, diabetes, aging, sedentary lifestyle, family hx, and social determinants of health all contribute.
  - Pathophysiologically, activation of the R-A-A system, SNS, and Salt + Water Retention (Volume excess) elevates BP.
  - Mono-genetic (Single gene) hypertensive disorders can occur (ie Liddle's Syndrome), but these are extremely rare.

Case 1 - Question 2

Based on His Demographics (54, M, AA), Is He at Higher or Lower Risk of Developing Target-organ Disease?

A. Higher
B. Lower
C. I am not sure

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Characteristics of Hypertension in African-American Patients

- **Earlier Onset of HTN**
- **Greater Severity of HTN**
- **Greater likelihood of target-organ disease**
  - **-LVH**
  - **-ESRD (4.2x)**
  - **-Heart Failure (1.5x)**
  - **-NF Stroke (1.3x) and Fatal Stroke (1.8x)**
- **Increased Overall Mortality**

JNC VI. Arch Intern Med. 1997; 157: 2413-2446

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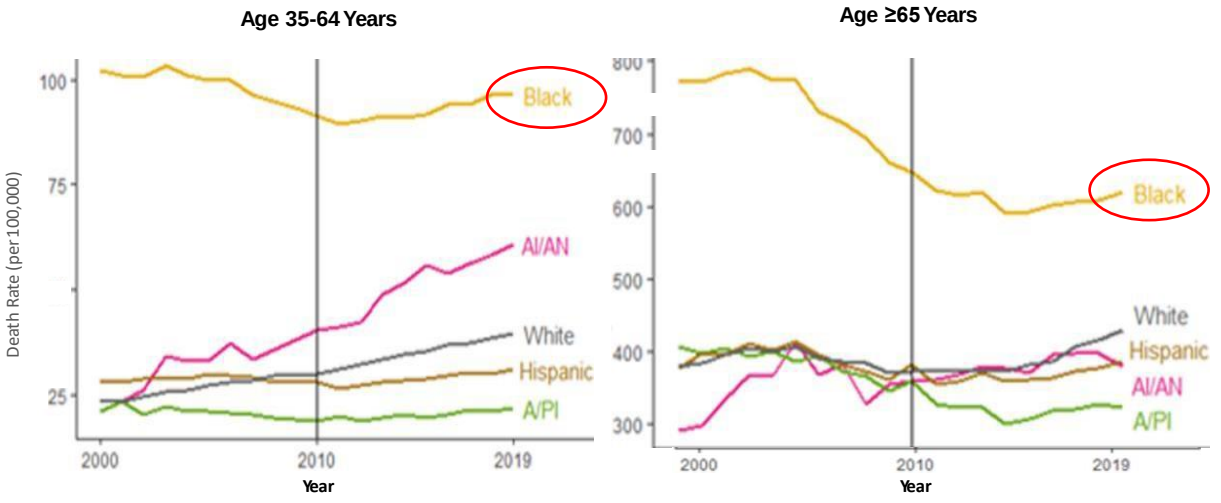
US Hypertension-Related CV Disease Mortality-2000-2019



Black-Non-Hispanic
AI/AN-American Indian/Alaska Native, Non-Hispanic
White-Non-Hispanic
A/PI -Asian/Pacific Islander, Non-Hispanic

Vaughan A et al. *JAHA* 2022;11:e024785.

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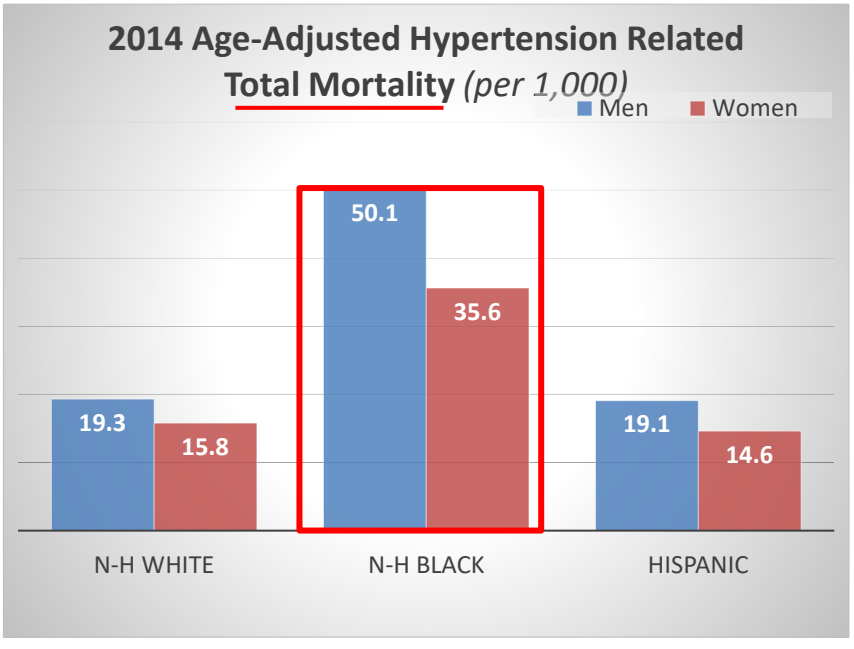

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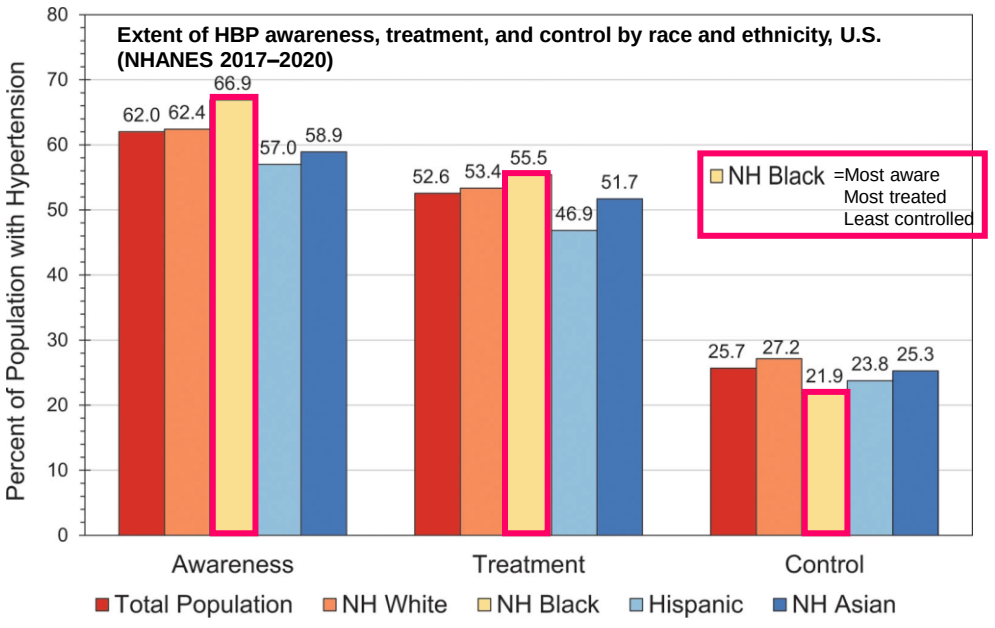

Connie W. Tsao. Circulation. Heart Disease and Stroke Statistics—2023 Update: A Report From the American Heart Association,

11

Case 1 - Question 3

In Addition to Lifestyle Modification, and Properly Teaching Him How to Take His BP at Home, with His BP of 158/96 mm Hg, Which of the Following Would You Now Do for This Patient?

A. I would not add antihypertensive Rx at this time.
B. I would start Lisinopril 20 mg qam.
C. I would start Amlodipine 5 mg qam.
D. I would start Hctz 25 mg qam.
E. I would start Benazepril 20 mg/amlodipine 5 mg qam.

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Antihypertensive Drug Treatment of Hypertension

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.

Guideline for the **Prevention**, Detection, Evaluation, and Management of High Blood Pressure in Adults; *Hypertension; JACC* Nov 2017

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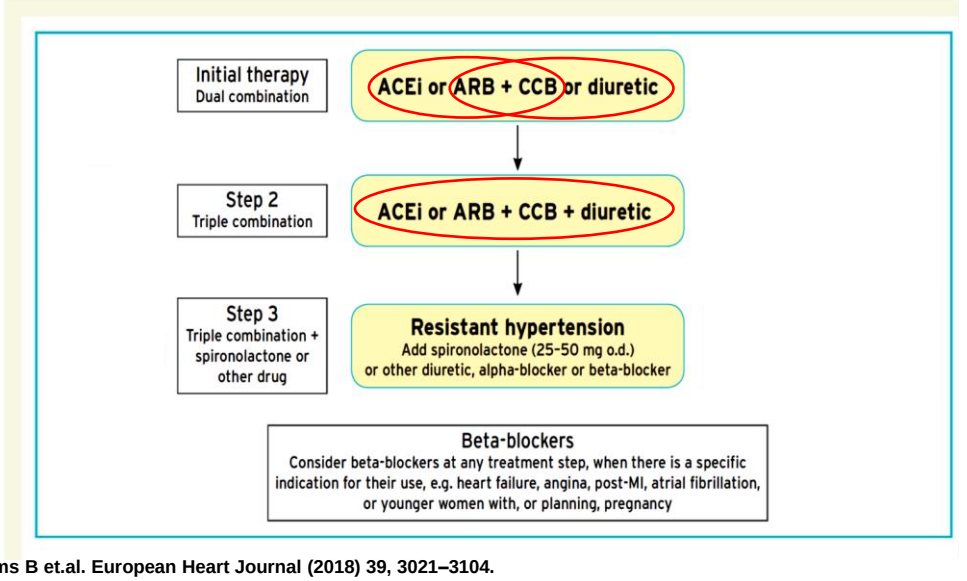
Ideal Dual then Triple Coverage-ESC 2018 and 2024



Williams B et.al. European Heart Journal (2018) 39, 3021–3104.

2024 ESC Guidelines for the management of elevated BP and HTN. *European Hrt Jnl* 2024-doi: 10.1093/eurohearti/ehae178

14

2/3 of Adults Will Require Combination Antihypertensive Therapy to Attain BP Control

JNC 7: "More than two-thirds of hypertensive individuals cannot be controlled on one drug and will require two or more antihypertensive agents from different drug classes."[1-5]

Chobanian AV, et al. JNC 7. *Hypertension*. 2003;42:1206–1252

1. Cushman WC, et al (ALLHAT). *J Clin Hypertension*. 2002;4:393–404.
2. Hansson L, et al (HOT). *Lancet*. 1998;351:1755–1762.
3. Black HR, et al (CONVINCE). *JAMA*. 2003;289: 2073–2082.
4. Dahlof B, et al (LIFE). *Lancet*. 2002;359:995–1003.
5. Materson BJ, et al (VA). *NEJM*. 1993;328:914–921.

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Why Use Combination Therapy?

- Adding an additional BP medication at standard dose has ~3x the BP-lowering effect as doubling the dose of the initial medication

Remember 7/9/11 (BP fall with ½, full & double standard dose)

Whelton PK, Carey RM, et al. 2017 ACC/AHA/ high BP guideline. *Hypertension*. 2018;71:e13–e115.

Law M R, Morris J K, Wald N J. Use of blood pressure lowering drugs in the prevention of cardiovascular disease: meta-analysis of 147 randomised trials in the context of expectations from prospective epidemiological studies *BMJ.* 2009; 338:b1665.

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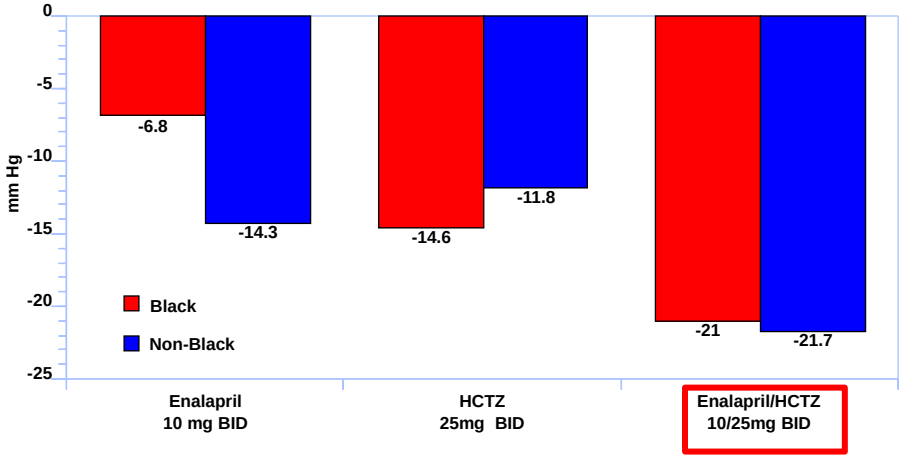
Mean Change in SBP (mmHg) After Week 8 of Rx Independent of Racial Construct



Vidt DG. J Hypertension 1984;2 (suppl 2):81-88

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Case 1 - Question 4

Should Race (Ethnicity) Influence Your Initial Choice of Antihypertensive Medication?

A. Yes.
B. No.
C. I am not sure.

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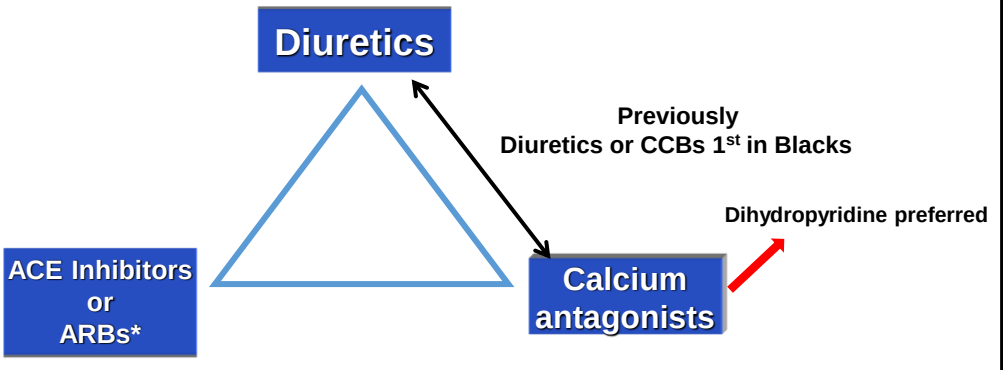
Initial Medications for the Management of Hypertension

Lifestyle Modification—Especially Diet and Exercise



* Recommended for CKD or Clinical Proteinuria
Combining ACEI with ARB discouraged-Class 3, Harm

2014 Evidence-Based Guideline for the Management of High Blood Pressure in Adults: Report From the Panel Members Appointed to the Eighth Joint National Committee (JNC 8). JAMA 2014; 311(5): 507-520. Feb 5, 2014

2017 ACC-AHA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults. Whelton PK, Carey RM et al. Hypertension 2018; 71:e13-e115.

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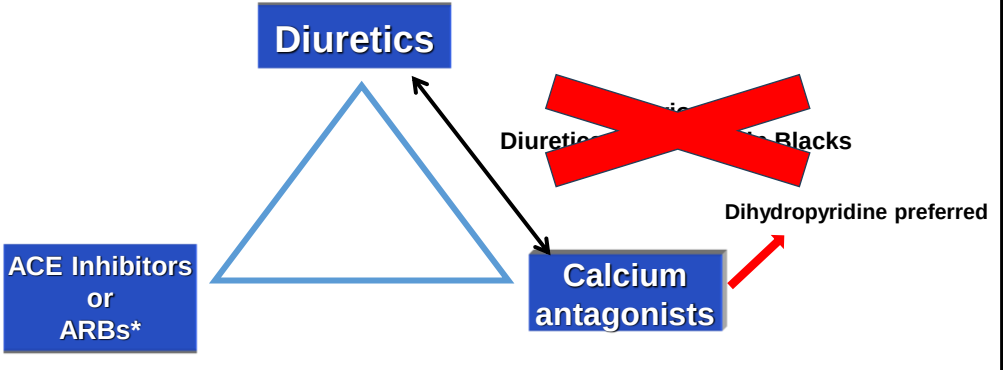
Initial Medications for the Management of Hypertension

Lifestyle Modification—Especially Diet and Exercise



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2017 ACC-AHA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults. Whelton PK, Carey RM et al. Hypertension 2018; 71:e13-e115.

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Key Point: Previous Evidence-Based Monotherapy Did Not Improve HTN Control Rates

Hypertension
Volume 79, Issue 2, February 2022; Pages 338-348
https://doi.org/10.1161/HYPERTENSIONAHA.121.17102

ORIGINAL ARTICLE

Self-Reported Antihypertensive Medication Class and Temporal Relationship to Treatment Guidelines

See Editorial, pp 349–351

Brent M. Egan, Jianing Yang, Michael K. Rakotz, Susan E. Sutherland, Kenneth A.

NHANES data comparing self-reported medication use before and after JNC-8/ACC/AHA race-based HTN guidelines

- Black individuals reported increased CCB use and decreased renin-angiotensin system blocker use
- Rates of monotherapy increased in Blacks
- HTN control decreased

Egan B.M. et al. *Hypertension* 2022; 121:26–34

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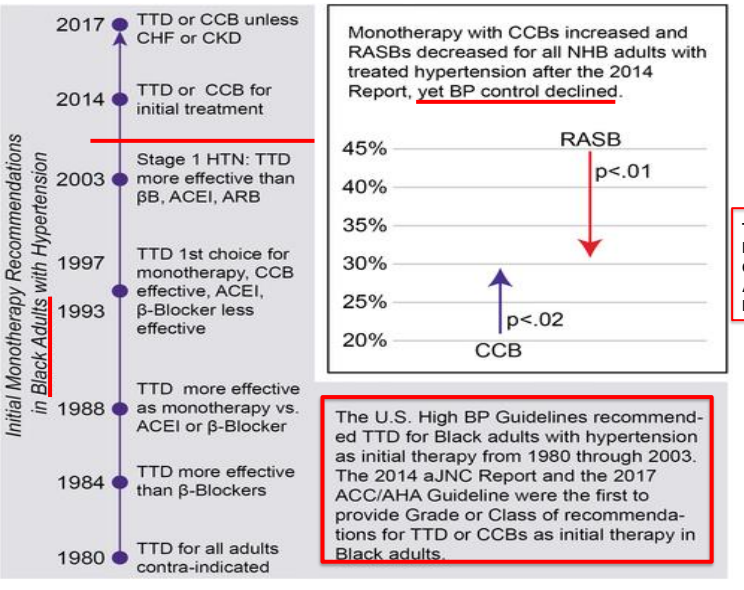
Antihypertensive Class in Black and White Adults: Temporal Relationship to Guidelines



TTD=thiazide type diuretic
RASB=RAS blocker
CCB=calcium channel blocker
ACEI=ACE inhibitor
NHB=Non-Hispanic Blacks

Egan B. et al. *Hypertension*. Volume: 79, Issue: 2, Pages: 338-348. February 2022

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Differences in Hypertension Medication Prescribing for Black Americans vs Non-Black Americans on BP Control

Retrospective 2-yr EMR observation of 10,875 patients with HTN age 18-85 on 1- or 2 BP drugs

Medication	Non-Black/AA	Black/AA
Monotherapy		
Thiazide	27.7%	41.3%
Calcium Chanel Blocker	30.1%	40.1%
ACE-I/ARB	42.3%	↓ 18.6%
2-Drug Regimen		
Thiazide and CCB	19.8%	↑ 35.8%
Thiazide and ACE-I/ARB	49.4%	↓ 44.3%
CCB and ACE-I/ARB	30.8%	↓ 19.8%

Holt H. et al. *J Am Board Fam Med* 2022;35:26–34

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EDITORIAL

Race and Antihypertensive Drug Therapy: Edging Closer to a New Paradigm

"The time has come to shift the focus from race-specific monotherapy treatment recommendations by adopting comprehensive team-based multi-level care models that use race-informed communication, self-care, and dietary strategies coupled with race-agnostic treatment algorithms that minimize therapeutic inertia and promote prescription of an adequate intensity of drug therapy. Recommending optimization of pervasively used monotherapy for Black hypertensives, a thus far unsuccessful strategy, offers no opportunity for improving hypertension control for all patients while eliminating racial disparities in the same. The evidence documenting racial disparities in drug responses is neither synonymous with the best practices nor is it a necessary component of exemplary hypertension control programs."

Flack, JM and Buhnerkempe, M.G. *Hypertension* 2022;79:349-351. Published Feb 2022

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Race-based Antihypertensive Management

- **Race is a social and not a biologic construct.**
- **Yet, racial disparities are critical to address when designing strategies to improve BP control.**
- **The longstanding use of Black race to select antihypertensive drug therapy and in atherosclerotic risk calculation has not addressed racial disparities in BP control.**
- **Race-agnostic drug therapy coupled with greater emphasis on diet/lifestyle modification in Black patients should be the cornerstone of a race-informed approach to hypertension therapeutics.**

Flack JM, et al. *Am J Hypertens*. July 2024 10.1093/ajh/hpae093.

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Hypertension

ORIGINAL ARTICLE

Improved Persistence to Medication, Decreased Cardiovascular Events and Reduced All-Cause Mortality in Hypertensive Patients With Use of Single-Pill Combinations: Results From the START-Study

Roland E. Schmieder, Sven Wassmann, Hans-Georg Predel, Burkhard Weisser, Jörg Blettenberg, Anton Gillessen, Olaf Randerath, Antje Mevius, Thomas Wilke, Michael Böhm

(Hypertension. 2023;80:1127–1135. DOI: 10.1161/HYPERTENSIONAHA.122.20810.)

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Methodology of START-Study

- Retrospective Observational Claims Data Analysis.
- Hypertensive Adults 18 years and older.
- All patients treated with renin-angiotensin system combinations given as single pill or identical multi-pills covering the years 2012 to 2018.
- Patients were not allowed to have any of the fixed-dose combinations evaluated the last year prior to the inclusion in the data set analysis.
- Followed up to at least 1 year.
- 1:1 propensity score matching used.
- Persistence to medication, CV events, and all-cause mortality were compared using non-parametric tests.
- Results were reported as incidence rate ratios and hazard ratios.
- Adherence with the single-pill fixed-dose combination antihypertensive agents was improved 20-50% over the same medications given as multiple single-pill antihypertensive agents.

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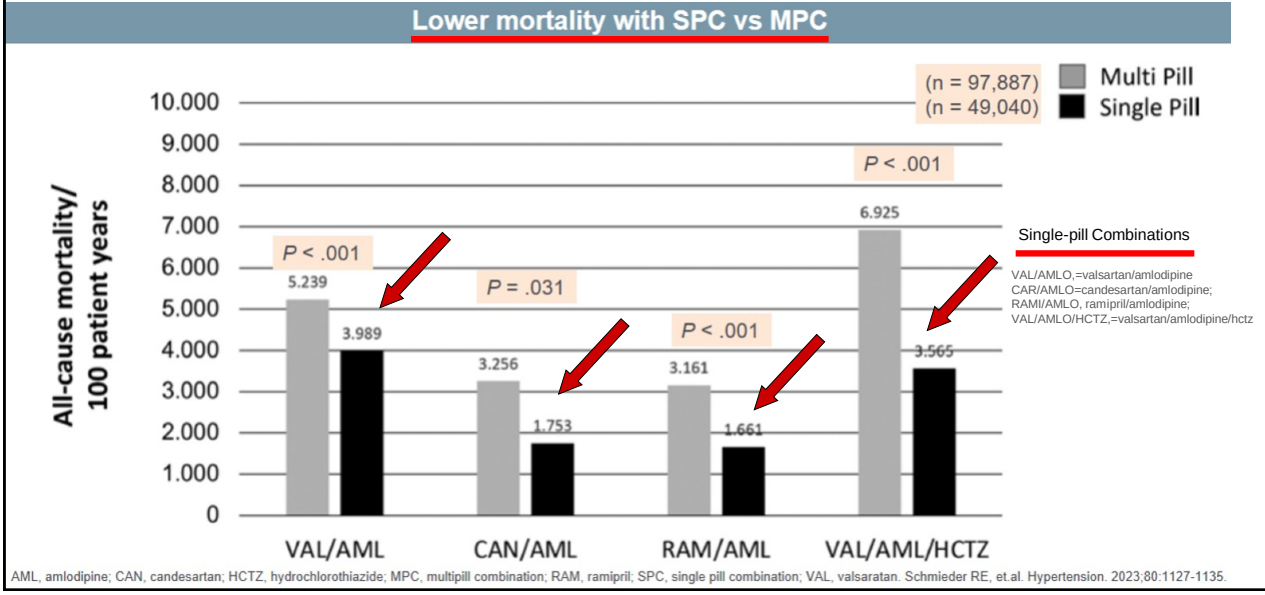
All-Cause Mortality in Single-Pill Combination vs Multi-pill Combination Groups: The START Study



AML, amlodipine; CAN, candesartan; HCTZ, hydrochlorothiazide; MPC, multipill combination; RAM, ramipril; SPC, single pill combination; VAL, valsaratan. Schmieder RE, et al. Hypertension. 2023;80:1127-1135.

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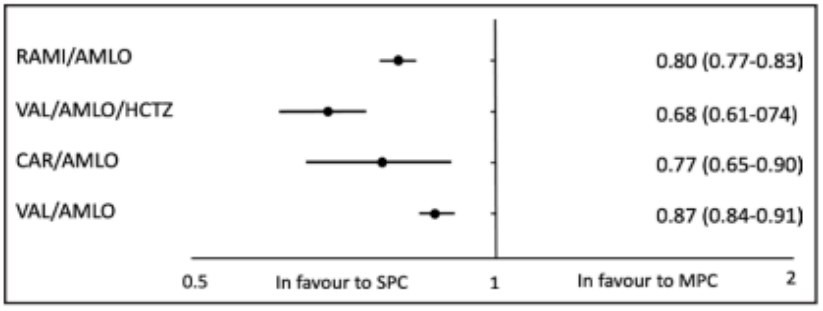
Reduced All-Cause Hospitalization and All-Cause Mortality in the SPC vs MPC Groups in Patients w HTN

Results for the composite outcome of All-Cause Hospitalization and All-Cause Death



Comparisons are done between matched SPC (Single-Pill Combinations) versus MPC (Multiple Pill Combinations) cohorts..

RAMI/AMLO, ramipril/amlodipine;
VAL/AMLO/HCTZ,=valsartan/amlodipine/hydrochlorothiazide
CAR/AMLO=candesartan/amlodipine;
VAL/AMLO,=valsartan/amlodipine

Fig 3. Schmieder RE et al. Hypertension May.2023;80:1127–1135.

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Improved Adherence with SPC's

Study*	Design	SPC, N	FEC, N	†PDC SPC vs. FEC, *p*-value
Ah, *et al*	RetroDB	20,175	20,175	80% vs. 70%, $p < 0.01$
Breitscheidel, *et al*	RertroDB	45,511	26,172	78.1% vs. 71.5%, $p < 0.0001$
Degli Esposti, *et al*	RetroCoh	302	791	79.8% vs. 70.9%, $p < 0.01$
Dickson, *et al*	RetroCoh	2336	3368	63.4% vs. 49%, $p < 0.0001$
Hess, *et al*	RetroCoh	7225	7224	76.9% vs. 54.4%, $p < 0.001$
Ho, *et al*	RetroDB	13,176	4392	58% vs 47%, $p < 0.001$
Hsu, *et al*	RetroDB	5725	1623	42.1% vs 32.4%, $p < 0.001$
Jin-Young, *et al*	RetroOB	757	707	MPR $\geq$ 80%: 91.9% vs. 88.9%, NS
Koval, *et al*	RandPG	39	36	87% vs. 61%, $p < 0.05$
Machniki, *et al*	RetroDB	1884	1884	70.0% vs. 60.6%, $p < 0.0001$
Marazzi, *et al*	RanPro	154	152	94% vs. 85%, $p = 0.034$
Schweizer, *et al*	NRPro	197	138	100% vs. 92%, p=NS
Tung, *et al*	RetroDB	1136	4544	PDC $\geq$ 80%: 65.0% vs. 56.9%, $p < 0.001$
Yang, *et al*	RetroDB	382,476	197,375	72.8% vs. 61.3% (11.6% [11.4–11.7])

* Adapted from Parati. et al.Hypertension 2021;77(2):692-705

†When only medication possess ratio (MPR) provided, MPR multiplied × 100 and expressed as percent to approximate proportion of days covered (PDC).

SPC: single-pill combinations; FEC: free equivalent combinations; RetroDB: retrospective database design; RetroCor: retrospective cohort; RetroOb: retrospective observational; RanPro: randomised, prospective; NRPro: non-randomised prospective; P = NS: not significant or not provided.

Table 1. Egan, B.M. Et al. Blood Pressure, 31:1, pg 164-168. 2022

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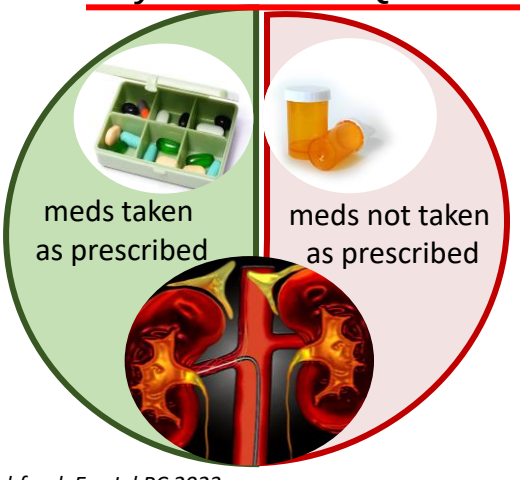
TRIO Ultrasound Renal Denervation-ON 3 MEDS at Screening:

Their BP at Screening in the Office Qualified for the Study

1 Month Later Having Been on a Triple Single-Pill Combination Agent Only 43% Now Qualified for the Study by 24-hr ABPM



Single-Pill Triple Combinations now Improved adherence and patients no longer qualified for the Study

Fisher & Mahfoud, Eur Jnl PC 2023

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Triple Fixed Dose Combinations-Good Rx 3/1/24

Tribenzor (olmesartan / amlodipine / HCTZ)	40mg/10mg/25mg (30 tablets)	$55.78	View prices
Exforge HCT (amlodipine / valsartan / HCTZ)	10mg/320mg/25mg (30 tablets)	$59.83	View prices

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First and Only Key Clinical Antihypertensive Trial in Patients with Hypertension to Establish Best Initial Fixed-Dose Single Combination Therapy

- **ACCOMPLISH (Avoiding Cardiovascular Events through COMbination Therapy in Patients LIving with Systolic Hypertension) (2008)**

Jamerson K. et al. N Engl J Med Volume 359(23):2417-2428 December 4, 2008

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ACCOMPLISH Trial

Benazepril plus Amlodipine or Hydrochlorothiazide for Hypertension in High-Risk Patients

- Compared Benazapril-Amlodipine with Benazapril-HCTZ in 11.506 high-risk patients
- Baseline BP 145/80 mm Hg with underlying predominantly cardiac disease or other target organ involvement
- Combined CV endpoint (CV death, nonfatal MI, nonfatal stroke, hospitalization from angina, resuscitation from sudden cardiac death, coronary revascularization)
- At 3 years, Composite endpoint lower in Benazapril- Amlodipine arm

Jamerson K. et al. N Engl J Med Volume 359(23):2417-2428 December 4, 2008

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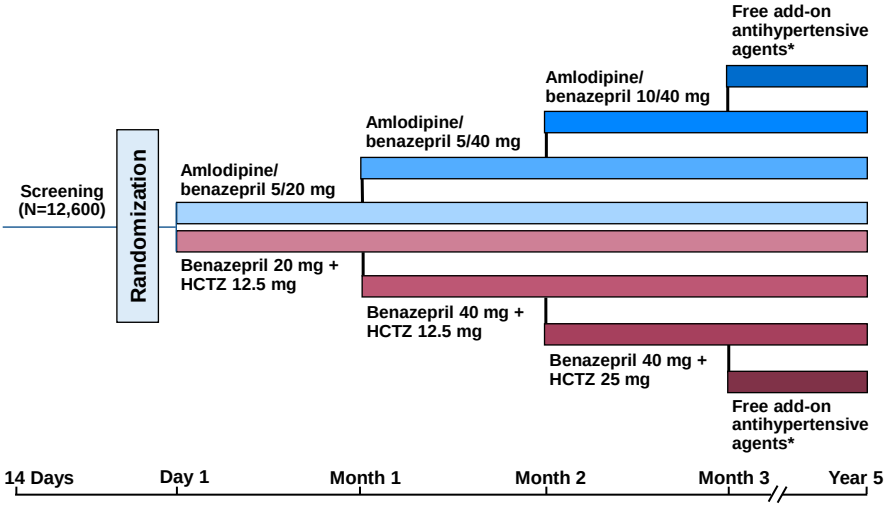
ACCOMPLISH: Study Design



*β-blockers
α-blockers
clonidine
loop diuretics

Patients were seen at six months following Day 1, and at six-month intervals until the end of the five year trial. Target blood pressure was <140/90 mmHg; <130/80 mmHg in patients with diabetes or renal insufficiency.

Jamerson KA et al. *Am J Hypertens*. 2004;17:793–801.

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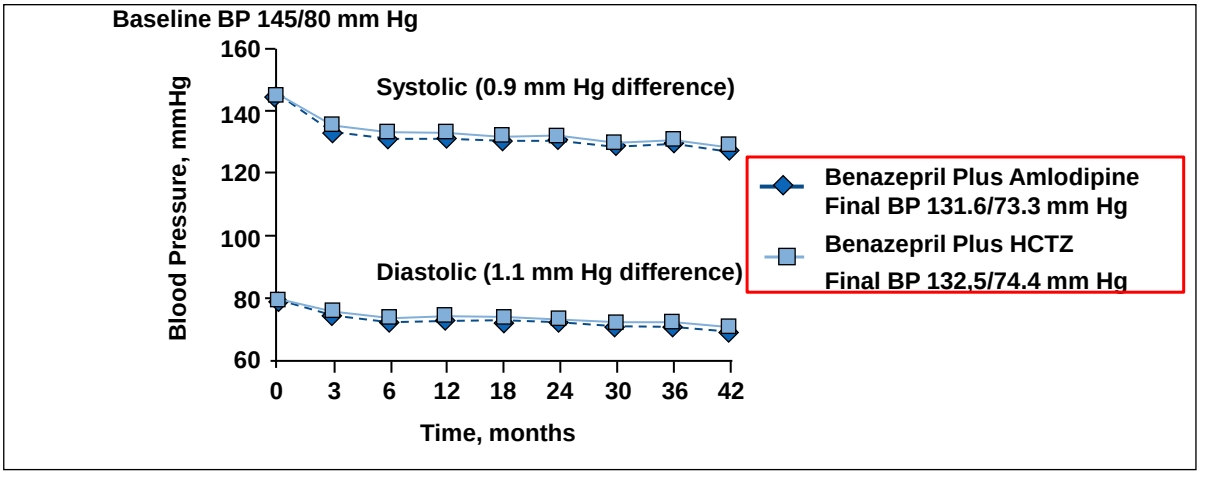
ACCOMPLISH: Treatment Effects on Blood Pressure



N=11,506 high-risk patients with hypertension with mean BP on entry 145/80 mm Hg

Fig 1. Jamerson K et al. *N Engl J Med*. 2008;359:2417–2428.

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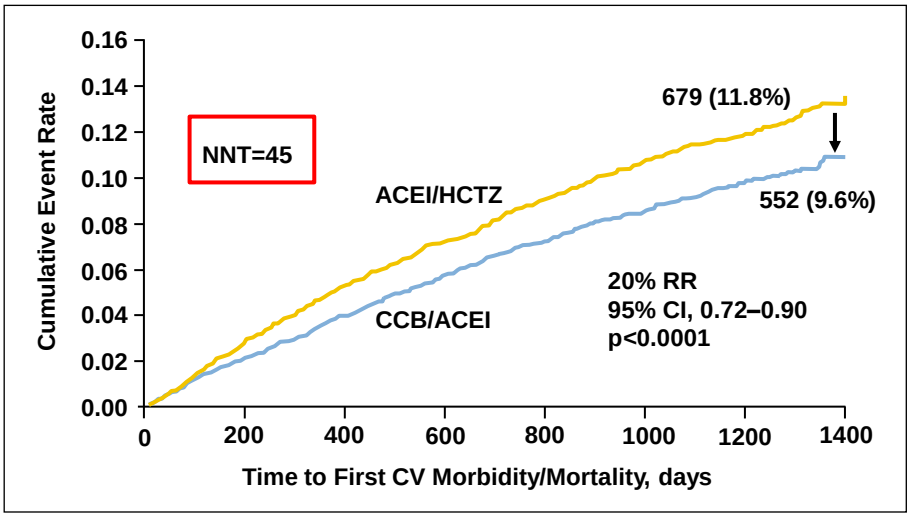
ACCOMPLISH: Primary Outcome



Jamerson K et al. *N Engl J Med.* 2008;359:2417–2428.

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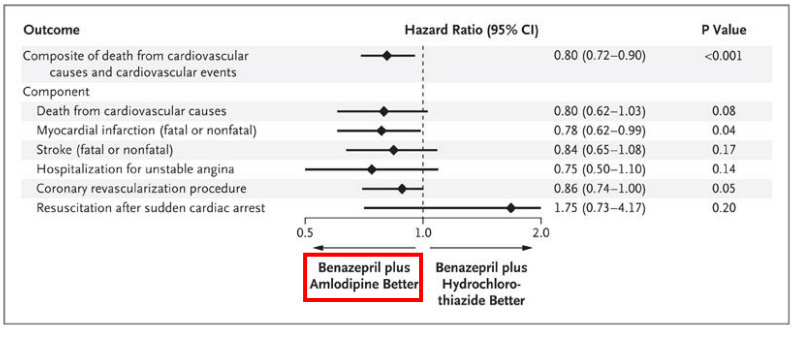
Original Article

Benazepril Plus Amlodipine or Hydrochlorothiazide for Hypertension in High-Risk Patients

Hazard Ratios for the Primary Outcome and the Individual Components



Jamerson K et al. N Engl J Med 2008;359:2417-2428

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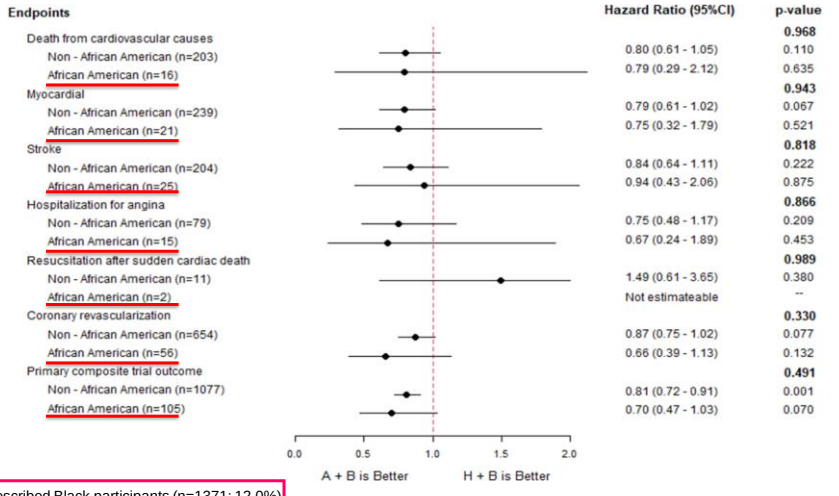
CV Benefits of Combination ACE Inhibition Plus Calcium Channel Blockade in Black Hypertensive Patients



Self-described Black participants (n=1371; 12.0%)
All others (n=10 083; 88%)

Brook R.D. et al. Hypertension. 2021; Vol: 78, Issue: 4, Pages: 1150-1152.

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DRUG COMBINATIONS IN HYPERTENSION: RECOMMENDATIONS

Preferred

- ACE inhibitor/diuretic*
- ARB/diuretic*
- ACE inhibitor/CCB*
- ARB/CCB*

*Single Pill Combinations available in the US

Acceptable

- Beta blocker/diuretic*
- CCB (dihydropyridine)/β-blocker
- CCB/diuretic
- Direct Renin inhibitor/diuretic
- Direct Renin inhibitor/ARB
- Thiazide diuretics/K+ sparing diuretics*

Unacceptable

- ACE inhibitor/ARB
- ACE inhibitor/β-blocker
- ARB/β-blocker
- CCB (nondihydropyridine)/β-blocker
- Centrally acting agent/β-blocker

*Good Rx 90 days 11/1/24 at Costco

"Ideal" Combinations Available**

Benazepril 40 mg/Amlodipine 10 mg	$16.75 (30)
+	
Spironolactone 25/HCTZ 25	$17.99 (30)

Gradman AH, Basile JN, Carter BL, Bakris GL; American Society of Hypertension Writing Group. *J Am Soc Hypertens.* 2010;4:42-50.
**Basile Personal Communication-Good Rx site 5/15/24, Costco/Publix

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SUMMARY of CASE 1:

1. The vast majority of patients with hypertension have essential or primary hypertension.
2. Patients with elevated BP's in our office are often non-adherent to both lifestyle and pharmacologic therapy.
3. Self-identified African-American patients with hypertension are at an increased risk of CV mortality and overall mortality which does not seem to be related to their unawareness or their receiving treatment for their hypertension. They are, however, less likely to have their BP controlled.
4. In an effort to overcome clinical inertia and to reduce mortality and hospitalizations in those with hypertension, initially starting single pill fixed-dose combination agents to improve adherence, BP control, and outcome can be recommended for all patients
5. The ideal combination agent may not be with hctz, but with amlodipine and a RAS-blocking combination according to the ACCOMPLISH trial, regardless of race.
6. The next best cost-conscious fixed dose combination to be added may be spiro/hctz.

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Case 2

- 78-year-old WF with no significant medical history for ASCVD, CKD, or Diabetes presents for evaluation on no medications.
- She has had hypertension for over 40 years and was on 1 antihypertensive agent, a "fluid pill", for many years.
- She has been off her medication for 2 years and wants to know if she should restart her medication.
- No history of out-of-office BP measurement, her average office BP measurement today (3 measurements) was 142/92 mm Hg.
- P exam-unremarkable, eyegrounds showed slight arteriolar narrowing.
- Labs-sodium 138, potassium 4.2, glucose 86, creatinine 0.78 (eGFR 70), Total chol-160, HDL-C 50, Trig-100, LDL-C-90, EKG-NSR, o/w nl.

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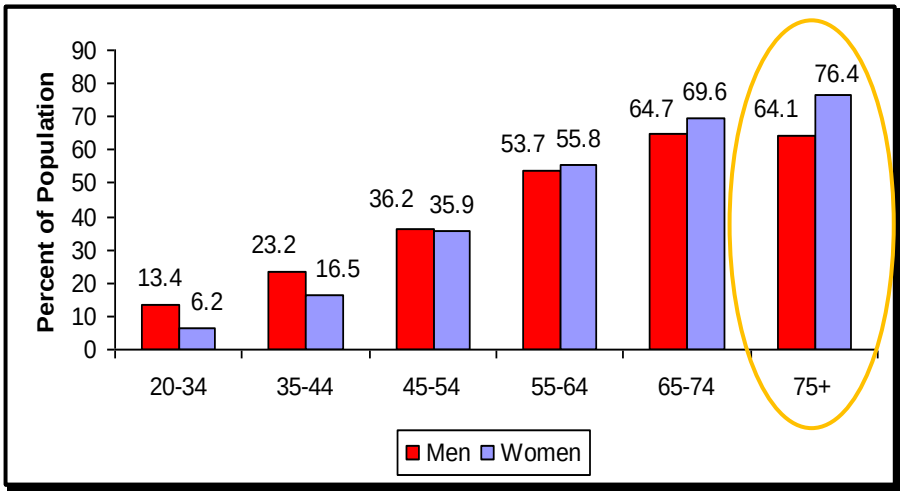
Case 2, Question 1

What Would You Do Next?

A. Ask patient to perform home (out-of-office self-monitoring of BP) and bring the BP values to the office at the follow-up appt in 1 month.
B. Calculate the 10-year ASCVD risk score.
C. Begin Lifestyle modification.
D. All of the above
E. None of the above

Prevalence of High Blood Pressure in Adults by Age and Sex



(NHANES: 2005-2006). Source: NCHS and NHLBI.

Out-of-Office and Self-Monitoring of BP

COR	LOE	Recommendation for Out-of-Office and Self-Monitoring of BP
I	A^{SR}	**Out-of-office BP measurements are recommended to confirm the diagnosis of hypertension and for titration of BP-lowering medication, in conjunction with telehealth counseling or clinical interventions.**

SR indicates systematic review.

Table 8 2017 ACC-AHA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults; *Hypertension;* JACC Nov 2017

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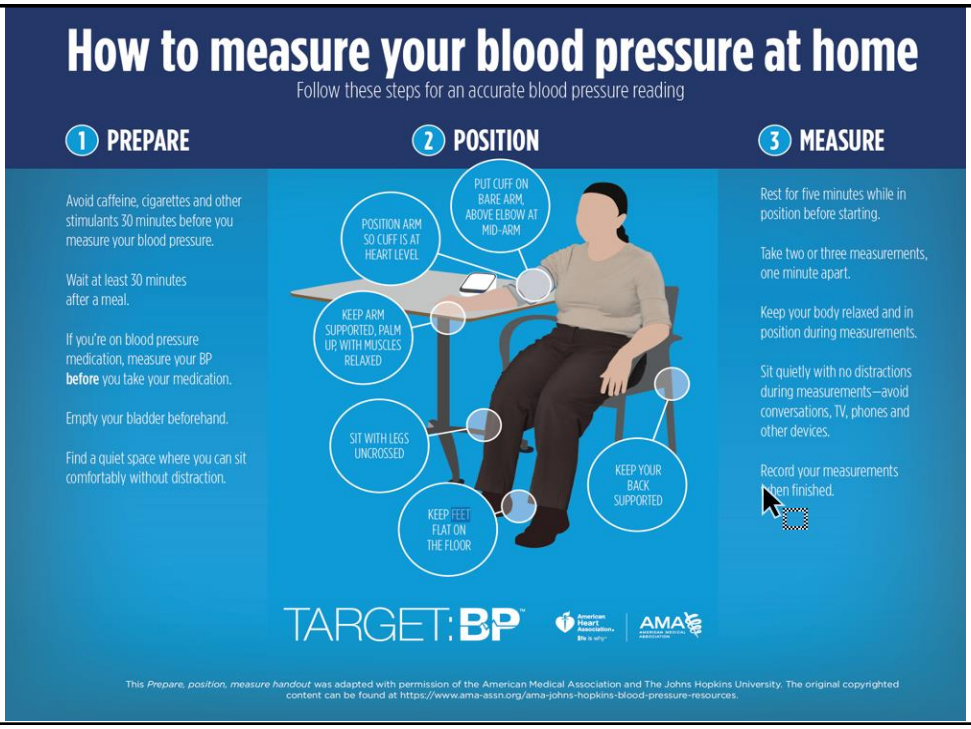
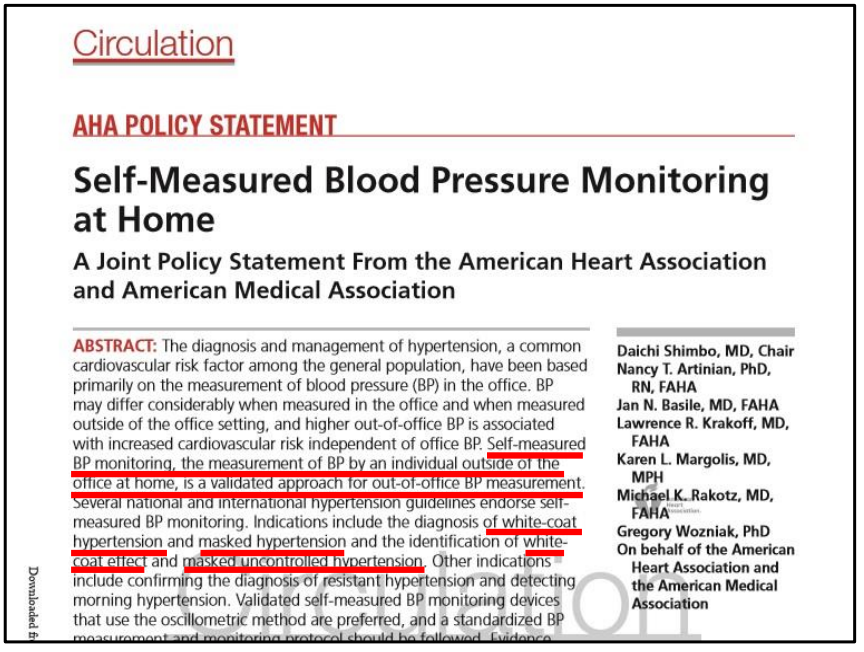


46



Circulation

AHA POLICY STATEMENT

Self-Measured Blood Pressure Monitoring at Home

A Joint Policy Statement From the American Heart Association and American Medical Association

ABSTRACT: The diagnosis and management of hypertension, a common cardiovascular risk factor among the general population, have been based primarily on the measurement of blood pressure (BP) in the office. BP may differ considerably when measured in the office and when measured outside of the office setting, and higher out-of-office BP is associated with increased cardiovascular risk independent of office BP. Self-measured BP monitoring, the measurement of BP by an individual outside of the office at home, is a validated approach for out-of-office BP measurement. Several national and international hypertension guidelines endorse self-measured BP monitoring. Indications include the diagnosis of white-coat hypertension and masked hypertension and the identification of white-coat effect and masked uncontrolled hypertension. Other indications include confirming the diagnosis of resistant hypertension and detecting morning hypertension. Validated self-measured BP monitoring devices that use the oscillometric method are preferred, and a standardized BP measurement and monitoring protocol should be followed. Evidence

Daichi Shimbo, MD, Chair
Nancy T. Artinian, PhD, RN, FAHA
Jan N. Basile, MD, FAHA
Lawrence R. Krakoff, MD, FAHA
Karen L. Margolis, MD, MPH
Michael K. Rakotz, MD, FAHA
Gregory Wozniak, PhD
On behalf of the American Heart Association and the American Medical Association

Shimbo D., Artinian N, Basile J. et al. *Circulation* 2020; 142:e42-e63. July 28, 2020.

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Out-of-Office Blood (Self) Pressure Measurement

- **Provides a better risk prediction than office-based monitoring**
- **Correlates better with the cardiac (LVH) and renal (albuminuria) consequences of hypertension than office readings**

Use and Advantages:

- **Helps identify WCH and masked hypertension**
- **Readings in the am and before bed may reveal patterns in blood pressure and periods when control is inadequate (Masked UnControlled Hypertension)**
- **Improves patient adherence**
- **Reduces costs**

Pickering TG, White W. *J Clin Hypertens*. 2008;10:850–855;

Izzo JL, Sica DA, Black HR, eds, and the Council for High Blood Pressure Research (American Heart Association). *Hypertension Primer: The Essentials of High Blood Pressure*. 4th ed. Philadelphia; 2008:339–342.

48

New Centers for Medicare and Medicaid Services (CMS) Incentives for using SMBP (Self or Home Measured BP):
Coverage & Reimbursement

2020 CPT codes for Self or Home Measured BP

- Medicare has coverage for Self or Home Measured BP in their 2020 fee schedule

99473: Education/Training

SMBP using a device validated for clinical accuracy; patient education/training and device calibration
- Can be submitted once
- Staff time = $11.19 for patient education

Patients choose 1 week per month, twice in the am when first waking up and twice before getting into bed.
28 measurements throw out 1st day

99474: Monthly Patient Use

SMBP using a device validated for clinical accuracy; separate self-measurements of two readings, one minute apart, twice daily over a 30-day period (minimum of 12 readings), collection of data reported by the patient and/or caregiver to the physician or other qualified health care professional, with report of average systolic and diastolic pressures and subsequent communication of a treatment plan to the patient
- Can be submitted monthly
- Provider = $15.16 monthly for data entered/treatment plan communicated to patient. **Will increase the use of telehealth in BP control**.

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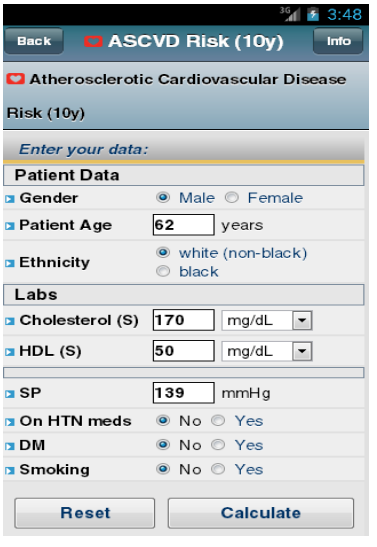
CVD Risk Prediction Does Not Need to be Complicated



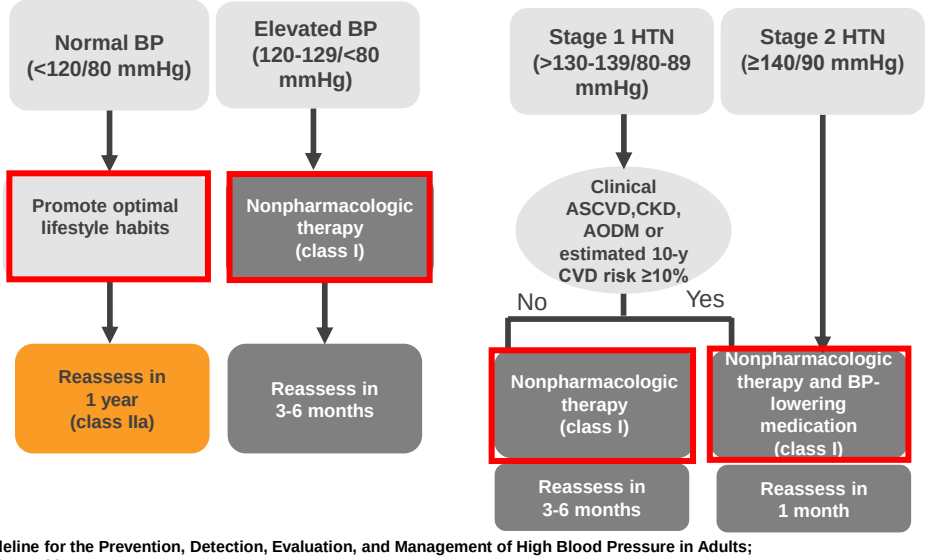
http://tools.acc.org/ASCVD-Risk-Estimator/

50

Case 2 (Cont.)

- Current 10-year ASCVD Risk: 25.8%
- Lifetime ASCVD Risk: only for 20 to 59 years of age
- Optimal ASCVD Risk: 16.6%

Algorithm: BP Thresholds and Recommendations for Treatment and Follow-Up



2017 ACC-AHA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults; *Hypertension*; JACC Nov 2017

Treatment Starts with Non-Pharmacologic (Lifestyle) Management Each with a 1A LOE

Goal	Nonpharmacological Interventions	Dose	Systolic BP Impact in Hypertension	Systolic BP Impact in Normotension
Weight loss	Weight/ body fat	• Best goal is ideal body weight • Expect about 1 mm Hg for every 1 kg reduction in body weight	-5 mm Hg	-2/3 mm Hg
Healthy diet	DASH dietary pattern	• 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/day, most Americans 3400 mg/day • 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/day, preferably by consumption of a diet rich in potassium	-4/5 mm Hg	-2 mm Hg
Physical activity	Aerobic	• 90-150 min/week • 65%-75% heart rate reserve	-5/8 mm Hg	-2/4 mm Hg
Physical activity	Dynamic resistance	• 90-150 min/week; 50%-80% 1 rep maximum • 6 exercises, 3 sets/exercise, 10 repetitions/set	-4 mm Hg	-2 mm Hg
Physical activity	Isometric resistance	• 4 x 2 min (hand grip), 1 min rest between exercises, 30%-40% maximum voluntary contraction, 3 sessions/week; 8-10 weeks	-5 mm Hg	-4 mm Hg
Moderation of alcohol intake	Alcohol consumption	• ≤1 drink daily for women • ≤2 drinks daily for men Drink= 5 oz of wine, 12 oz of beer 1 oz 100 proof or 1.5 oz of 70 proof	-4 mm Hg	-3 mm Hg

Adapted from Whelton PK et al. *J Am Coll Cardiol.* 2018;71:e127-e248.

LOE-Level Of Evidence

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Fresh Fruits High in Potassium

FRUIT	Serving	K(mEq)
Blueberries, raw	1/2 cup	1.7
Grapes	10	2.4
Pineapple, raw	1/2 cup	2.9
Plum	1	2.9
Strawberries	1/2 cup	3.2
Cherries, sweet, raw	10	3.9
Apple	1 medium	4.1
Peach	1	4.4
Peaches, canned	1/2 cup	4.1
Pear	1	5.3
Orange	1	6.1
Banana	1 medium	11.6
Raisins	1/4 cup	14.2
Watermelon	1/8	14.4
Avocado	1/2	15.4
Grapefruit	1/2	21.2
Cantaloupe	1/2	21.2

Highest

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Foods Rich in Potassium

Fruits-Raisins, Prunes, Apricots, Dates, Strawberries, Bananas, Watermelon, Cantaloupe, Citrus Fruits

Vegetables-Beets, Greens, Spinach, Tomatoes, Mushrooms, Peas, Beans

Fish-Salmon, Cod

Soy products, Veggie Burgers, Turkey, Beef

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Case 2 (Cont.)

- She returns in 1 month with her home BPs stating that she feels well and has gone on a label-reading diet trying to avoid processed and high-salt foods while increasing high potassium foods (fruits and vegetables).
- Her BPs at home have been 138-142/84-88 mm Hg)
- She asks you what she should do for her BP?

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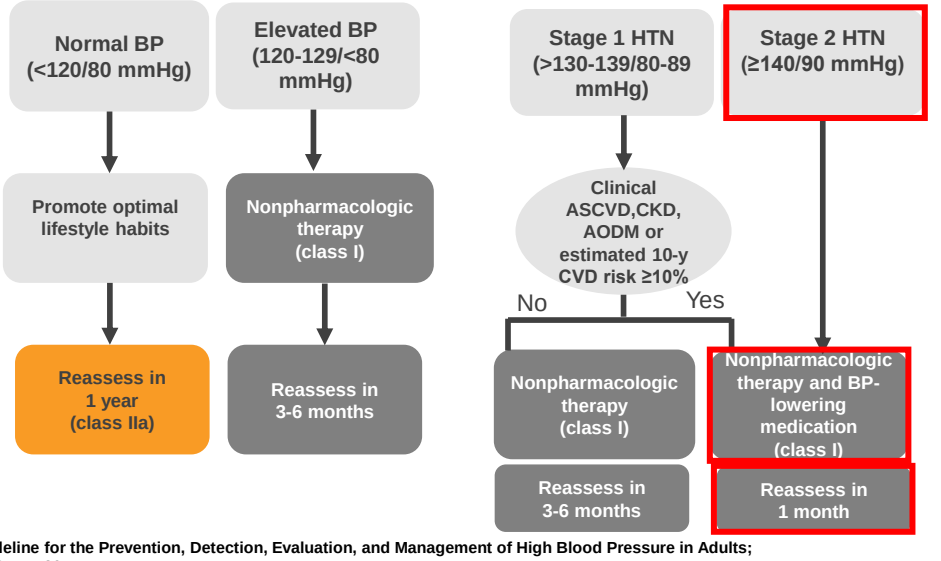
Case 2, Question 2

What Is Your Target for BP Control in This 78-year-old Patient?

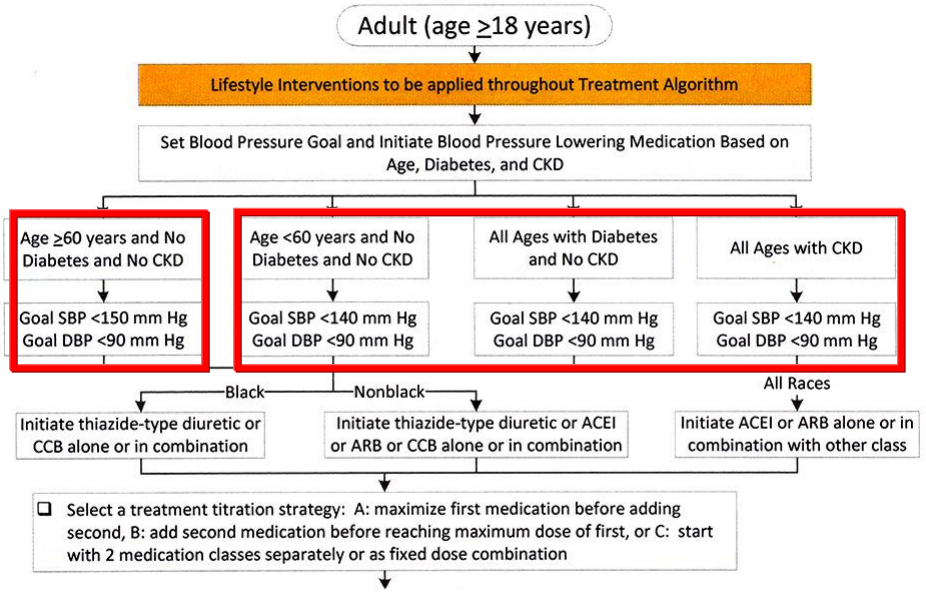
A. < 150/90 mm Hg
B. < 140/90 mm Hg
C. < 130/80 mm Hg
D. < 120/80 mm Hg
E. I am unsure

Algorithm: BP Thresholds and Recommendations for Treatment and Follow-Up



2017 ACC-AHA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults; *Hypertension*; JACC Nov 2017

JNC 8 Hypertension Guideline Management Algorithm-Endorsed by the AAFP and ACP



James PA, Oparil S, Carter BL et al. *JAMA* 2014: 311 (5):507-520, Feb 5, 2014.

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BONUS DIGITAL CONTENT

Practice Guidelines

Blood Pressure Targets in Adults With Hypertension: A Clinical Practice Guideline From the AAFP

Sarah Coles, MD, FAAFP, Colorado Plateau Family and Community Medicine Residency Program, North County HealthCare, Flagstaff, Arizona; University of Arizona College of Medicine, Phoenix, Arizona
Lynn Fisher, MD, FAAFP, University of Kansas School of Medicine, Wichita, Kansas
Kenneth W. Lin, MD, MPH, Lancaster General Hospital Family Medicine Residency Program, Lancaster, Pennsylvania
Corey Lyon, DO, FAAFP, University of Colorado School of Medicine, Denver, Colorado
Alexis A. Vosooney, MD, Allina Health Group, West Saint Paul, Minnesota
Melanie D. Bird, PhD, MSAM, American Academy of Family Physicians, Leawood, Kansas

Am Fam Physician. 2022;106(6):721-722

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TABLE 4

Comparison of Recommended Blood Pressure Targets in Recent Guidelines

Guideline	18 to 59 years of age (mm Hg)	60 to 69 years of age (mm Hg)	70 to 79 years of age (mm Hg)	Older than 80 years (mm Hg)
2022 American Academy of Family Physicians*	< 140/90	< 140/90	< 140/90	< 140/90
2022 National Institute for Health and Care Excellence[13]	< 140/90	< 140/90	< 140/90	< 150/90
2021 European Society of Hypertension Council[14]	< 130/80†	< 130/80†	< 140/80	< 140/80
2020 International Society of Hypertension‡[44]	< 130/80	< 140/90§	< 140/90	< 140/90
2020 U.S. Department of Veterans Affairs/U.S. Department of Defense‖[15]	< 130/90¶	< 150/90	< 150/90	< 150/90
2017 American College of Cardiology/American Heart Association*[16]	< 130/80	< 130/80	< 130/80	< 130/80
2017 American College of Physicians and American Academy of Family Physicians[11]	—	< 150/90	< 150/90	< 150/90
2014 Eighth Joint National Committee[10]	< 140/90	< 150/90	< 150/90	< 150/90

*—Lower targets are reasonable based on clinical judgment and patient preferences or values.
†—A target of less than 140/90 mm Hg is recommended for patients with chronic kidney disease.
‡—Recommendation is to treat all patients to less than 140/90 mm Hg but states it is optimal to treat persons younger than 65 years and people with coronary artery disease, chronic kidney disease, heart failure, previous stroke, chronic obstructive pulmonary disease, or diabetes mellitus to less than 130/80 mm Hg (less than 140/80 mm Hg in older patients).
§—Recommendation is to transition from target of 130/80 mm Hg to 140/90 mm Hg at 65 years of age.
‖—A target of less than 140/90 mm Hg is recommended in patients with diabetes.
¶—Recommendation is to treat all patients 18 to 59 years of age (including those with diabetes) to a systolic blood pressure target of less than 130 mm Hg. For patients 30 years and older, a diastolic blood pressure target of less than 90 mm Hg is recommended.

Information from references 10, 11, 13-16, and 44.

Am Fam Physician. 2022;106(6):721-722

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A SBP < 130 mm Hg Is Associated with Reduced CV Outcomes and Death

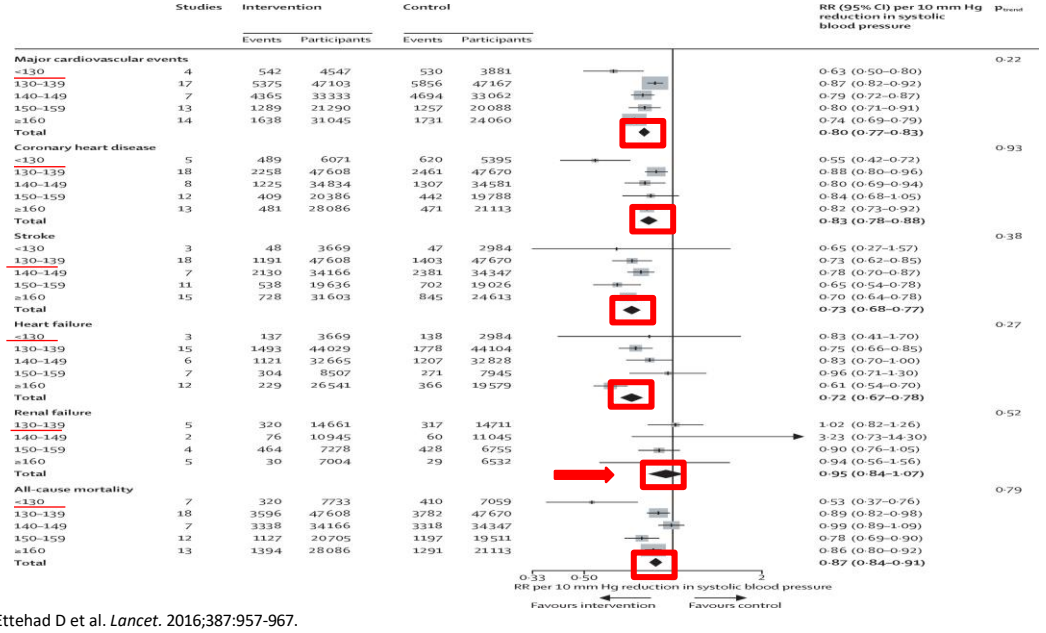

Figure 4. Ettehad D et al. *Lancet.* 2016;387:957-967.

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2017 ACC/AHA HYPERTENSION GUIDELINE
*ERC SYSTEMATIC REVIEW**

More intensive BP lowering significantly reduced CVD risk

Relative risks comparing SBP goal < 130 mm Hg versus higher goals*

CV Event	Relative Risk	95% CI
MI	0.86	0.76-0.99
Stroke	0.77	0.65-0.91
Heart failure	0.75	0.56-0.99
CVD composite	0.83	0.75-0.92

*Based on observational, meta-analyses, and clinical trials

Whelton PK, Carey RM et al. 2017 ACC-AHA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults. Hypertension 2018; 71:e13-e115.

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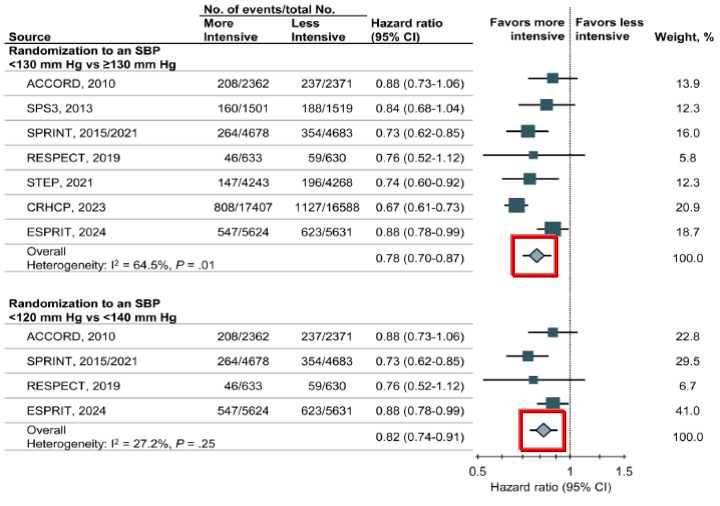
ORIGINAL ARTICLE

Optimal Antihypertensive Systolic Blood Pressure: A Systematic Review and Meta-Analysis

Figure 2. Major cardiovascular disease events.



Whelton P. et al. Hypertension November 2024;81:2329-2339.

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The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

A Randomized Trial of Intensive versus Standard Blood-Pressure Control

The SPRINT Research Group*

Published online at NEJM.org November 9, 2015
N Engl J Med. 2015 Nov 26;373:2103-16.

65

SPRINT Major Exclusion Criteria

- At least 50 years old (30% AA, 10% Hispanic, 58% White) with no upper age exclusion
- Systolic blood pressure
  - SBP: 130 – 180 mm Hg on 0 or 1 medication
  - SBP: 130 – 170 mm Hg on up to 2 medications
  - SBP: 130 – 160 mm Hg on up to 3 medications
  - SBP: 130 – 150 mm Hg on up to 4 medications
- Risk (one or more of the following 4 high-risk groups)
  - Presence of clinical or subclinical CVD (not stroke)-20%
  - Chronic Kidney Disease (CKD), defined as eGFR 20–59 ml/min/1.73m^2 -28%
  - Age ≥ 75 years-28%
  - Framingham Risk Score for 10-year CVD risk ≥ 15%-24%
    - Not needed if eligible based on preexisting CVD or CKD

SPRINT Research Group, NEJM 2015; 373:2103-2116.

66

SPRINT
Major Exclusion Criteria

- Stroke (SPS3)
- Diabetes (ACCORD)
- Congestive heart failure (symptoms or EF < 35%)
- Proteinuria >1g/d
- CKD with eGFR < 20 mL/min/1.73m^2 (MDRD)
- Adherence flags anywhere in the chart
- Non-Ambulatory
- Living in a Nursing Home

SPRINT Research Group, NEJM 2015; 373:2103-2116.

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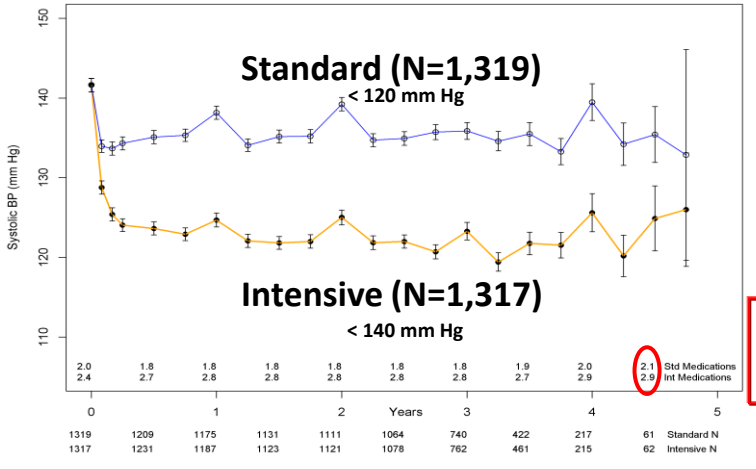
SPRINT_SENIOR
Systolic BP During Follow-up
(75 Years and Older)



Average SBP
During Follow-up

Standard
135.0 mmHg
95% CI (134.5, 135.5)

Intensive
123.7 mmHg
95% CI (123.2, 124.1)

# of classes of antihypertensive meds

# of Participants

Williamson et al. JAMA, 2016; 315:2673-82

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Baseline Characteristics: Participants 75 Years or Older

	Intensive N=1,317	Standard N=1,319	p-value
Age (years)	79.8 ± 3.9	79.9 ± 4.1	0.405
Gender (female)	499 (37.9)	501 (38)	0.992
Race/Ethnicity			0.879
White	977 (74.2)	987 (74.8)	
Black	225 (17.1)	226 (17.1)	
Hispanic	89 (6.8)	85 (6.4)	
Other	26 (2)	21 (1.6)	
History of CVD	338 (25.7)	309 (23.4)	0.197
10-year Framingham risk (%)	24.2 (16.8-32.8)	25 (17-33.4)	0.475
Number of antihypertensive meds	1.9 ± 1	1.9 ± 1	0.173
Baseline blood pressure (mmHg)			
Systolic	141.6 ± 15.7	141.6 ± 15.8	0.986
Diastolic	71.5 ± 11	70.9 ± 11	0.177
Body Mass Index (kg/m^2)	27.8 ± 4.9	27.7 ± 4.6	0.464
eGFR (CKD-EPI, ml/min/1.73m^2)	61.4 ± 17	61.2 ± 16.7	0.764
eGFR<60 ml/min/1.73m^2	614 (46.9)	608 (46.4)	0.859
Urine albumin / creatinine (mg/g)	13 (7.2-31.6)	13.4 (7.2-33.4)	0.505
Total cholesterol (mg/dL)	181.4 ± 39	181.8 ± 38.7	0.767
Fasting plasma glucose (mg/dL)	97.9 ± 12.1	98.2 ± 11.6	0.606

Williamson et al. JAMA, 2016; 315:2673-82

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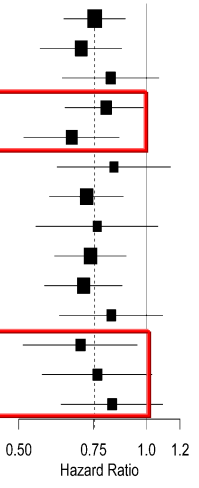
Experience in the Six Pre-specified Subgroup Populations of Interest

Primary Outcome (CVD Composite)

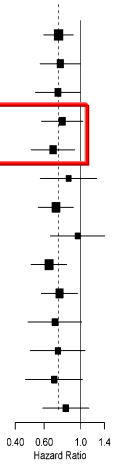
Subgroup	HR	P*(Treatment by subgroup interaction)
Overall	0.75 (0.64,0.89)	
No Prior CKD	0.70 (0.56,0.87)	0.36
Prior CKD	0.82 (0.63,1.07)	
Age < 75	0.80 (0.64,1.00)	0.32
Age ≥ 75	0.67 (0.51,0.86)	
Female	0.84 (0.62,1.14)	0.45
Male	0.72 (0.59,0.88)	
African−American	0.77 (0.55,1.06)	0.83
Non African−American	0.74 (0.61,0.90)	
No Prior CVD	0.71 (0.57,0.88)	0.39
Prior CVD	0.83 (0.62,1.09)	
SBP ≤ 132	0.70 (0.51,0.95)	0.77
132 < SBP < 145	0.77 (0.57,1.03)	
SBP ≥ 145	0.83 (0.63,1.09)	

*Unadjusted for multiplicity



All Cause Mortality

Subgroup	Intensive	Standard	HR	Int P
Overall	155/4678 (3.31)	210/4683 (4.48)	0.73 (0.60,0.90)	
No Prior CKD	85/3348 (2.54)	115/3367 (3.42)	0.75 (0.57,1.00)	0.76
Prior CKD	70/1330 (5.26)	95/1316 (7.22)	0.73 (0.53,1.00)	
Age < 75	82/3361 (2.44)	104/3364 (3.09)	0.77 (0.58,1.03)	0.58
Age ≥ 75	73/1317 (5.54)	106/1319 (8.04)	0.68 (0.50,0.92)	
Female	46/1684 (2.73)	54/1648 (3.28)	0.85 (0.57,1.26)	0.49
Male	109/2994 (3.64)	156/3035 (5.14)	0.71 (0.55,0.91)	
African−American	53/1454 (3.65)	55/1493 (3.68)	0.96 (0.65,1.40)	0.06*
Non African−American	102/3224 (3.16)	155/3190 (4.86)	0.64 (0.50,0.82)	
No Prior CVD	106/3738 (2.84)	140/3746 (3.74)	0.75 (0.58,0.96)	0.78
Prior CVD	49/940 (5.21)	70/937 (7.47)	0.70 (0.48,1.02)	
SBP ≤ 132	46/1583 (2.91)	64/1553 (4.12)	0.73 (0.49,1.07)	0.70
132 < SBP < 145	41/1489 (2.75)	63/1549 (4.07)	0.69 (0.46,1.03)	
SBP ≥ 145	68/1606 (4.23)	83/1581 (5.25)	0.81 (0.59,1.13)	



The SPRINT Research Group. N Engl J Med. 2015;373:2103-2116

*p=0.34, after Hommel adjustment for multiple comparisons

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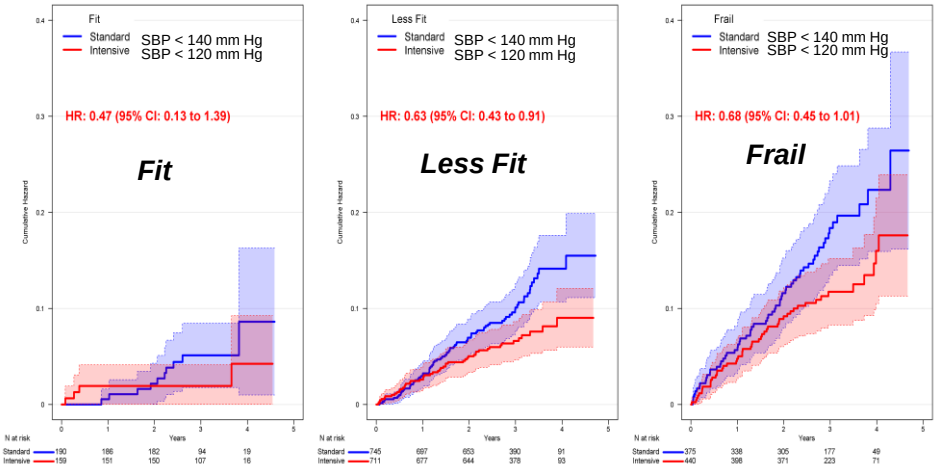
SPRINT
Systolic Blood Pressure Intervention Trial

SPRINT Primary Outcome by Frailty Status

Participants ≥75 years: Kaplan-Meier Survival Curves



Williamson et al. *JAMA*.2016;315:2673-2682.

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Number of Participants with a Monitored Clinical Measure During Follow-up in SPRINT SENIOR

	Intensive		Standard			
	N	%/yr	N	%/yr	HR	p-value
Sodium<130 mmol/L	66	1.7	44	1.2	1.51	0.034
Sodium>150 mmol/L	1	<0.1	0	-	-	0.290
Potassium<3 mmol/L	17	0.4	11	0.3	1.50	0.303
Potassium>5.5 mmol/L	68	1.8	64	1.7	1.01	0.975
Orthostatic hypotension	277	8.3	288	8.8	0.90	0.242
Orthostatic hypotension with dizziness	25	0.6	17	0.4	1.44	0.252

N denotes participants with events

Orthostatic hypotension defined as drop in systolic BP ≥20 mmHg or drop in diastolic ≥10 mmHg 1 minute after standing. Standing blood pressures were measured at screening, baseline, 1, 6, and 12 months and yearly thereafter. Participants were asked if they felt dizzy at the time the orthostatic measure was taken. Falls were also not more common in the intensive group.

Williamson et al. JAMA, 2016; 315:2673-82

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Age-Related Issues (Older Persons)

COR	LOE	Recommendations for Treatment of Hypertension in Older Persons
I	A	Treatment of hypertension with a SBP treatment goal of less than 130 mm Hg is recommended for non-institutionalized ambulatory community-dwelling adults (≥65 years of age) with an average SBP of 130 mm Hg or higher.
IIa	C-EO	For older adults (≥65 years of age) with hypertension and a high burden of co-morbidity and limited life expectancy, clinical judgment, patient preference, and a team-based approach to assess risk/benefit is reasonable for decisions regarding intensity of BP lowering and choice of antihypertensive drugs. (Shared-Decision Making)

Whelton PK, Carey RM et al. 2017 ACC-AHA Guideline for the Prevention, Detection, Evaluation, and Management of High BP in Adults. *Hypertension* 2018; 71:e13-e115.

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SPRINT-MIND: Effect of Intensive vs Standard Blood Pressure Control on Probable Dementia: A Randomized Clinical Trial

Table 2. Incidence of Probable Dementia and Mild Cognitive Impairment by Treatment Group

		Treatment Group					
		Intensive SBP < 120 mm Hg N=4278		Standard SBP < 140 mm Hg N=4285			
	Outcomes	No. With Outcome/Person-Years	Cases per 1000 Person-Years	No. With Outcome/Person-Years	Cases per 1000 Person-Years	Hazard Ratio (95% CI)[a]	*P* Value
Primary outcome	Probable dementia	149/20 569	7.2	176/20 378	8.6	0.83 (0.67-1.04)	.10
Secondary outcome	Mild cognitive impairment[b]	287/19 690	14.6	353/19 281	18.3	0.81 (0.69-0.95)	.007
Secondary outcome	Composite of mild cognitive impairment or probable dementia	402/19 873	20.2	469/19 488	24.1	0.85 (0.74-0.97)	.01

[a] Intensive treatment group vs standard treatment group based on Cox proportional hazards regression.

[b] Participants adjudicated as having probable dementia at the first follow-up visit (year 2) do not contribute to the analyses of mild cognitive impairment.

Treatment lasted a median of 3 years, and patients were followed for cognitive outcomes over a total of 5 years.

JAMA. 2019 Feb 12;321:553-561.

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Cognitive Decline and Dementia

Recommendation for Prevention of Cognitive Decline and Dementia		
COR	LOE	Recommendation
IIa	B-R	1. In adults with hypertension, BP lowering is reasonable to prevent cognitive decline and dementia.[S11.3-1–S11.3-6]

2017 Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults, *Hypertension* 2018 Jun;71(6):1269

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SPECIAL POPULATIONS

In Terms of Benefit on Cognitive Function in the Older Patient, the Concept of "Pack-Years of smoking" in relation to HTN is important.

It is more important to begin Controlling BP Earlier in Life, Than to Believe You Can Reverse Changes in Vascular and White Matter Disease After 60 Years of Age!

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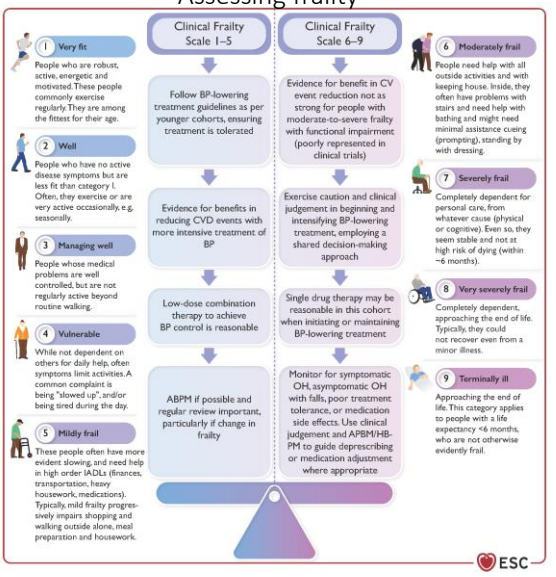
Older & Frail Patients: New Recommendations-esc 2024 Guideline

- ❖ Treatment in older patients (<85 years) who are not frail - same as younger people, provided BP-lowering is tolerated
- ❖ Screen level of frailty, as necessary
- ❖ **Consider higher treatment initiation BP threshold and more lenient targets** in persons ≥85 years +/- moderate-to-severe frailty or orthostasis or limited lifespan
- ❖ In patients ≥85 years and moderate-to-severe frailty, consider initial long-acting CCB or RAS, then low-dose diuretic.
- ❖ If BP decreases with frailty, consider deprescribing BP-lowering drugs



2024 ESC Guidelines for the management of elevated BP and HTN
European Hrt Jnl 2024-doi: 10.1093/eurohearti/ehae178

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Treating HTN in Older People

1. It is hoped that the older patient has had their BP controlled earlier in life to a BP < 130/80 mm Hg, but as patients get older, clinical judgement and co-morbidities should be taken into account as to the best BP target for that individual patient.
2. If a systolic BP goal of < 130 mm Hg is chosen in SPRINT-like patients, renal function, evaluation for hypotension, and electrolyte abnormalities need to be watched carefully.
3. In older patients with HTN, a high co-morbidity burden, or limited life expectancy, clinical judgment, patient preference, and a team-based approach to assess risk/benefit is reasonable for shared-decisions regarding intensity of BP lowering, choice of antihypertensive drugs, and consideration of de-prescribing medication.
4. "What is good for the heart seems to be good for the brain!"

2017 ACC-AHA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults; *Hypertension; JACC* Nov 2017

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