Outpatient Hypertension Management

UW Medicine|Valley Medical Center Grand Rounds

January 17, 2024

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Disclosures

- None

Objectives

- Epidemiology of hypertension
- Timeline of hypertension management guidelines
- Measuring blood pressure
- Current guidelines for hypertension management
  - 2017 ACC/AHA
  - 2017 ACP/AAFP in older adults
  - 2021 KDIGO guidelines for blood pressure management in CKD
  - 2022 AAFP
- Young adults?

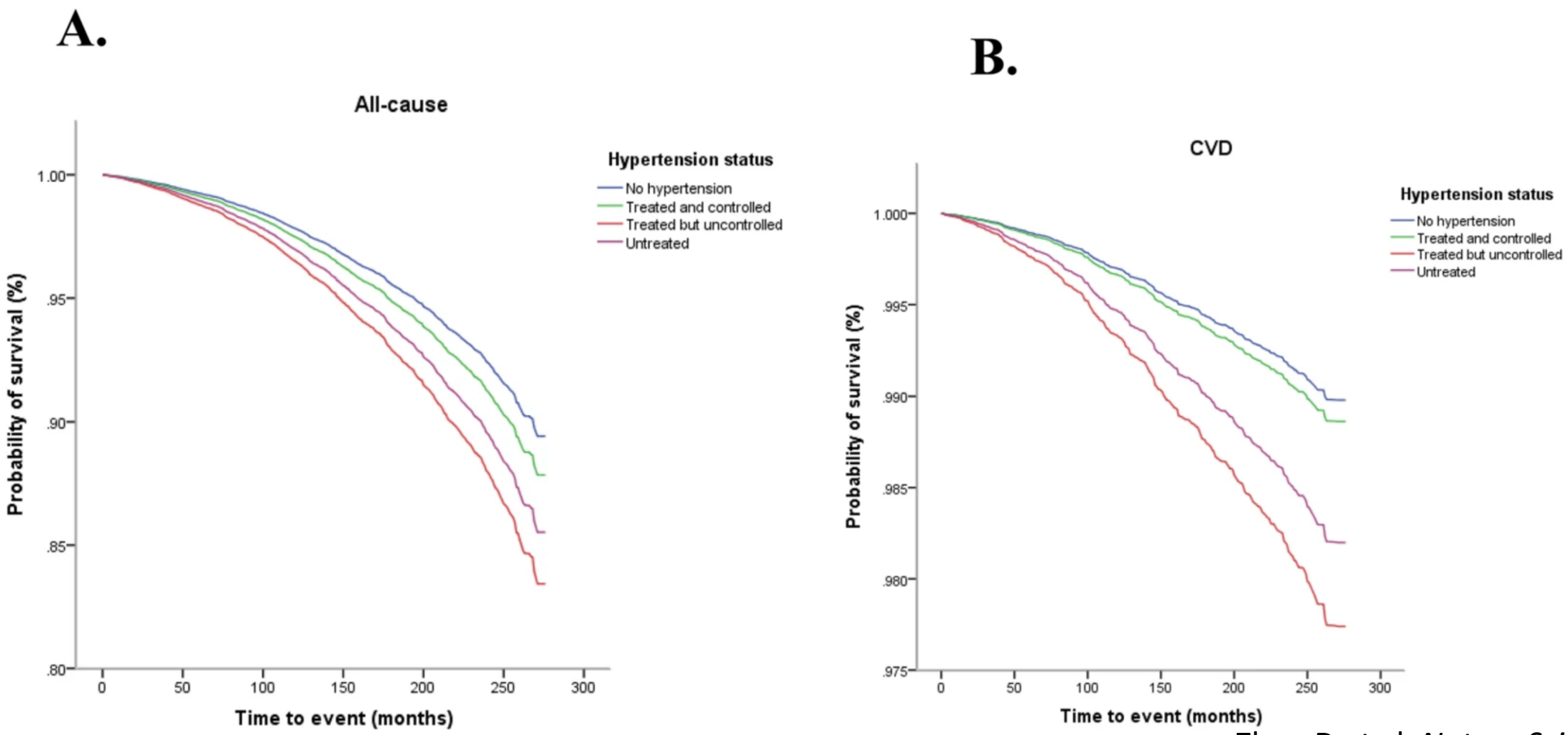
Epidemiology

- 1.28 billion adults world-wide aged 30-79 yrs have HTN (>140/90)
- ~ 46% of adults with HTN are unaware
- <42% of adults with HTN are diagnosed and treated
- 1/5 adults with HTN have it under control
- HTN is the major cause of premature death world-wide

WHO, 2023

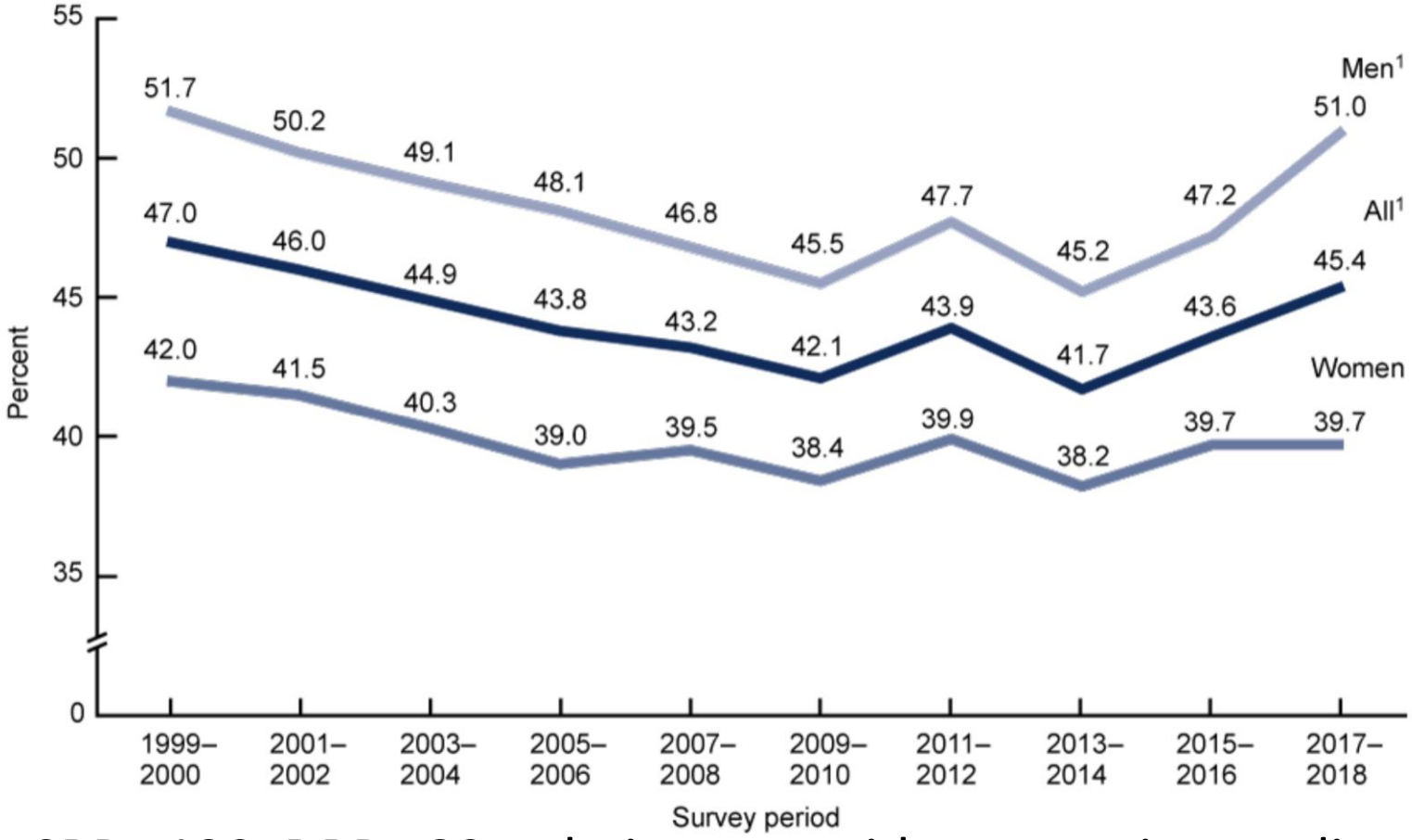
Uncontrolled HTN*: All-cause & CVD mortality

*JNC 8: <60 yrs BP <140/90, ≥ 60 yrs BP <150/90



Zhou D et al, *Nature Sci Rep*, 2018

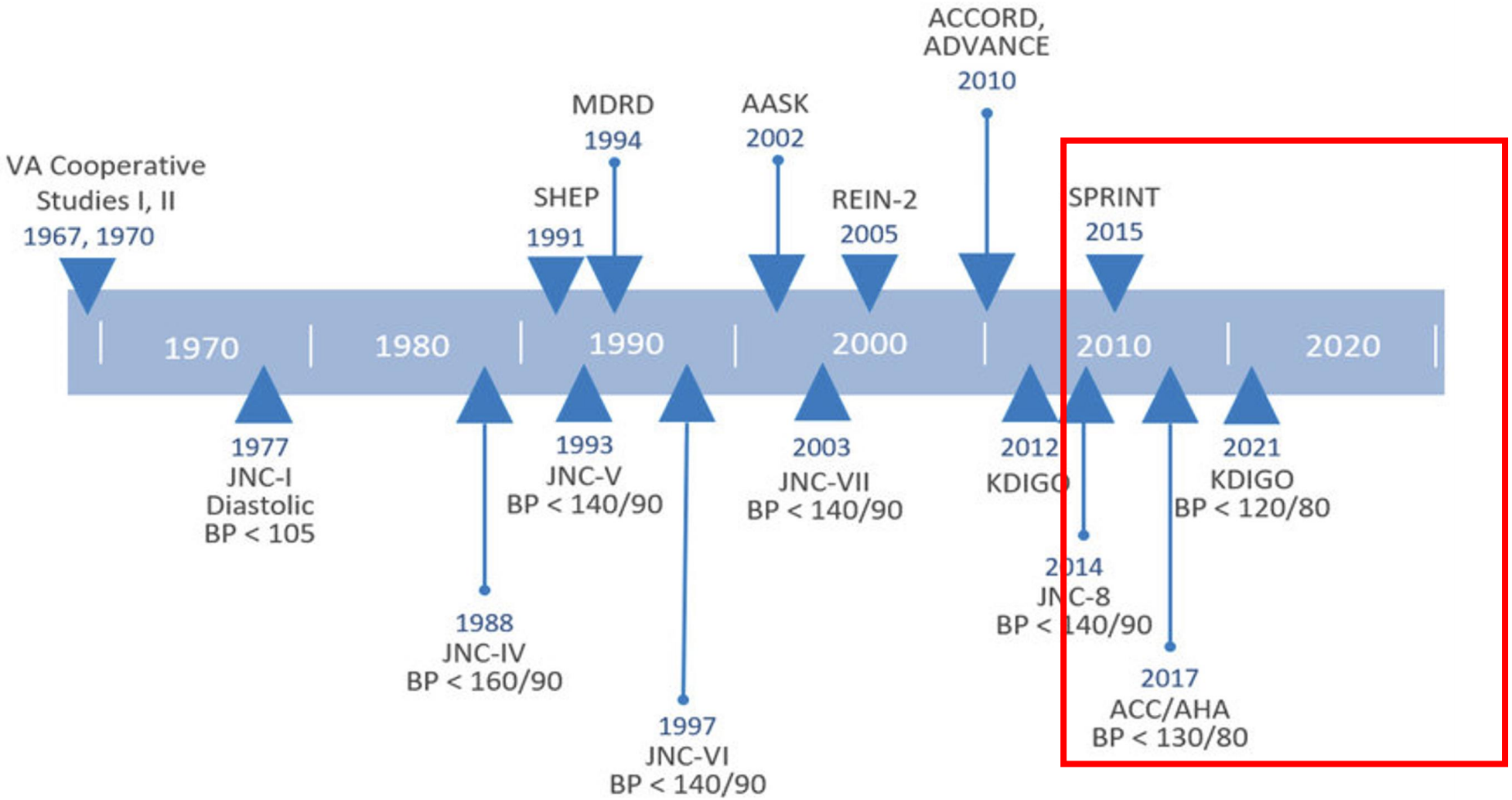
Age-adjusted trend in HTN prevalence among US adults;1999-2018 (NHANES)



HTN defined as SBP >130, DBP >80 or being on anti-hypertensive medications

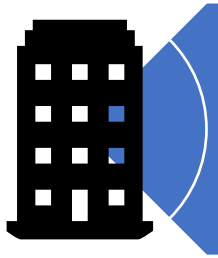
CDC, 2020

HTN management trials/guidelines



Herbert & Ibrahim, *Methodist DeBakey Cardiovasc J*, 2022

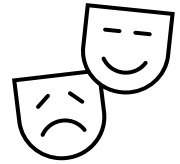
BP measurement



Office (OBPM)

(1) Standardized (2) Routine

≠ standardized BP protocols in RCT



Home (HBPM)

The USPSTF (2021), Level A

24-h ambulatory (ABPM)

Labile, nocturnal, white-coat, masked hypertension

Drawz PE et al, *JAMA Intern Med*, 2020

www.uspreventiveservicestaskforce.org

STANDARDISED OFFICE BLOOD PRESSURE MEASUREMENT

#NephJC

PREPARATION

30 min prior

Empty bladder

>5 minutes

TECHNIQUE

- ✓Validate
- ✓Calibrate
- ✓Manual or Auto

- ✓Arm supported
- ✓Cuff at RA level
- ✓Correct size
- ✓No clothing under cuff

- ✓Palpate to estimate SBP
- ✓Inflate 20-30mmHg higher
- ✓Deflate 2mmHg/sec
- ✓Korotkoff sounds

MEASUREMENT

X2

- ✓Both arms
- ✓Higher arm noted for future use
- ✓Repeat 1-2 minutes later

- ✓Record SBP/DBP
- ✓Average
  ≥2 readings
  ≥2 occasions
- ✓Note time of BP medication

Tell patient the BP verbally & in writing

Out of Office BPM can complement Standardised BPM

Home- based BPM

Ambulatory BPM

Can be used to detect white coat HTN / effect and masked HTN

Chapter 1. Blood Pressure Measurement
KDIGO 2021 Clinical Practice Guidelines for the Management of Blood Pressure in Chronic Kidney Disease
Suppl to KI 99 (2021) 99, S1-S87

Visual Abstract by @Dilushiwija

HBPM

2

2

3 days

https://www.validatebp.org/

Bello NA et al, *J Am Heart Assoc*, 2018

How to measure your blood pressure at home

TARGET:BP™ | American Heart Association. | AMA

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.

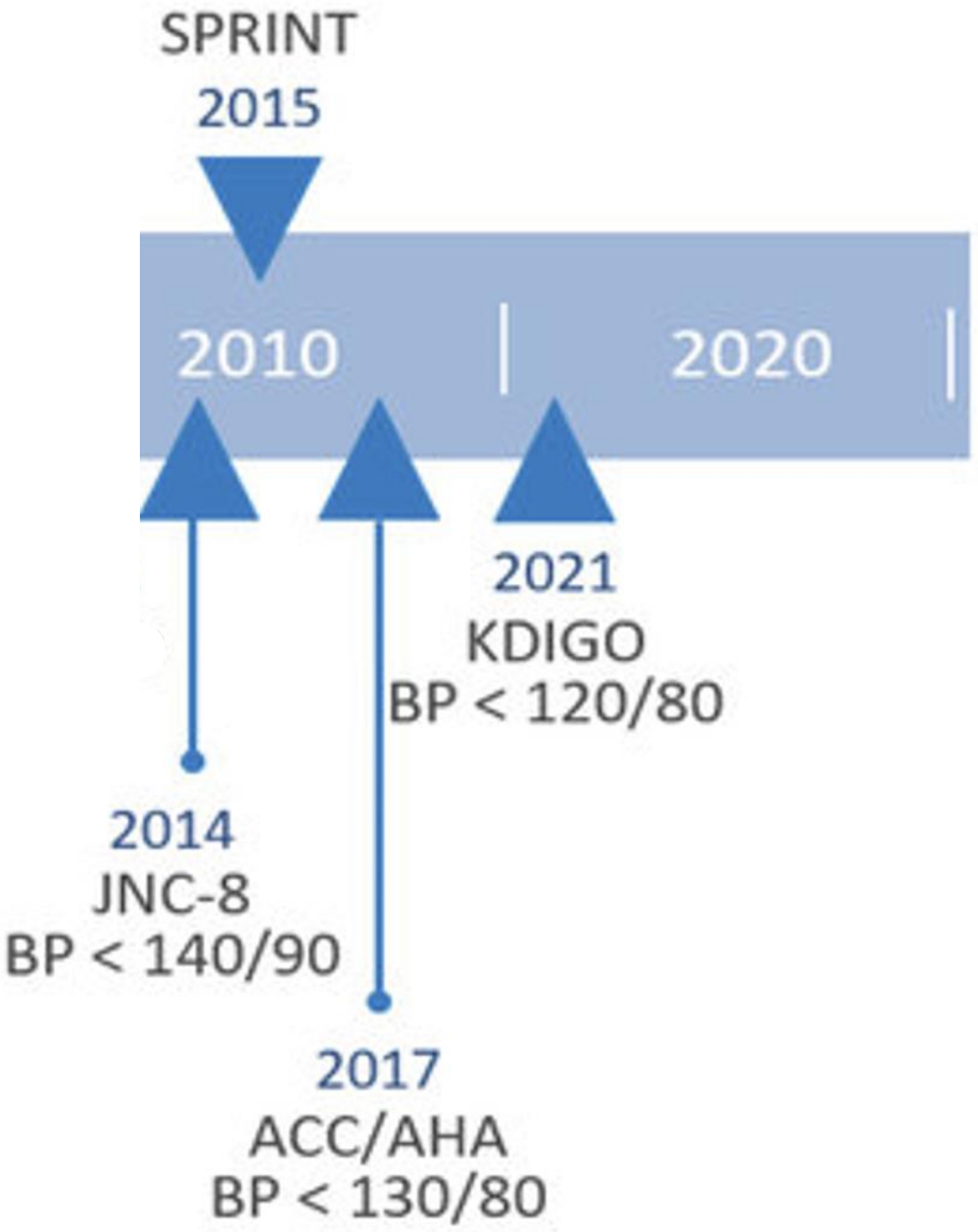
Record your measurements when finished.

Content provided by

AMA | MAPBP™

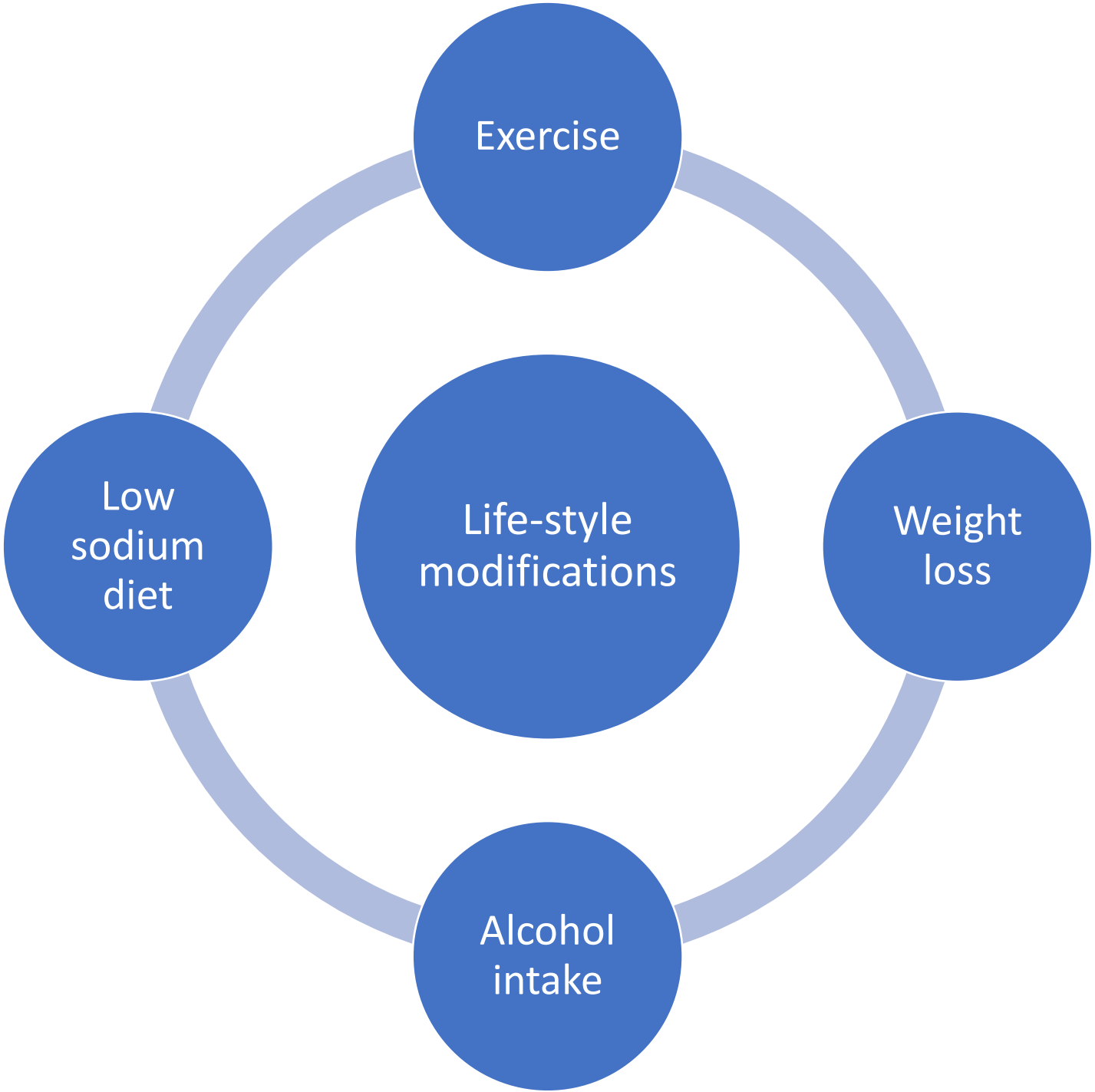
This Prepare, position, measure handout was adapted with permission of the American Medical Association and The Johns Hopkins University.
The original copyrighted content can be found at https://www.ama-assn.org/ama-johns-hopkins-blood-pressure-resources.

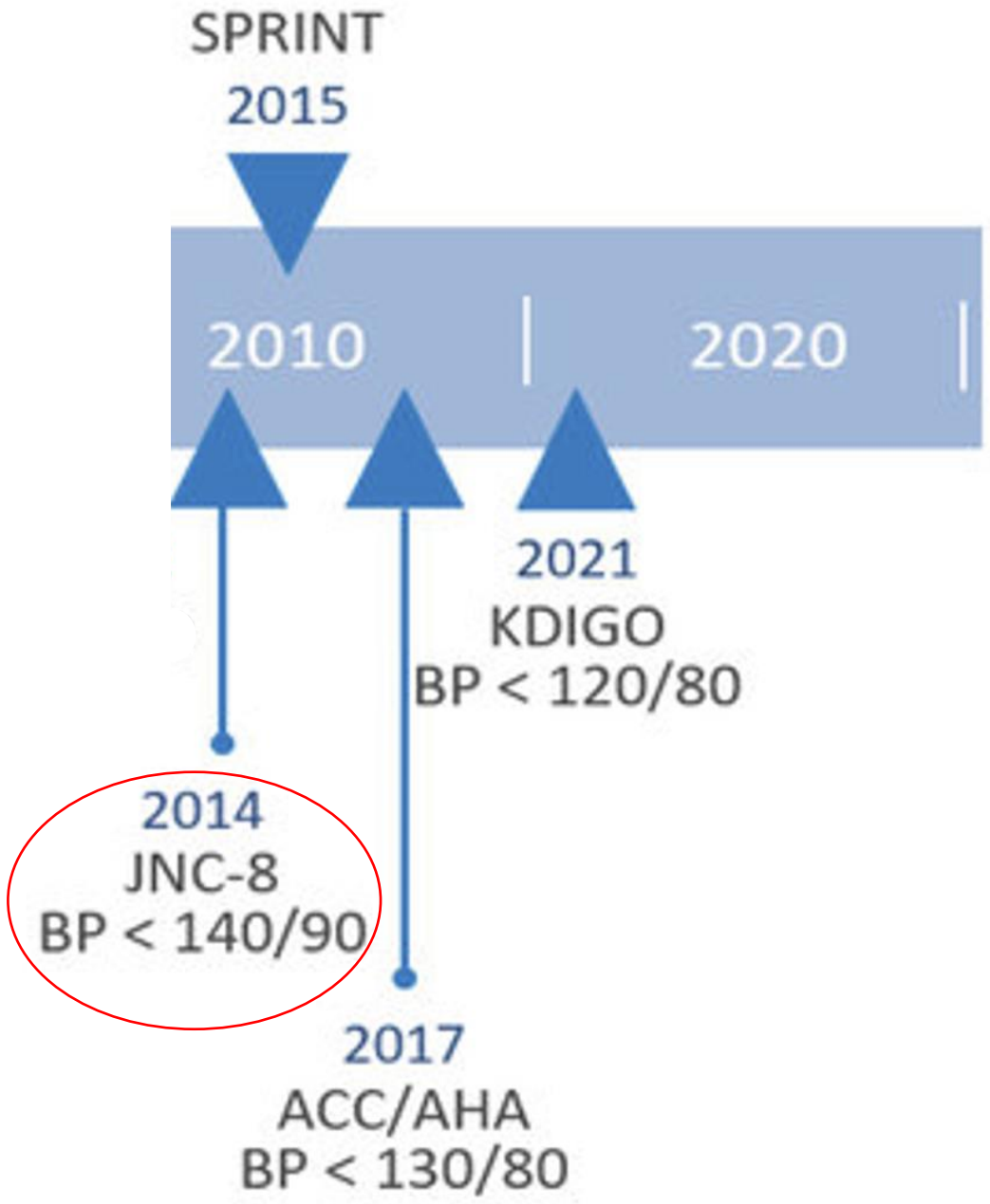
www.targetBP.org



HTN management trials/guidelines

Herbert & Ibrahim, *Methodist DeBakey Cardiovasc J*, 2022


Exercise
Low sodium diet
Life-style modifications
Weight loss
Alcohol intake

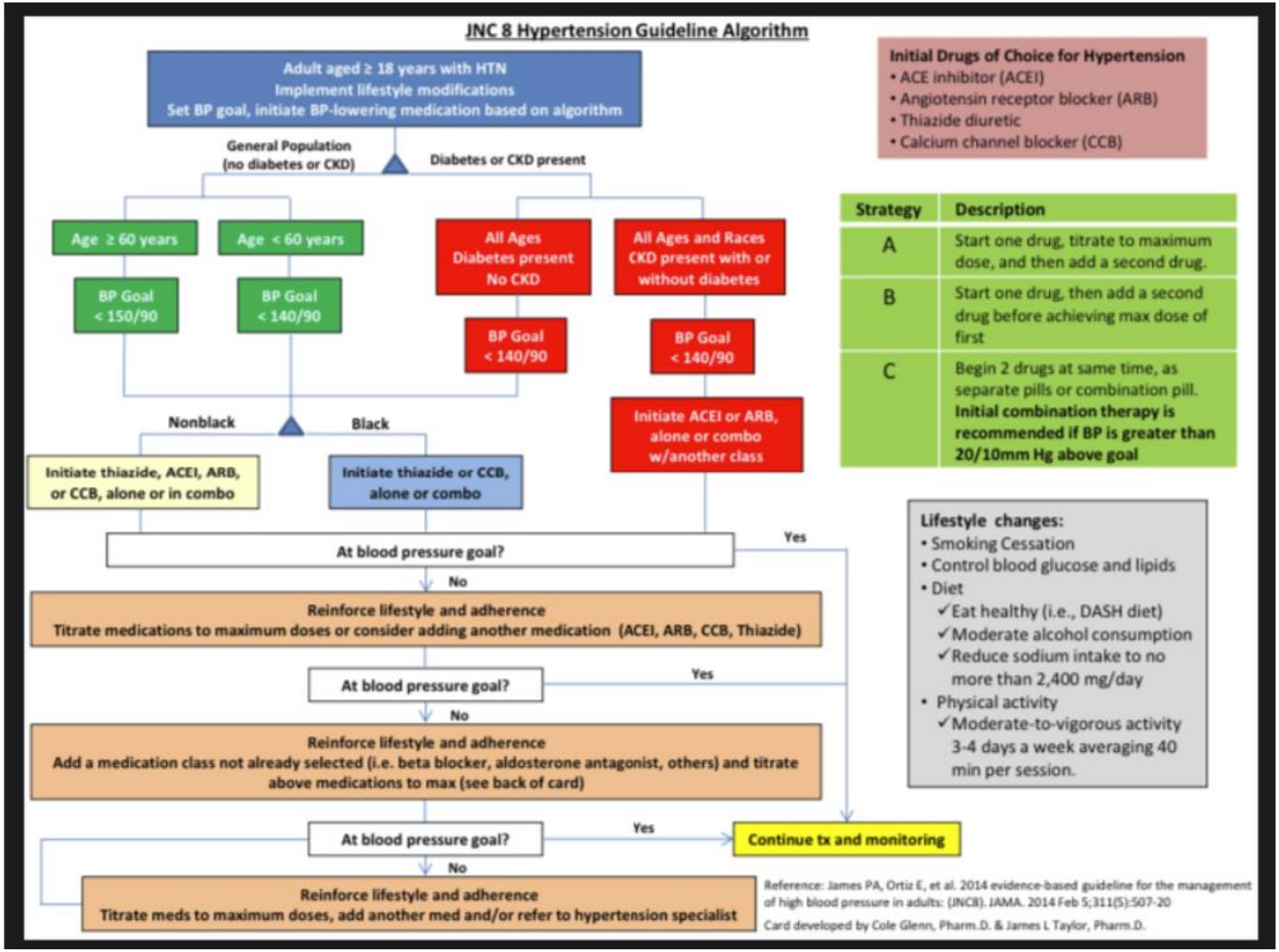


HTN management trials/guidelines

Herbert & Ibrahim, *Methodist DeBakey Cardiovasc J*, 2022

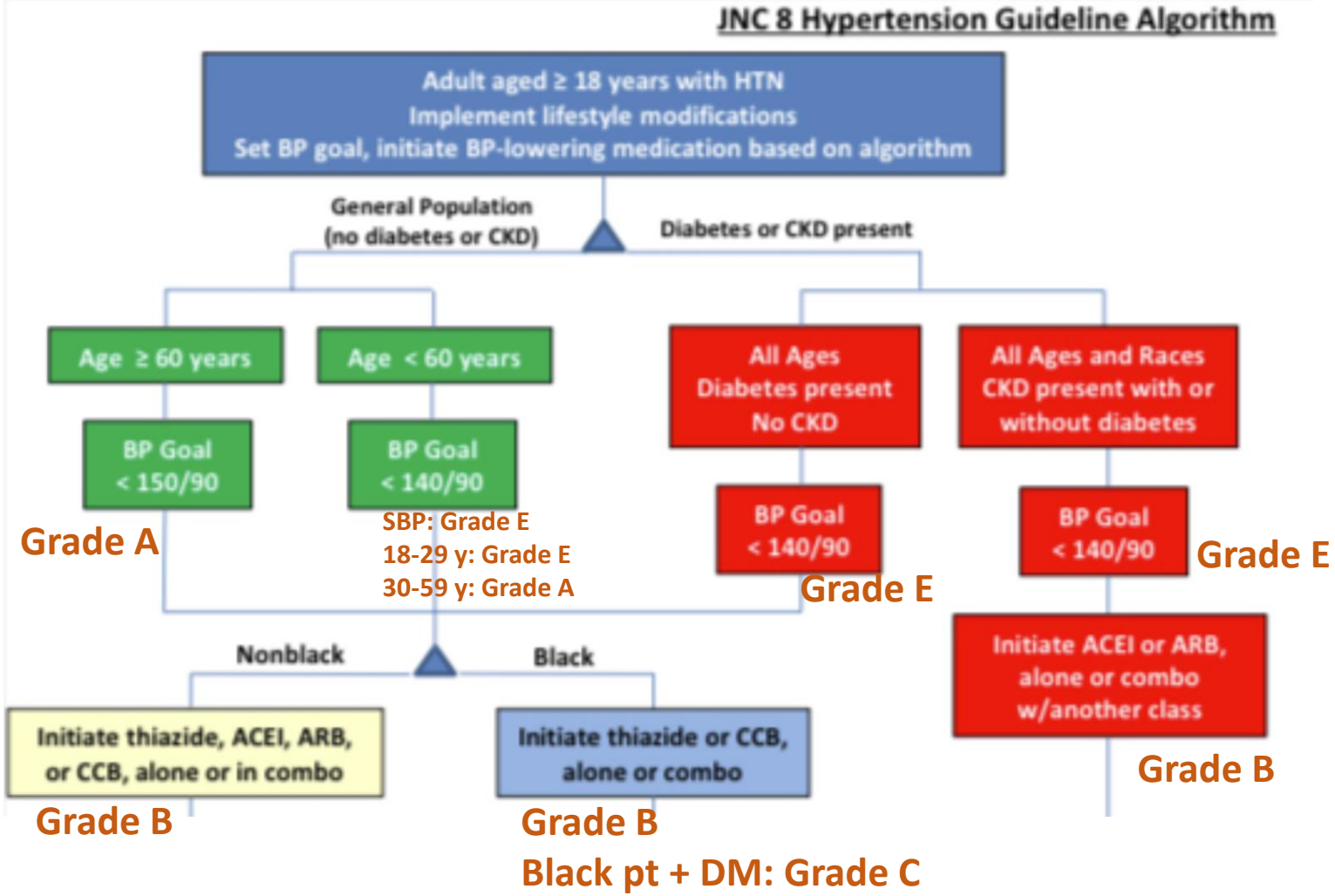
JNC-8 (2014)

Evidence based recommendations for management of high blood pressure in adults

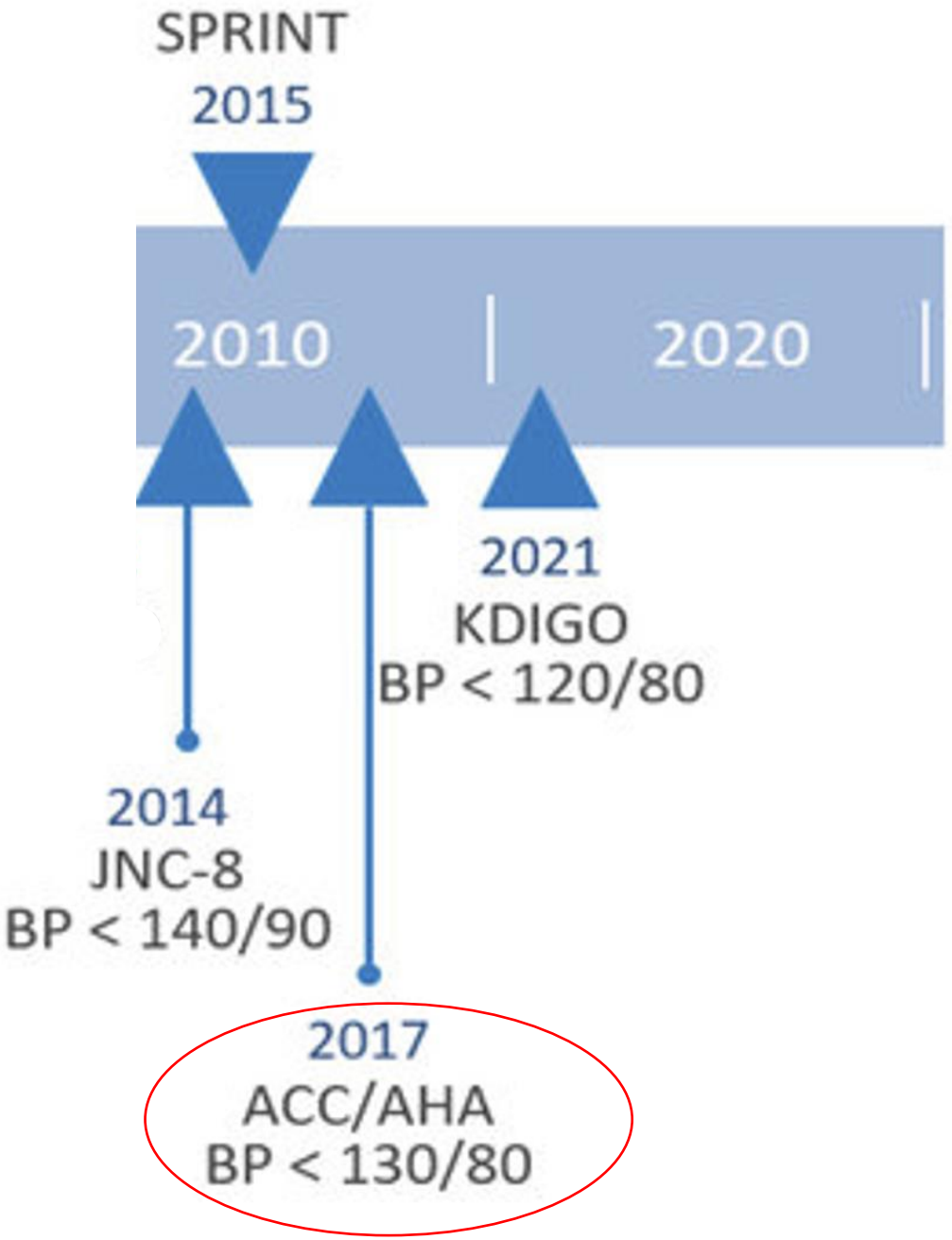


JNC-8 controversies

- Panel members withdrew
- Not accepted by ACC/AHA, NHLBI, ASH



James, PA et al, *JAMA*, 2014

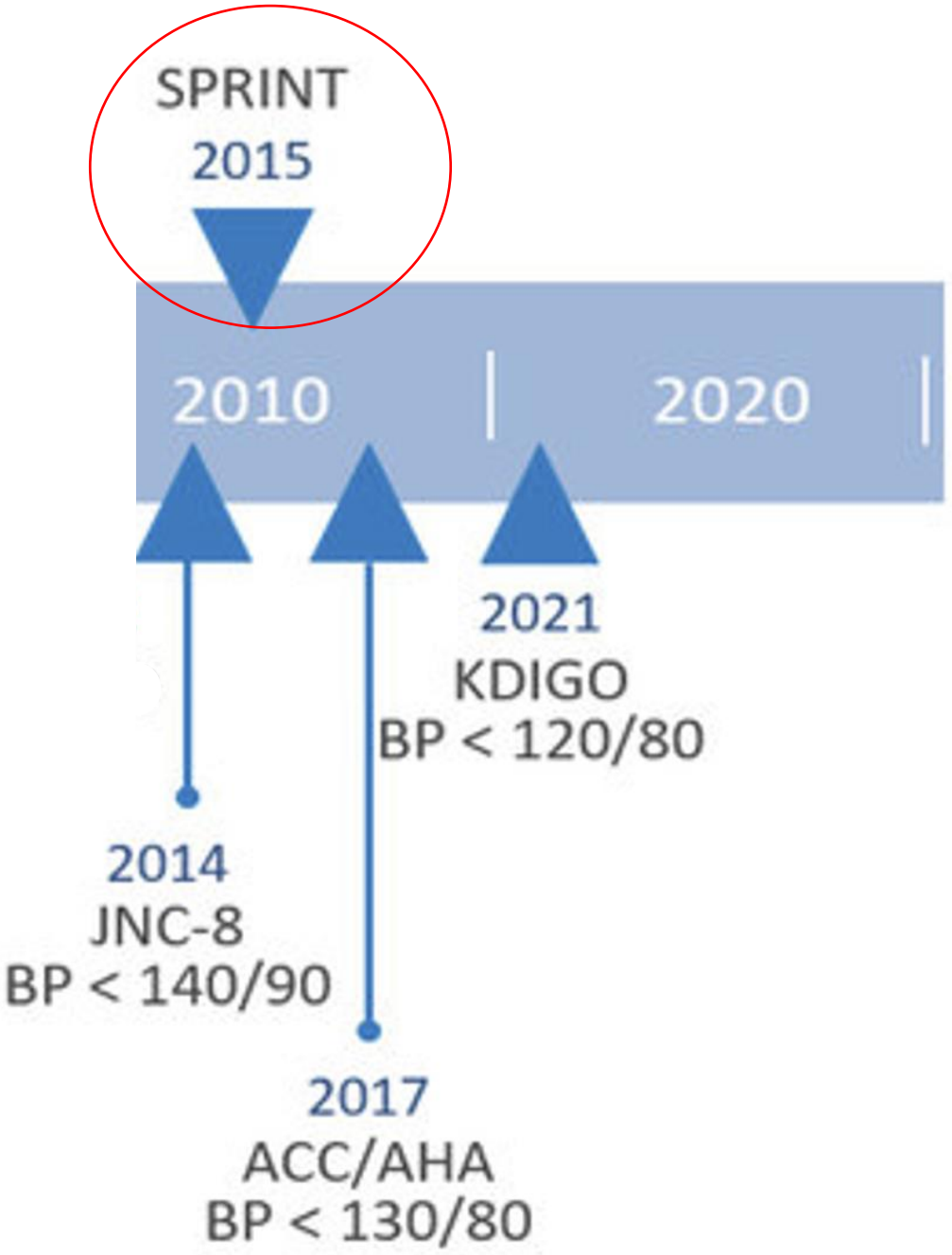


HTN management trials/guidelines

Herbert & Ibrahim, *Methodist DeBakey Cardiovasc J*, 2022

2017 ACC/AHA: <130/80

- SHEP: Systolic hypertension in the elderly program
- HYVET: Hypertension in the very elderly trial
- FEVER: Felodipine event reduction study
- JATOSH: Japanese trial to assess optimum systolic blood pressure in the elderly hypertensive patients
- VALISH: Valsartan in elderly isolated systolic hypertension study
- ACCORD: Action to control cardiovascular risk in diabetes
- SPS-3: Secondary prevention of subcortical strokes study
- **SPRINT: Systolic blood pressure intervention trial**



HTN management trials/guidelines

Herbert & Ibrahim, *Methodist DeBakey Cardiovasc J*, 2022

Systolic Blood Pressure Intervention Trial (SPRINT) - Randomized, open-label, multi-center trial

Age ≥ 50 yr, SBP ≥130mm Hg + one risk factor of heart disease
(CV dz, CKD, 10-yr Framingham CVD risk score ≥15% or age ≥75 years)
Notable exclusions: eGFR <20 mL/min/1.72m^2, h/o stroke, DM, LVEF <35%,

N = 4678
Intensive treatment SBP <120 mmHg

N = 4683
Standard treatment SBP <140 mmHg

Median follow-up 3.26 years

1.65% per yr	**Primary composite outcome of MI, ACS, CVA, HF or death from CV cause** HR = 0.75, 95% CI [0.64-0.89], p <0.001	2.19% per yr
1.03% per yr	**Death from any cause** HR = 0.73, 95% CI [0.6-0.9], p=0.003	1.4% per yr
0.25% per yr	**Death from CV cause** HR = 0.57, 95% CI [0.38-0.85], p=0.005	0.43% per yr
38.3% of patients	**Serious adverse events** HR = 1.04, p=0.25	37.1 % of patients

SPRINT Research Group, *NEJM*, 2015

SPRINT - Conclusion

In high-risk, non-diabetic individuals with HTN, including elderly, intensive BP control of SBP <120 vs. <140, reduced CV and all-cause mortality

2017 ACC/AHA guidelines

- Office BP vs. out-of-office BP
- Optimal target BP
- Choice of initial medication
- Monotherapy vs. combination therapy

2017 ACC/AHA guidelines

Office BP vs. out-of-office BP	• Out-of-office BP measurements for diagnosis and titration of medications (COR/LOE:1/A)
Optimal target BP	
Choice of initial medication	
Monotherapy vs. combination therapy	

2017 ACC/AHA guidelines

Office BP vs. out-of-office BP	• Out-of-office BP measurements for diagnosis and titration of medications (COR/LOE: Grade 1/A)
Optimal target BP	• HTN + known CVD or 10-yr ASCVD risk ≥10% : SBP <130 (COR/LOE: 1/B-R), DBP <80 (COR/LOE:1/C-EO) • HTN & no additional risk factors: SBP <130 (COR/LOE: 2b/B-NR), DBP <80 (COR/LOE: 2b/C-EO)
Choice of initial medication	
Monotherapy vs. combination therapy	


ACC/AHA <130/80 vs. SPRINT <120?
Standardized office BP – how feasible is it?
BP used as performance standard and quality measure?

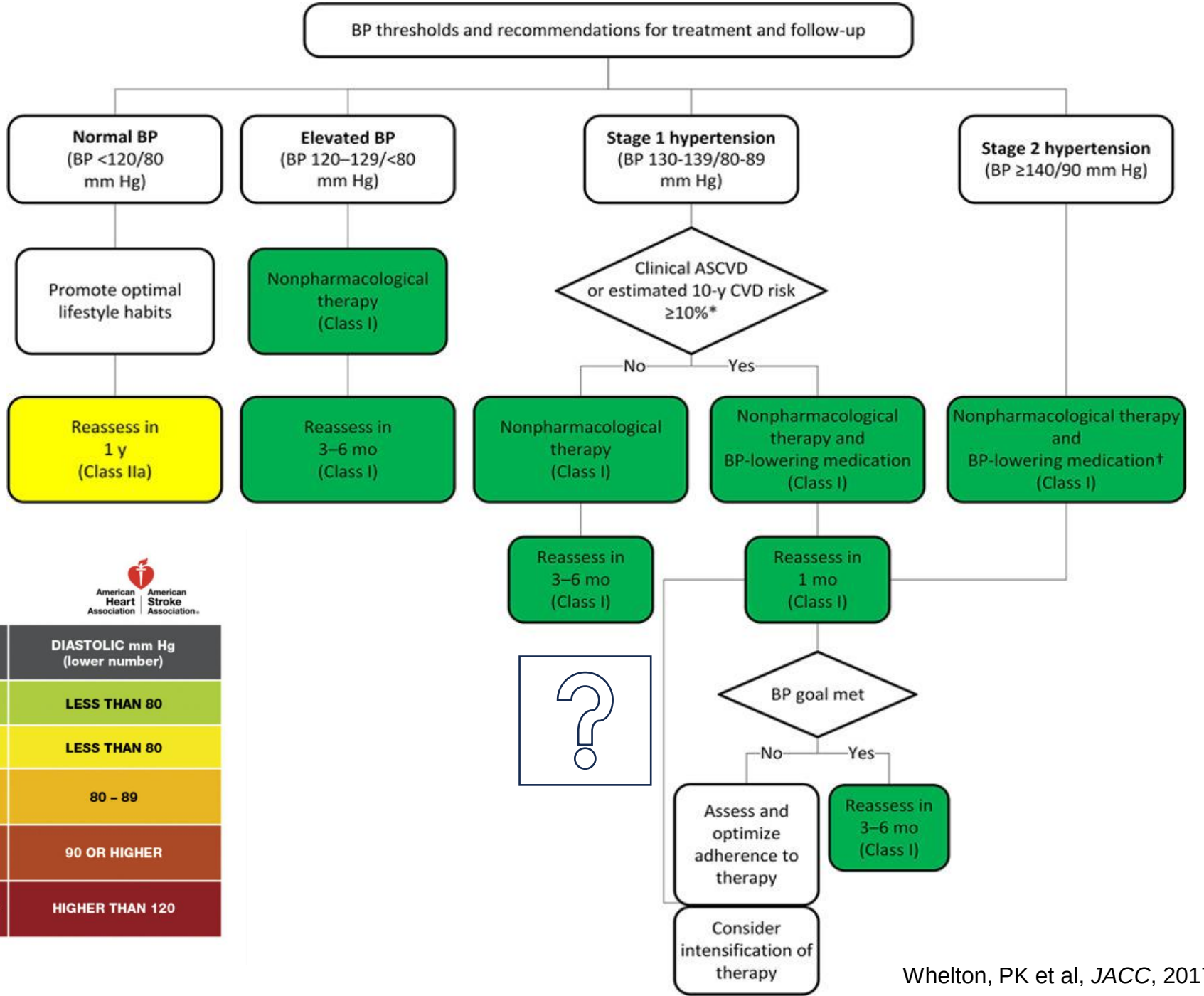
2017 ACC/AHA guidelines

Office BP vs. out-of-office BP	• Out-of-office BP measurements for diagnosis and titration of medications (COR/LOE:1/A)
Optimal target BP	• HTN + known CVD or 10-yr ASCVD risk ≥10% : SBP <130 (COR/LOE: 1/B-R), DBP <80 (COR/LOE: 1/C-EO) • HTN & no additional risk factors: SBP <130 (COR/LOE: 2b/B-NR), DBP <80 (COR/LOE: 2b/C-EO)
Choice of initial medication	• Initiation first line agents: Thiazide diuretics, ACEi/ARB, CCB (COR/LOE: 1/A)
Monotherapy vs. combination therapy	

2017 ACC/AHA guidelines

Office BP vs. out-of-office BP	• Out-of-office BP measurements for diagnosis and titration of medications (COR/LOE:1/A)
Optimal target BP	• HTN + known CVD or 10-yr ASCVD risk ≥10% : SBP <130 (COR/LOE: 1/B-R), DBP <80 (COR/LOE: 1/C-EO) • HTN & no additional risk factors: SBP <130 (COR/LOE: 2b/B-NR), DBP <80 (COR/LOE: 2b/C-EO)
Choice of initial medication	• Initiation first line agents: Thiazide diuretics, ACEi/ARB, CCB (COR/LOE: 1/A)
Monotherapy vs. combination therapy	• Co-morbid conditions • 2 drugs separate or combination for stage 2 HTN & avg BP >20/10mmHg above target (COR/LOE: 1/C-EO) • Stage I HTN, monotherapy acceptable to keep <130/80(COR/LOE:2a/C-EO)

2017 ACC/AHA guidelines



Blood Pressure Categories

American Heart Association | American Stroke Association

BLOOD PRESSURE CATEGORY	SYSTOLIC mm Hg (upper number)		DIASTOLIC mm Hg (lower number)
NORMAL	LESS THAN 120	and	LESS THAN 80
ELEVATED	120 – 129	and	LESS THAN 80
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1	130 – 139	or	80 – 89
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2	140 OR HIGHER	or	90 OR HIGHER
HYPERTENSIVE CRISIS (consult your doctor immediately)	HIGHER THAN 180	and/or	HIGHER THAN 120

Whelton, PK et al, *JACC*, 2017

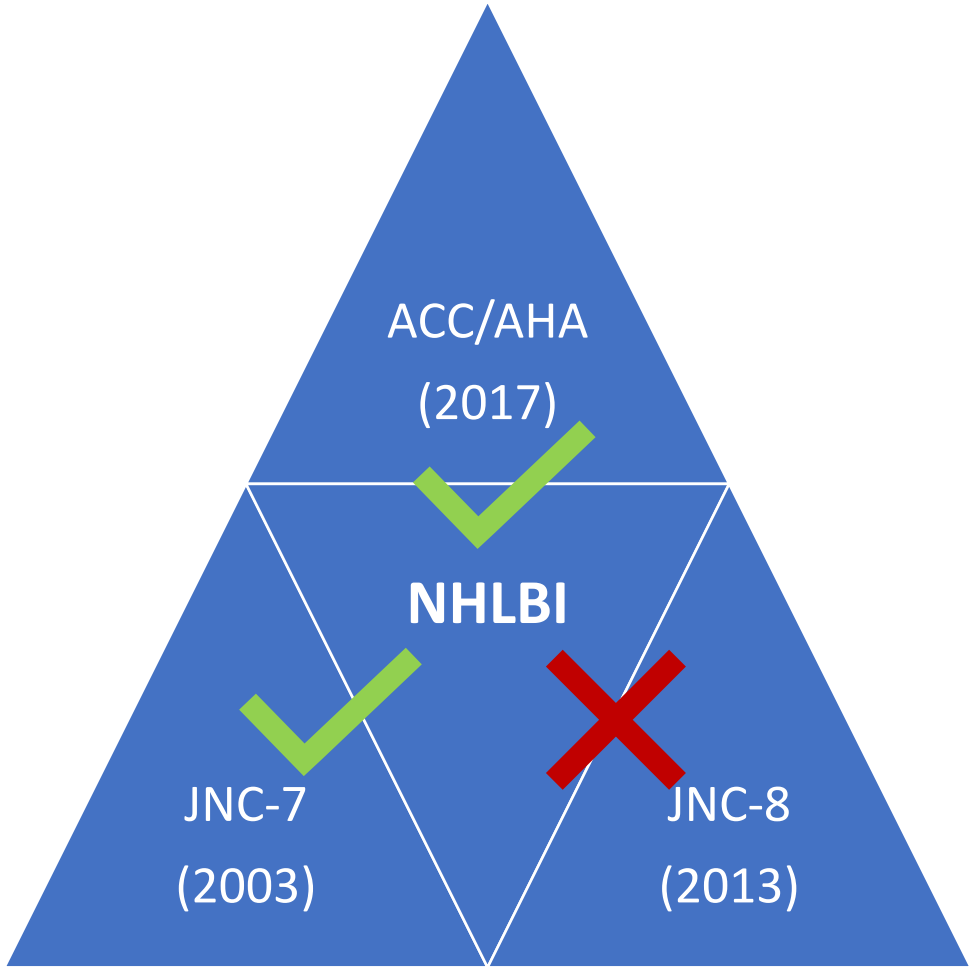
2017 ACP/AAFP

Concern for:

- Conflicts of interest
- Deviation from IOM recommended practices for developing trustworthy guidelines

ACP/AAFP

- Primary care groups declined to participate in ACC/AHA guideline panel
- Did not endorse 2017 ACC/AHA HTN guidelines
- 2017 ACP/AAFP HTN guidelines for older adults with hypertension



2017 ACC/ACP older adults (≥ 60 yrs)

Systematic review of RCT for primary outcome: all-cause mortality, morbidity and mortality related to stroke, major cardiac events (fatal & non-fatal MI, SCD)

Observational data for harms

Treatment of higher (<150 mmHg) vs. lower (≤ 140 mmHg) SBP targets for adults aged ≥ 60 yrs with HTN

Qaseem, A et al, *Annals Int Med*, 2017

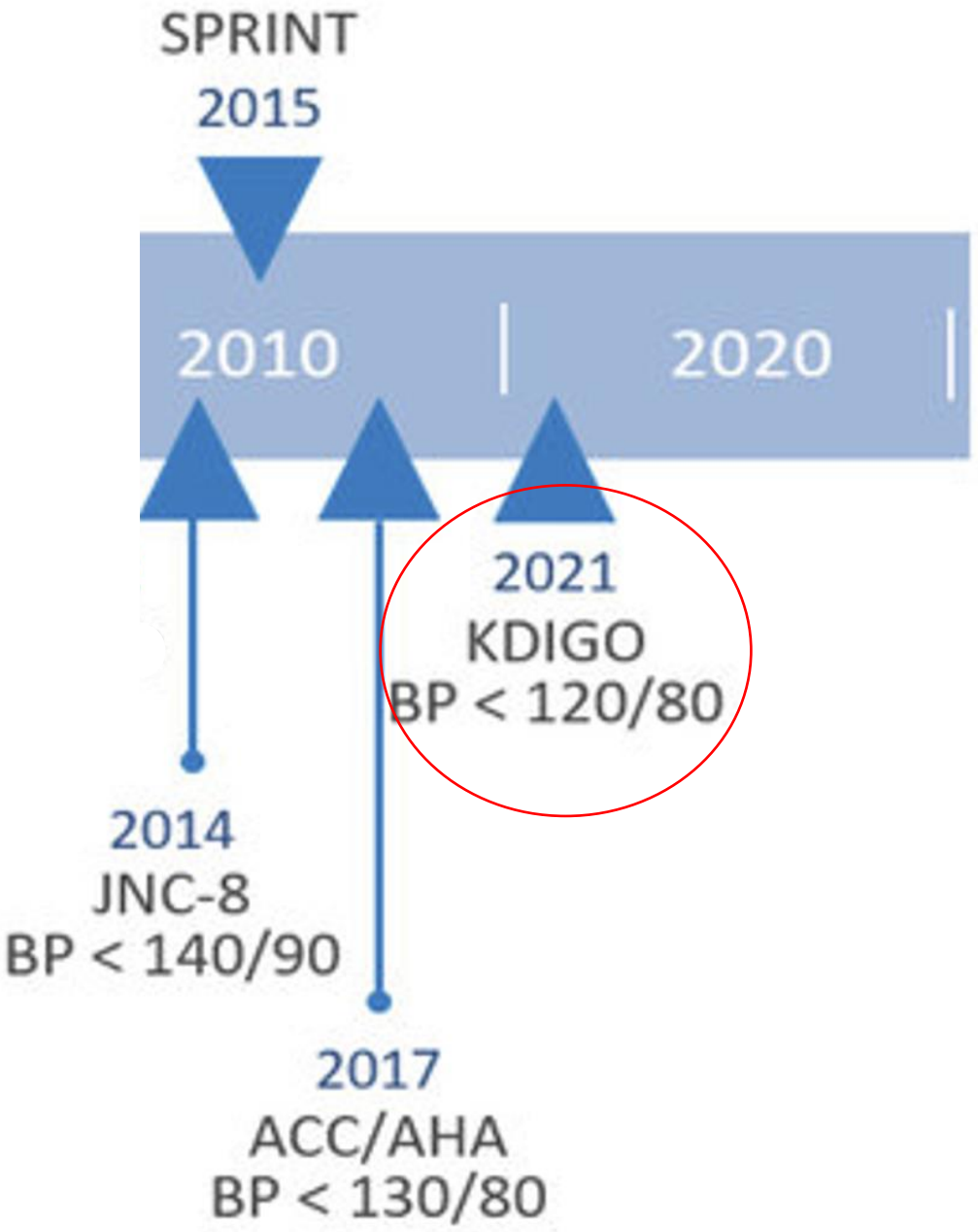
2017 ACC/ACP older adults (≥ 60 yrs)

1. Initiate treatment to target SBP <150, to reduce risk of stroke, cardiac events and possibly death (strong recommendation)

2. Initiate or intensify treatment to target SBP <140 in those with h/o stroke or TIA to reduce recurrence risk (weak recommendation)

3. Initiate or intensify treatment to target SBP <140 those with high cardiovascular risk based on individual assessment (weak recommendation)

Qaseem, A et al, *Annals Int Med*, 2017

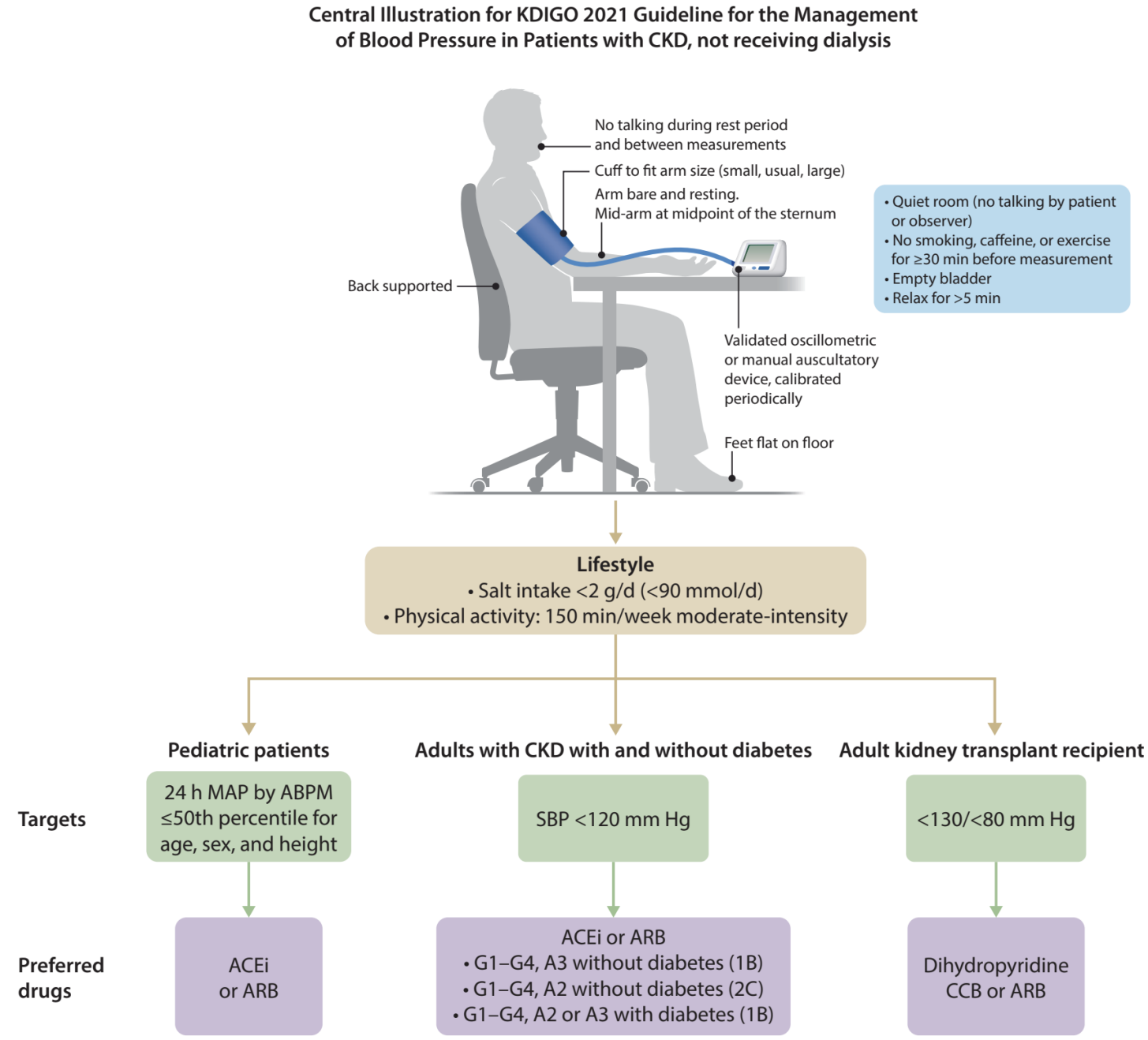


HTN management trials/guidelines

Herbert & Ibrahim, *Methodist DeBakey Cardiovasc J*, 2022

2021 KDIGO

- Standardized office BP
- Non-dialysis CKD: SBP <120 for CVD and all-cause mortality reduction
- RASi for CKD + albuminuria with or without diabetes
- Transplant:
  - <130/<80 “reasonable goal”
  - CCB or ARB



KDIGO Blood Pressure Workgroup, *Kidney Int*, 2021

2021 KDIGO – rationale for SBP <120mmHg

- CVD leading cause of death in CKD, not ESKD
- SPRINT- CV & mortality benefits in non-diabetic CKD
- ACCORD – reduction in stroke in diabetes, albeit few patients with eGFR <60mL/min/m^2
- Meta-analysis – reduction in CV risk proportional to BP lowering

KDIGO Blood Pressure Workgroup, *Kidney Int*, 2021

Intensive BP Lowering Reduces GFR But Does Not Increase Injury Biomarkers

978 of 2,646 Participants With CKD

Mean age 72 years

INTERVENTION

Intensive BP Lowering
(SBP < 120 mm Hg)
Baseline mean eGFR 44.8
N = 519

Standard BP Lowering
(SBP < 140 mm Hg)
Baseline mean eGFR 45.2
N = 459

1-YEAR OUTCOMES

Marker	Ratio of Intensive to Standard BP Arm	*P*
eGFR	↓ 7%	< 0.001
ACR	↓ 32%	< 0.001
B2M	↓ 29%	0.005
A1M	↓ 24%	0.002
YKL-40, IL-18, UMOD, MCP-1, KIM-1, NGAL	*No Difference Between Groups*	

ARTICLE: Effects of Intensive BP Lowering on Kidney Tubule Injury in CKD: A Longitudinal Subgroup Analysis in SPRINT
Rakesh Malhotra, Timothy Craven, Walter T. Ambrosius, et al
Am J Kidney Dis (ePub Oct 2, 2018) | DOI: 10.1053/j.ajkd.2018.07.015 |

AJKD AMERICAN JOURNAL OF KIDNEY DISEASES

ACTION TO CONTROL CARDIOVASCULAR RISK IN DIABETES

ACCORD

Intensive BP Lowering Reduces GFR But Does Not Increase Injury Biomarkers

529 of 4,733 Participants

- Age 62 ± 6.5 years
- Type 2 Diabetes

INTERVENTION

Intensive BP Lowering
(SBP < 120 mm Hg)
Baseline mean eGFR 85.9
N = 260

Standard BP Lowering
(SBP < 140 mm Hg)
Baseline mean eGFR 85.4
N = 269

2-YEAR OUTCOMES

Marker	Ratio of Intensive to Standard BP Arm	*P*
eGFR	↓11%	< 0.001
ACR	↓30%	0.004
IL-18	↓14%	0.04
KIM-1	↓12%	NS
MCP-1	↓ 7%	NS
YKL-40	↓15%	NS

Effect of Intensive Blood Pressure Lowering on Kidney Tubule Injury: Findings From the ACCORD Trial Study Participants
Girish N. Nadkarni, Kinsuk Chauhan, Veena Rao, et al
Am J Kidney Dis (ePub Oct 2, 2018) | DOI: 10.1053/j.ajkd.2018.07.016 |

AJKD
AMERICAN JOURNAL OF KIDNEY DISEASES

2022 AAFP

1

All adults, BP target <140/90mmHg to reduce the risks of all-cause and cardiovascular **mortality** (strong recommendation)

2

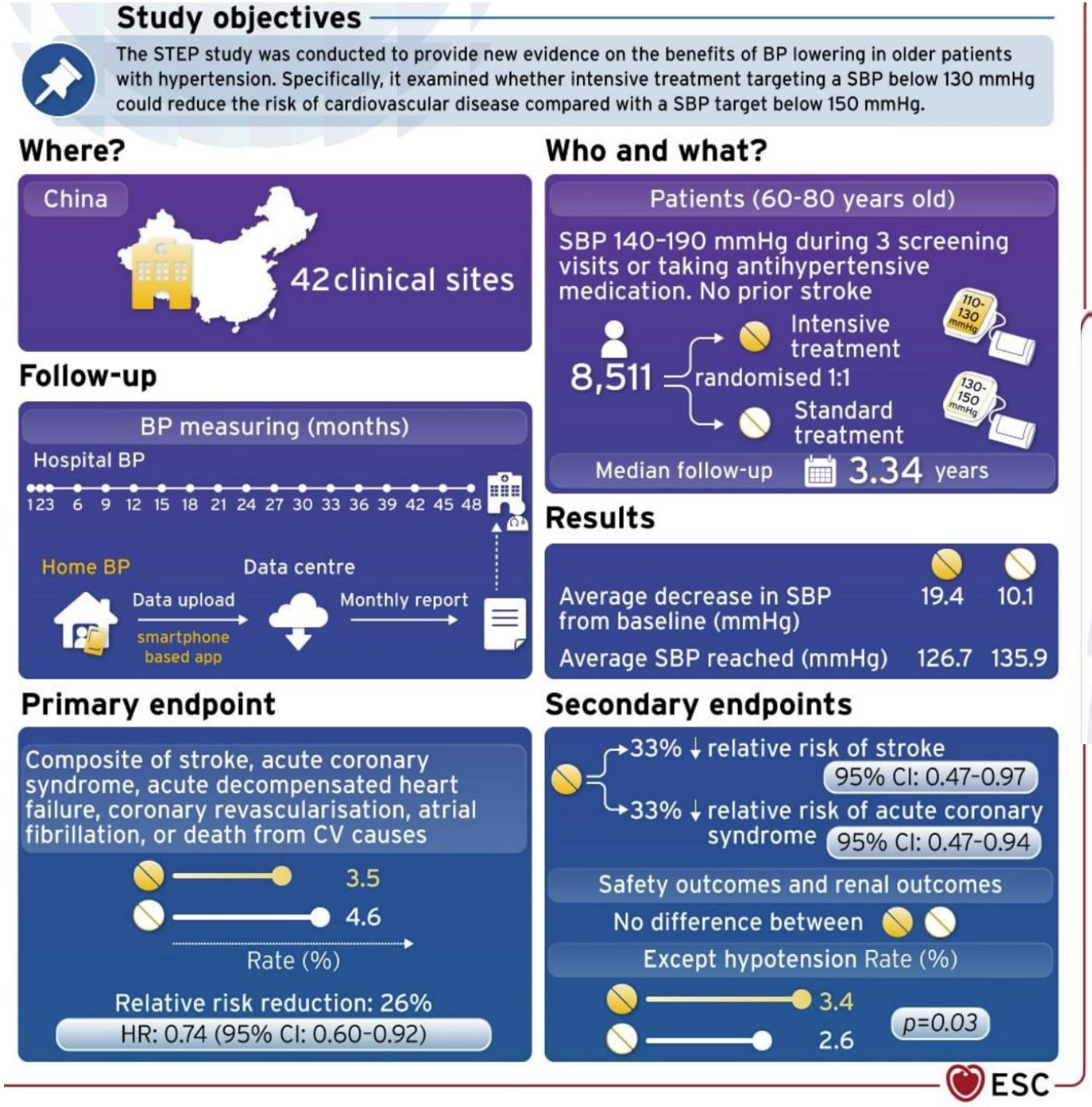
Consider a BP target <135/85 mmHg to reduce the risk of myocardial infarction (weak recommendation)

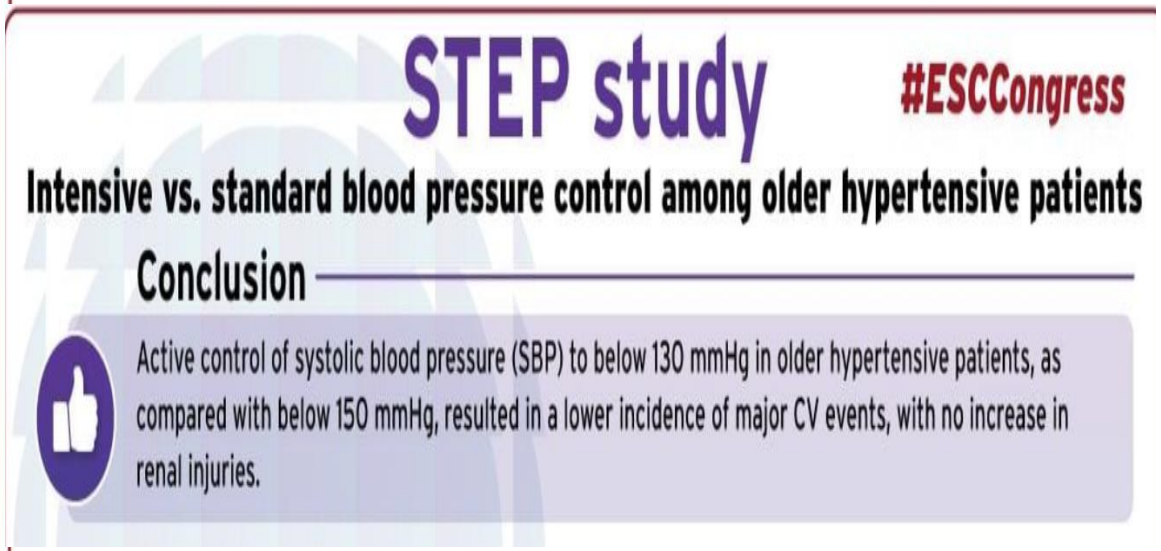
Potential harms: cost of medications, drug-drug interactions, adverse events (falls, syncope, “AKI”)

Coles, S et al, *Ann Fam Med*, 2023

Guidelines	BP target
2014 JNC-8	<150/90, <140/90
2017 ACC/AHA	<130/80
2017 ACP/AAFP (≥ 60 years)	<150, ≤140
2021 KDIGO for CKD	<120/80, <130/80 (transplant)
2022 AAFP (all adults)	<140/90, <135/85

STEP Study - 2021



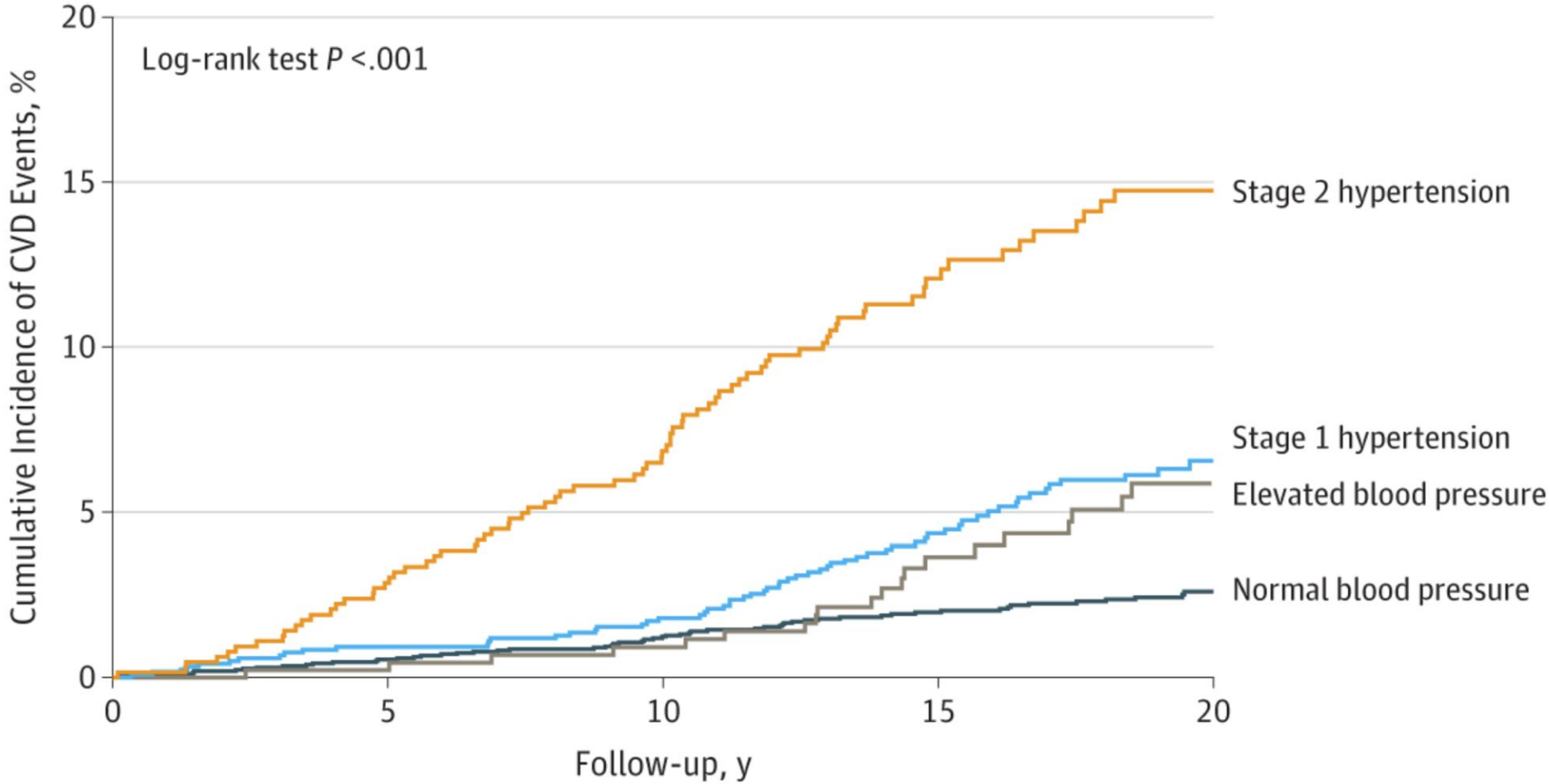


The STEP Study Group, *NEJM*, 2021

Young adults

- Hypertension without elevated 10- yr ASCVD risk
  - Understudied, lower-risk group will require very long follow-up to see clinically significant results
  - No trial evidence supporting decrease in CVD morbidity & mortality
- Observational data: high life-time risk, benefit of BP control early in life
- In the absence of clear guidelines for younger patients with low 10-yr risk
  - Focus on life-time risk
  - Prevention of progression of HTN

Allen NB, et al, *JAMA*, 2014



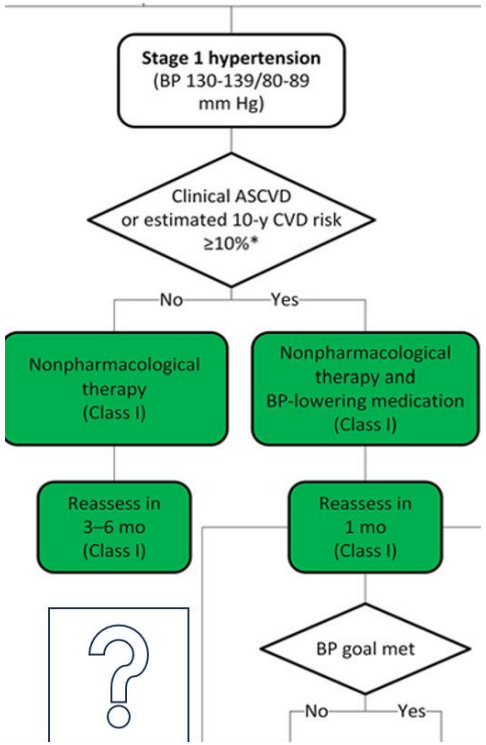
No. at risk					
Blood pressure					
Normal	2574	2522	2351	1824	813
Elevated	445	437	409	286	99
Hypertension					
Stage 1	1194	1158	1078	732	284
Stage 2	638	603	519	314	105

Yano, Y et al, *JAMA*, 2018

Young adults

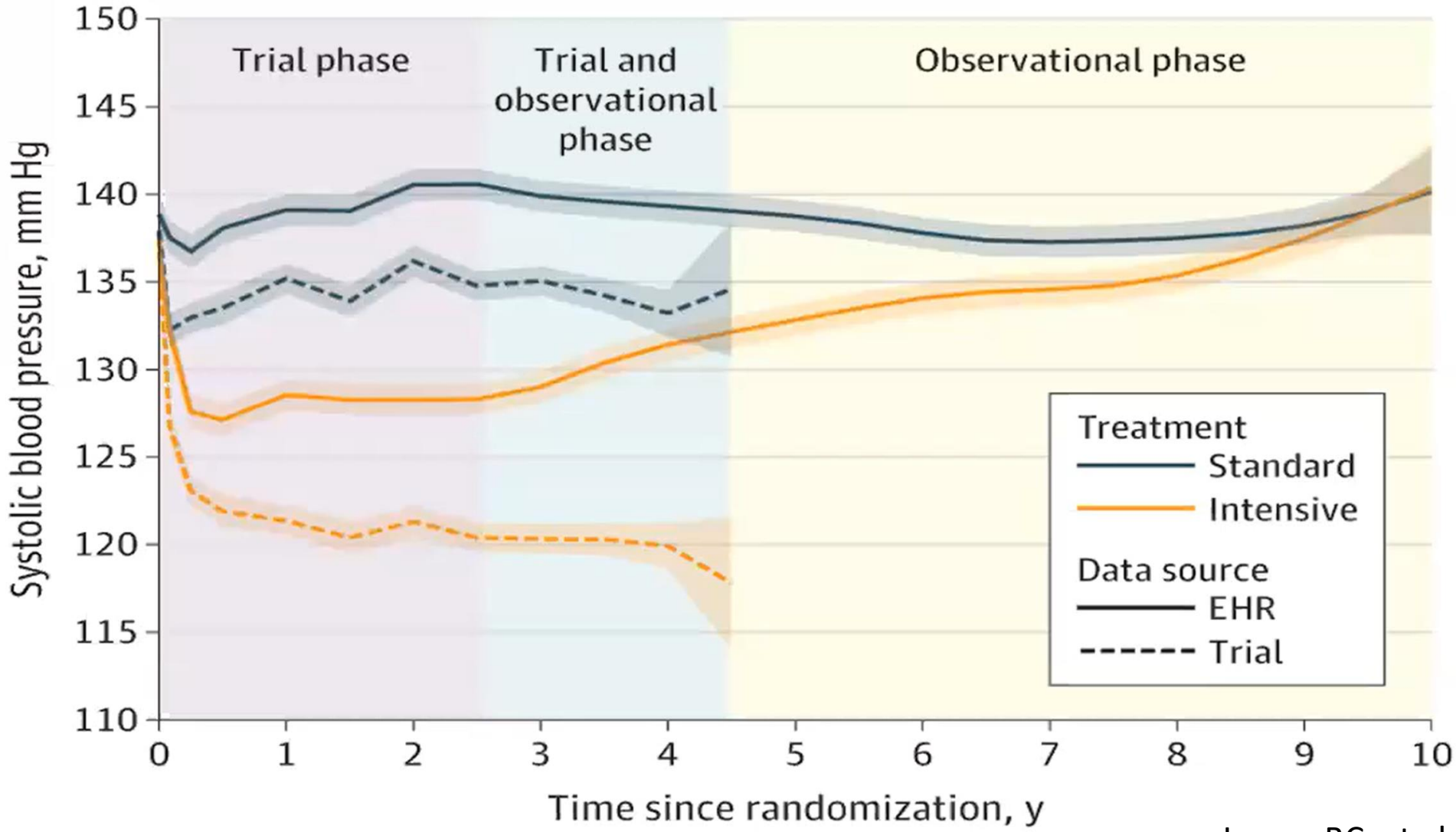
2017 ACC/AHA
Adults with an **elevated BP or stage 1 hypertension who have an estimated 10-year ASCVD risk less than 10%** should be managed with nonpharmacological therapy and have a repeat BP evaluation within 3 to 6 months

2021 AHA Scientific statement
Medications if BP >130/80 mmHg after 6 months of lifestyle therapy
System changes are necessary



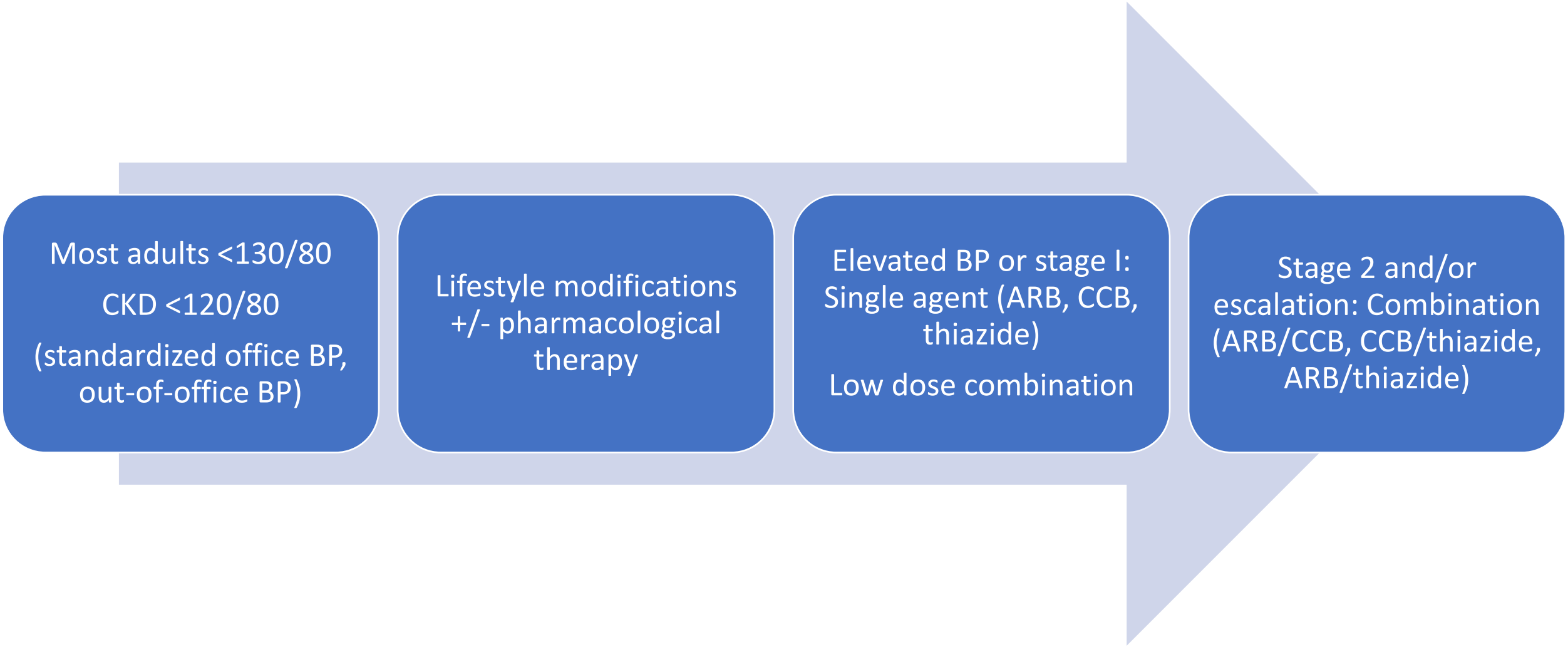
Jones DW, et al, *Hypertension*, 2021

5 years post-SPRINT



Jaeger BC, et al, *JAMA Cardiol*, 2022

Bottom-line

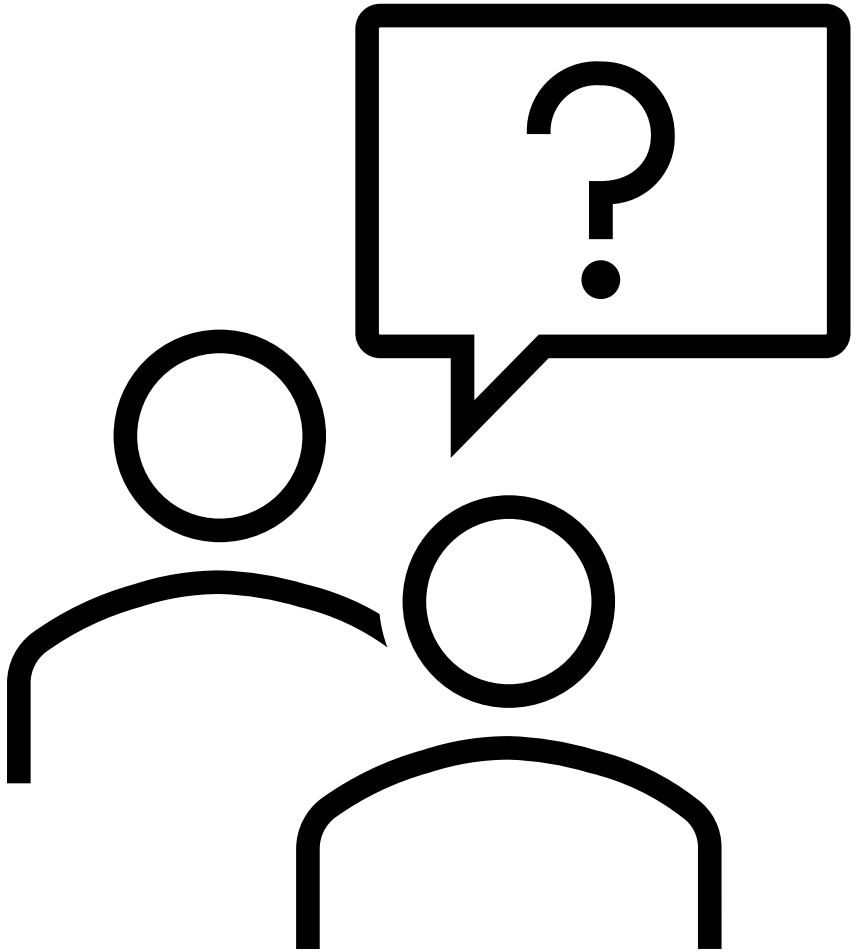


*co-morbid conditions, drug allergies, resistant hypertension, individualized risk vs. benefit if AE, race – social construct

Take home points

- Shared decision making — Effective guidelines are followed by patients and practitioners
- Guidelines should not replace clinical judgement
- Standardized office blood pressure > routine office blood pressure
- Combination therapy of anti-HTN to achieve target BP in an individual patient
- Lifestyle modifications
- Overcoming clinical inertia for improved patient outcomes

Questions



Supplementary slides

SPRINT MIND

JAMA Network™

QUESTION Does intensive blood pressure control compared with standard control reduce the occurrence of dementia?

CONCLUSION This randomized clinical trial of adults with hypertension found that intensive systolic blood pressure (SBP) control (target <120 mm Hg) did not significantly reduce the risk of probable dementia.

POPULATION

6029 Men
3332 Women

Adults aged ≥50 years with hypertension and without diabetes or stroke

Mean age: 68 years

LOCATIONS

102
US sites
(including Puerto Rico)

INTERVENTIONS

9361 Patients randomized
8563 Patients analyzed
(≥1 cognitive assessment)

4278	4285
Intensive control	**Standard control**
(Target SBP <120 mm Hg)	(Target SBP <140 mm Hg)

Median treatment period, 3.3 years

PRIMARY OUTCOME

Occurrence of adjudicated probable dementia

SECONDARY OUTCOMES

Adjudicated mild cognitive impairment (MCI)

Composite outcome of MCI or probable dementia

FINDINGS

PRIMARY OUTCOME: Adjudicated probable dementia

Intensive control	Standard control
149 patients	176 patients
(7.2 cases/1000 person-years)	(8.6 cases/1000 person-years)

Hazard ratio: 0.83 (95% CI, 0.67-1.04)

SECONDARY OUTCOME: Adjudicated MCI

Intensive control	Standard control
287 patients	353 patients
(14.6 cases/1000 person-years)	(18.3 cases/1000 person-years)

Hazard ratio: 0.81 (95% CI, 0.69-0.95)

SECONDARY OUTCOME: Composite outcome

Intensive control	Standard control
402 patients	469 patients
(20.2 cases/1000 person-years)	(24.1 cases/1000 person-years)

Hazard ratio: 0.85 (95% CI, 0.74-0.97)

The SPRINT MIND Investigators for the SPRINT Research Group. Effect of intensive vs standard blood pressure control on probable dementia: a randomized clinical trial [published January 28, 2019]. *JAMA*. doi:10.1001/jama.2018.21442

Heart failure events in a clinical trial on arterial hypertension:
new insights into the SPRINT trial

SPRINT trial population

post-hoc analysis

9361 participants

Intervention

intensive systolic blood pressure lowering < **120 mmHg**

randomization 1:1

standard systolic blood pressure lowering < **140 mmHg**

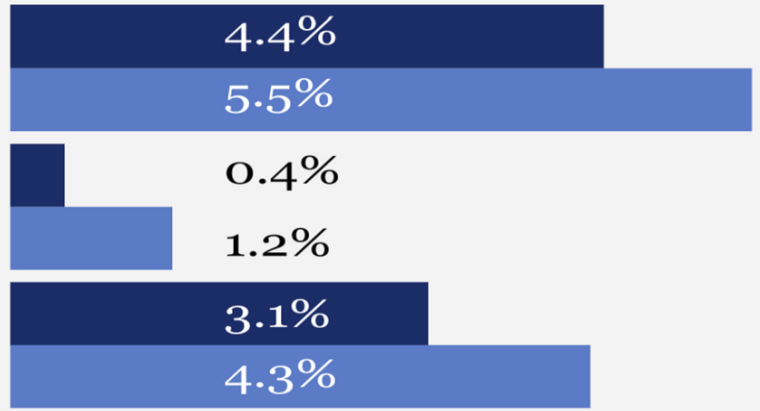
Outcome

1) composite clinical endpoint: myocardial infarction, stroke, acute coronary syndrome, cardiovascular death = primary SPRINT outcome excluding heart failure events

2) cardiovascular deaths (excluding heart failure)

3) all-cause deaths (excluding heart failure)

Results



Hazard ratio:
0.79, 95% CI 0.66–0.95

0.52, 95% CI 0.33–0.81

0.73, 95% CI 0.59–0.90

Conclusions

Intensive lowering of systolic blood pressure (to <120 mm Hg) using the SPRINT methodology is associated with a 21% reduced risk (p = 0.012) of a composite endpoint (myocardial infarction, acute coronary syndrome other than myocardial infarction, stroke, and cardiovascular death) compared with the standard treatment (lowering the target SBP to <140 mm Hg)

2010

ACCORD BP TRIAL

Effects of intensive blood-pressure control in type 2 diabetes mellitus

Multicenter, randomized, controlled, open-label trial

Objective: In patients with T2DM at high risk for CV events, does intensive BP control (SBP <120 mmHg) reduce rates of nonfatal MI, nonfatal stroke, or CV mortality when compared to standard BP control (SBP <140 mmHg)?

4,733 patients

Inclusion criteria: Patients with type 2 diabetes mellitus, hemoglobin A1C ≥7.5% and either active CVD or at risk for CVD.

Intensive BP control (n=2,362) VS **Conventional BP control (n=2,371)**

PRIMARY OUTCOME

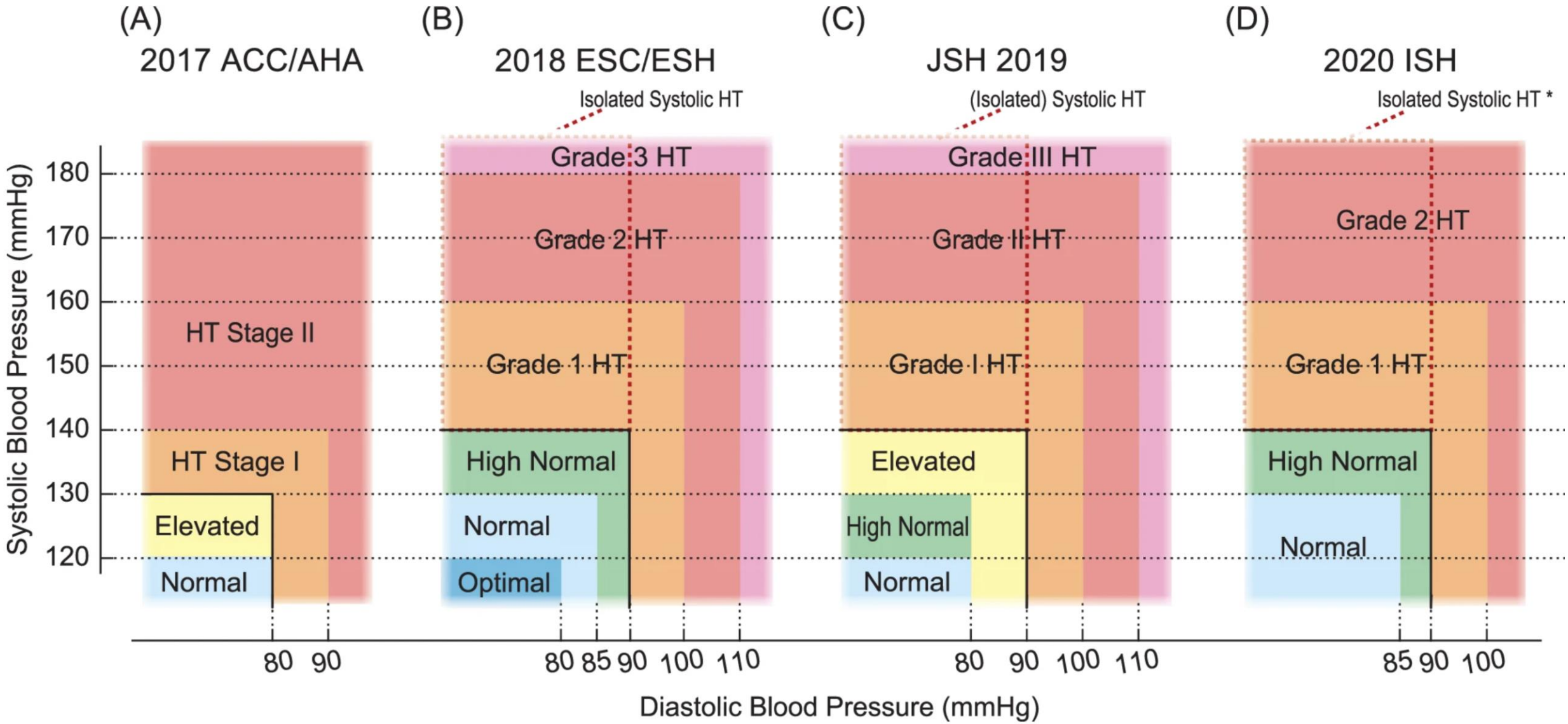
Intensive BP control	Outcome	Conventional BP control
1.87	Nonfatal MI, nonfatal stroke, or CV mortality %/yr HR 0.88; 95% CI 0.73-1.06; P=0.20	2.09

SECONDARY OUTCOME

Intensive BP control	Outcome	Conventional BP control
1.13	Nonfatal MI %/yr HR 0.87; 95% CI 0.68-1.10; P=0.25	1.28
0.32	Any stroke %/yr HR 0.59; 95% CI 0.39-0.89; P=0.01; NNT 476/yr	0.53

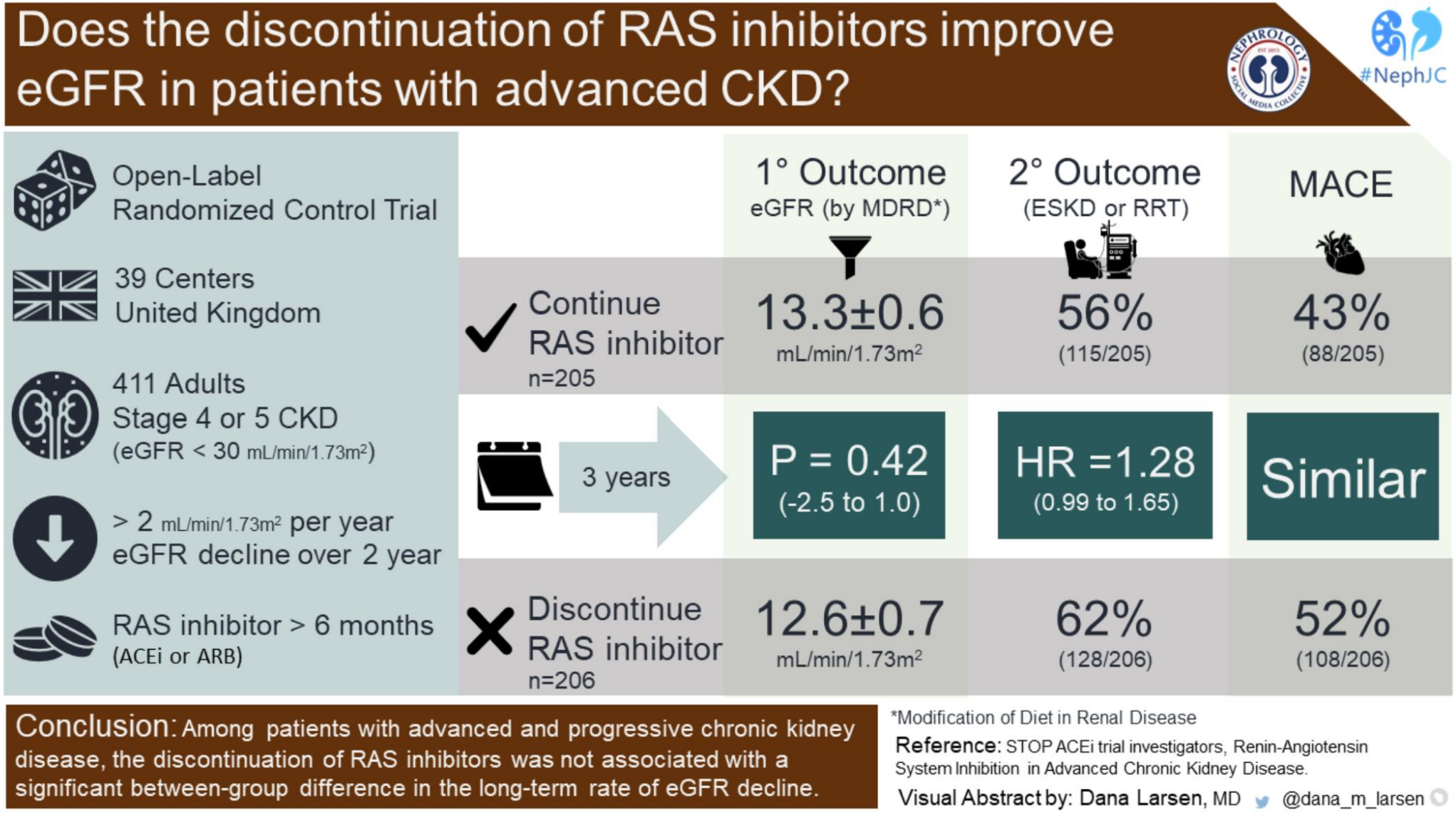
Conclusion: In patients with type 2 diabetes at high risk for CV events, targeting a systolic blood pressure of less than 120 mm Hg, as compared with less than 140 mm Hg, did not reduce the rate of a composite outcome of fatal and nonfatal major cardiovascular events.

ACCORD Study Group.. NEJM, 2010. 362(17):1575-1585.

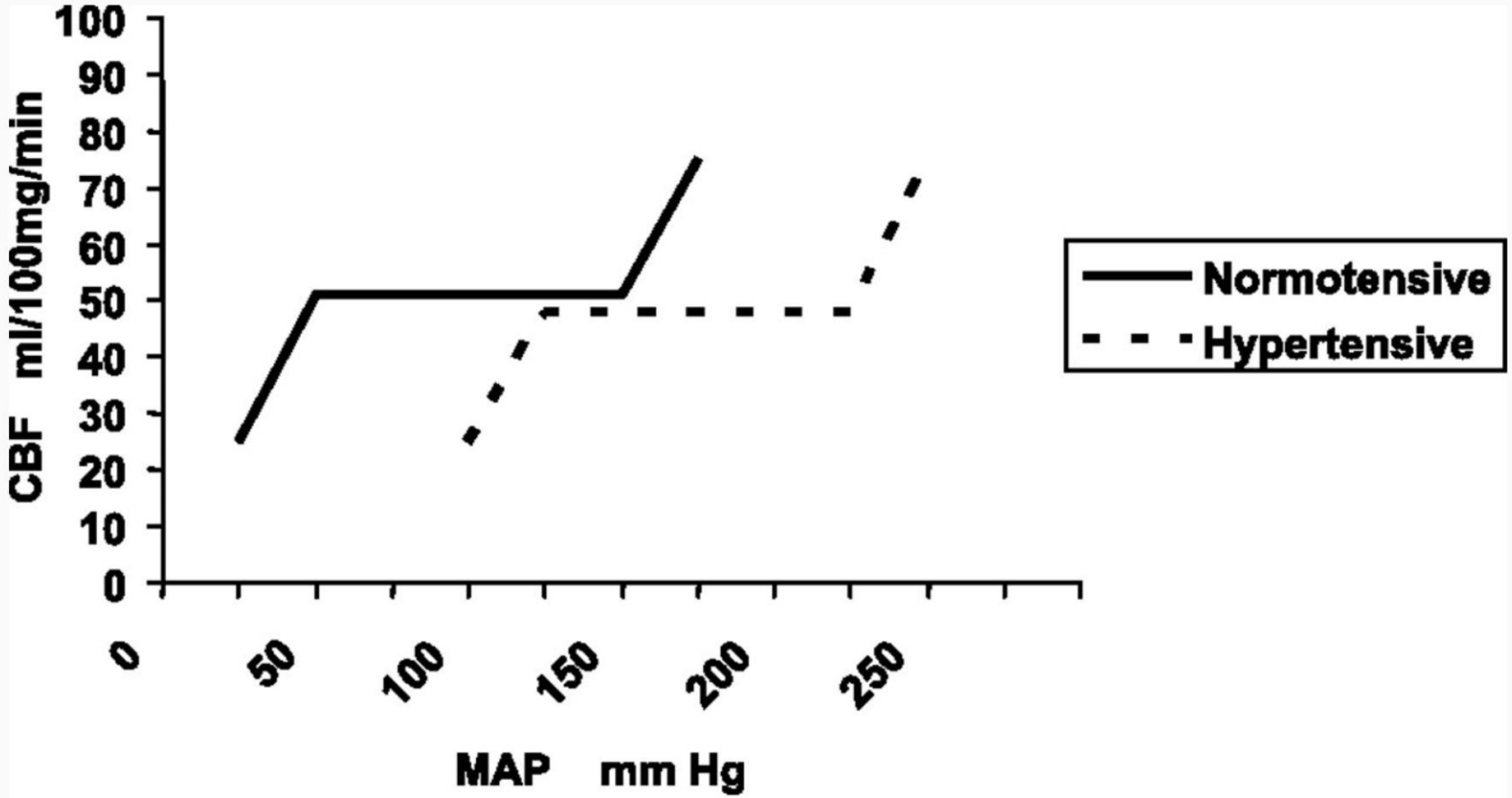


Asayama, K, *Nature Hypertension Research*, 2023

STOP-ACEi



The STOP-ACEi investigators, *NEJM*, 2022



CBF=cerebral blood flow; MAP=mean arterial pressure