

How to Treat Hypertension in the Post SPRINT Era

James H. Horner, MD, Symposium:
SPRINT Ahead – An Update in Hypertension
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Presenter Disclosure Information

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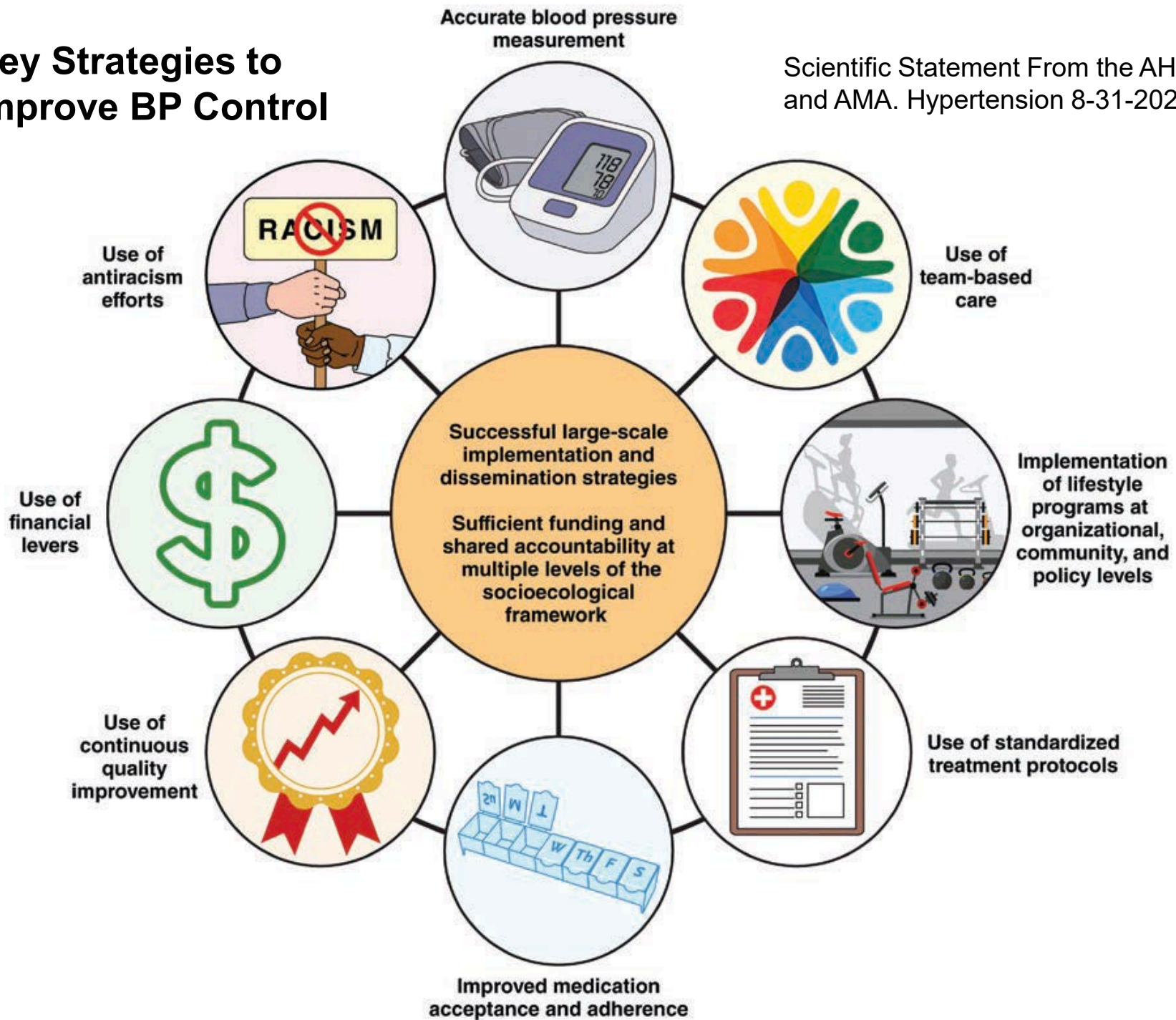
FINANCIAL DISCLOSURE:

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- ReCor Medical
- NIH

Key Strategies to Improve BP Control

Scientific Statement From the AHA and AMA. Hypertension 8-31-2023

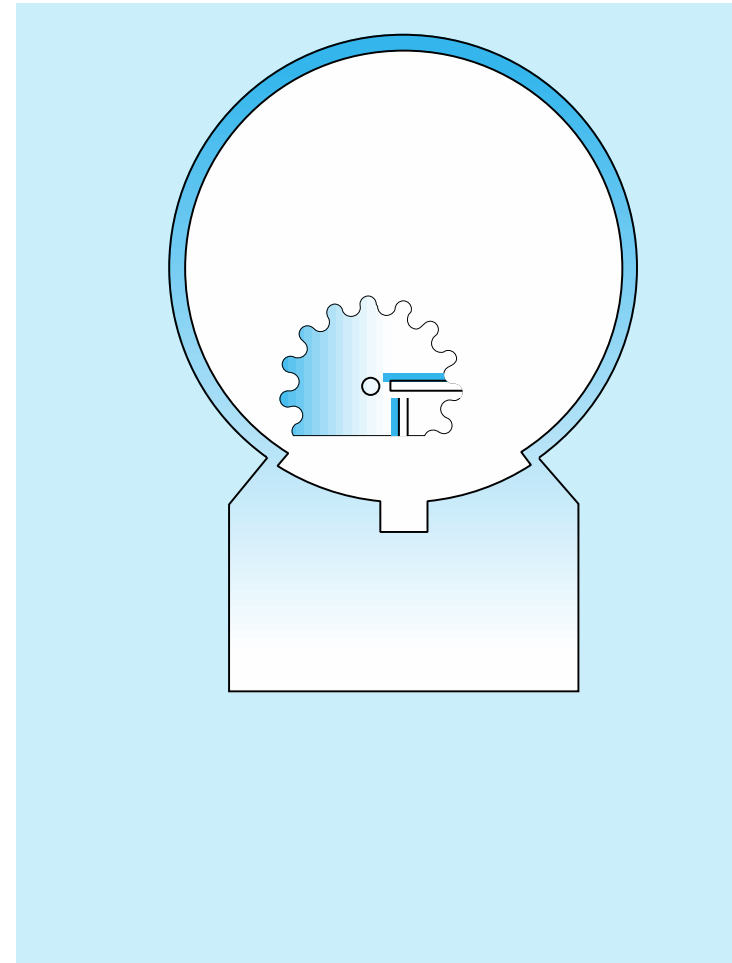


Office BP: Auscultatory Method

Mercury

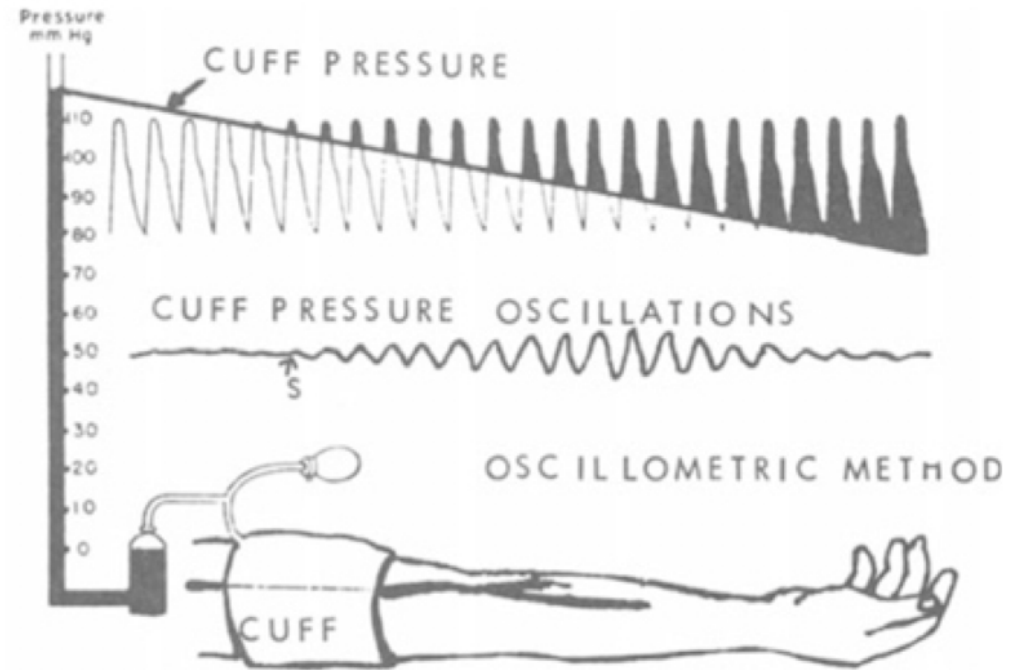


Aneroid



Korotkoff 1905; Shevchenko 1996; Geddes LA. 1991; Beevers 2011

Office BP: Oscillometric Method



Cuff pressure at point of maximal oscillations is used to estimate BP

Marey 1876; Geddes LA. 1991

Sphygmomanometer options

- **Mercury manometer:**
 - banned in many clinical settings
 - Introduces observer error without frequent retraining
- **“Manual” aneroid device:**
 - needs frequent (every 6-12 months) calibration or assume it is inaccurate.
 - Introduces other observer errors.
- **Automated (oscillometric) method**
 - Best option to minimize observer errors
 - Best if fully automated device (push button and leave patient undisturbed)
- **Cuffless BP devices:** may be available in near future

Where To Look for validated devices for office or home

- Most devices sold on the market have not been rigorously validated.
- American Medical Association Validated Device List (VDL): [Validatebp.org](https://www.validatebp.org)
- Alternative: [Stridebp.org](https://www.stridebp.org)

Accurate Measurement of BP in the Office

COR	LOE	Recommendation for Accurate Measurement of BP in the Office
I	C-EO	For diagnosis and management of high BP, proper methods are recommended for accurate measurement and documentation of BP.

I would have said the LOE is “A”, based on proper technique used in the epidemiologic studies and the major HTN outcome trials defining BP levels to determine risk, treatment thresholds, and BP goals.

International Consensus on Standardized Clinic Blood Pressure Measurement – A Call to Action

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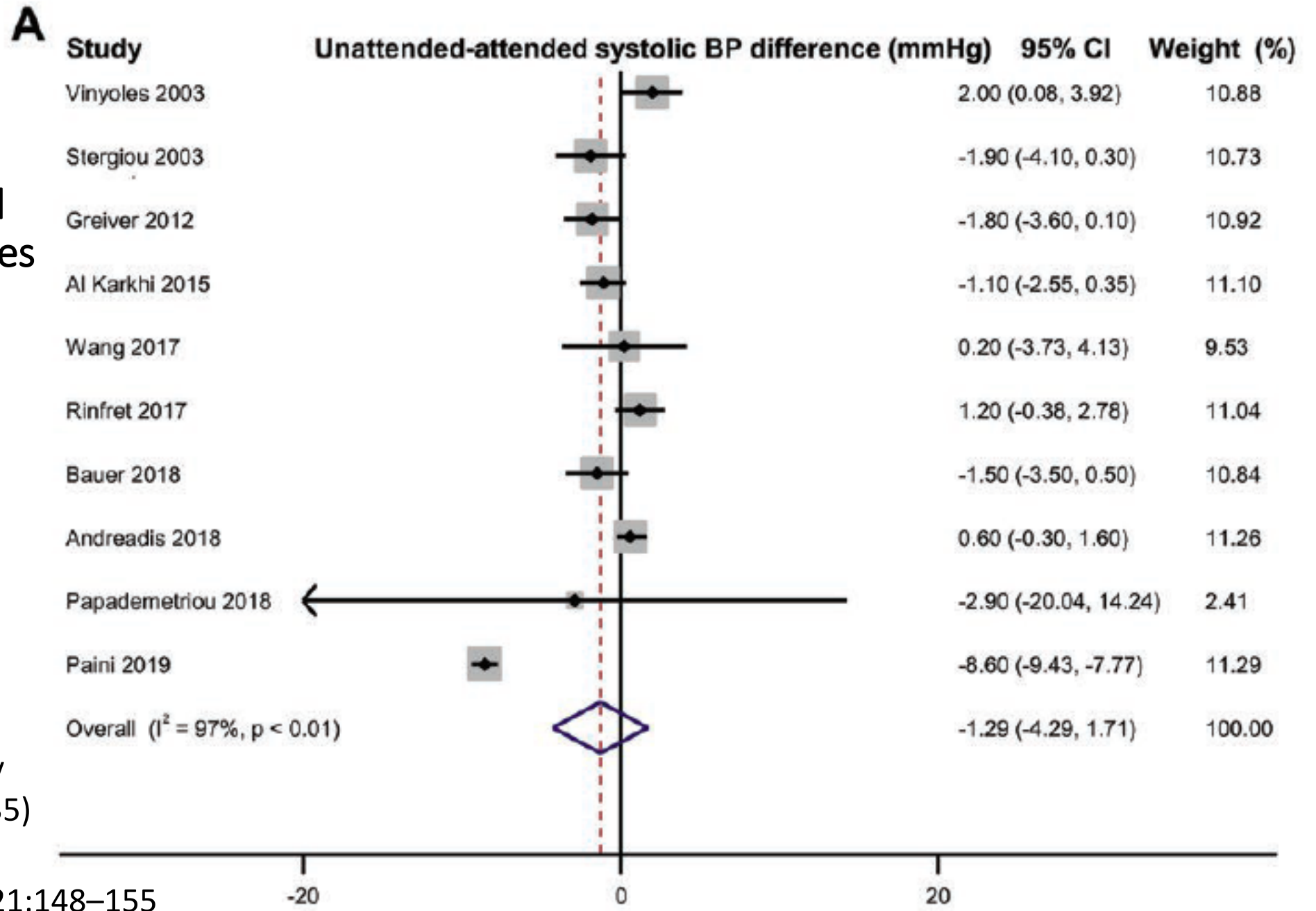
Routine Office BP versus Automated Office BP (mm Hg)

Study	N	Routine Office BP	Automated Office BP	Δ BP
Graves	104	152/84	136/79	16/5
Beckett	481	151/83	140/80	11/3
Myers-16	309	153/87	132/75	21/12
Myers-18	254	150/89	133/80	17/9
Myers-19	303	150/81	133/74	17/7
Mean		151/85	135/78	16/7

BP Measurement: of Paramount Importance!

- Patient seated with back supported and arm bared and supported at heart level.
- Patient should refrain from smoking or ingesting caffeine for 30 minutes prior to measurement.
- Measurement should begin after 5 minutes of rest (patient should not talk and not be spoken to).
- Use appropriate cuff size and validated equipment.
 - About 1/2 of U.S adults need a large adult cuff.
- Both SBP and DBP should be recorded. Check both arms on first visit: if >15 mm Hg different use higher arm.
- ≥2 readings: averaged or use median of 3 readings. 30-60sec between readings.
- Most practical way to do this: fully automated oscillometric manometer, preset to wait 5 minutes and take/average 3 readings (sometimes referred to as AOBP).

Unattended versus attended automated office blood pressure: Systematic review and meta-analysis of studies using the same methodology for both methods



DBP also not significantly different: 0.45 (-1.24, 0.35)

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 for most adults who are overweight. 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/d, but aim for at least a 1000-mg/d 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

*Type, dose, and expected impact on BP in adults with a normal BP and with hypertension.
 DASH indicates Dietary Approaches to Stop Hypertension; and SBP, systolic blood pressure.
 Resources: Your Guide to Lowering Your Blood Pressure With DASH—How Do I Make the DASH?
 Available at: <https://www.nhlbi.nih.gov/health/resources/heart/hbp-dash-how-to>.
 Top 10 Dash Diet Tips. Available at: http://dashdiet.org/dash_diet_tips.asp

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

*Type, dose, and expected impact on BP in adults with a normal BP and with hypertension.

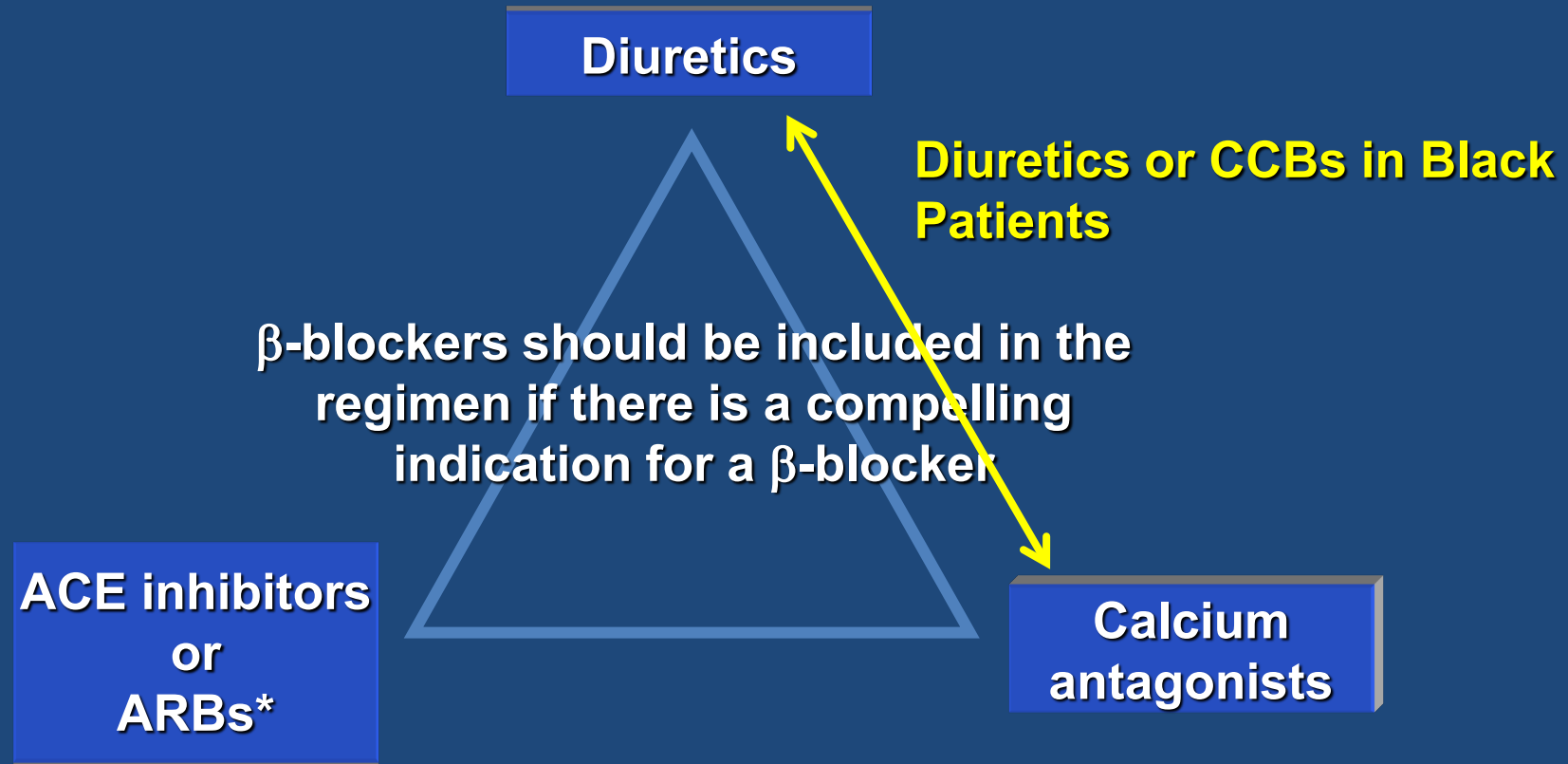
†In the United States, one “standard” drink contains roughly 14 g of pure alcohol, which is typically found in 12 oz of regular beer (usually about 5% alcohol), 5 oz of wine (usually about 12% alcohol), and 1.5 oz of distilled spirits (usually about 40% alcohol).

Antihypertensive Drug Classes Currently used for Management of HTN

- Diuretics:
 - Thiazide-type
 - Loop
 - K-sparing
- Renin angiotensin system blockers:
 - Angiotensin converting-enzyme (ACE) inhibitors
 - Angiotensin receptor blockers (ARBs)
 - Direct renin inhibitors (DRIs)
- Calcium channel blockers (CCBs)
- Beta-blockers (BBs)
- Alpha-beta blockers
- Alpha₁-blockers
- Central alpha agonists
- Direct arterial vasodilators:
 - hydralazine
 - minoxidil

Best outcome data in HTN trials

Initial Choices of Medications



* Recommended for CKD
Combining ACEI with ARB discouraged

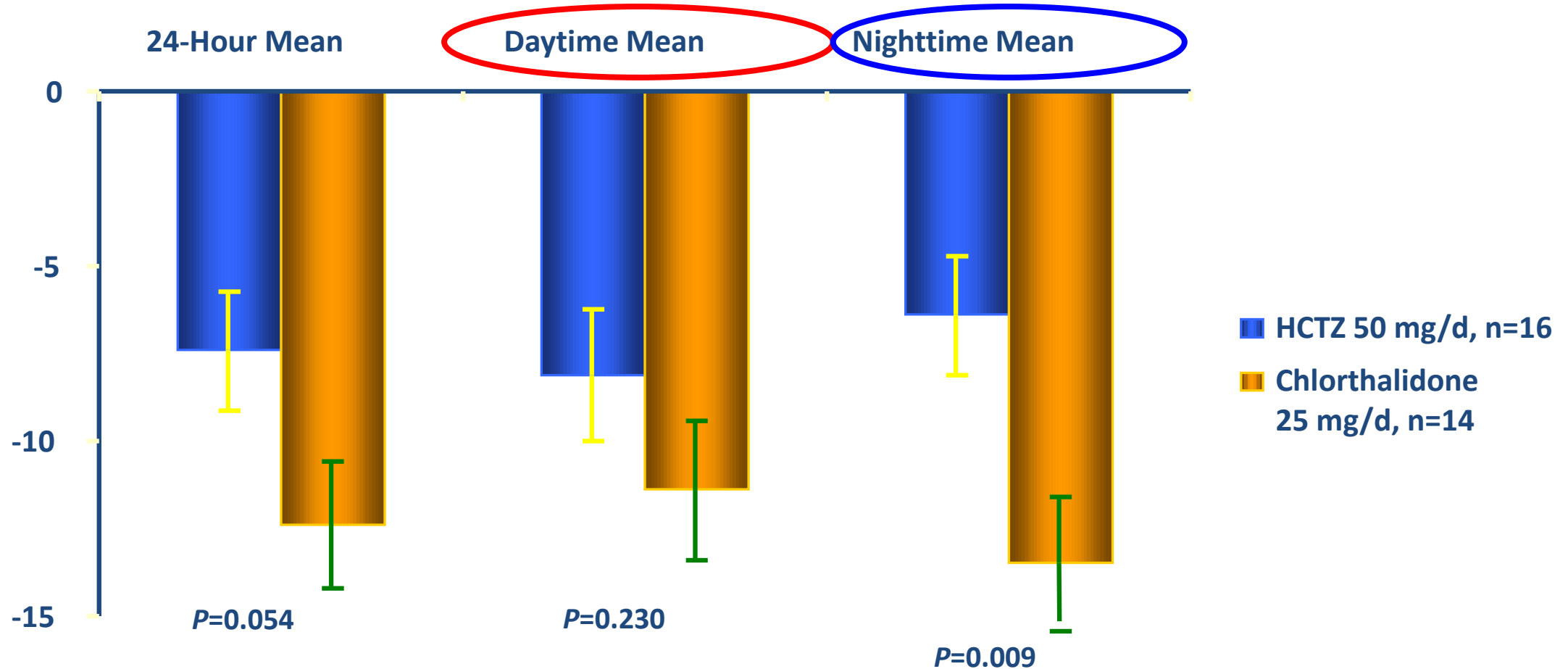
SPRINT BP Intervention

- BP monitored monthly for 3 months and every 3 months thereafter (additional visits could be scheduled)
- Lifestyle background therapy recommended for all
- Antihypertensive medication titration decisions based on seated visit BP with fully automated BP manometer, using a structured stepped-care approach
- Classes with the best CVD outcomes in trials given priority
 - Chlorthalidone encouraged as thiazide-type diuretic
 - Amlodipine encouraged as CCB
- Periodic assessment for orthostatic hypotension and related symptoms

Cushman, et al. Hypertension 2022; 79:2071-2080



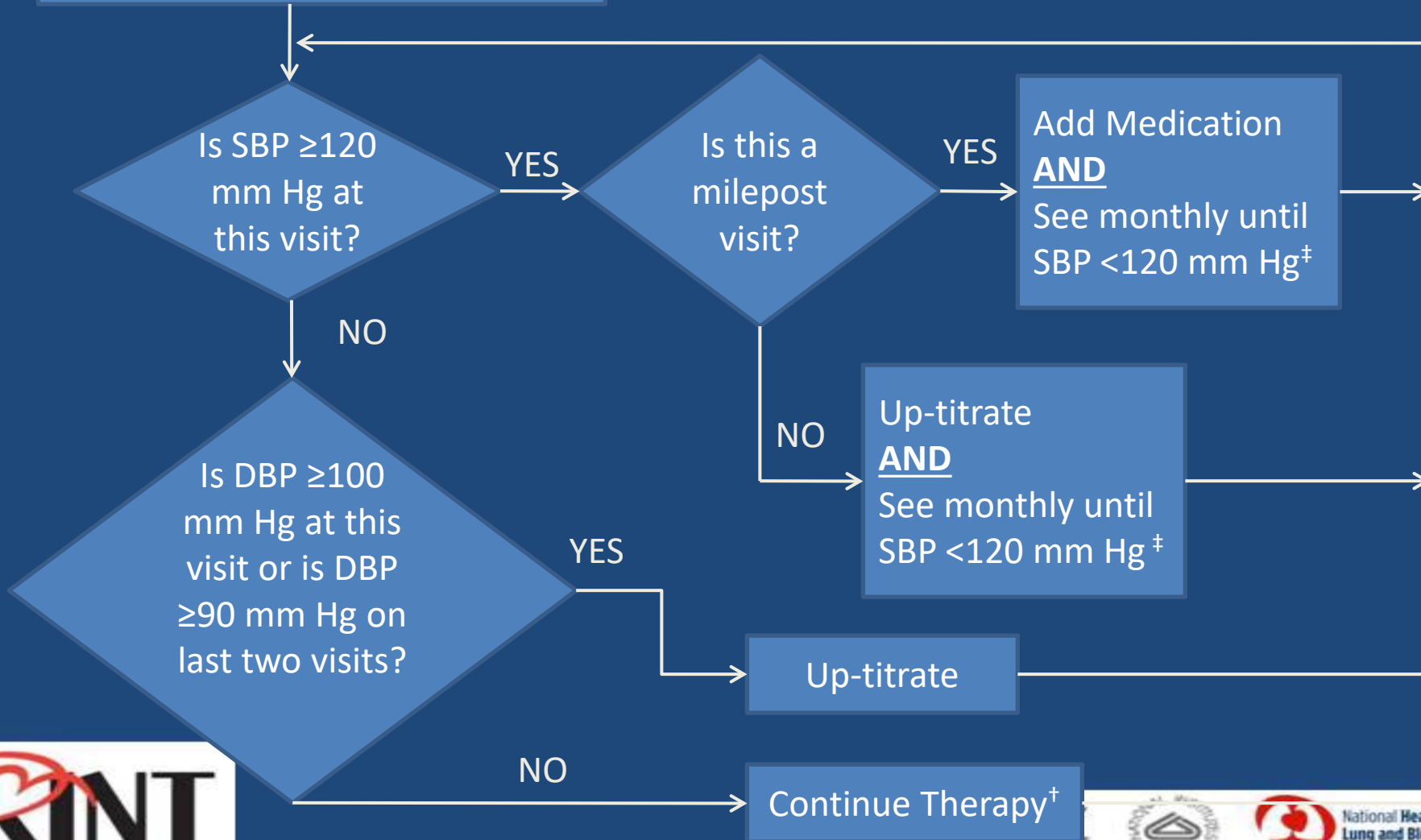
Chlorthalidone 25 mg vs HCTZ 50 mg: Change in 24-Hour Mean Systolic Blood Pressure



Start Here: begin with 2-3 drug therapy* using a thiazide-type diuretic**, and/or an ACEI or ARB (but not both) and/or a CCB

Intensive Group Algorithm

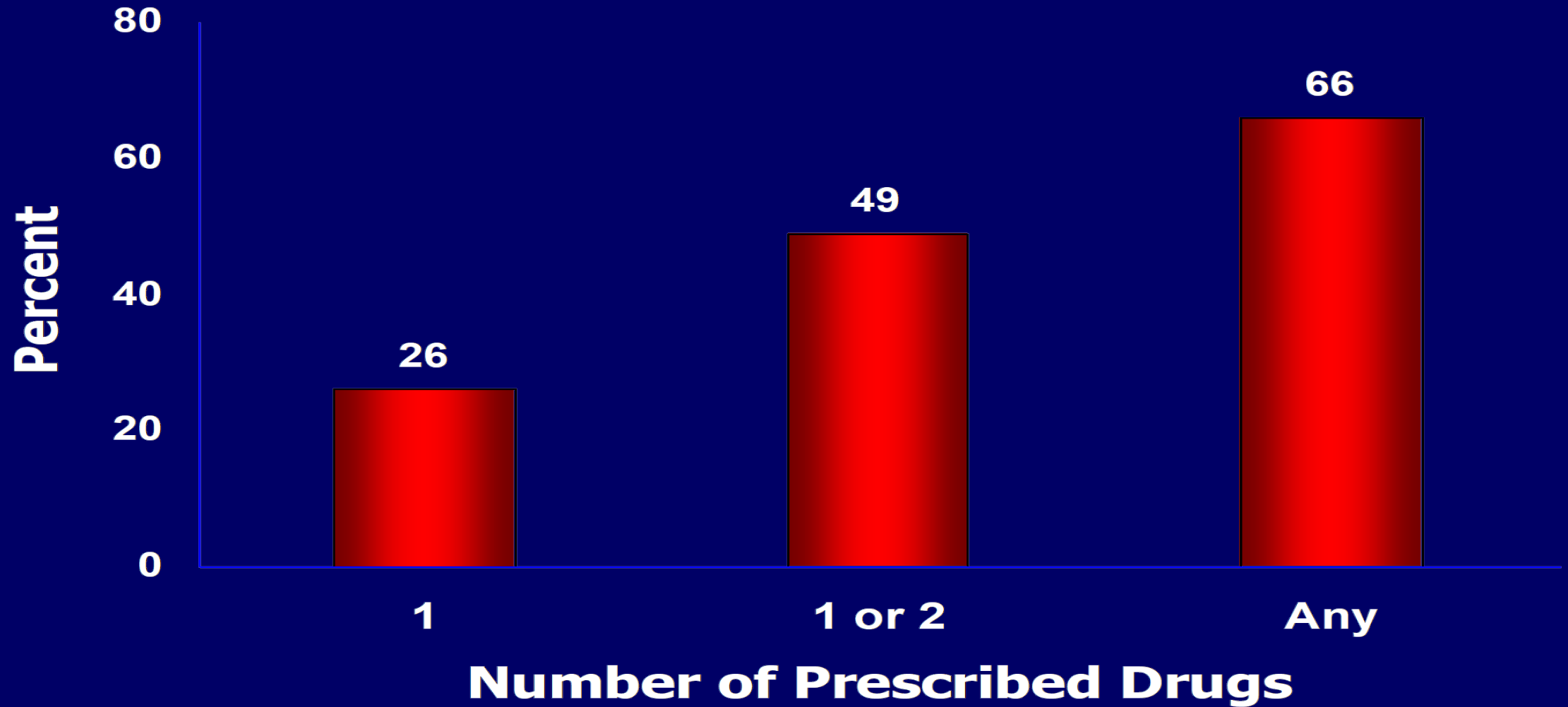
Goal <120 mm Hg



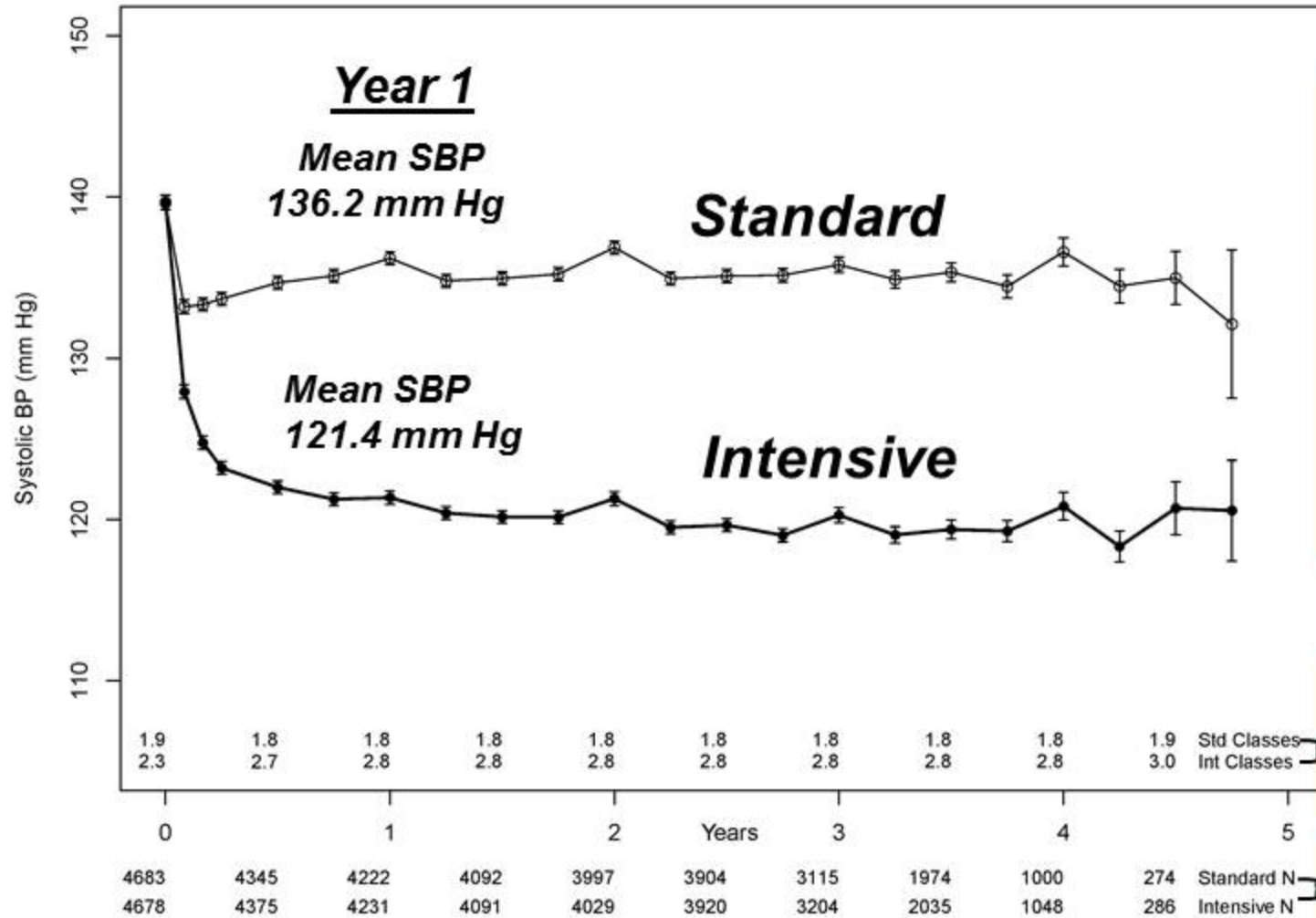
* could start with 1 drug if ≥75 yrs old
** could use or add loop diuretic if CKD
‡ or decision made not to intensify further
† can modify if side effects

ALLHAT

Cumulative Percent Controlled (BP <140/90 mm Hg) at Five Years



Systolic BP During Follow-up



**Average SBP
(During Follow-up)**

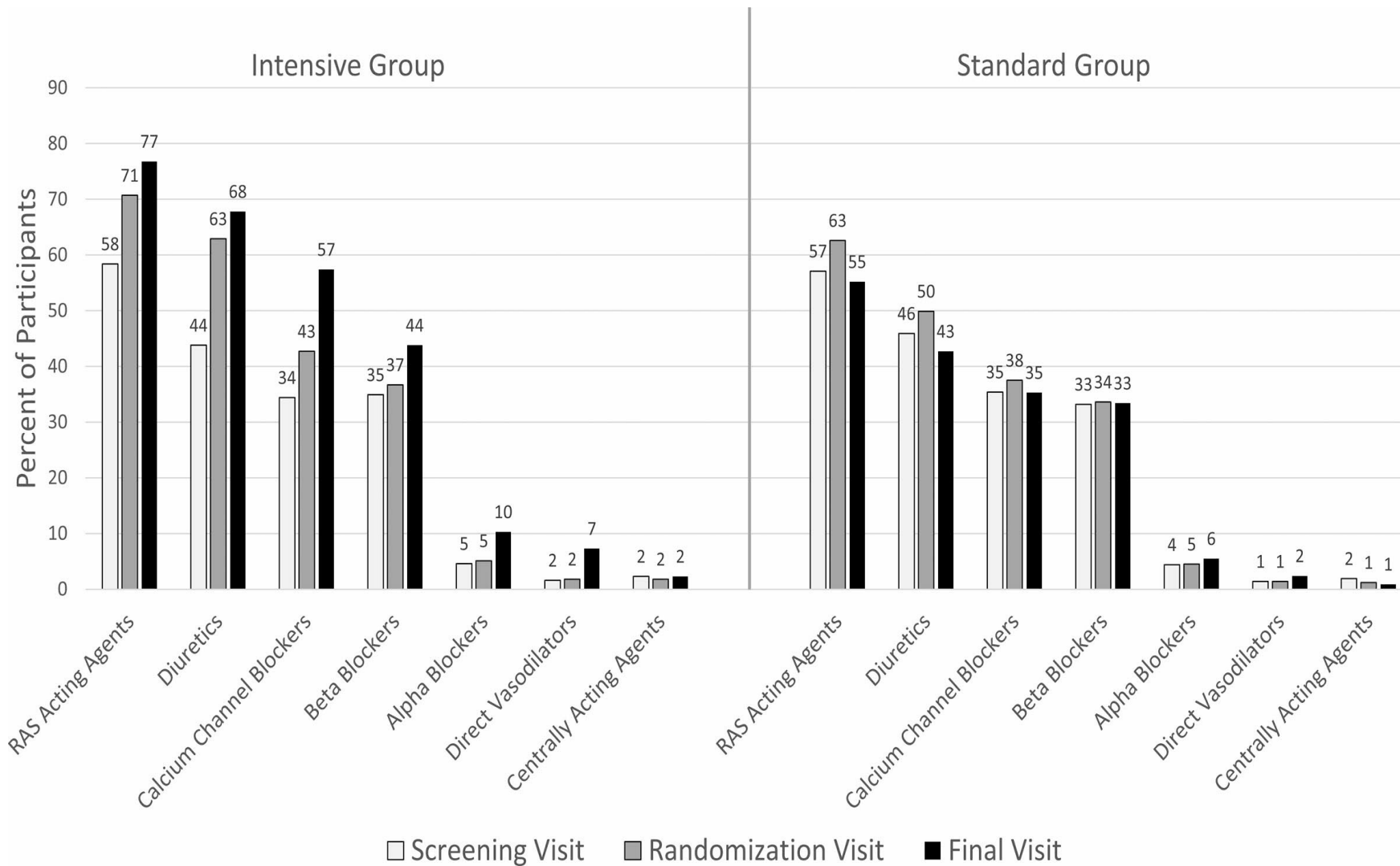
**Standard:
134.6 mm Hg**

**Intensive:
121.5 mm Hg**

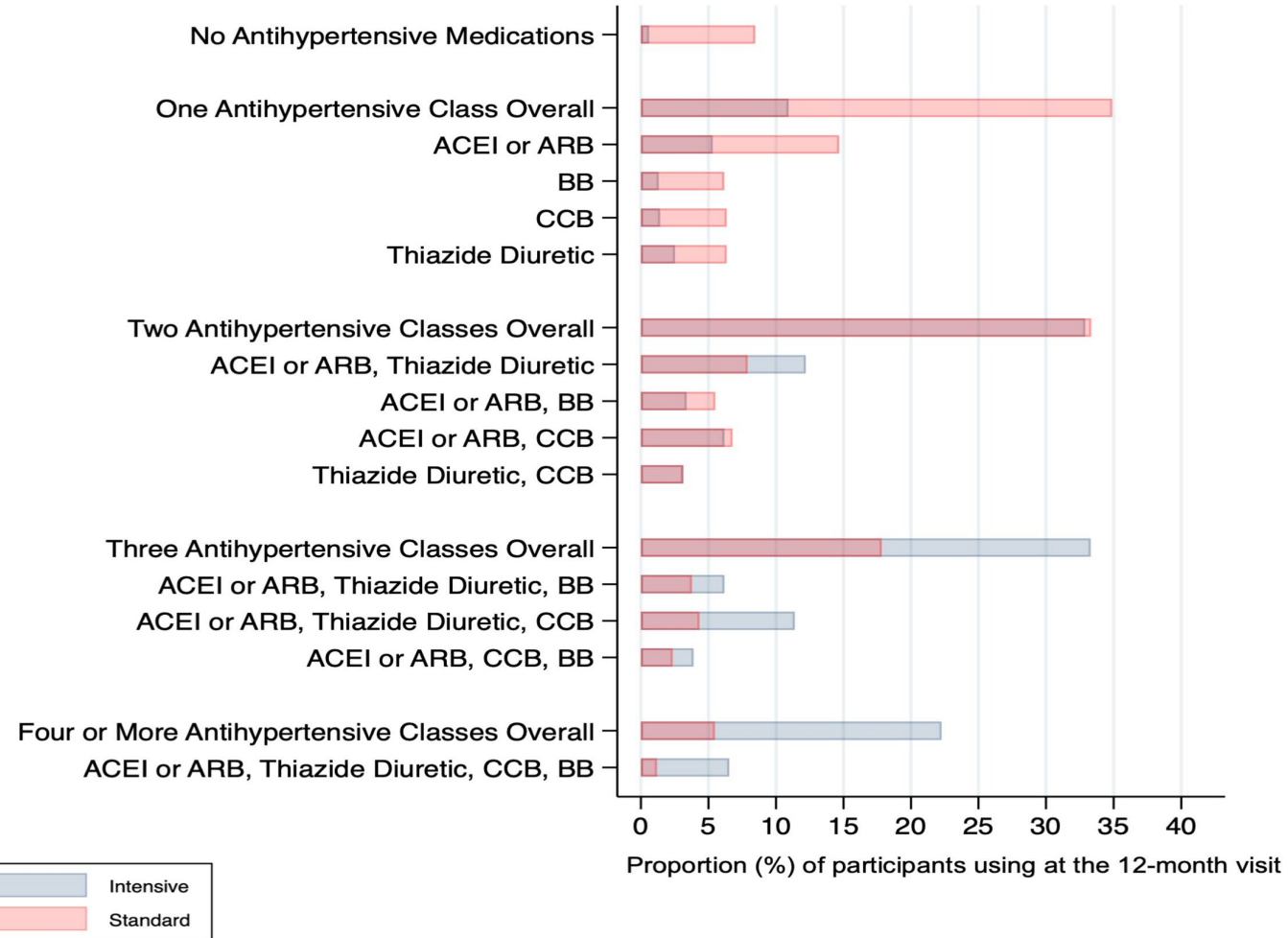
**Average number of
antihypertensive
medications**

**Number of
participants**

Antihypertensive Drug Classes in SPRINT



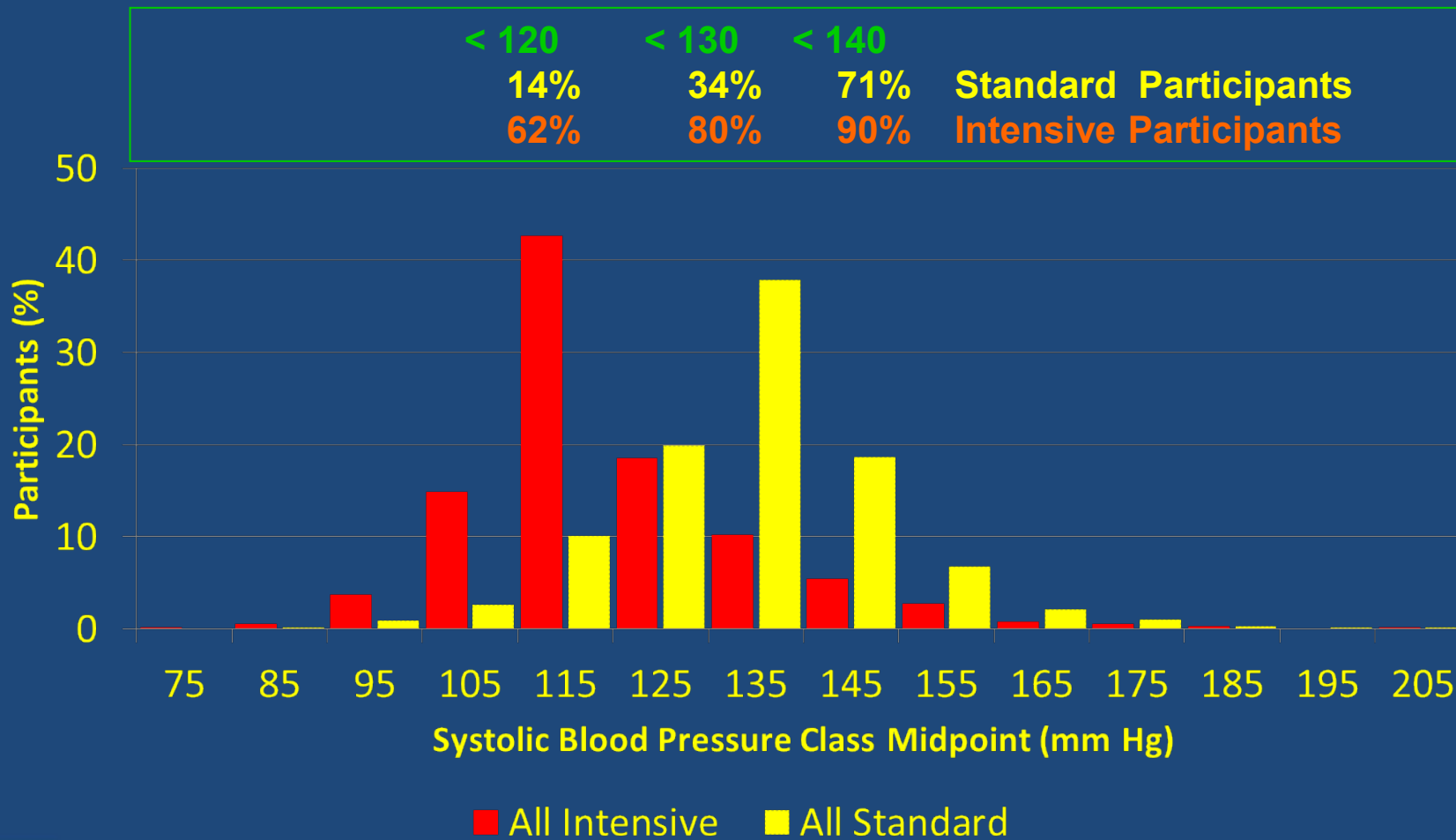
What were the unique antihypertensive medication combinations used by participants of the Systolic Blood Pressure Intervention Trial (SPRINT)?



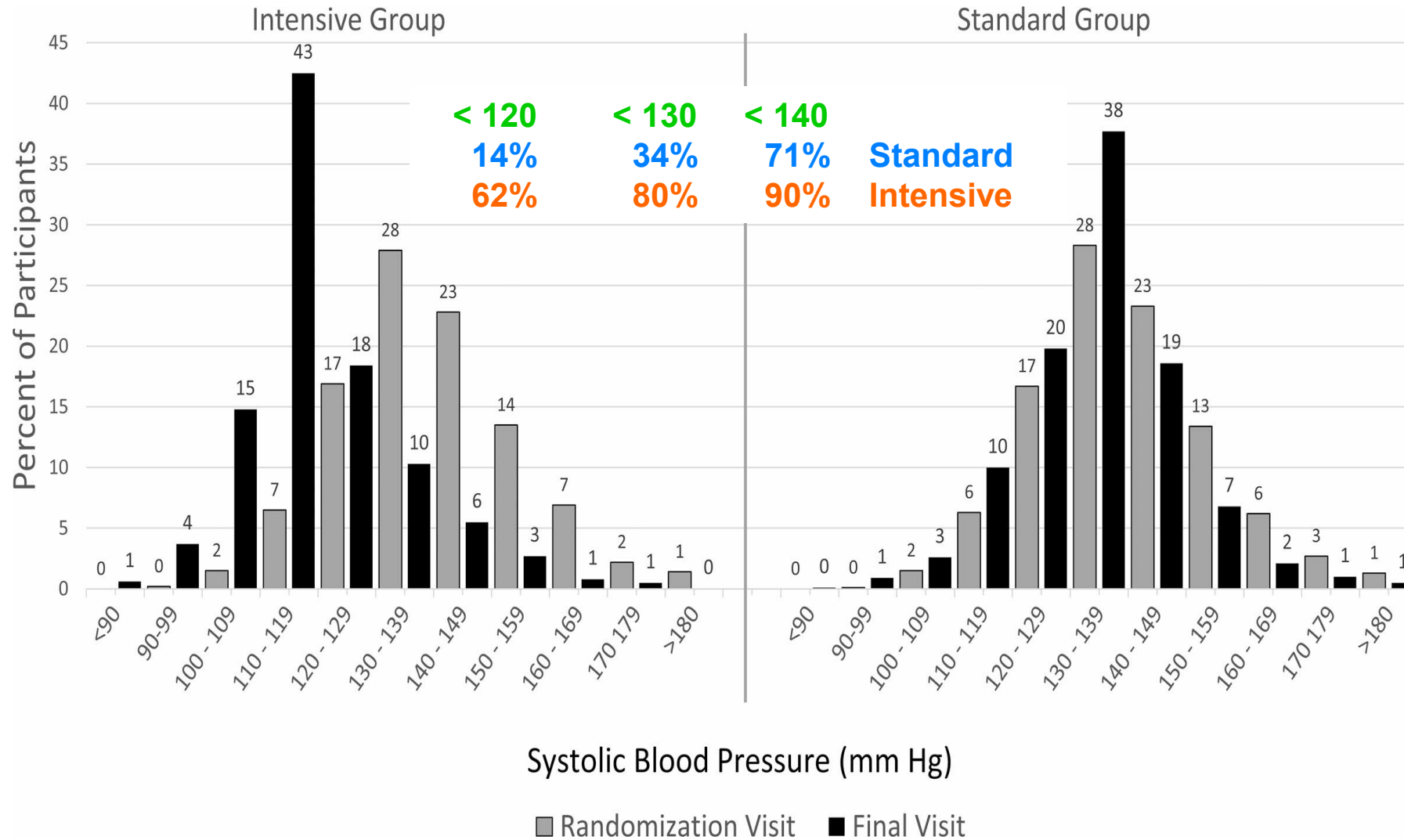
Catherine G. Derington. Hypertension. Antihypertensive Medication Regimens Used in the Systolic Blood Pressure Intervention Trial, Volume: 80, Issue: 3, Pages: 590-597, DOI: (10.1161/HYPERTENSIONAHA.122.20373)

Systolic Distribution by Treatment Group

Most Recent Visit Per Participant



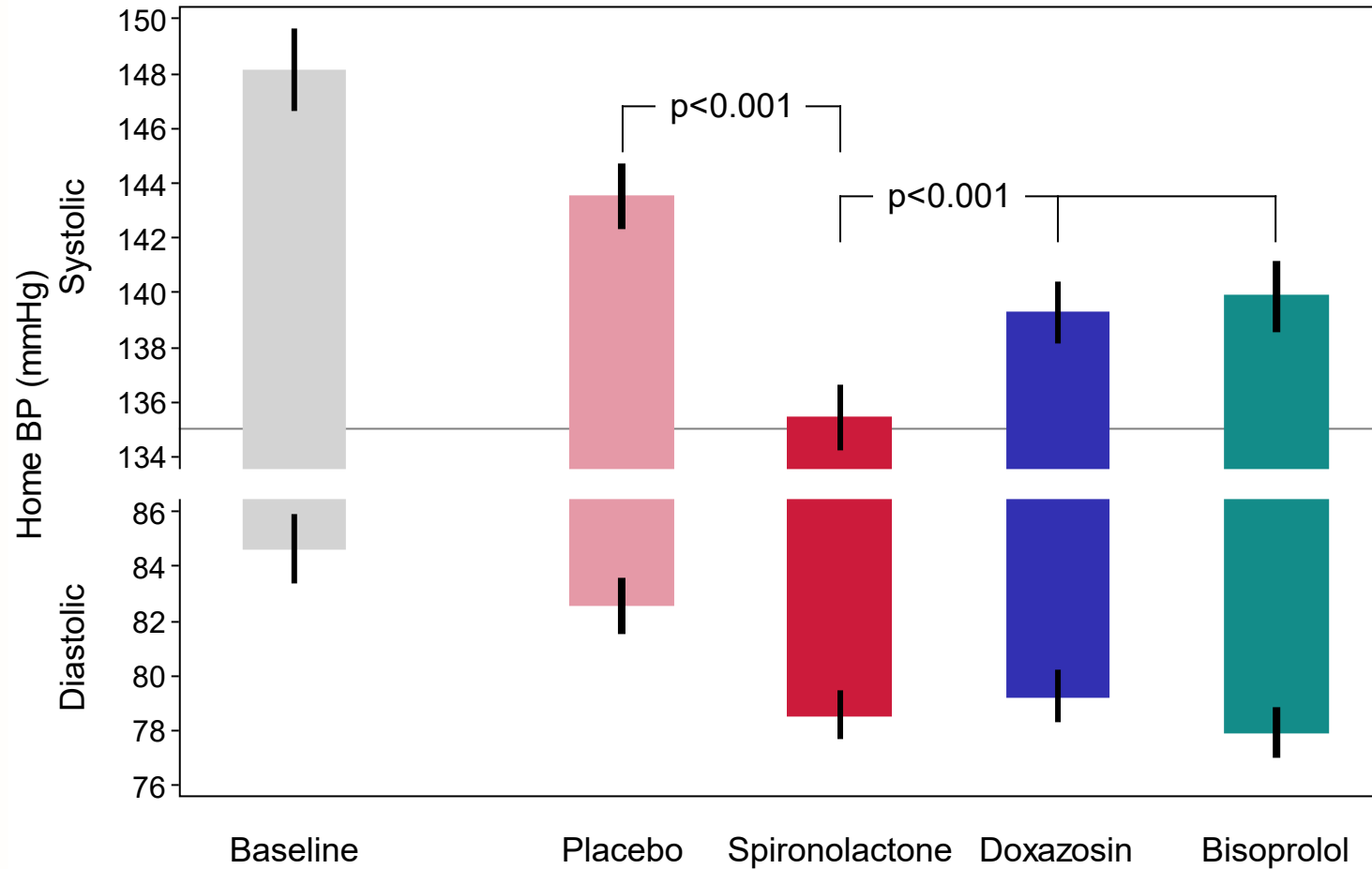
Systolic Blood Pressure Distribution in SPRINT



Management of Side Effects

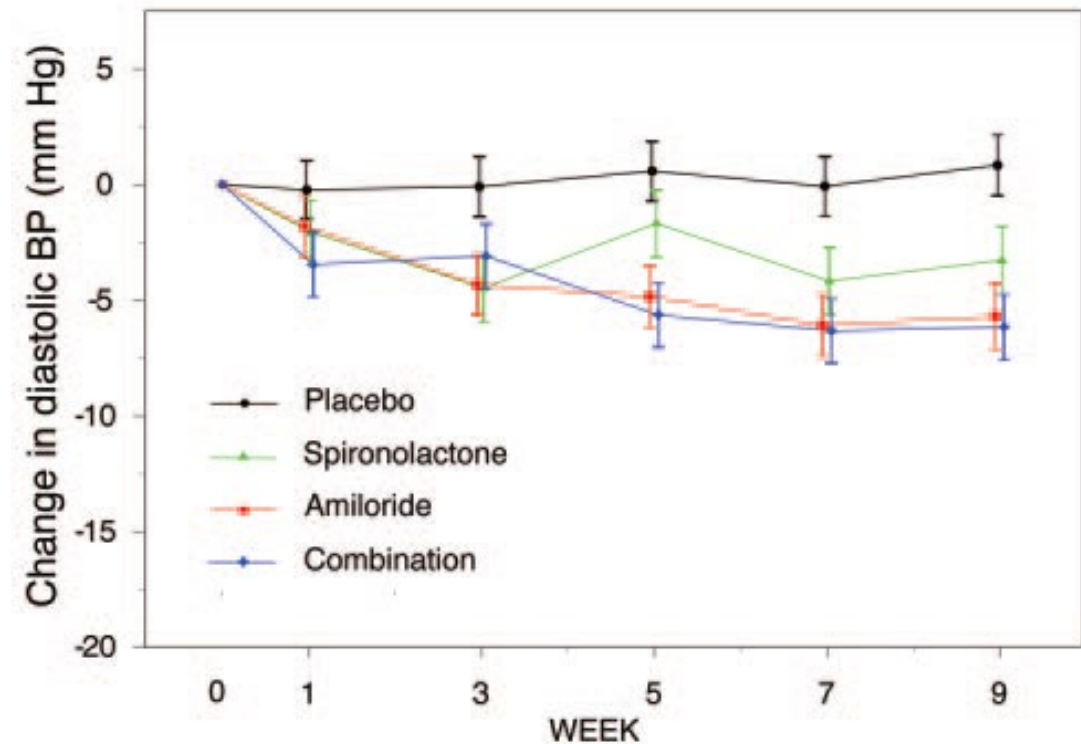
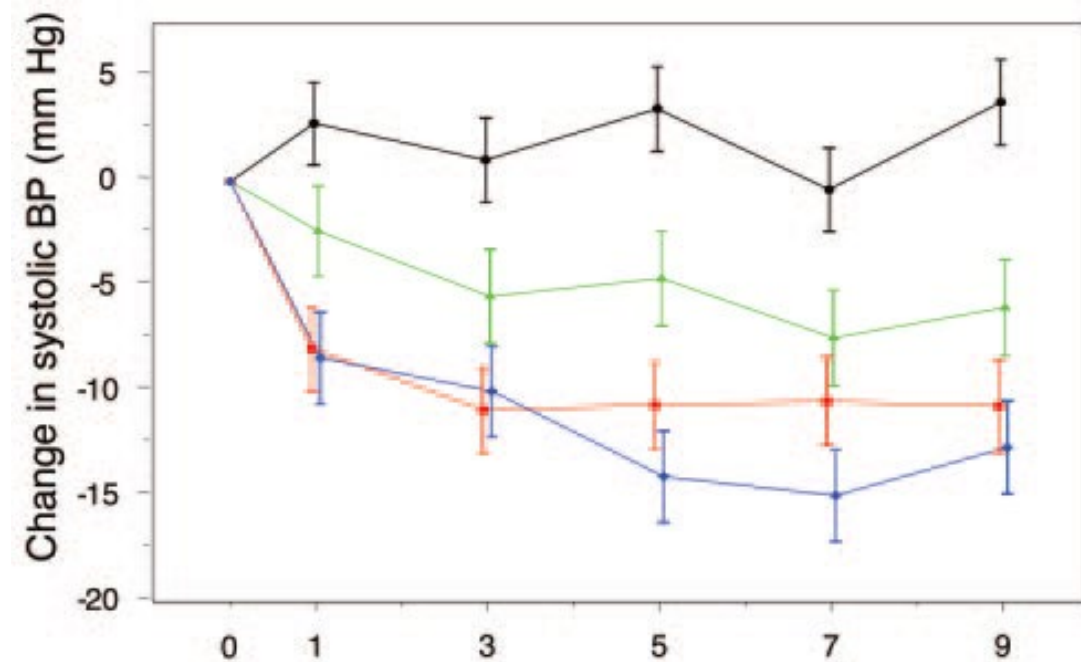
- In SPRINT (with SPRINT medications) adverse effects were similar in both groups.
- Orthostatic hypotension was LESS common in intensive group
- Some AEs (AKI, hypotension, electrolyte disturbances) were more common in intensive group, but <2% more and usually reversible and easy to manage.
- No increase in falls or fractures.
- Older participants had more AEs, but no difference between randomized groups.

Primary Outcome (Average Home SBP)



Improvement in BP in Black Patients Uncontrolled with Diuretic+CCB

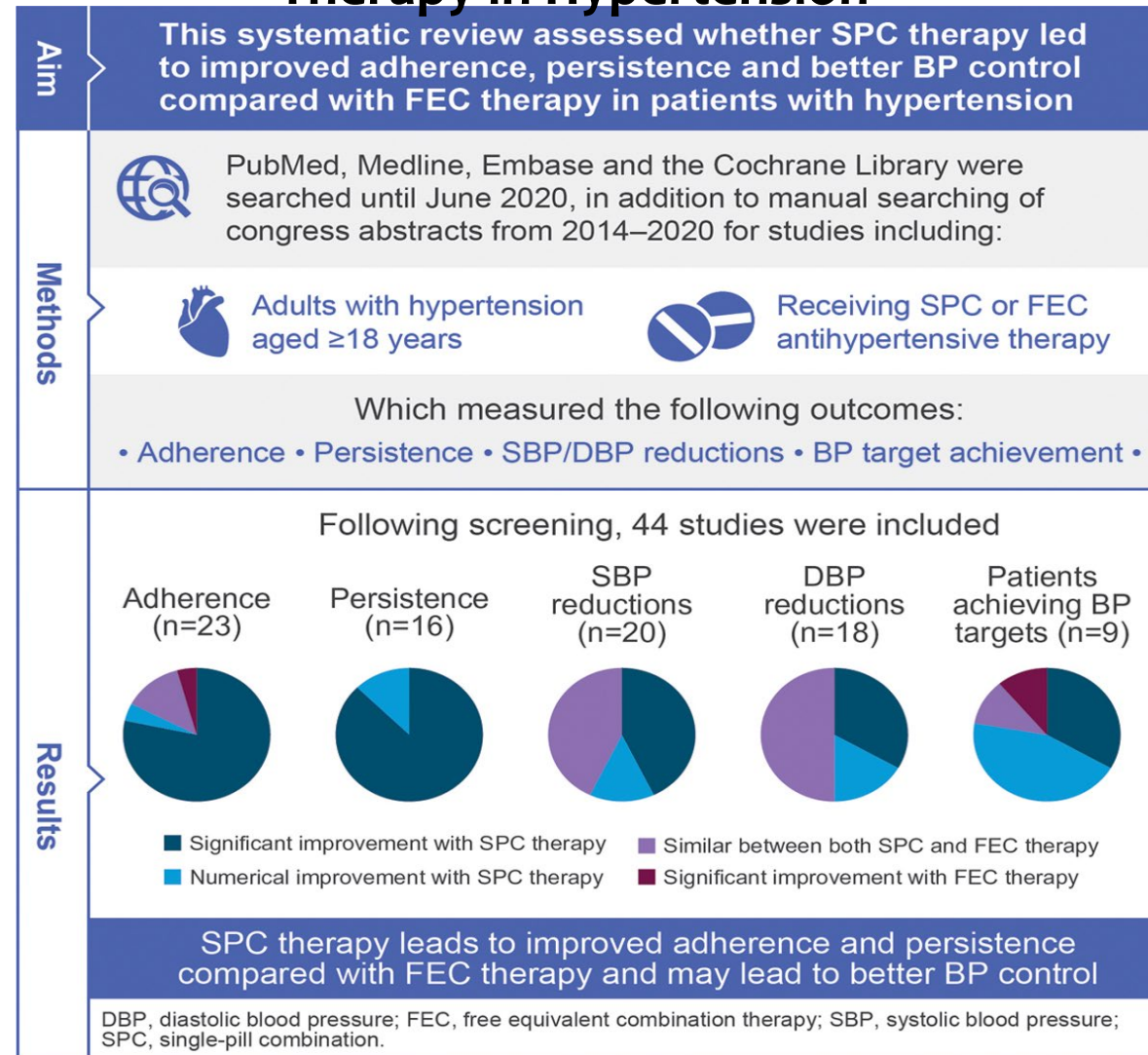
2X2 factorial design (n=98):
amiloride (10 mg/d)
spironolactone (25 mg/d)
combination of both drugs
placebo



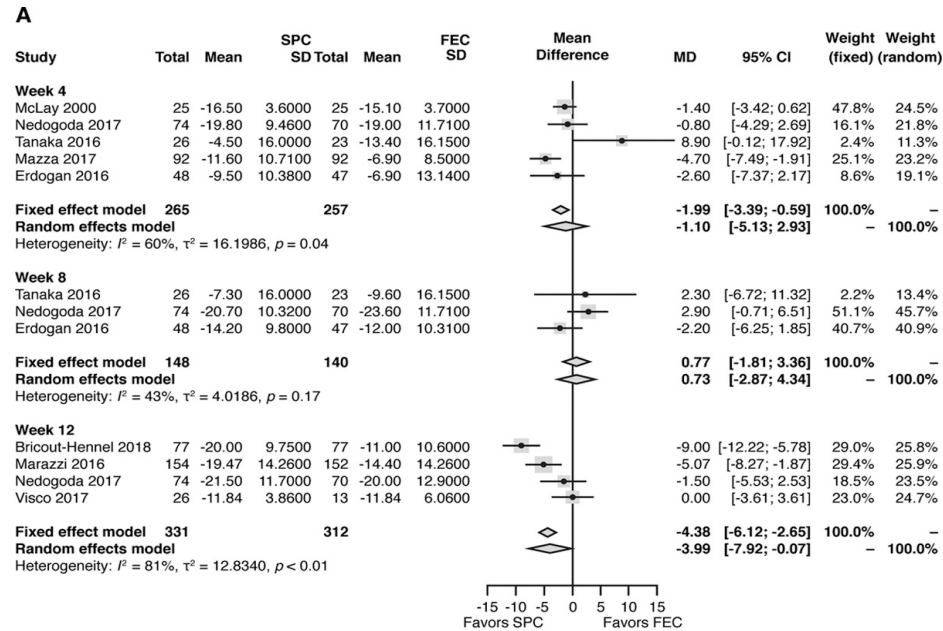
Drugs to Consider Adding to Initial 2-3 Drug Combinations

- **spironolactone or amiloride:** especially if K^+ low or 1° aldosteronism.
- **alpha blocker:** especially if LUTS
- **alternative CCB:** avoid combining non-DHP c BB
- **beta-blocker:** safe to combine (except with non-DHP CCB) but does not add much efficacy to RAS blocker.
- **vasodilator:** hydralazine or minoxidil
- **alpha-beta blocker:** labetalol or carvedilol
- **central agonist:** most side effects frequency

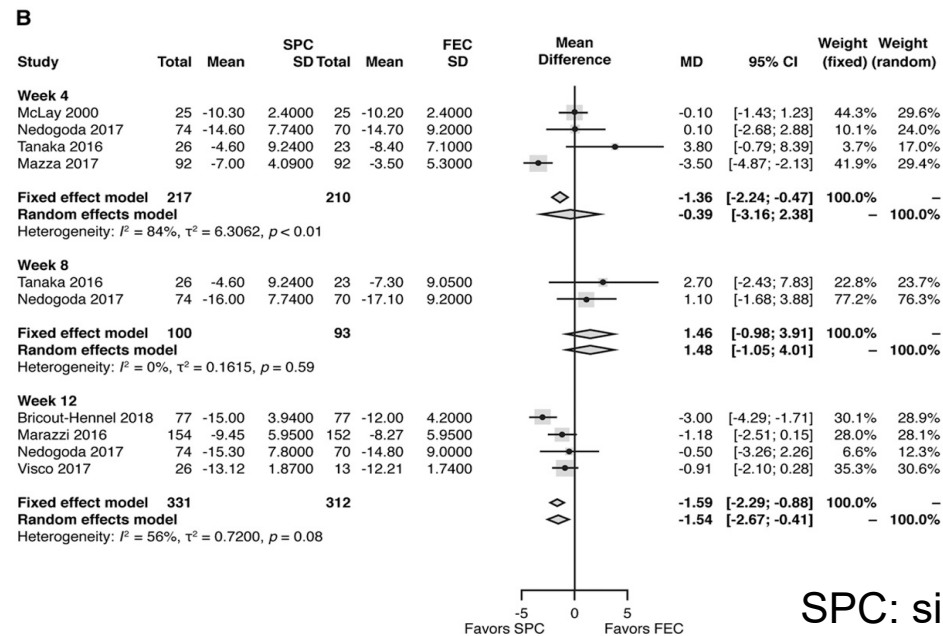
Adherence to Single-Pill Versus Free-Equivalent Combination Therapy in Hypertension



Relative reduction in BP: SPC therapy vs FEC therapy



SBP

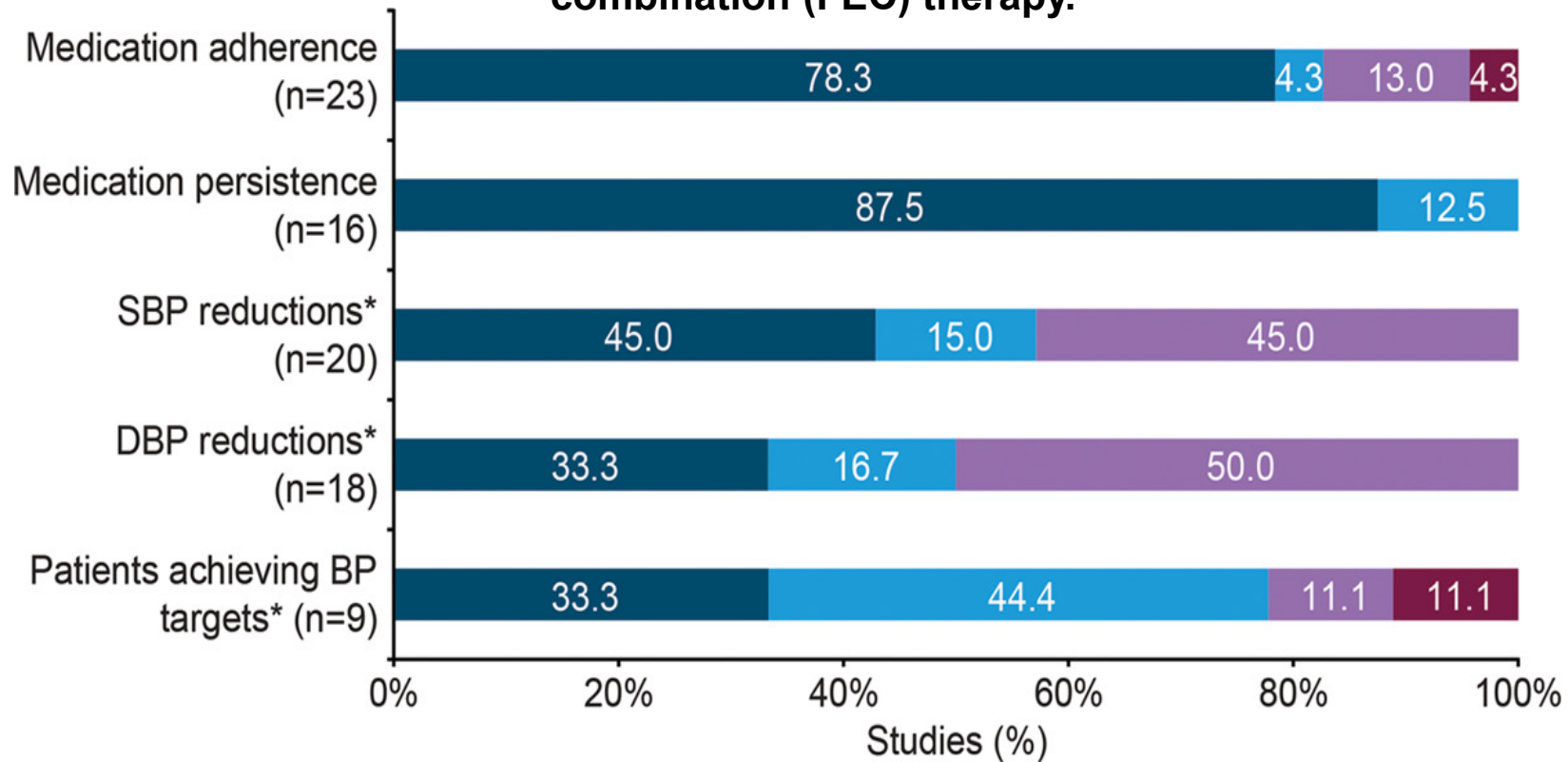


DBP

SPC: single-pill combination
FEC: free-equivalent combination



Proportion of studies demonstrating differences in adherence, persistence, blood pressure (BP) target achievement, and BP reductions in patients receiving single-pill combination (SPC) therapy or free-equivalent combination (FEC) therapy.



- Significant improvement with SPC therapy
- Numerical improvement with SPC therapy
- Similar between both SPC and FEC therapy
- Significant improvement with FEC therapy



Conclusions

- Measure BP accurately in clinic and at home.
- Encourage lifestyle changes for prevention or treatment of HTN.
- Start with antihypertensive classes alone or in combination with the best cardiovascular outcome data.
- Act rapidly: titrate medications at least monthly, intensify until at goal or decision made to stop intensifying – most patients need at least 3 medications.
- Expect some side effects when treating HTN appropriately – most can be managed effectively.
- Consider single-pill combinations (SPCs) frequently to improve adherence and BP control.

Thank you!

Clinic, Home, and Ambulatory BP Measurements



Clinic Measurements	Home BP Monitoring	Ambulatory BP Monitoring
Description		
<ul style="list-style-type: none"> • BP measured in a medical setting • Patient should be seated, resting quietly with their back supported and feet flat on the floor 	<ul style="list-style-type: none"> • BP measured while seated at home, resting quietly with back supported and feet flat on the floor • BP readings obtained in the morning and evening 	<ul style="list-style-type: none"> • BP measured during routine activities • 48 to 72 readings obtained over 24 hours
Strengths		
<ul style="list-style-type: none"> • Associated with cardiovascular outcomes • Only method that has been used to guide treatment in large outcome trials 	<ul style="list-style-type: none"> • Strong association with cardiovascular outcomes • Detects white coat and masked hypertension 	<ul style="list-style-type: none"> • Strong association with cardiovascular outcomes • Detects white coat and masked hypertension • BP measured at work and at night (i.e., during sleep)
Weaknesses		
<ul style="list-style-type: none"> • Less precise as only 1 or 2 BP measurements typically obtained • Many factors affect the accuracy of readings • Requires training and frequent re-training of staff 	<ul style="list-style-type: none"> • Patients may not correctly measure and report their BP • Requires patient training and re-training • Many home devices are not validated 	<ul style="list-style-type: none"> • Not tolerated by some patients • Equipment is not widely available • Requires two clinic visits: to set up and return the device

Muntner, P. et al. Blood Pressure Assessment in Adults in Clinical Practice and Clinic-Based Research. J Am Coll Cardiol. 2019;73(3):317–35.

FIGURE 1 BP Phenotypes Defined by Combinations of Clinic and Out-of-Clinic BP

Hypertension* based on: Clinic Blood Pressure	Yes	White Coat Hypertension	Sustained Hypertension
	No	Normotension	Masked Hypertension
		No	Yes

Hypertension[†] based on:
Out-of-clinic Blood Pressure

Muntner, P. et al. Blood Pressure Assessment in Adults in Clinical Practice and Clinic-Based Research. J Am Coll Cardiol. 2019;73(3):317–35.

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.

However:

1. Some recent studies and meta-analysis suggest people with WCH have elevated CVD risk.
2. Those with WCH were never excluded from major treatment trials and we did not know who they were.
3. People with masked HTN were never included in trials.

Therefore, I recommend using OOO BPs to “inform” diagnosis and treatment decisions.
2020 VA/DoD and 2021 KDIGO HTN guidelines reflect this.