

# *Update on Current Trends in Hypertension Management*

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# Disclosure of Relationships

## Over the Past 12 months

- Speakers Bureau: Lundbeck, Amgen
- Consultant: Lundbeck, Amgen
- Major Stock shareholder: None
- Other support, Tangible or intangible: None

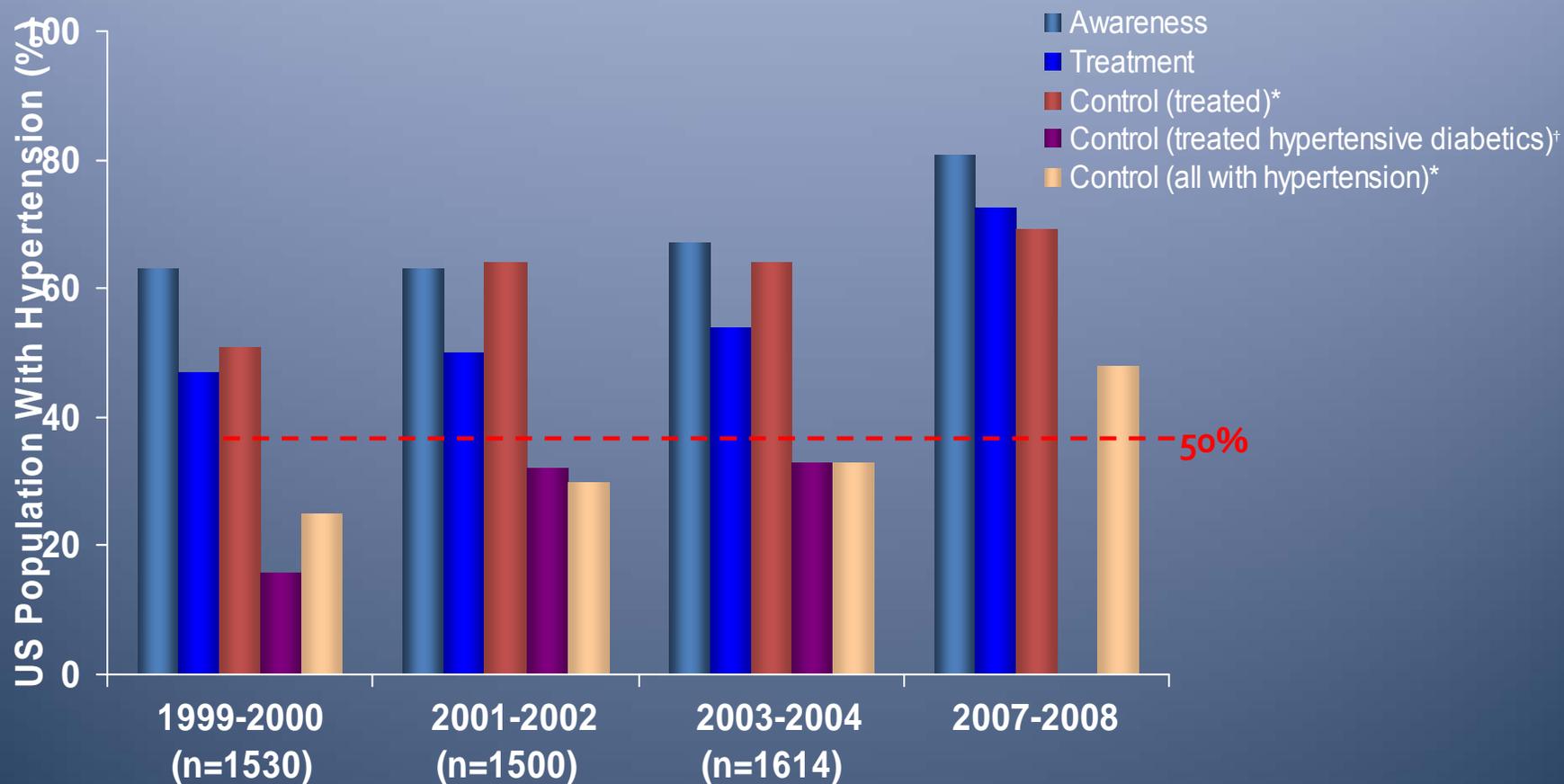
# Objectives

- Present the current epidemiology of hypertension
- Review the core elements of hypertension diagnosis and classification which are essential to all of the guidelines.
- The SPRINT Trial Results and implications for treatment goals

# EPIDEMIOLOGY

# Nearly One in Three US adults has Hypertension: Prevalence of 33.5%

Rates of Blood Pressure Control Are Low



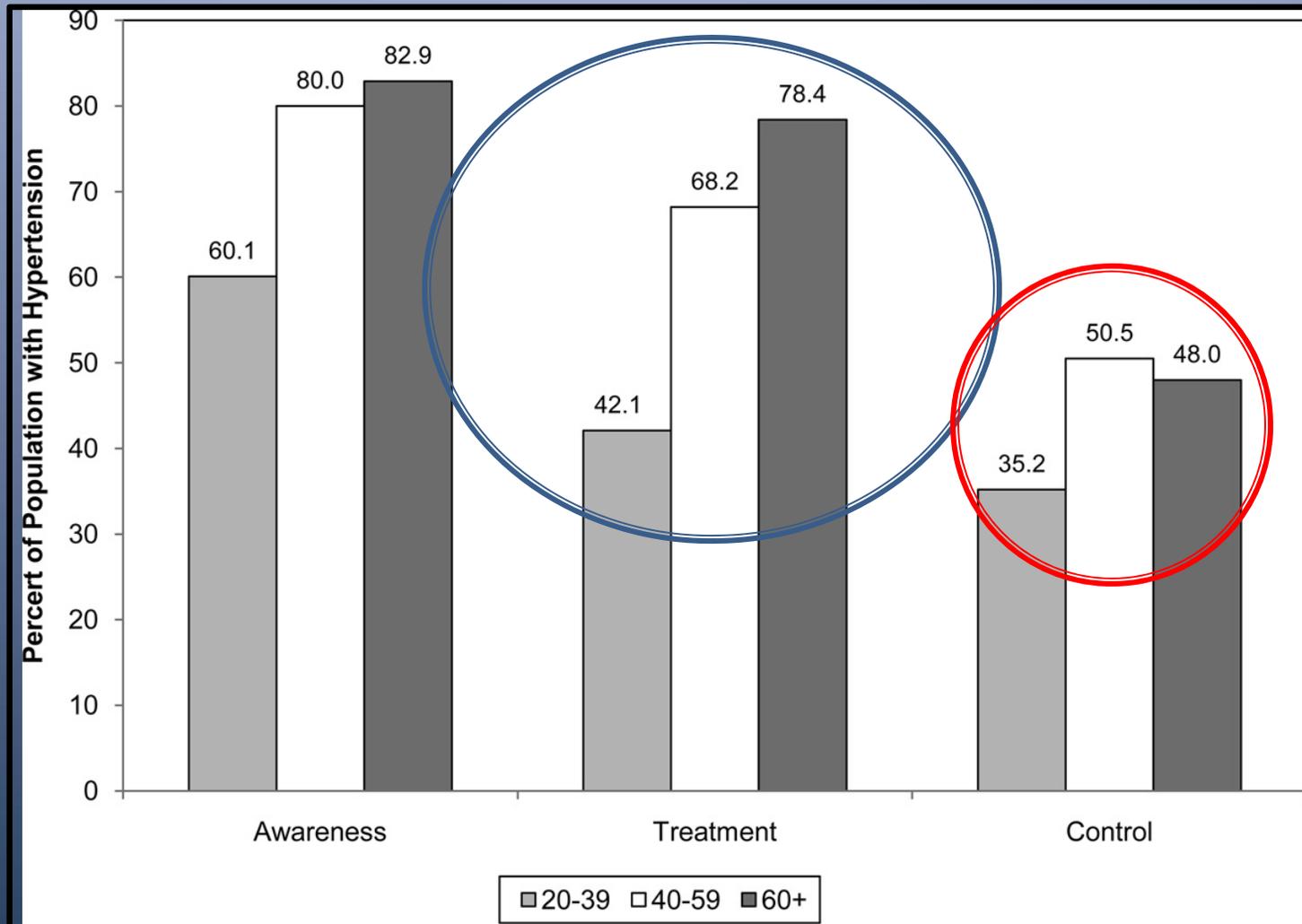
\* Blood pressure (BP) <140/90 mm Hg in non-diabetic patients or BP <130/80 in diabetic patients.

† BP <130/80 mm Hg.

Ong KL et al. *Hypertension*. 2007;49:69-75. Egan BM *JAMA* 2010;303:2043

AHA Statistics 2011 *Circ* 2011;123:e18

# 2005-2008 NHANES Data on Hypertension by Age



# Diagnosis and Classification of Hypertension

# What Is Hypertension?: Classification of Hypertension

JNC 7 Definitions

Blood Pressure (mm Hg)		Category
Systolic	Diastolic	
<120	and <80	Normal
<b>120-139</b>	<b>or 80-89</b>	<b>Prehypertension</b>
140-159	or 90-99	Stage 1 hypertension
≥160	or ≥100	Stage 2 hypertension

# Hypertension Writing Group: Proposed New Definition of Hypertension

- Hypertension is a progressive cardiovascular syndrome arising from complex and interrelated etiologies. Early markers of the syndrome are often present before blood pressure elevation is sustained; therefore, hypertension cannot be classified solely by discrete blood pressure thresholds. Progression is strongly associated with functional and structural cardiac and vascular abnormalities that damage the heart, kidneys, brain, vasculature and other organs and lead to premature morbidity and death.

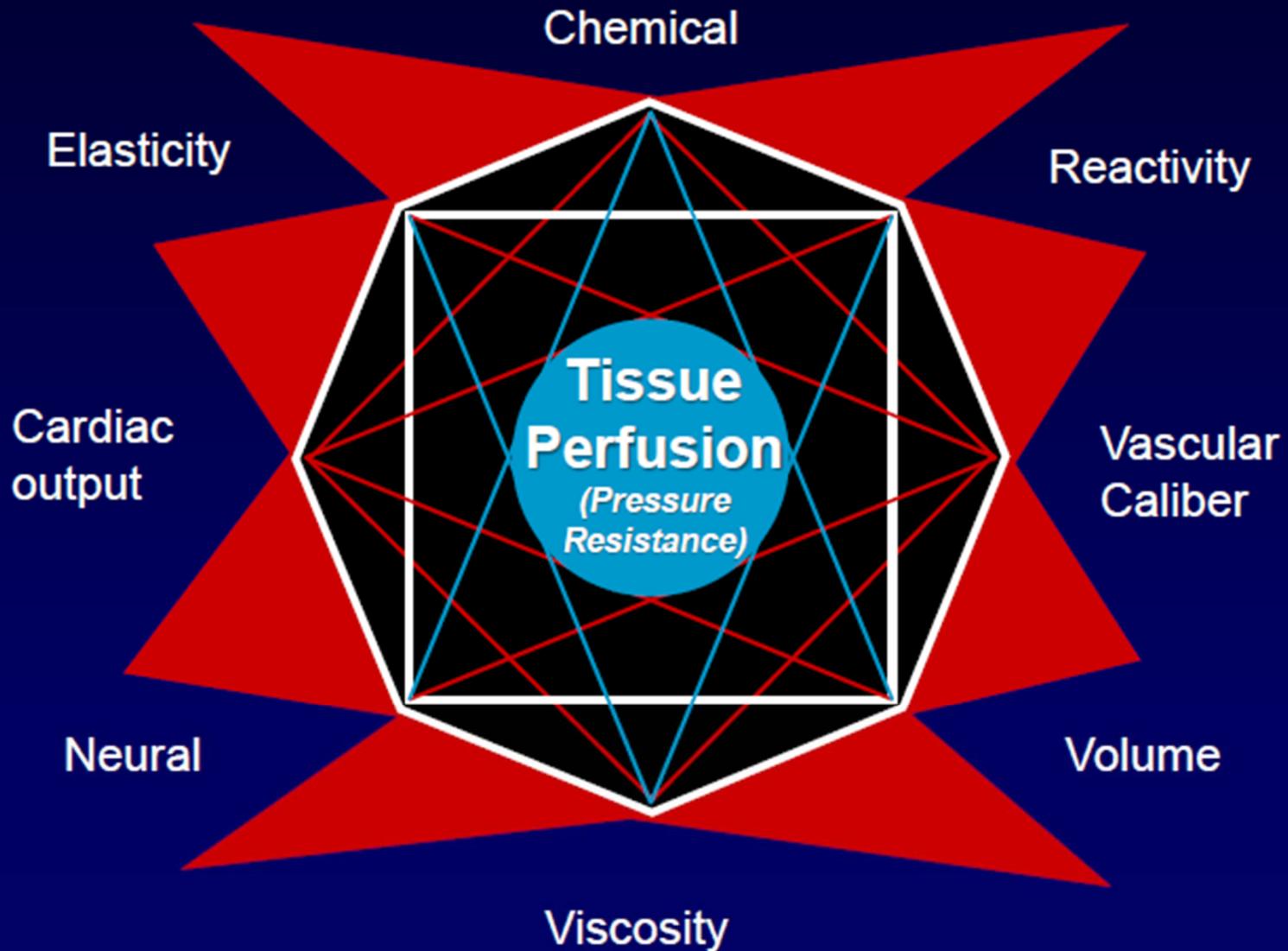
# Blood Pressure Regulatory Systems

- Interactive regulatory systems integrate short-term and long-term cardiovascular and metabolic responses

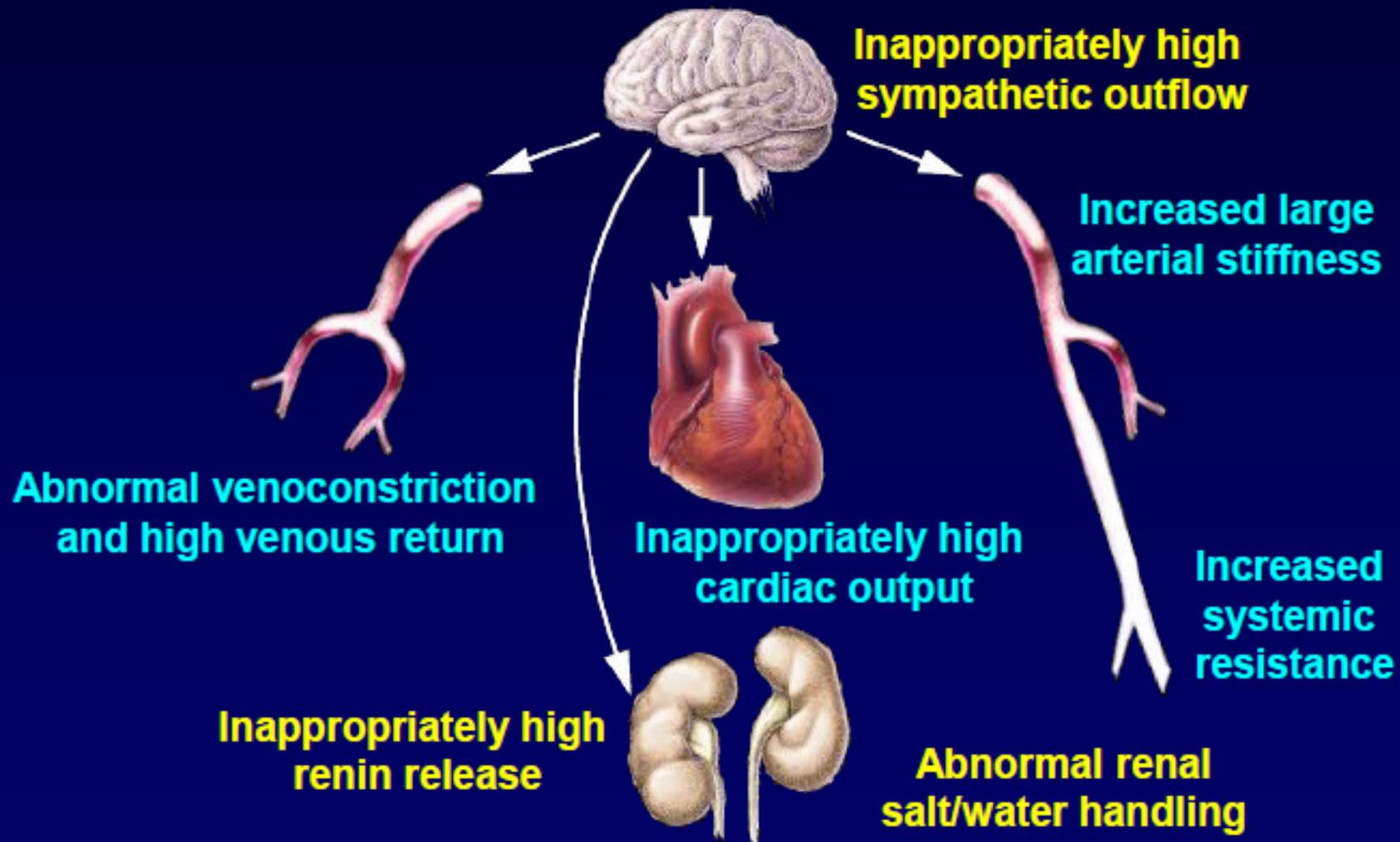
System	Response Time
SNS	Seconds to minutes
RAAS	Minutes to hours
Kidney (salt and water balance)	Hours to days

- These regulatory systems remain the major target of antihypertensive drugs

# The Mosaic Theory of Hypertension



# Pathophysiology of Chronic Hypertension



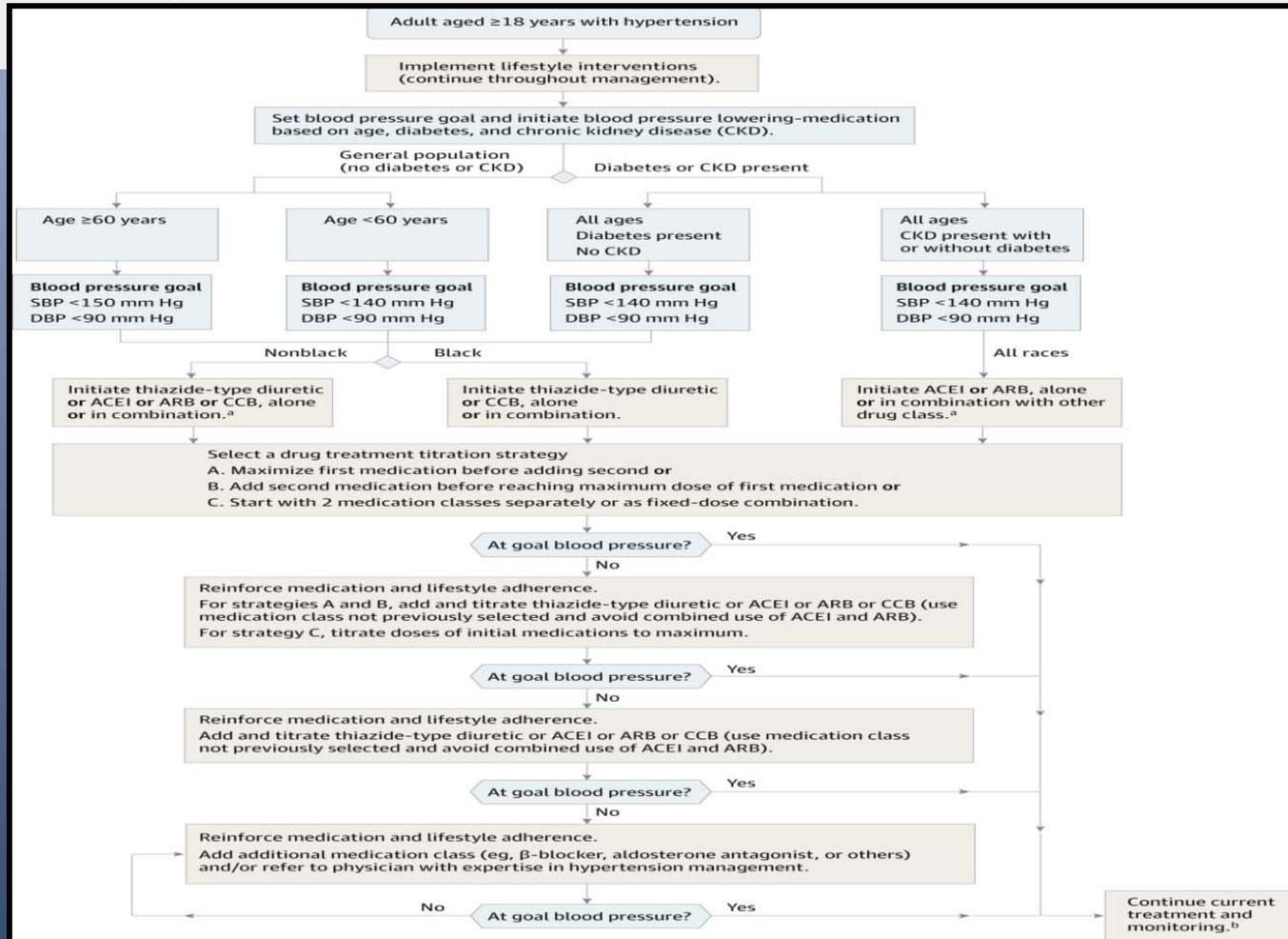
# Resistant Hypertension

- Blood pressure that remains uncontrolled with use of 3 antihypertensive agents. Ideally one of the agents should be a diuretic and all agents should be prescribed at doses to provide optimal benefit.
- Estimated prevalence 10%–15% of hypertensive population or 7–10 million Americans

# Hypertension Guidelines and Consensus Statements

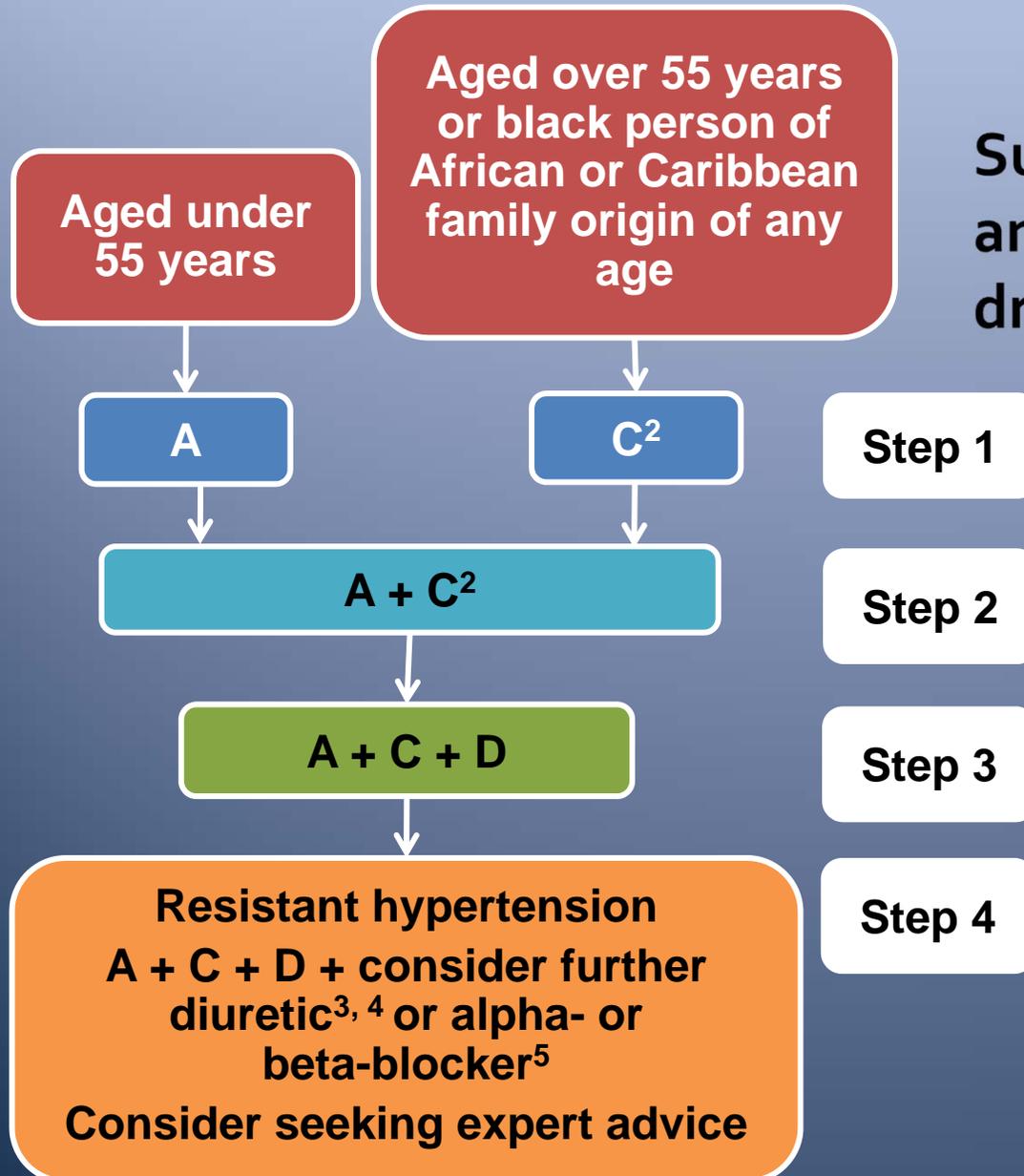
How did they get there?

From: **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. 2013;():. doi:10.1001/jama.2013.284427



2014 Hypertension Guideline Management Algorithm. SBP indicates systolic blood pressure; DBP, diastolic blood pressure; ACEI, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; and CCB, calcium channel blocker.<sup>a</sup> ACEIs and ARBs should not be used in combination.<sup>b</sup> If blood pressure fails to be maintained at goal, reenter the algorithm where appropriate based on the current individual therapeutic plan.

## Summary of antihypertensive drug treatment



### Key

A: ACEI or low-cost ARB<sup>1</sup>

C: CCB

D: Thiazide-like diuretic

# Treatment Goals According to Risk Category or Stratum



Risk Category	Recommendation	Goal BP
<p><b>Primary Prevention</b>                      BP <math>\geq</math>135/85 mmHg <u>without</u> target-organ damage,<sup>†</sup> preclinical CVD,<sup>‡</sup> or CVD<sup>§</sup></p>	<p>Lifestyle Modification*                      (up to 3 months without drugs) + Drug Therapy</p>	<p>&lt;135/85 mmHg</p>
<p><b>Secondary Prevention/                      Target-Organ Damage</b>                      BP <math>\geq</math>130/80 mmHg <u>with</u> target-organ damage,<sup>†</sup> preclinical CVD,<sup>‡</sup> and/or the presence of CVD<sup>§</sup></p>	<p>Lifestyle Modification                      + Drug Therapy</p>	<p>&lt;130/80 mmHg</p>

\*Up to 3 months of comprehensive lifestyle modification without drugs if BP <145/90 mmHg without target-organ damage or other risk-enhancing comorbidities.

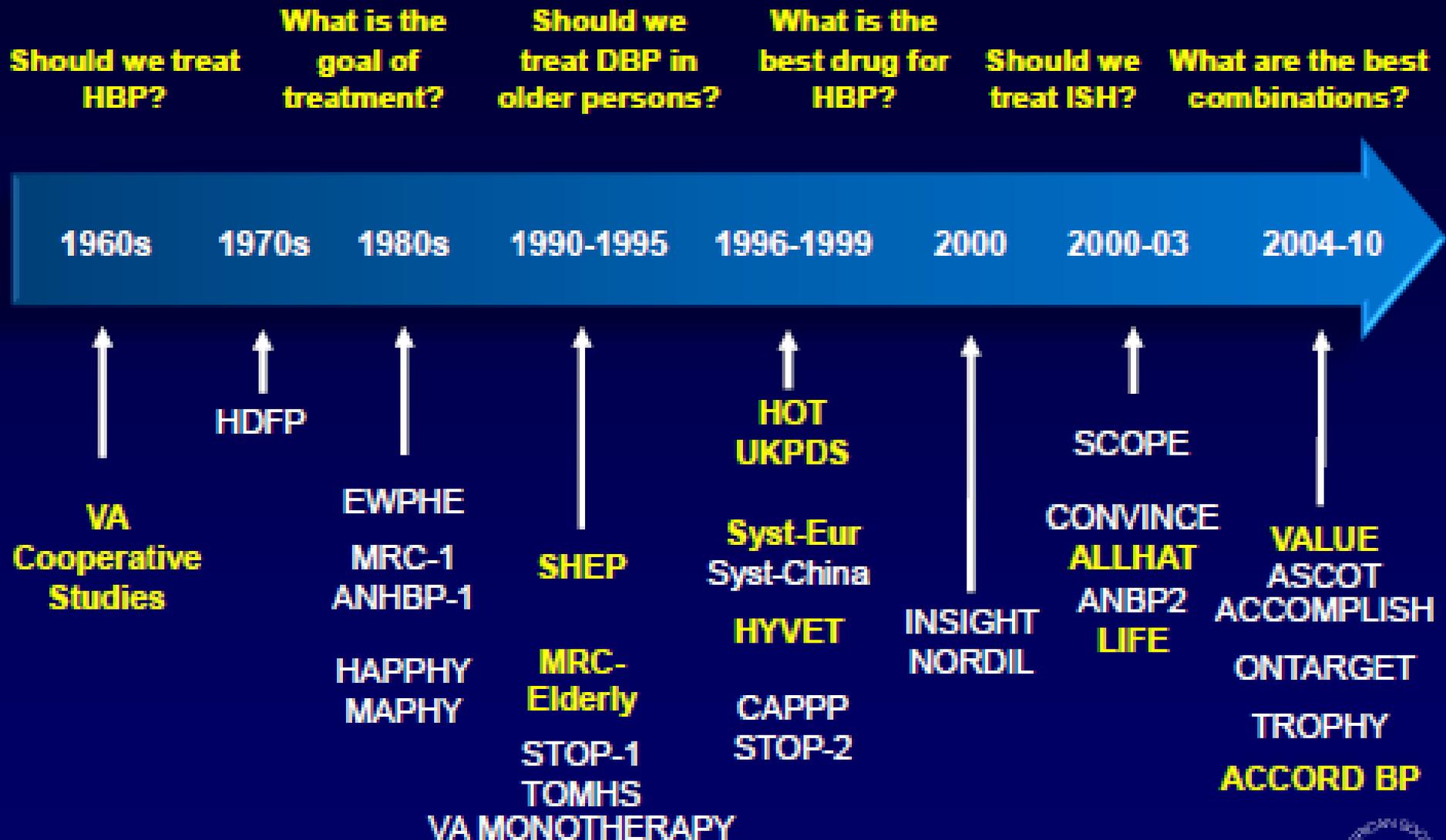
<sup>†</sup>Target-organ damage is defined as albumin:creatinine ratio >200 mg/g, estimated glomerular filtration rate (eGFR) <60 mL/min/1.73 m<sup>2</sup>, or electro- or echocardiographic evidence of left ventricular hypertrophy (LVH).

<sup>‡</sup>Indicators of preclinical CVD: metabolic syndrome, Framingham risk score >20%, prediabetes (impaired fasting glucose [100-125 mg/dL] and/or impaired glucose tolerance [2-hr postload glucose of 140-199 mg/dL]), diabetes mellitus.

<sup>§</sup>CVD includes heart failure (systolic or diastolic), CHD/post-myocardial infarction, peripheral arterial disease, stroke, transient ischemic attack, and/or abdominal aortic aneurysm.

How did they come to these  
recommendations?

# Key Clinical Trials in Hypertension



Adapted from Black H, 2003.



# Questions Addressed by Landmark Clinical Trials

- Does the treatment of hypertension reduce the risk of morbid events?
- At what BP level is treatment beneficial?
- To what level should BP be reduced?
- Which drugs are most effective?

# BP Targets and Achieved BP in HTN Intervention Studies in Elderly

	<b>SHEP<sup>1</sup></b>	<b>Syst-Eur<sup>2</sup></b>	<b>HYVET<sup>3</sup></b>
<b>Subjects (n)</b>	4736	4695	3845
<b>Inclusion BP Criteria (mm Hg)</b>	160-219 / <90	160-219 / <95	160-190 / <110
<b>Goal SBP (mm Hg)</b>	<160 or $\geq 20$ reduction	< 150 or $\geq 20$ reduction	<150
<b>Mean Achieved BP (mm Hg)</b>	143/68	151/79	144/78
<b>Follow-up (y)</b>	4.5 (mean)	2.0 (median)	1.8 (mean)

1. SHEP Cooperative Research Group. *JAMA*. 1991;265(24):3255-3264.
2. Staessen JA, et al. *Lancet*. 1997;350(9080):757-764.
3. Beckett NS, et al; for HYVET Study Group. *N Engl J Med*. 2008;358(18):1887-1898.



# Questions Addressed by Landmark Clinical Trials

- Does the treatment of hypertension reduce the risk of morbid events?
- **At what BP level is treatment beneficial?**
- **To what level should BP be reduced?**
- Which drugs are most effective?

# ACCORD Blood Pressure Trial

## Study Population

- 4,733 patients with type 2 diabetes (mean age 62.2 years)
  - Age 40+ with cardiovascular disease, or
  - Age 55+ with significant atherosclerosis, albuminuria, LVH, or at least 2 cardiovascular risk factors

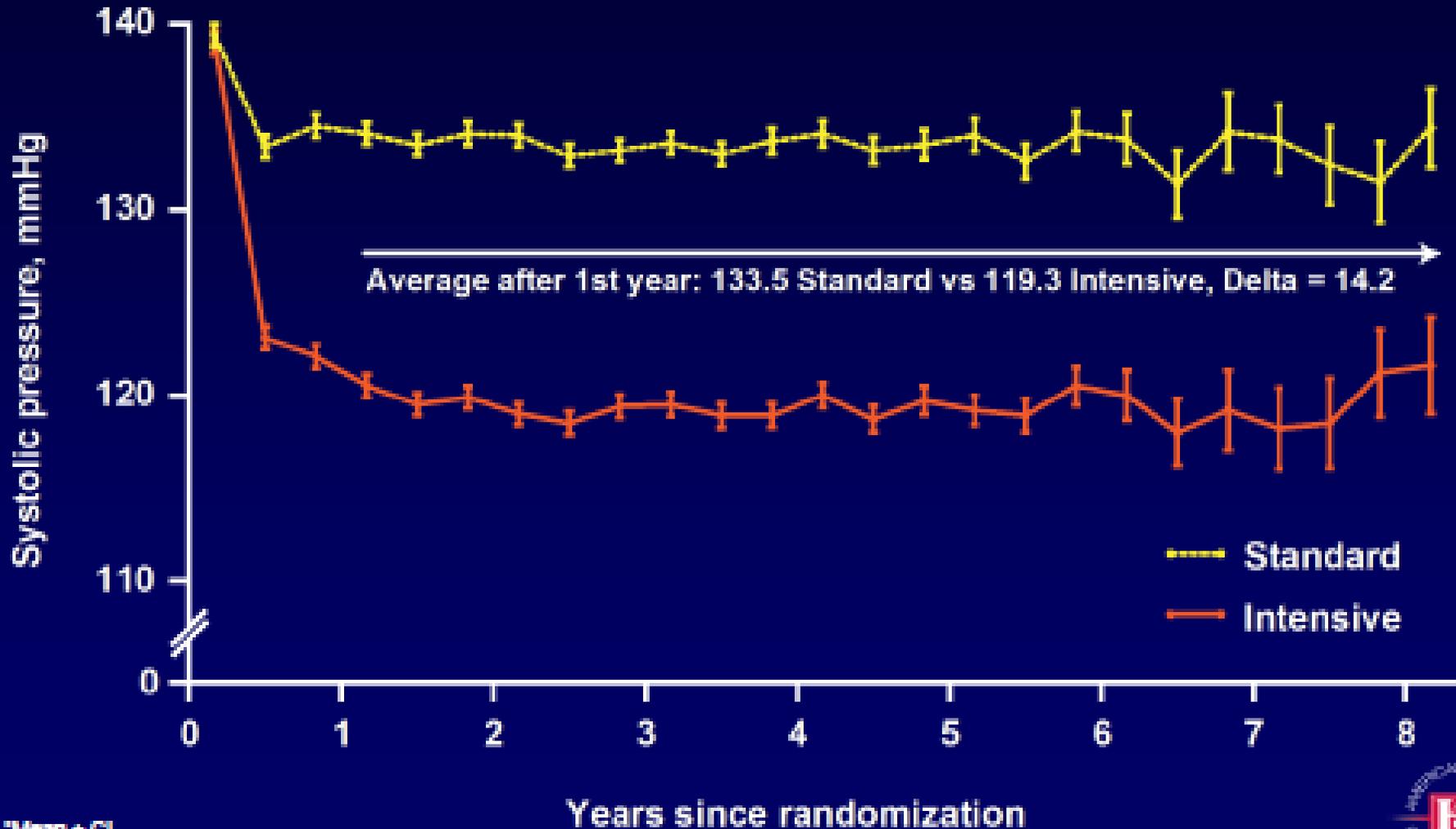
## Treatment Groups

- **Intensive therapy:** Using treatments that targeted SBP <120 mm Hg
- **Standard therapy:** Using treatments that targeted SBP <140 mm Hg

# ACCORD: Systolic Blood Pressure

Mean # Meds

Intensive:	3.2	3.4	3.5	3.4
Standard:	1.9	2.1	2.2	2.3



\*Mean ± CI

The ACCORD Study Group. *New Engl J Med.* 2010;362:1575-1585.



# ACCORD: Primary and Secondary Outcomes

	Intensive Events (%/yr)	Standard Events (%/yr)	HR (95% CI)	<i>P</i>
Primary	208 (1.87)	237 (2.09)	0.88 (0.73-1.06)	0.20
Total Mortality	150 (1.28)	144 (1.19)	1.07 (0.85-1.35)	0.55
Cardiovascular Deaths	60 (0.52)	58 (0.49)	1.06 (0.74-1.52)	0.74
Nonfatal MI	126 (1.13)	146 (1.28)	0.87 (0.68-1.10)	0.25
Nonfatal Stroke	34 (0.30)	55 (0.47)	0.63 (0.41-0.96)	0.03
Total Stroke	36 (0.32)	62 (0.53)	0.59 (0.39-0.89)	0.01

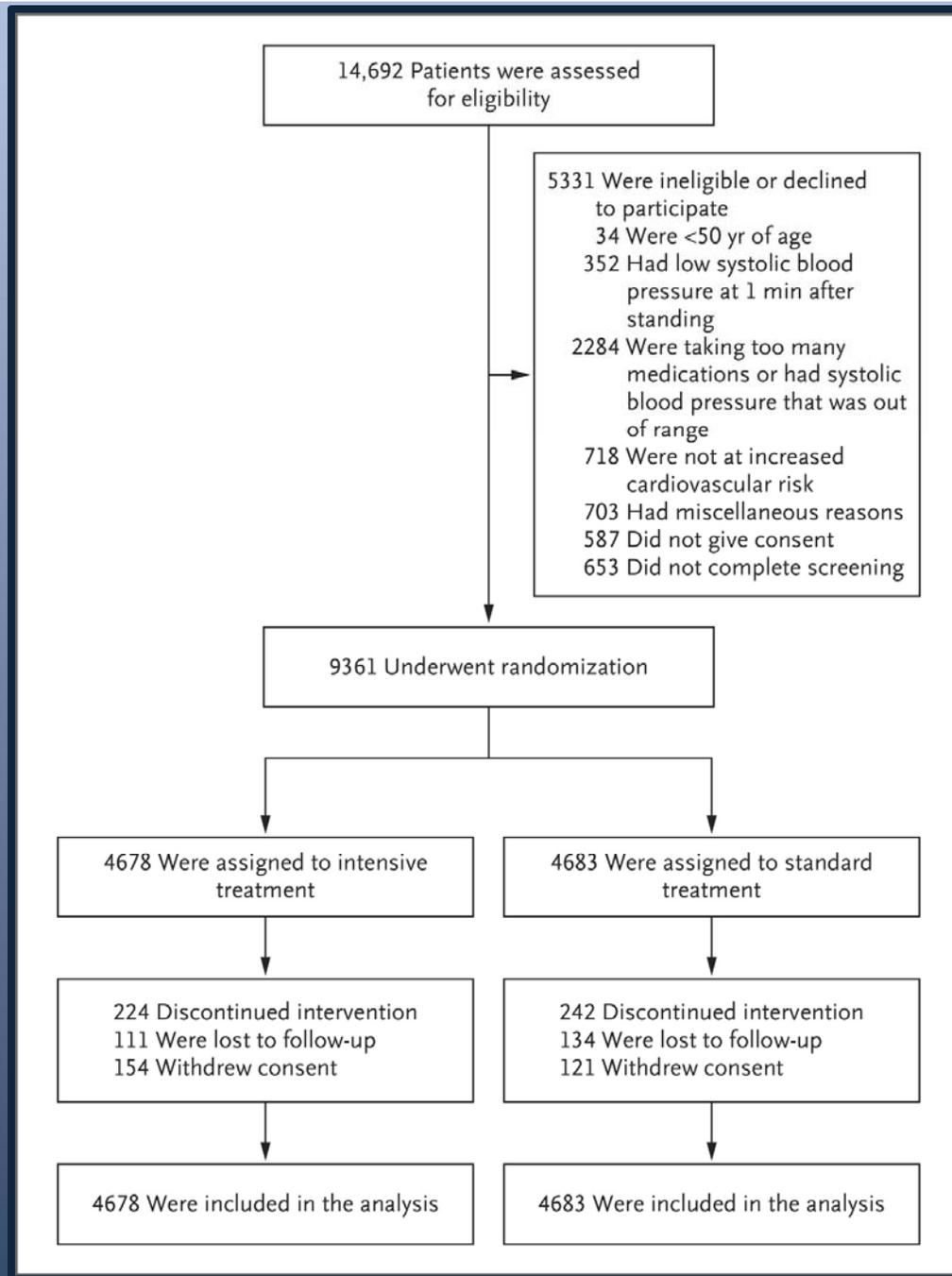
## Also examined:

- Fatal/Nonfatal HF (HR=0.94, *P*=.67)
- Composite of fatal coronary events, nonfatal MI and unstable angina (HR=0.94, *P*=0.50)
- Composite of the primary outcome, revascularization and unstable angina (HR=0.95, *P*=0.40)

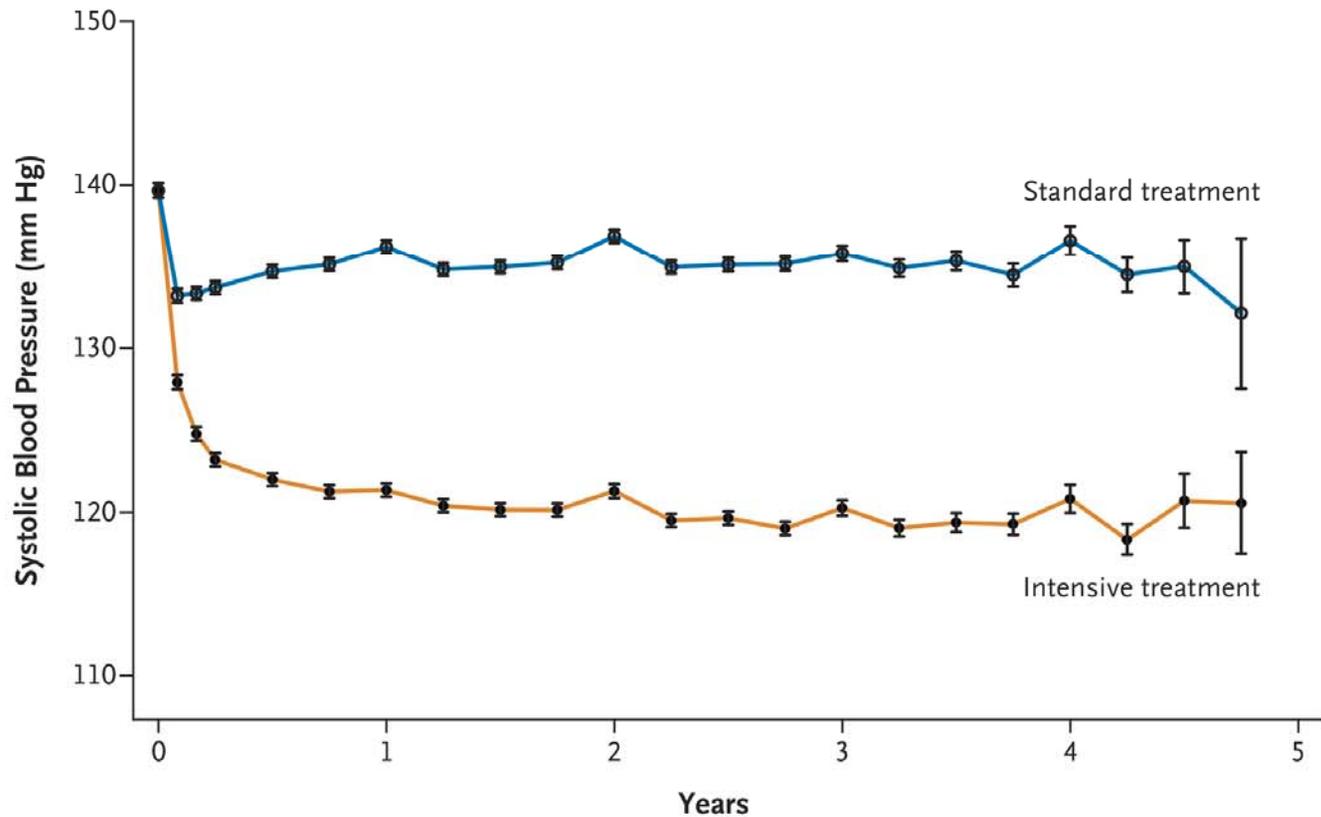
# **SPRINT TRIAL: Systolic Blood Pressure Intervention Trial**

**A Randomized Trial of Intensive versus Standard Blood-Pressure Control**

- Patients at increased cardiovascular risk but without diabetes were assigned to intensive treatment of systolic BP (target, <120 mm Hg) or standard treatment (target, <140 mm Hg).
- After a median of 3.26 years, the rate of cardiovascular events was significantly lower with intensive treatment.



# SPRINT TRIAL: Systolic Blood Pressure Trend



## No. with Data

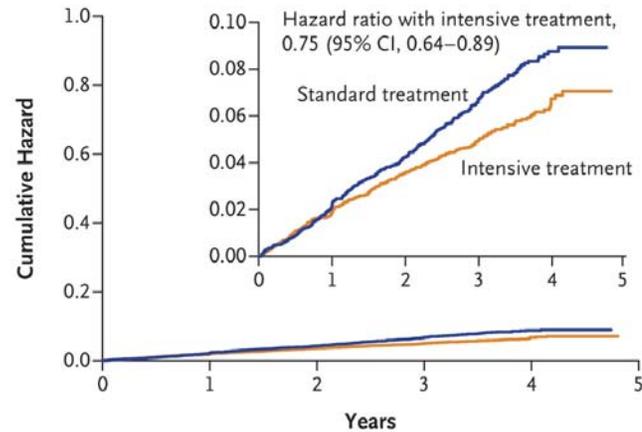
Standard treatment	4683	4345	4222	4092	3997	3904	3115	1974	1000	274
Intensive treatment	4678	4375	4231	4091	4029	3920	3204	2035	1048	286

## Mean No. of Medications

Standard treatment	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.9
Intensive treatment	2.3	2.7	2.8	2.8	2.8	2.8	2.8	2.8	2.8	3.0

# SPRINT Trial: Primary Outcome and Death from Any Cause.

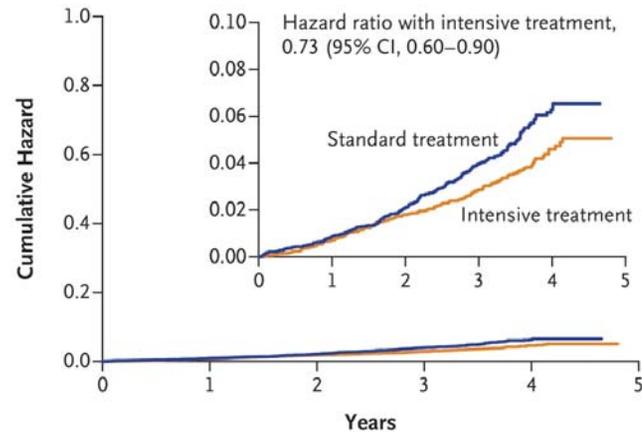
**A Primary Outcome**



**No. at Risk**

Standard treatment	4683	4437	4228	2829	721
Intensive treatment	4678	4436	4256	2900	779

**B Death from Any Cause**



**No. at Risk**

Standard treatment	4683	4528	4383	2998	789
Intensive treatment	4678	4516	4390	3016	807

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



# SPRINT Trial: Baseline Characteristics of the Study Participants.

**Table 1. Baseline Characteristics of the Study Participants.\***

Characteristic	Intensive Treatment (N = 4678)	Standard Treatment (N = 4683)
Criterion for increased cardiovascular risk — no. (%)†		
Age ≥75 yr	1317 (28.2)	1319 (28.2)
Chronic kidney disease‡	1330 (28.4)	1316 (28.1)
Cardiovascular disease	940 (20.1)	937 (20.0)
Clinical	779 (16.7)	783 (16.7)
Subclinical	247 (5.3)	246 (5.3)
Framingham 10-yr cardiovascular disease risk score ≥15%	2870 (61.4)	2867 (61.2)
Female sex — no. (%)	1684 (36.0)	1648 (35.2)
Age — yr		
Overall	67.9±9.4	67.9±9.5
Among those ≥75 yr of age	79.8±3.9	79.9±4.1
Race or ethnic group — no. (%)§		
Non-Hispanic black	1379 (29.5)	1423 (30.4)
Hispanic	503 (10.8)	481 (10.3)
Non-Hispanic white	2698 (57.7)	2701 (57.7)
Other	98 (2.1)	78 (1.7)
Black race¶	1454 (31.1)	1493 (31.9)
Baseline blood pressure — mm Hg		
Systolic	139.7±15.8	139.7±15.4
Diastolic	78.2±11.9	78.0±12.0
Distribution of systolic blood pressure — no. (%)		
≤132 mm Hg	1583 (33.8)	1553 (33.2)
>132 mm Hg to <145 mm Hg	1489 (31.8)	1549 (33.1)
≥145 mm Hg	1606 (34.3)	1581 (33.8)
Serum creatinine — mg/dl	1.07±0.34	1.08±0.34
Estimated GFR — ml/min/1.73 m <sup>2</sup>		
Among all participants	71.8±20.7	71.7±20.5
Among those with estimated GFR ≥60 ml/min/1.73 m <sup>2</sup>	81.3±15.5	81.1±15.5
Among those with estimated GFR <60 ml/min/1.73 m <sup>2</sup>	47.8±9.5	47.9±9.5
Ratio of urinary albumin (mg) to creatinine (g)	44.1±178.7	41.1±152.9
Fasting total cholesterol — mg/dl	190.2±41.4	190.0±40.9
Fasting HDL cholesterol — mg/dl	52.9±14.3	52.8±14.6
Fasting total triglycerides — mg/dl	124.8±85.8	127.1±95.0
Fasting plasma glucose — mg/dl	98.8±13.7	98.8±13.4
Statin use — no./total no. (%)	1978/4645 (42.6)	2076/4640 (44.7)
Aspirin use — no./total no. (%)	2406/4661 (51.6)	2350/4666 (50.4)
Smoking status — no. (%)		
Never smoked	2050 (43.8)	2072 (44.2)
Former smoker	1977 (42.3)	1996 (42.6)
Current smoker	639 (13.7)	601 (12.8)
Missing data	12 (0.3)	14 (0.3)
Framingham 10-yr cardiovascular disease risk score — %	20.1±10.9	20.1±10.8
Body-mass index‡	29.9±5.8	29.8±5.7
Antihypertensive agents — no./patient	1.8±1.0	1.8±1.0
Not using antihypertensive agents — no. (%)	432 (9.2)	450 (9.6)

\* Plus-minus values are means ±SD. There were no significant differences (P<0.05) between the two groups except for statin use (P=0.04). To convert the values for creatinine to micromoles per liter, multiply by 88.4. To convert the values for cholesterol to millimoles per liter, multiply by 0.02586. To convert the values for triglycerides to millimoles per liter, multiply by 0.01129. To convert the values for glucose to millimoles per liter, multiply by 0.05551. GFR denotes glomerular filtration rate, and HDL, high-density lipoprotein.

† Increased cardiovascular risk was one of the inclusion criteria.

‡ Chronic kidney disease was defined as an estimated glomerular filtration rate of less than 60 ml per minute per 1.73 m<sup>2</sup> of body-surface area.

§ Race and ethnic group were self-reported.

¶ Black race includes Hispanic black and black as part of a multiracial identification.

‡ The body-mass index is the weight in kilograms divided by the square of the height in meters.

# SPRINT TRIAL: Primary and Secondary Outcomes and Renal Outcomes.

**Table 2. Primary and Secondary Outcomes and Renal Outcomes.\***

Outcome	Intensive Treatment		Standard Treatment		Hazard Ratio (95% CI)	P Value
	no. of patients (%)	% per year	no. of patients (%)	% per year		
<b>All participants</b>	<b>(N = 4678)</b>		<b>(N = 4683)</b>			
Primary outcome†	243 (5.2)	1.65	319 (6.8)	2.19	0.75 (0.64–0.89)	<0.001
Secondary outcomes						
Myocardial infarction	97 (2.1)	0.65	116 (2.5)	0.78	0.83 (0.64–1.09)	0.19
Acute coronary syndrome	40 (0.9)	0.27	40 (0.9)	0.27	1.00 (0.64–1.55)	0.99
Stroke	62 (1.3)	0.41	70 (1.5)	0.47	0.89 (0.63–1.25)	0.50
Heart failure	62 (1.3)	0.41	100 (2.1)	0.67	0.62 (0.45–0.84)	0.002
Death from cardiovascular causes	37 (0.8)	0.25	65 (1.4)	0.43	0.57 (0.38–0.85)	0.005
Death from any cause	155 (3.3)	1.03	210 (4.5)	1.40	0.73 (0.60–0.90)	0.003
Primary outcome or death	332 (7.1)	2.25	423 (9.0)	2.90	0.78 (0.67–0.90)	<0.001

\* CI denotes confidence interval, and CKD chronic kidney disease.

† The primary outcome was the first occurrence of myocardial infarction, acute coronary syndrome, stroke, heart failure, or death from cardiovascular causes.

‡ The composite renal outcome for participants with CKD at baseline was the first occurrence of a reduction in the estimated GFR of 50% or more, long-term dialysis, or kidney transplantation.

§ Reductions in the estimated GFR were confirmed by a second laboratory test at least 90 days later.

¶ Incident albuminuria was defined by a doubling of the ratio of urinary albumin (in milligrams) to creatinine (in grams) from less than 10 at baseline to greater than 10 during follow-up. The denominators for number of patients represent those without albuminuria at baseline.

|| No long-term dialysis or kidney transplantation was reported among participants without CKD at baseline.

# SPRINT TRIAL: Primary and Secondary Outcomes and Renal Outcomes.

**Table 2. Primary and Secondary Outcomes and Renal Outcomes.\***

Outcome	Intensive Treatment		Standard Treatment		Hazard Ratio (95% CI)	P Value
	no. of patients (%)	% per year	no. of patients (%)	% per year		
<b>Participants with CKD at baseline (N=1330 vs N=1316)</b>						
Composite renal outcome†	14 (1.1)	0.33	15 (1.1)	0.36	0.89 (0.42–1.87)	0.76
≥50% reduction in estimated GFR‡	10 (0.8)	0.23	11 (0.8)	0.26	0.87 (0.36–2.07)	0.75
Long-term dialysis	6 (0.5)	0.14	10 (0.8)	0.24	0.57 (0.19–1.54)	0.27
Kidney transplantation	0		0			
Incident albuminuria¶	49/526 (9.3)	3.02	59/500 (11.8)	3.90	0.72 (0.48–1.07)	0.11
<b>Participants without CKD at baseline (N=3332 vs N=3345)</b>						
≥30% reduction in estimated GFR to <60 ml/min/1.73 m²§	127 (3.8)	1.21	37 (1.1)	0.35	3.49 (2.44–5.10)	<0.001
Incident albuminuria¶	110/1769 (6.2)	2.00	135/1831 (7.4)	2.41	0.81 (0.63–1.04)	0.10

\* CI denotes confidence interval, and CKD chronic kidney disease.  
† The primary outcome was the first occurrence of myocardial infarction, acute coronary syndrome, stroke, heart failure, or death from cardiovascular causes.  
‡ The composite renal outcome for participants with CKD at baseline was the first occurrence of a reduction in the estimated GFR of 50% or more, long-term dialysis, or kidney transplantation.  
§ Reductions in the estimated GFR were confirmed by a second laboratory test at least 90 days later.  
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The SPRINT Research Group. N Engl J Med 2015;373:2103-2116

# SPRINT Trial: Serious Adverse Events, Conditions of Interest, and Monitored Clinical Events.

**Table 3. Serious Adverse Events, Conditions of Interest, and Monitored Clinical Events.**

Variable	Intensive Treatment (N=4678)	Standard Treatment (N=4683)	Hazard Ratio	P Value
	<i>no. of patients (%)</i>			
Serious adverse event*	1793 (38.3)	1736 (37.1)	1.04	0.25
Conditions of interest				
Serious adverse event only				
Hypotension	110 (2.4)	66 (1.4)	1.67	0.001
Syncope	107 (2.3)	80 (1.7)	1.33	0.05
Bradycardia	87 (1.9)	73 (1.6)	1.19	0.28
Electrolyte abnormality	144 (3.1)	107 (2.3)	1.35	0.02
Injurious fall†	105 (2.2)	110 (2.3)	0.95	0.71
Acute kidney injury or acute renal failure‡	193 (4.1)	117 (2.5)	1.66	<0.001
Emergency department visit or serious adverse event				
Hypotension	158 (3.4)	93 (2.0)	1.70	<0.001
Syncope	163 (3.5)	113 (2.4)	1.44	0.003
Bradycardia	104 (2.2)	83 (1.8)	1.25	0.13
Electrolyte abnormality	177 (3.8)	129 (2.8)	1.38	0.006
Injurious fall†	334 (7.1)	332 (7.1)	1.00	0.97
Acute kidney injury or acute renal failure‡	204 (4.4)	120 (2.6)	1.71	<0.001
Monitored clinical events				
Adverse laboratory measure§				
Serum sodium <130 mmol/liter	180 (3.8)	100 (2.1)	1.76	<0.001
Serum sodium >150 mmol/liter	6 (0.1)	0		0.02
Serum potassium <3.0 mmol/liter	114 (2.4)	74 (1.6)	1.50	0.006
Serum potassium >5.5 mmol/liter	176 (3.8)	171 (3.7)	1.00	0.97
Orthostatic hypotension¶				
Alone	777 (16.6)	857 (18.3)	0.88	0.01
With dizziness	62 (1.3)	71 (1.5)	0.85	0.35

\* A serious adverse event was defined as an event that was fatal or life-threatening, that resulted in clinically significant or persistent disability, that required or prolonged a hospitalization, or that was judged by the investigator to represent a clinically significant hazard or harm to the participant that might require medical or surgical intervention to prevent one of the other events listed above.

† An injurious fall was defined as a fall that resulted in evaluation in an emergency department or that resulted in hospitalization.

‡ Acute kidney injury or acute renal failure were coded if the diagnosis was listed in the hospital discharge summary and was believed by the safety officer to be one of the top three reasons for admission or continued hospitalization. A few cases of acute kidney injury were noted in an emergency department if the participant presented for one of the other conditions of interest.

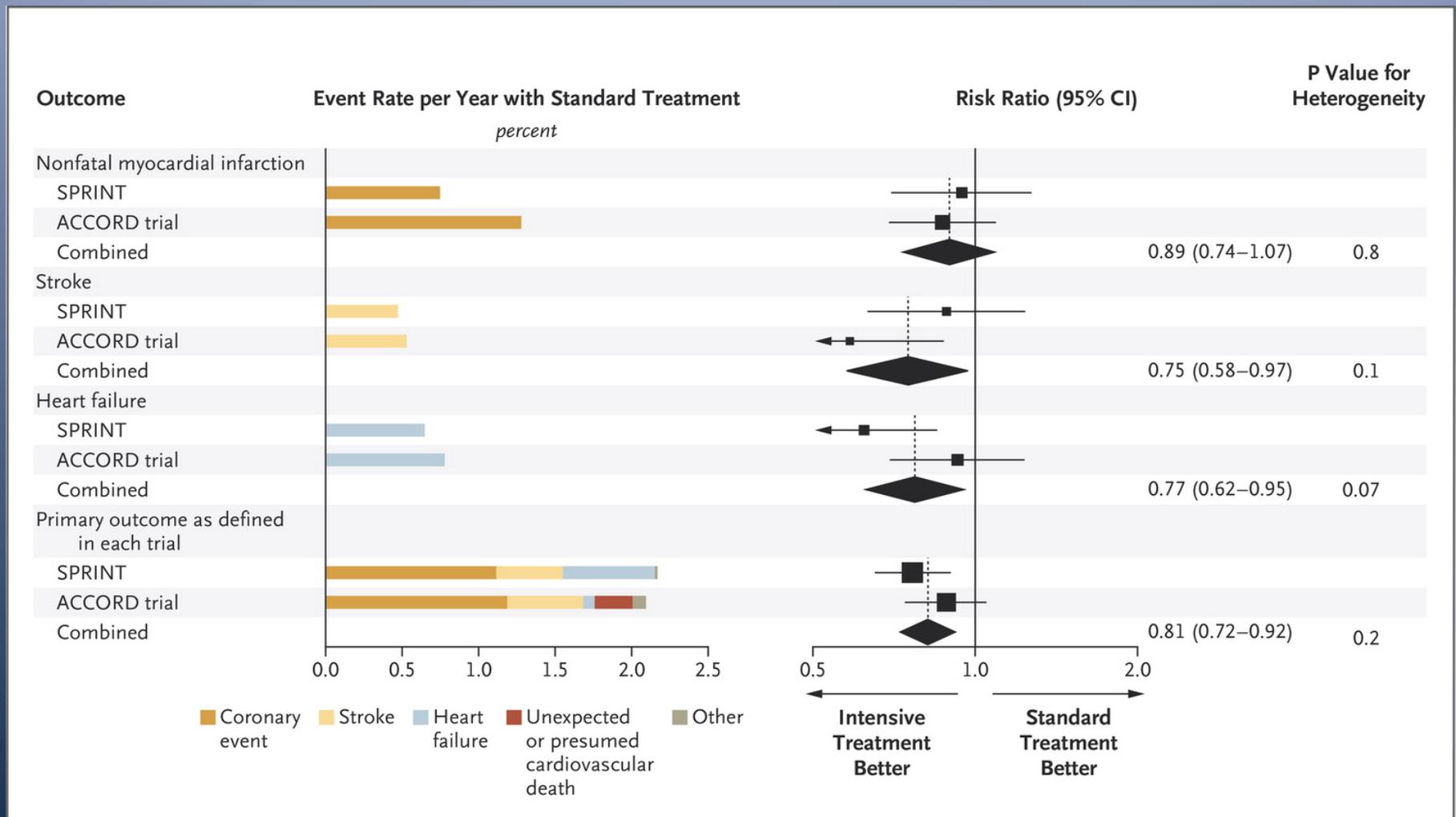
§ Adverse laboratory measures were detected on routine or unscheduled tests; routine laboratory tests were performed at 1 month, then quarterly during the first year, then every 6 months.

¶ Orthostatic hypotension was defined as a drop in systolic blood pressure of at least 20 mm Hg or in diastolic blood pressure of at least 10 mm Hg at 1 minute after the participant stood up, as compared with the value obtained when the participant was seated. Standing blood pressures were measured at screening, baseline, 1 month, 6 months, 12 months, and yearly thereafter. Participants were asked if they felt dizzy at the time the orthostatic measure was taken.

# SPRINT TRIAL CONCLUSION

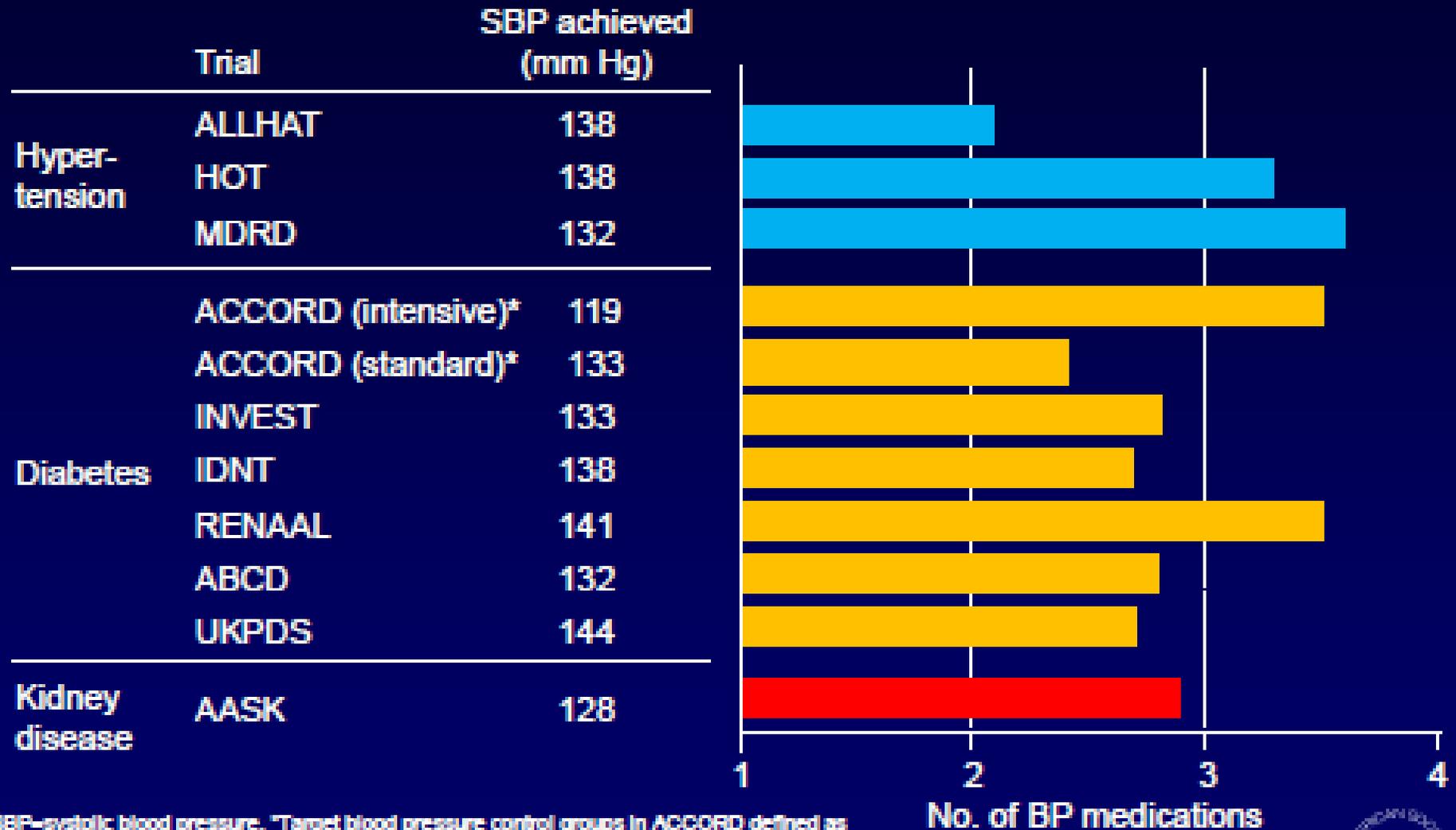
Among patients at high risk for cardiovascular events but without diabetes, targeting a systolic blood pressure of less than 120 mm Hg, as compared with less than 140 mm Hg, resulted in lower rates of fatal and nonfatal major cardiovascular events and death from any cause, although significantly higher rates of some adverse events were observed in the intensive-treatment group.

# Outcomes Data from SPRINT and the ACCORD Trial and Combined Data from Both Trials.



Perkovic V, Rodgers A. N Engl J Med 2015;373:2175-2178.

# Multiple Medications Are Required to Achieve BP Control in Clinical Trials



SBP=systolic blood pressure. \*Target blood pressure control groups in ACCORD defined as <120 mm Hg (intensive) and <140 mm Hg (standard).

Copley JB, Rosario R. *Diabetes Monit*. 2005;51:548-614.

The ACCORD Study Group. *N Engl J Med*. 2010 Mar 14. [Epub ahead of print]

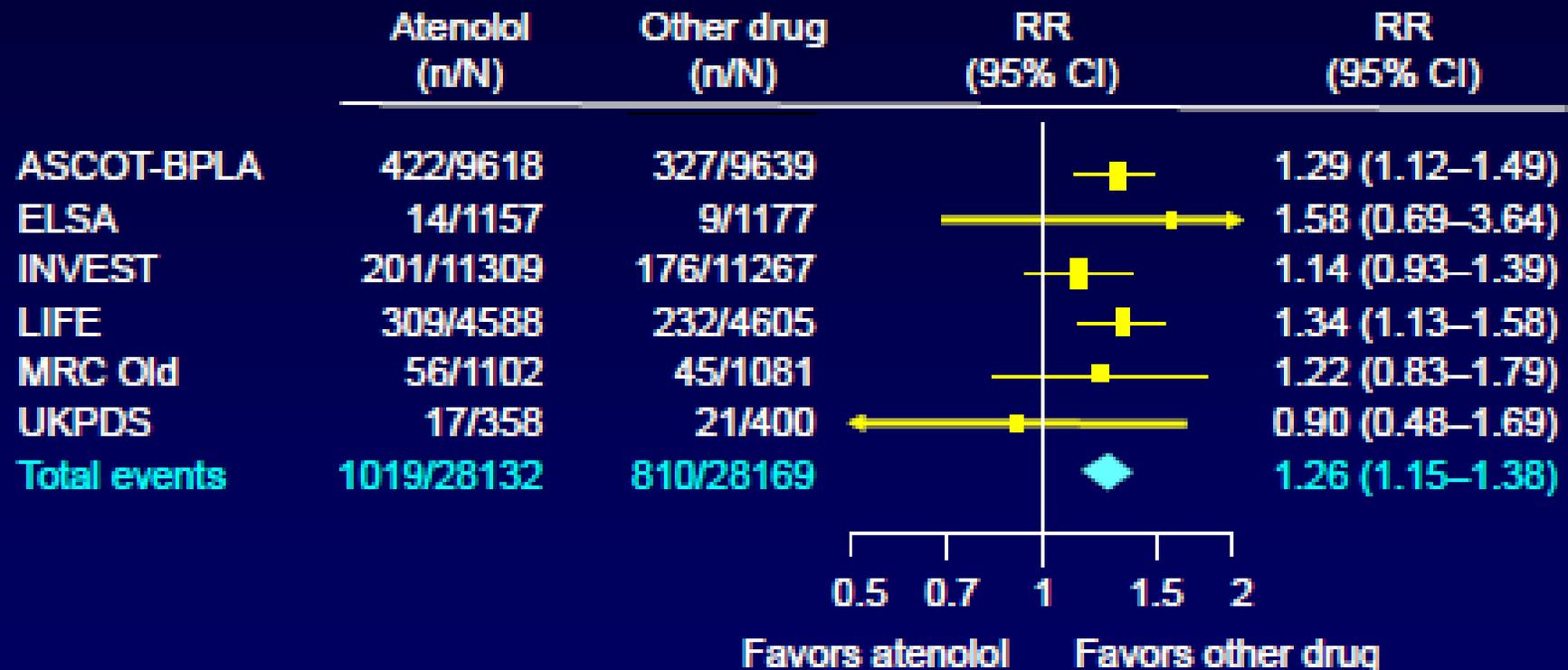


# Questions Addressed by Landmark Clinical Trials

- Does the treatment of hypertension reduce the risk of morbid events?
- At what BP level is treatment beneficial?
- To what level should BP be reduced?
- **What are the best drugs for hypertension?**

# β-Blocker Meta-analysis

## Stroke: Atenolol vs Other Antihypertensive Agents



ASCOT-BPLA, Anglo-Scandinavian Cardiac Outcomes Trial–Blood Pressure Lowering Arm; CI, confidence interval; ELSA, European Lacidipine Study on Atherosclerosis; INVEST, International Verapamil-Trandolapril Study; LIFE, Losartan Intervention For Endpoint reduction; MRC, Medical Research Council; RR, relative risk; UKPDS, United Kingdom Prospective Diabetes Study.  
Lindholm LH et al. *Lancet*. 2005;366(9496):1545–1553.



# National Institute for Health and Clinical Excellence (NICE) Places $\beta$ -Blockers as Fourth-Line Treatment for Uncomplicated Hypertension



- Beta-blockers are not a preferred initial therapy for hypertension
- If treatment with three drugs is required, the combination of ACE inhibitor or ARB, calcium-channel blocker and thiazide-like diuretic should be used
- Beta-blockers may be considered in younger people, particularly:
  - those with an intolerance or contraindication to ACE inhibitors and ARB's
  - women of child-bearing potential
  - people with evidence of increased sympathetic drive
- If therapy is initiated with a beta-blocker and a second drug is required, add a calcium-channel blocker rather than a thiazide-like diuretic to reduce the person's risk of developing diabetes

# Drug Combinations in HTN: ASH Recommendations

<b>Preferred</b>	<ul style="list-style-type: none"><li>• ACE inhibitor/diuretic*</li><li>• ARB/diuretic*</li><li>• ACE inhibitor/CCB*</li><li>• ARB/CCB*</li></ul>
<b>Acceptable</b>	<ul style="list-style-type: none"><li>• <math>\beta</math>-blocker/diuretic*</li><li>• CCB (dihydropyridine)/<math>\beta</math>-blocker</li><li>• CCB/diuretic</li><li>• Renin inhibitor/diuretic*</li><li>• Renin inhibitor/ARB**</li><li>• Thiazide diuretics/<math>K^+</math> sparing diuretics*</li></ul>
<b>Less effective</b>	<ul style="list-style-type: none"><li>• ACE inhibitor/ARB</li><li>• ACE inhibitor/<math>\beta</math>-blocker</li><li>• ARB/<math>\beta</math>-blocker</li><li>• CCB (nondihydropyridine)/<math>\beta</math>-blocker</li><li>• Centrally acting agent/<math>\beta</math>-blocker</li></ul>

\*Single-pill combinations available in the United States.  
Gradman AH et al. *J Am Soc Hypertens.* 2010;4:42.



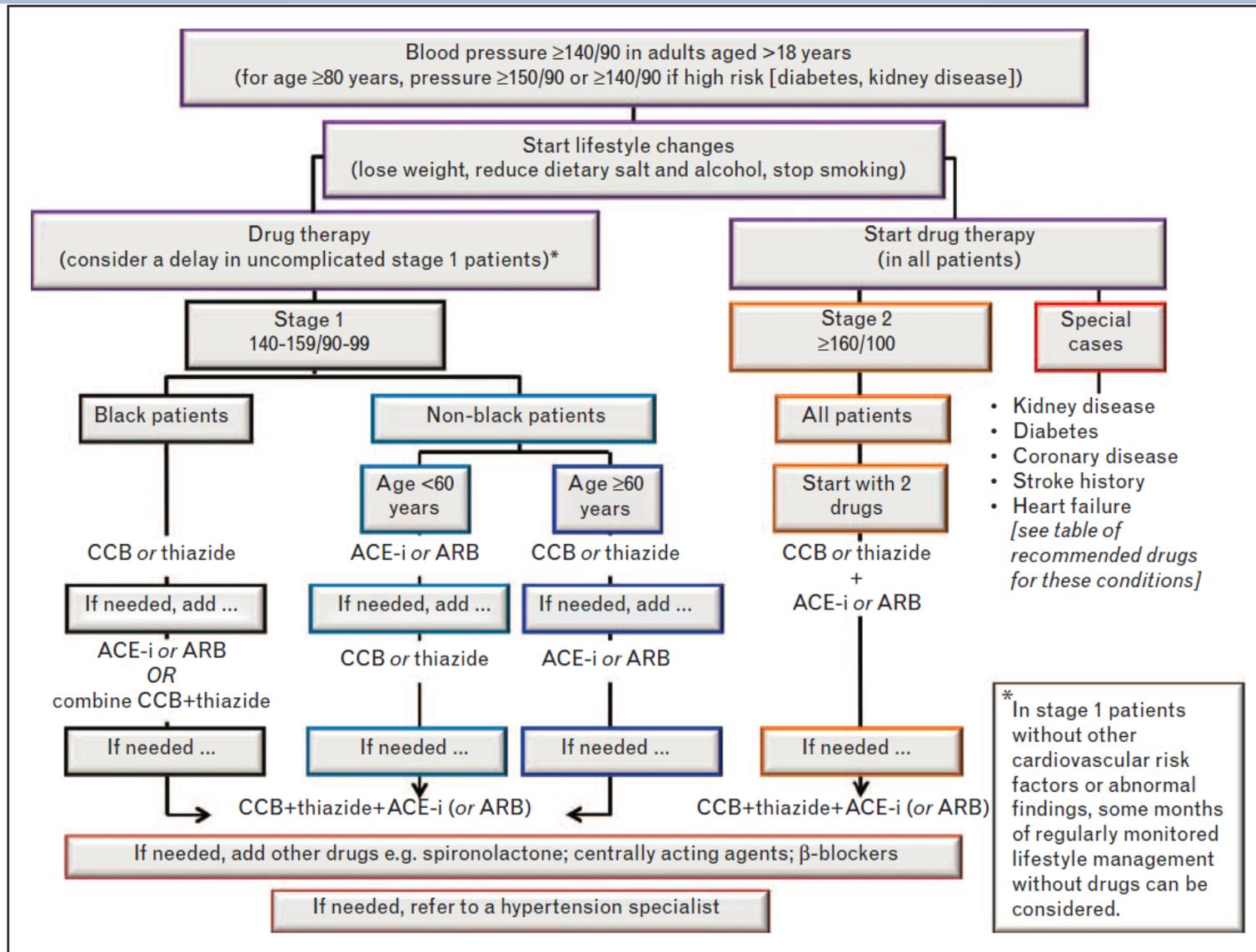
# Generalized Treatment Recommendations

- Life style modifications (weight loss, exercise, low-salt/high fiber diet)
- Standard triple regimen of ACE inhibitor or ARB, thiazide diuretic, and long-acting calcium channel blocker
- Preferential use of chlorthalidone
- Consider use of aldosterone antagonist (spironolactone, eplerenone, amiloride) as fourth drug
- Vasodilating beta-blocker as fifth drug
- Centrally-acting agent as fifth drug (clonidine, guanfacine)
- Vasodilating agents (hydralazine, minoxidil) as last resort

## Guideline

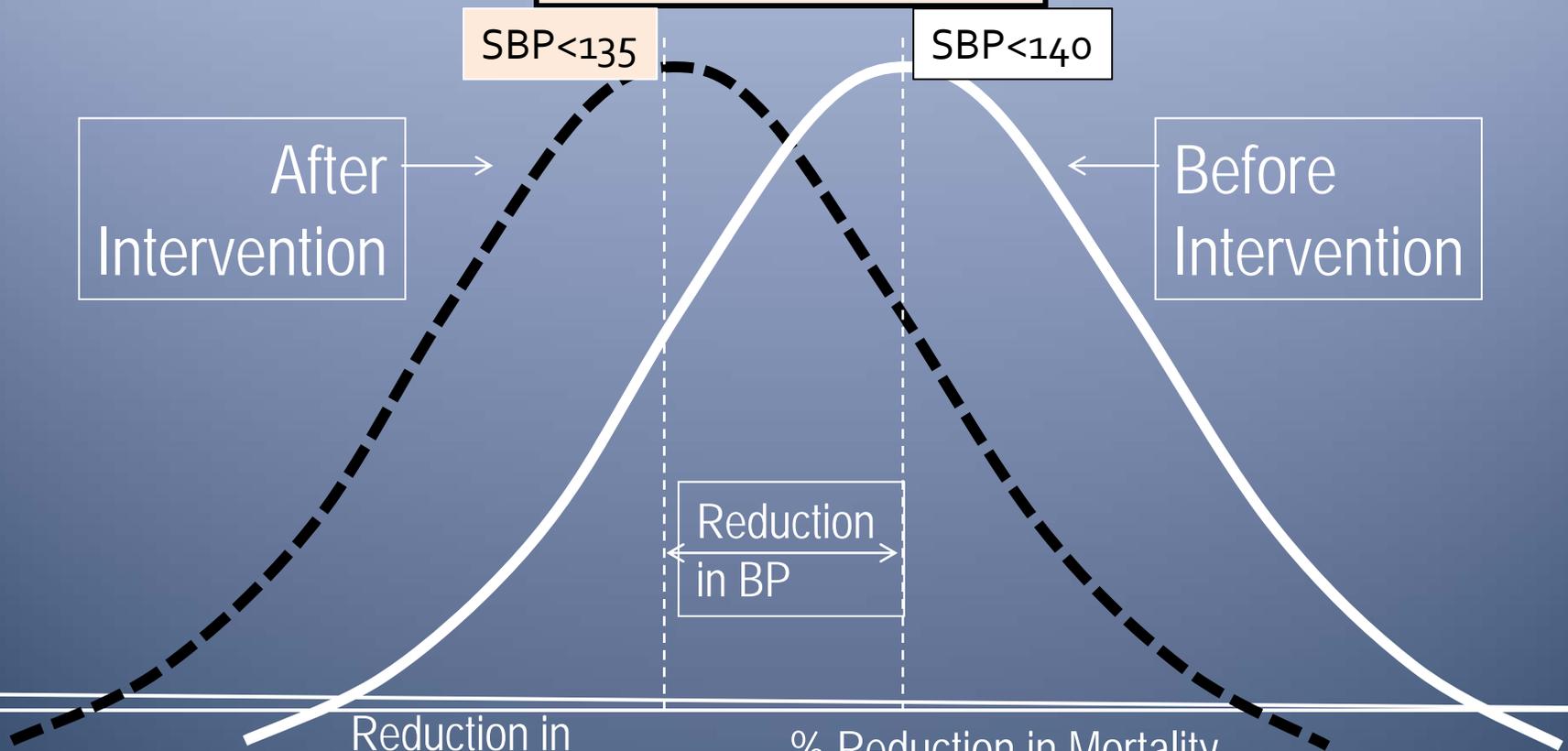
# Clinical Practice Guidelines for the Management of Hypertension in the Community. A Statement by the American Society of Hypertension and the International Society of Hypertension

Michael A. Weber<sup>a</sup>, Ernesto L. Schiffrin<sup>b</sup>, William B. White<sup>c</sup>, Samuel Mann<sup>d</sup>, Lars H. Lindholm<sup>e</sup>, John G. Kenerson<sup>f</sup>, John M. Flack<sup>g</sup>, Barry L. Carter<sup>h</sup>, Barry J. Materson<sup>i</sup>, C. Venkata S. Ram<sup>j</sup>, Debbie L. Cohen<sup>k</sup>, Jean-Claude Cadet<sup>l</sup>, Roger R. Jean-Charles<sup>m</sup>, Sandra Taler<sup>n</sup>, David Kountz<sup>o</sup>, Raymond Townsend<sup>p</sup>, John Chalmers<sup>q</sup>, Agustin J. Ramirez<sup>r</sup>, George L. Bakris<sup>s</sup>, Jiguang Wang<sup>t</sup>, Aletta E. Schutte<sup>u</sup>, John D. Bisognano<sup>v</sup>, Rhian M. Touyz<sup>w</sup>, Dominic Sica<sup>x</sup>, and Stephen B. Harrap<sup>y</sup>



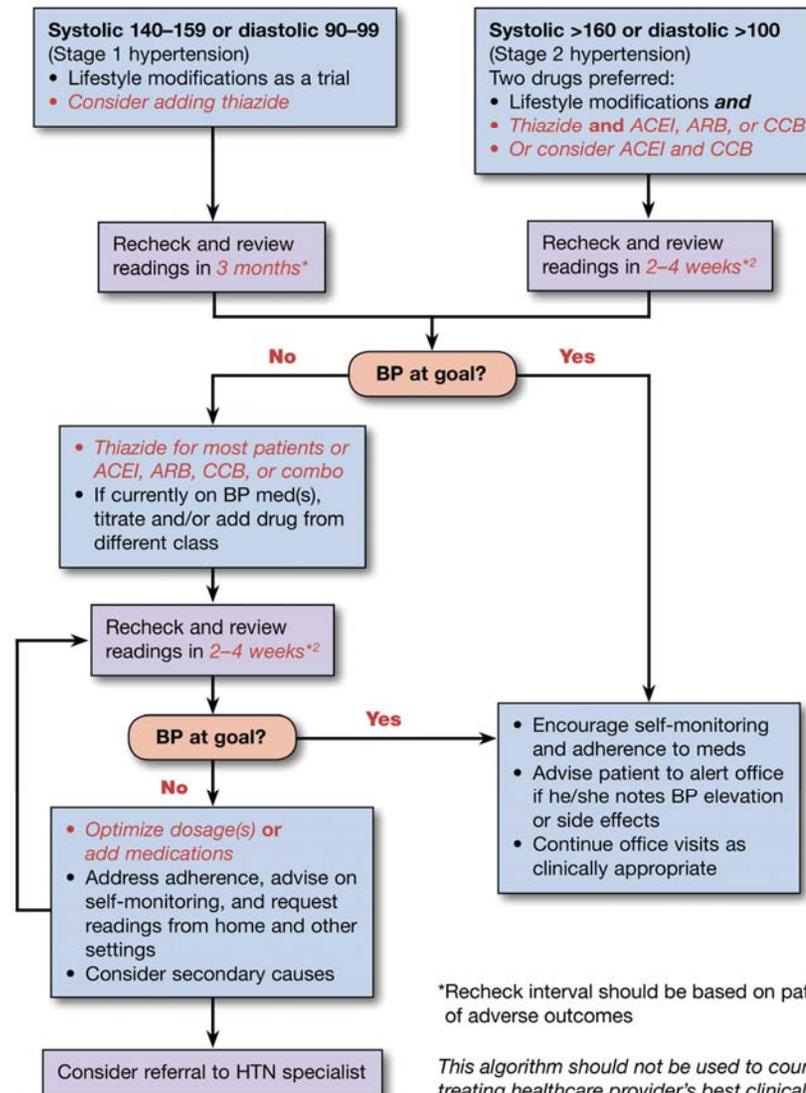
# Population-Based Strategy

## SBP Distributions



Reduction in SBP mmHg	% Reduction in Mortality		
	Stroke	CHD	Total
2	-6	-4	-3
3	-8	-5	-4
5	-14	-9	-7

# Controlling Hypertension in Adults<sup>1</sup>



# Summary

- ❖ Previous Guidelines recommend treatment goal of  $<140/90$  for most of the population.
- ❖ Recent trials such as ACCORD and SPRINT suggest different goals for specific populations
  - ❖ ACCORD: Diabetics  $<140/90$
  - ❖ SPRINT: Non-diabetics  $<120/80$
  - ❖ SPRINT: There are differences in outcomes by CKD and age. This may affect new recommendations
- ❖ All of the guidelines have removed beta blockers from the first line of therapy. (ACE/ARB, CCB, Diuretics are first line treatment options)
- ❖ EXPECT NEW GUIDELINES FROM AHA/ACC/ASH in 2016-2017