



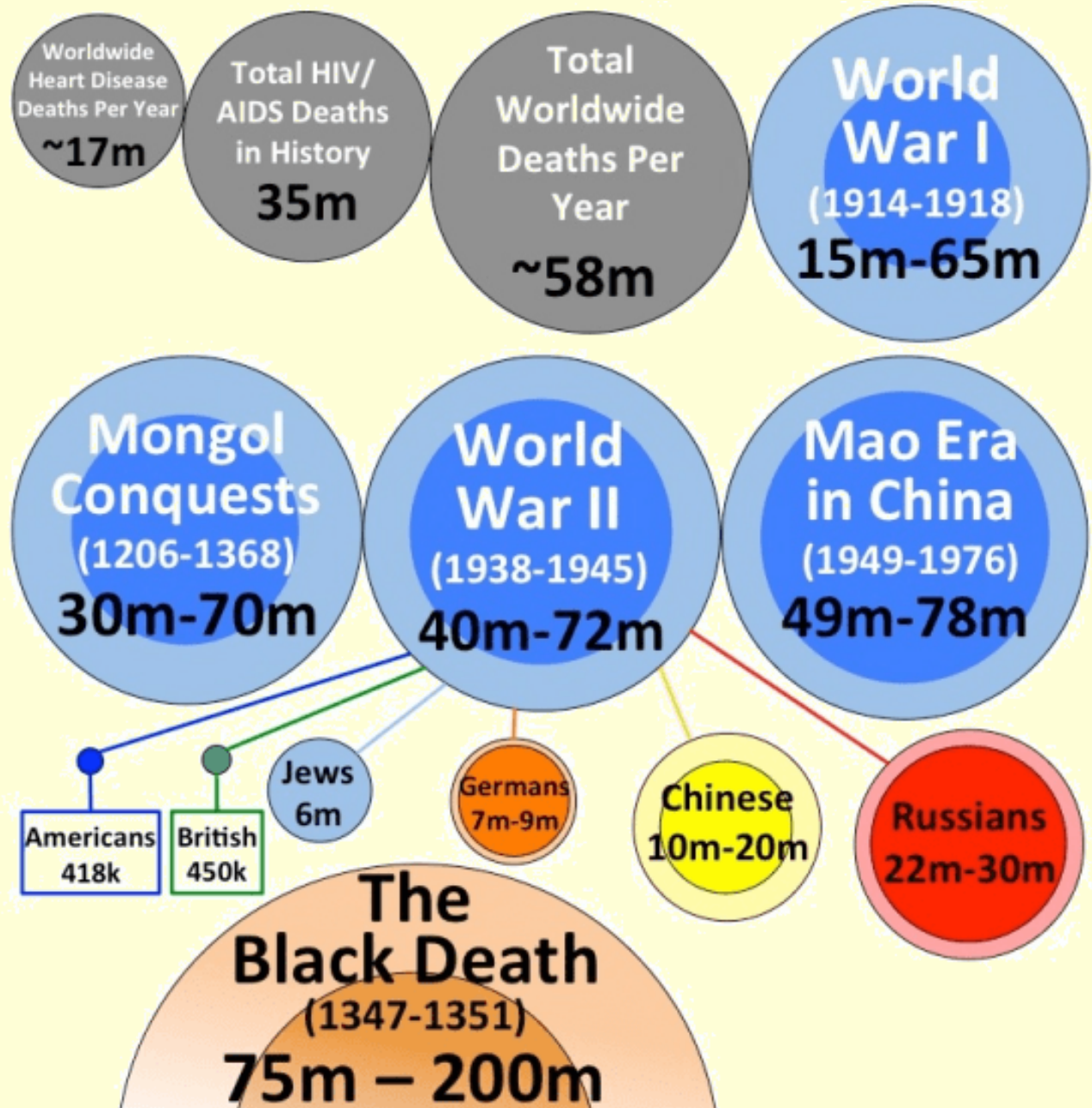


Hypertension

A Continuous Medical Disaster



History of major human worldwide disastrous, Where is Hypertension?



	Risk factor	Deaths (millions)	Percentage of total
	<i>World</i>		
1	High blood pressure	7.5	12.8
2	Tobacco use	5.1	8.7
3	High blood glucose	3.4	5.8
4	Physical inactivity	3.2	5.5
5	Overweight and obesity	2.8	4.8
6	High cholesterol	2.6	4.5
7	Unsafe sex	2.4	4.0
8	Alcohol use	2.3	3.8
9	Childhood underweight	2.2	3.8
10	Indoor smoke from solid fuels	2.0	3.3

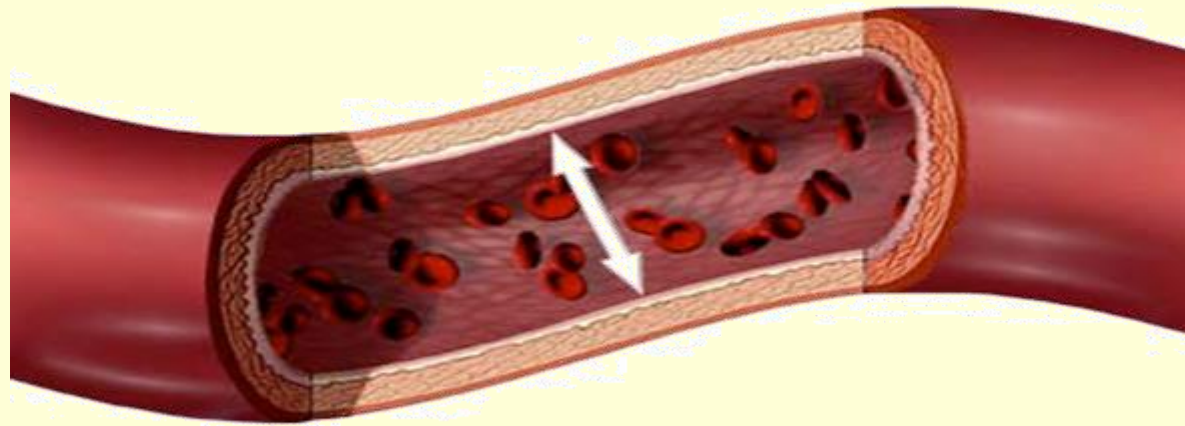
The Importance of Hypertension

- It is still widely controversial
- Its Prevalence (30-50%)
- The first killer and disability (Benign?)
- A silent killer
- A masked killer
- Financial burden
- Preventable
- Satisfactory treatable



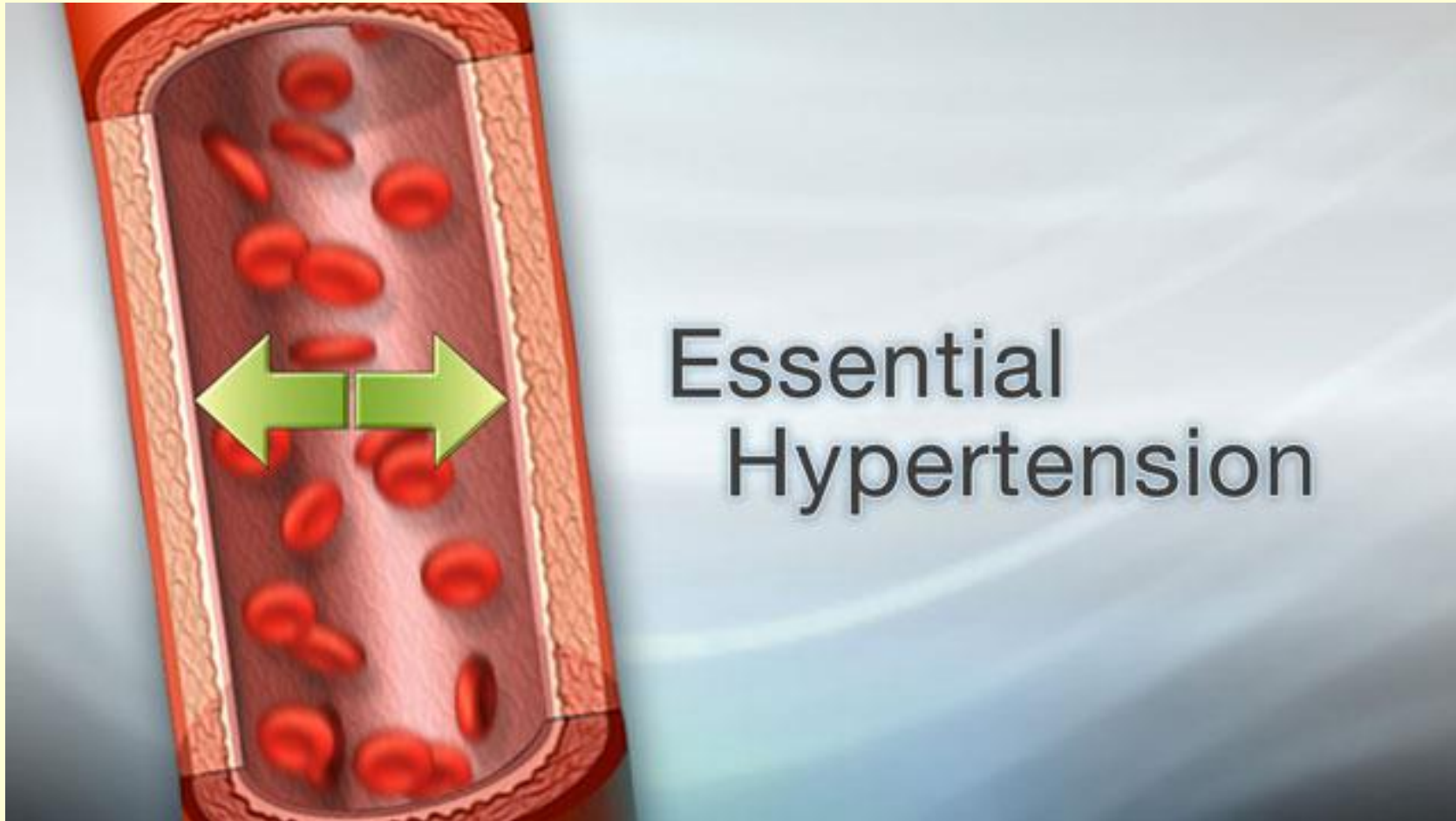
Definition of Blood Pressure

The pressure exerted by blood against the artery walls through which it flows

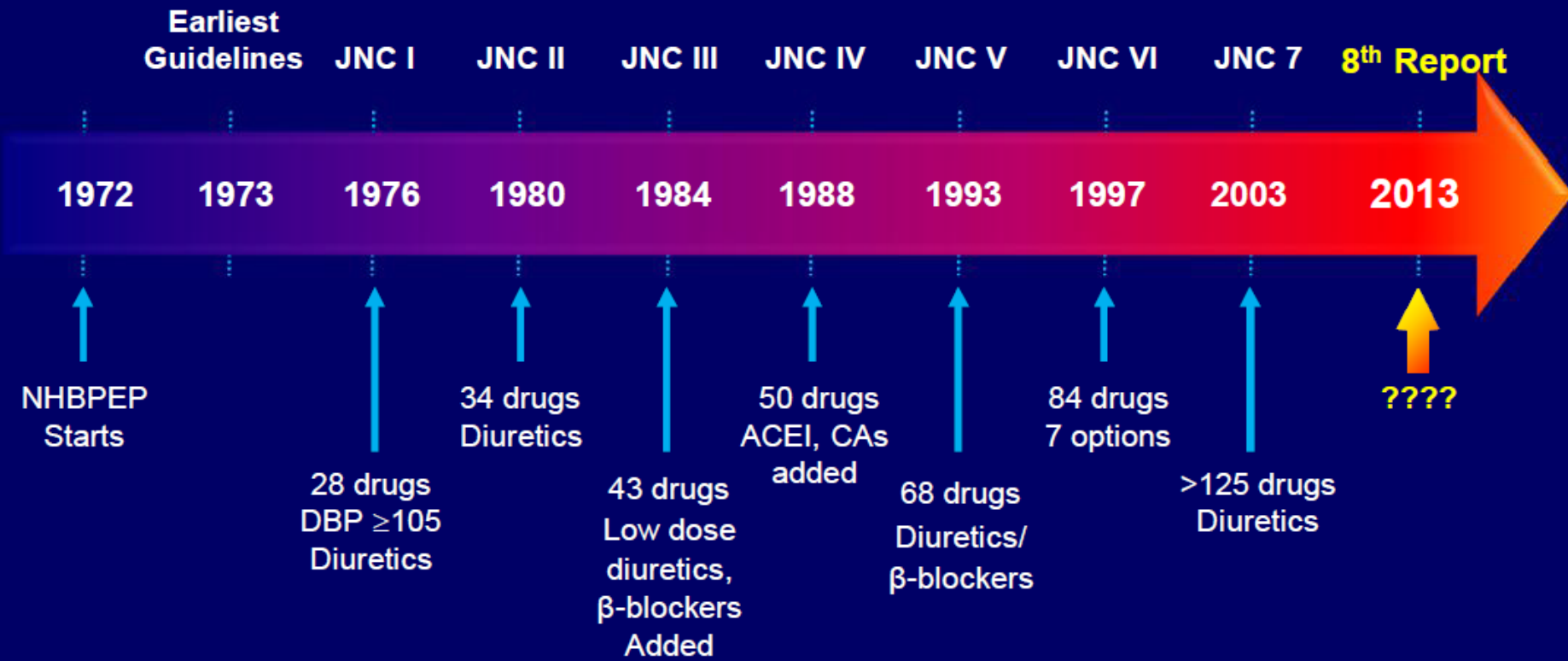


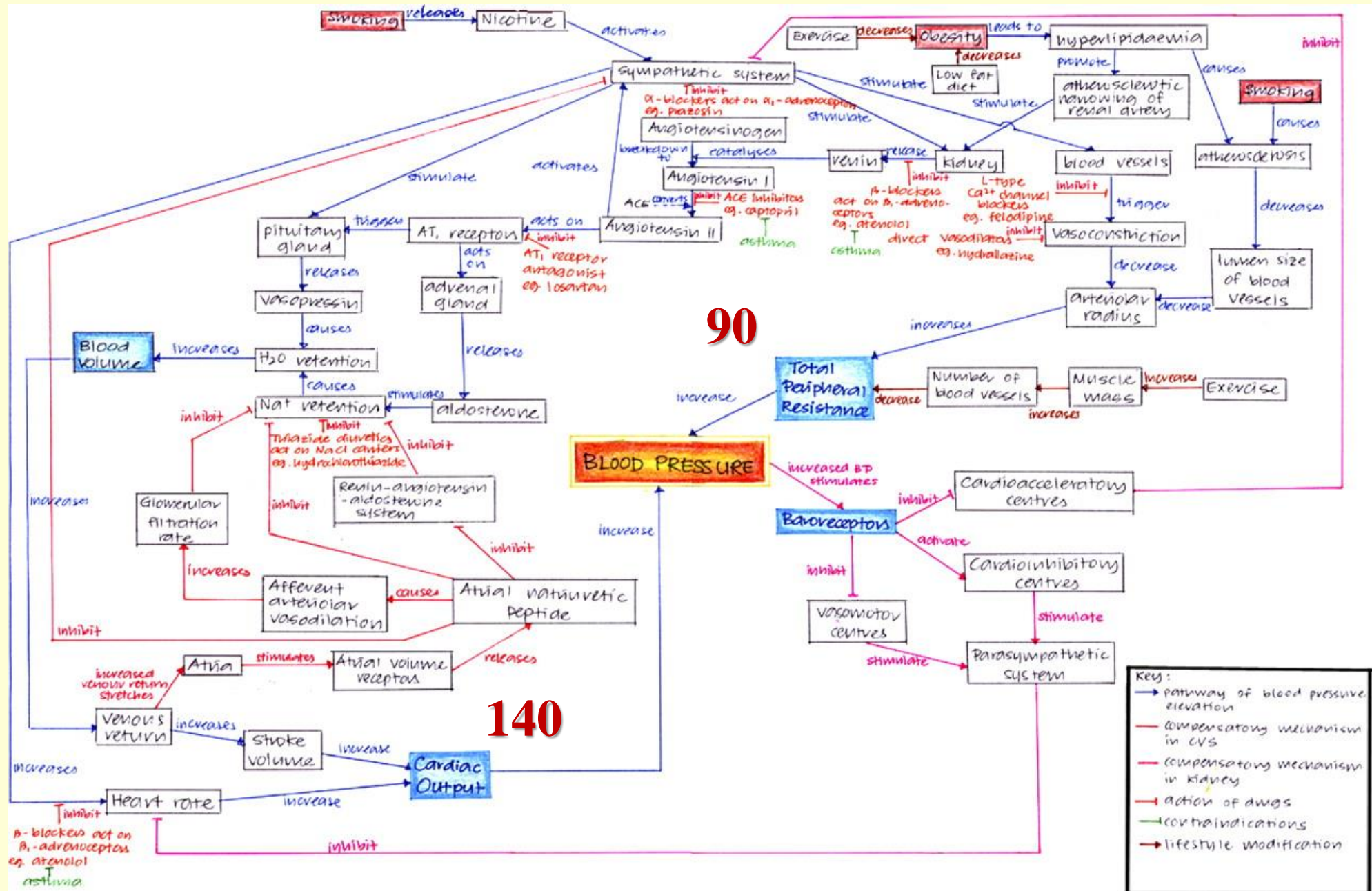
$$BP = CO \times SVR$$

ارتفاع التوتر (الضغط) الضروري Essential



Development of Hypertension Guidelines: the JNCs and Drug Therapy





“Blood pressure continuously fluctuates to such a degree that the same two minutes of blood pressure will never be seen throughout the whole life of an animal.”

Stephen Hales

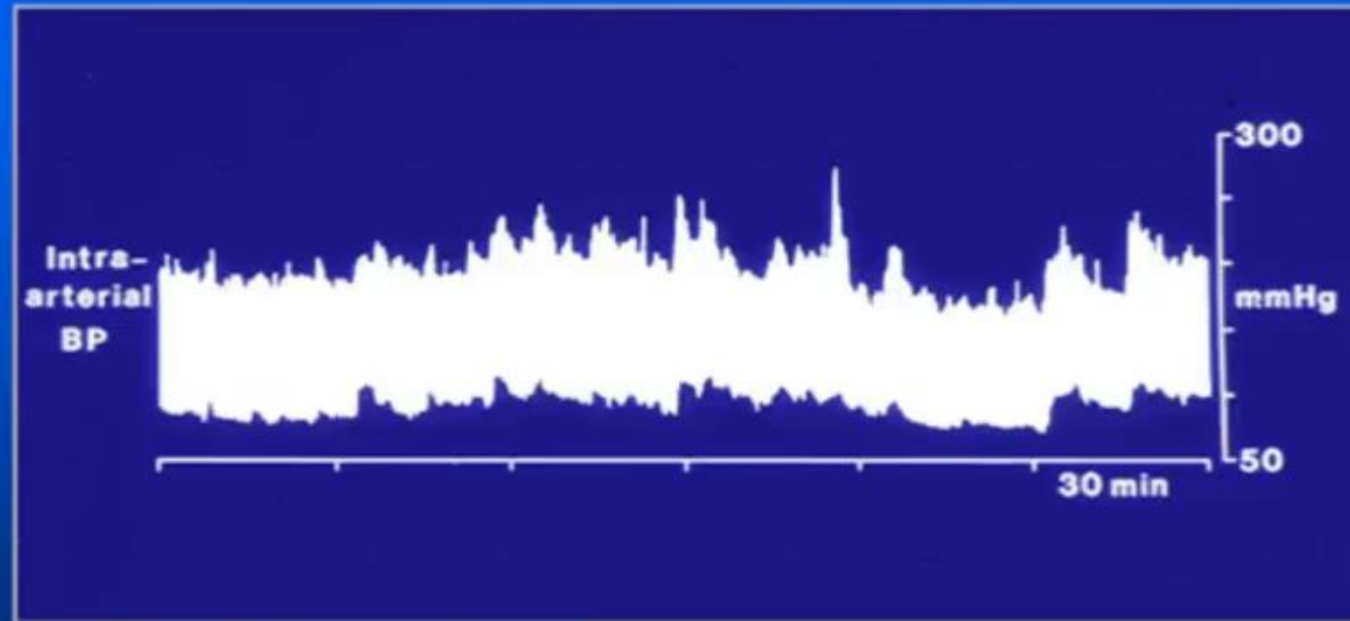
“On account of some hydraulick and hydrostatick experiments made on the blood vessels of animals”

In: *Statistical Essays: Containing Hemastatick;*
London 1733.



CARDIOVASCULAR PHYSIOLOGY:

BP is a highly variable parameter



Intra-arterial BP recording in a subject lying supine, at rest

Hypertension is defined as:

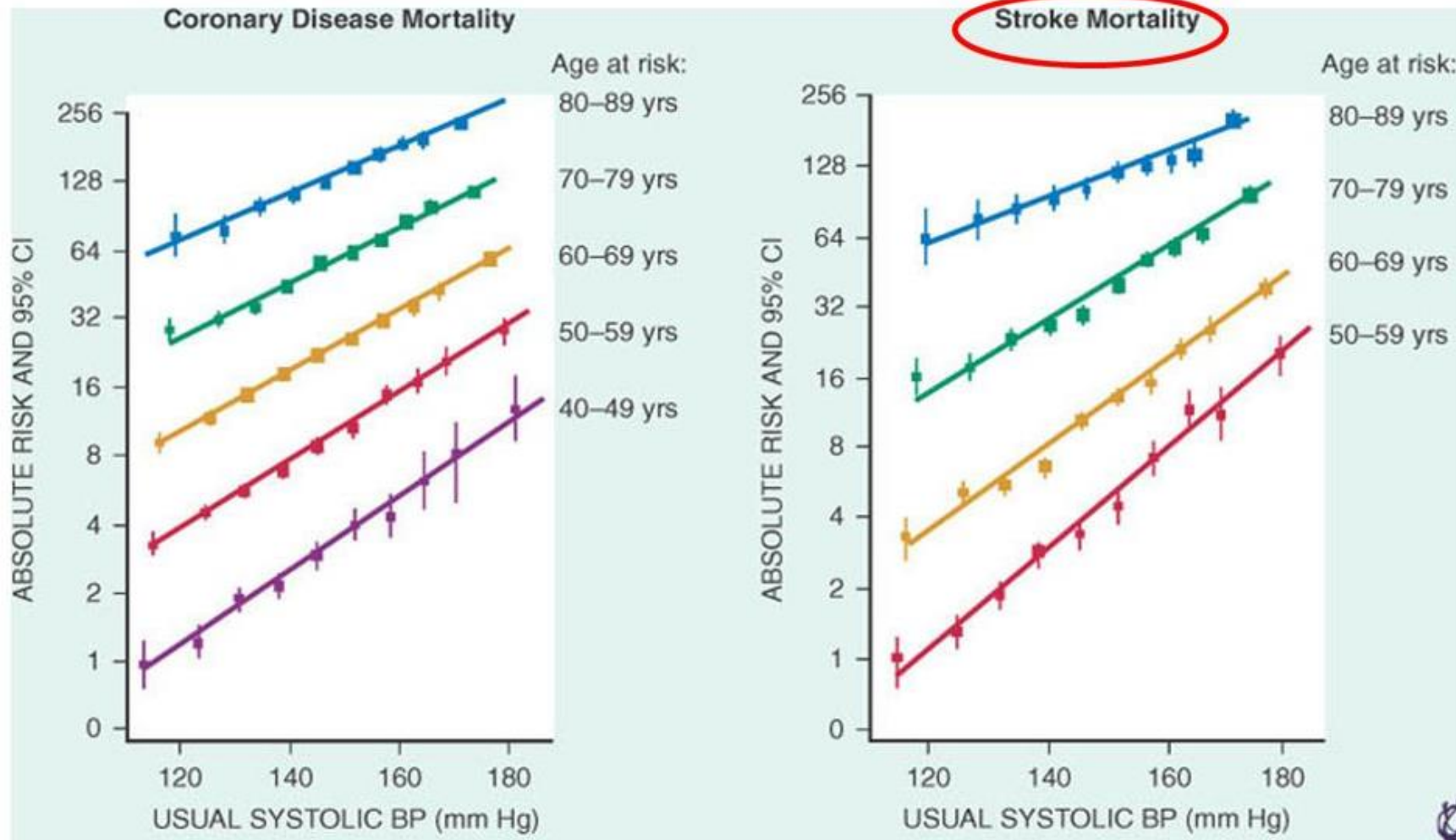
- The **level** of blood pressure linked with a **doubled increased long-term risk for adverse events**

OR

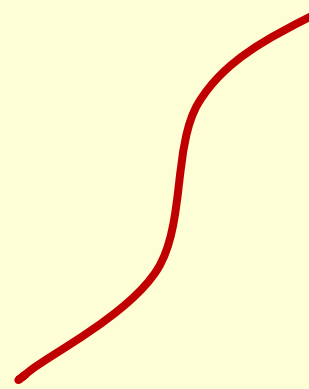
The **level** of blood pressure at which the benefits of action (i.e. therapeutic intervention) exceed those of inaction.”

Evans and Rose Brit Med Bull 1971;27:37-42

Absolute risks of CAD (left) and stroke mortality (right) for each decade of life by usual systolic blood pressure (BP) level

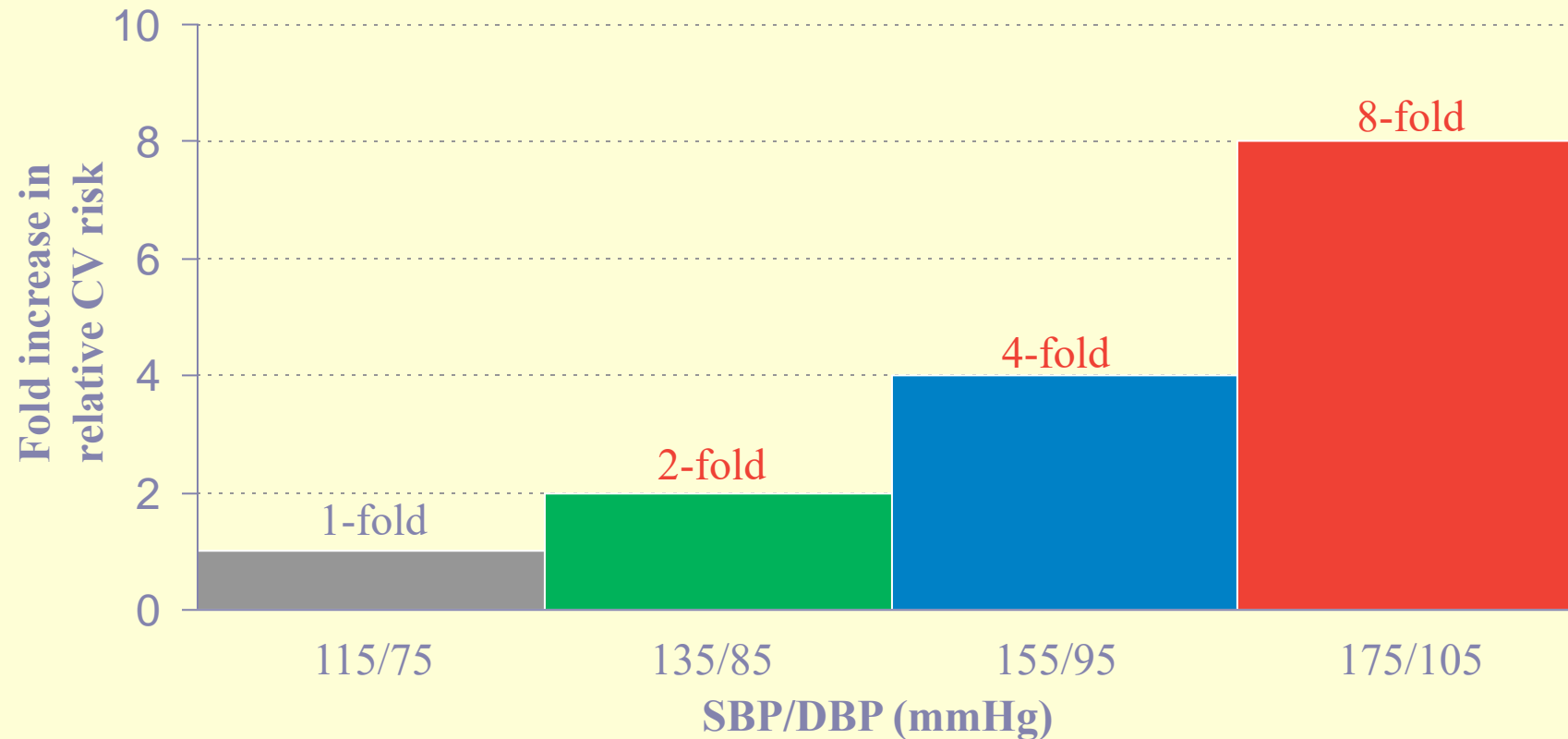


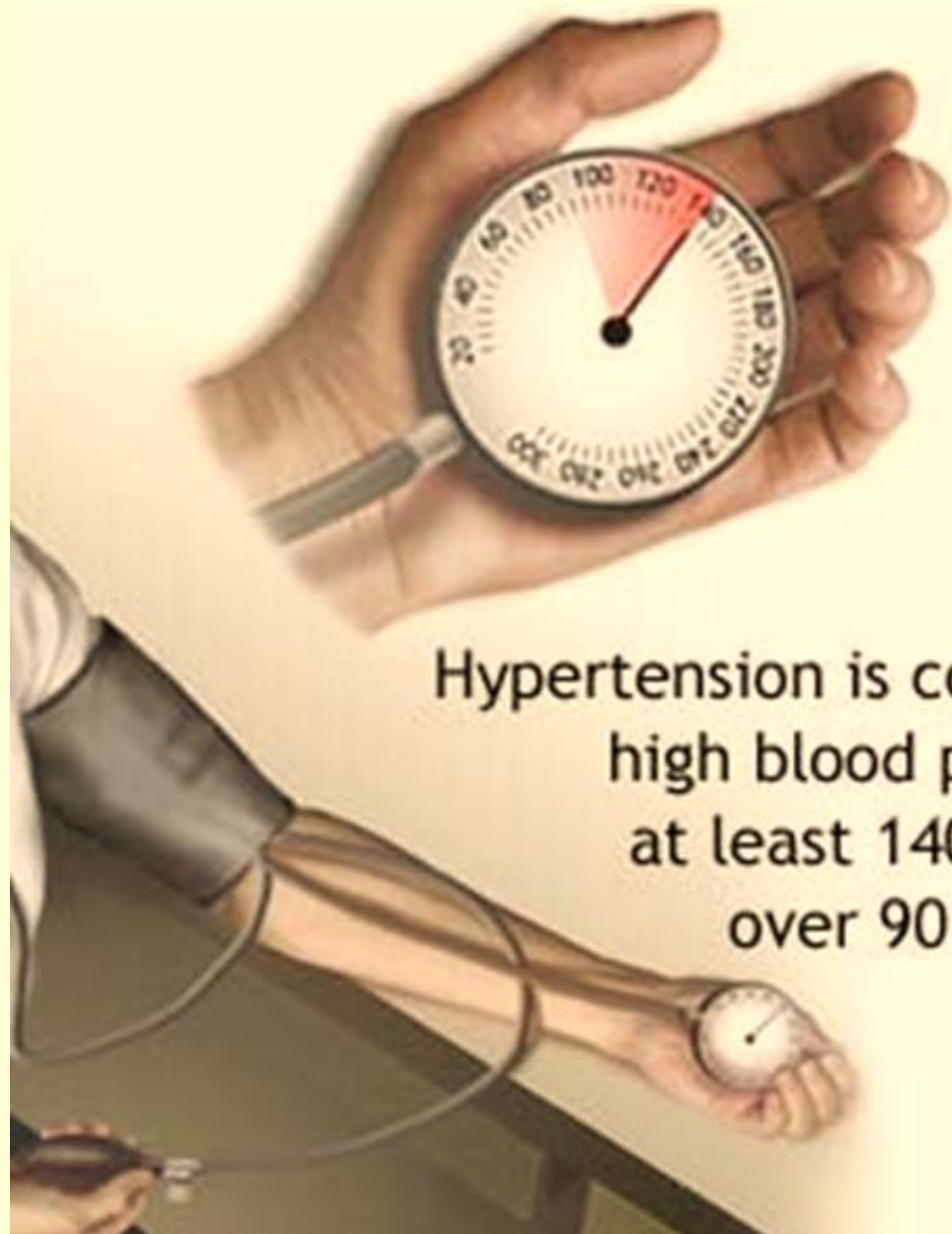
**A meta-analysis of individual data for 1,000,000 adults in 61 prospective studies.
*Lancet 360:1903, 2002.***



Risk of CV Mortality Doubles With Each 20/10 mmHg BP Increase

- Meta-analysis of 61 prospective, observational studies
- 1 million adults aged 40–69 y with BP > 115/75 mmHg
- 12.7 million person-years





Hypertension is consistently high blood pressure of at least 140 (systolic) over 90 (diastolic)



BP: 400/200

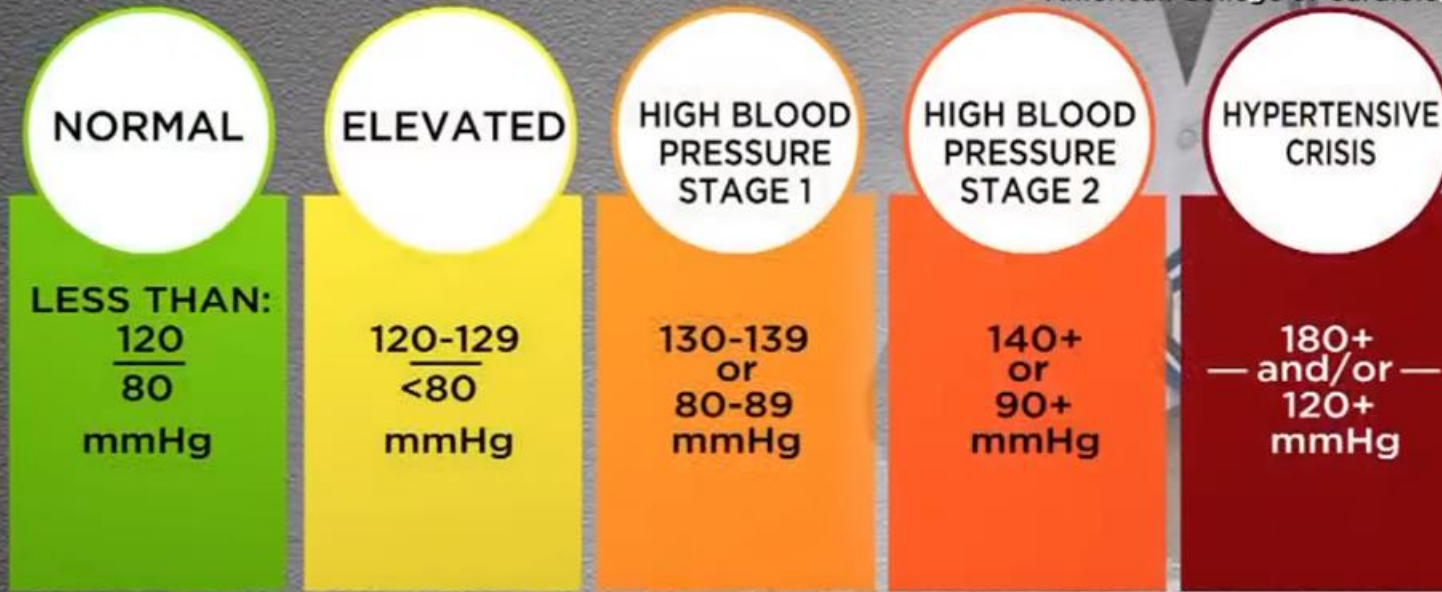
	Normal	Prehypertension	High
SYSTOLIC	<120 mm Hg	120-139 mm Hg	140+ mm Hg
DIASTOLIC	<80 mm Hg	80-89 mm Hg	90+ mm Hg



VALUES FOR
NORMAL BLOOD PRESSURE, PREHYPERTENSION
AND HIGH BLOOD PRESSURE

New Blood Pressure Categories

Source: American Heart Association/
American College of Cardiology

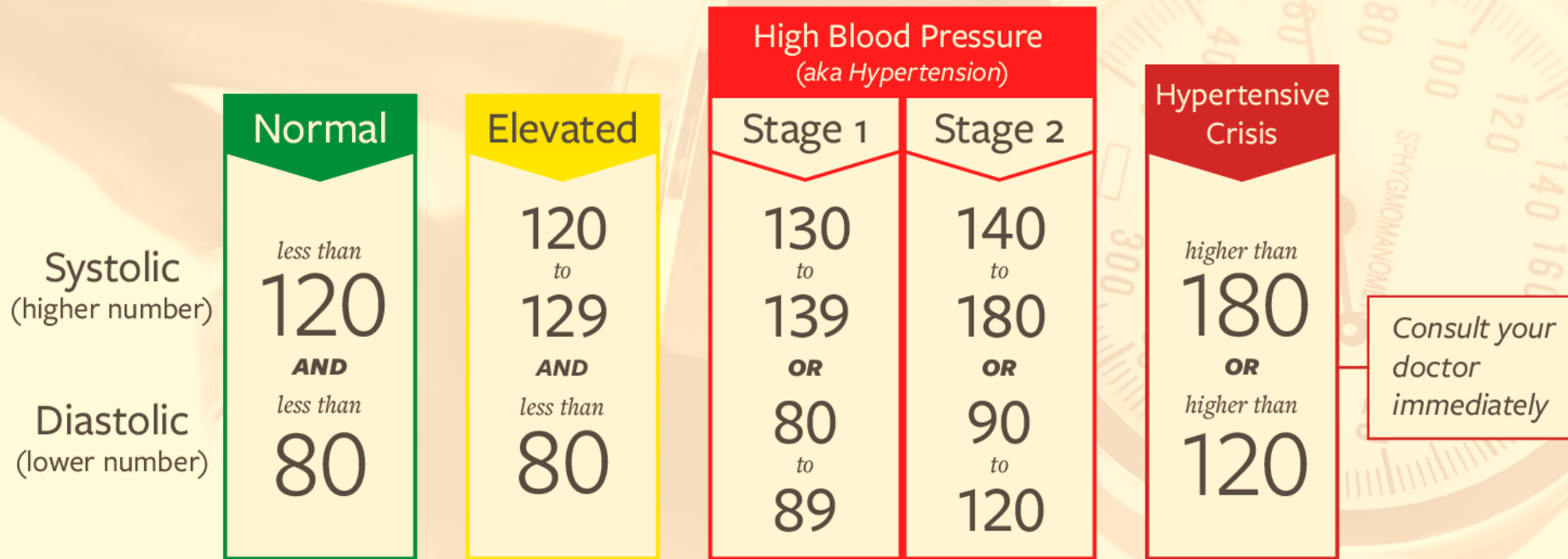


ACC/AHA 2017



BLOOD PRESSURE HEART-FACTS

DO YOU HAVE HIGH BLOOD PRESSURE?



Understand what your blood pressure numbers mean for your health, and what you can do to lower them.

LEARN **MORE** @ [texasheart.org](https://www.texasheart.org)  TEXAS HEART[®] INSTITUTE

Cardio-vascular Risk Assessment

www.cvriskcalculator.com

**BP > 130/80
recommend starting
anti-hypertensive
drugs based on
ASCVD risk score of
> 10%.**

Age (years)	<input type="text" value="40-79"/>
Gender	<input checked="" type="radio"/> Male <input type="radio"/> Female
Race	<input type="radio"/> African American <input checked="" type="radio"/> Other
Total cholesterol (mg/dL)	<input type="text" value="130-320"/>
HDL cholesterol (mg/dL)	<input type="text" value="20-100"/>
Systolic blood pressure (mmHg)	<input type="text" value="90-200"/>
Diastolic blood pressure (mmHg)	<input type="text" value="30-140"/>
Treated for high blood pressure	<input checked="" type="radio"/> No <input type="radio"/> Yes
Diabetes	<input checked="" type="radio"/> No <input type="radio"/> Yes
Smoker	<input checked="" type="radio"/> No <input type="radio"/> Yes
<input type="button" value="Calculate"/>	

CVD Risk Factors Common in Patients With Hypertension

Modifiable Risk Factors*	Relatively Fixed Risk Factors†
<ul style="list-style-type: none">• Current cigarette smoking, secondhand smoking• Diabetes mellitus• Dyslipidemia/hypercholesterolemia• Overweight/obesity• Physical inactivity/low fitness• Unhealthy diet	<ul style="list-style-type: none">• CKD• Family history• Increased age• Low socioeconomic/educational status• Male sex• Obstructive sleep apnea• Psychosocial stress

*Factors that can be changed and, if changed, may reduce CVD risk.

†Factors that are difficult to change (CKD, low socioeconomic/educational status, obstructive sleep apnea, cannot be changed (family history, increased age, male sex), or, if changed through the use of current intervention techniques, may not reduce CVD risk (psychosocial stress).

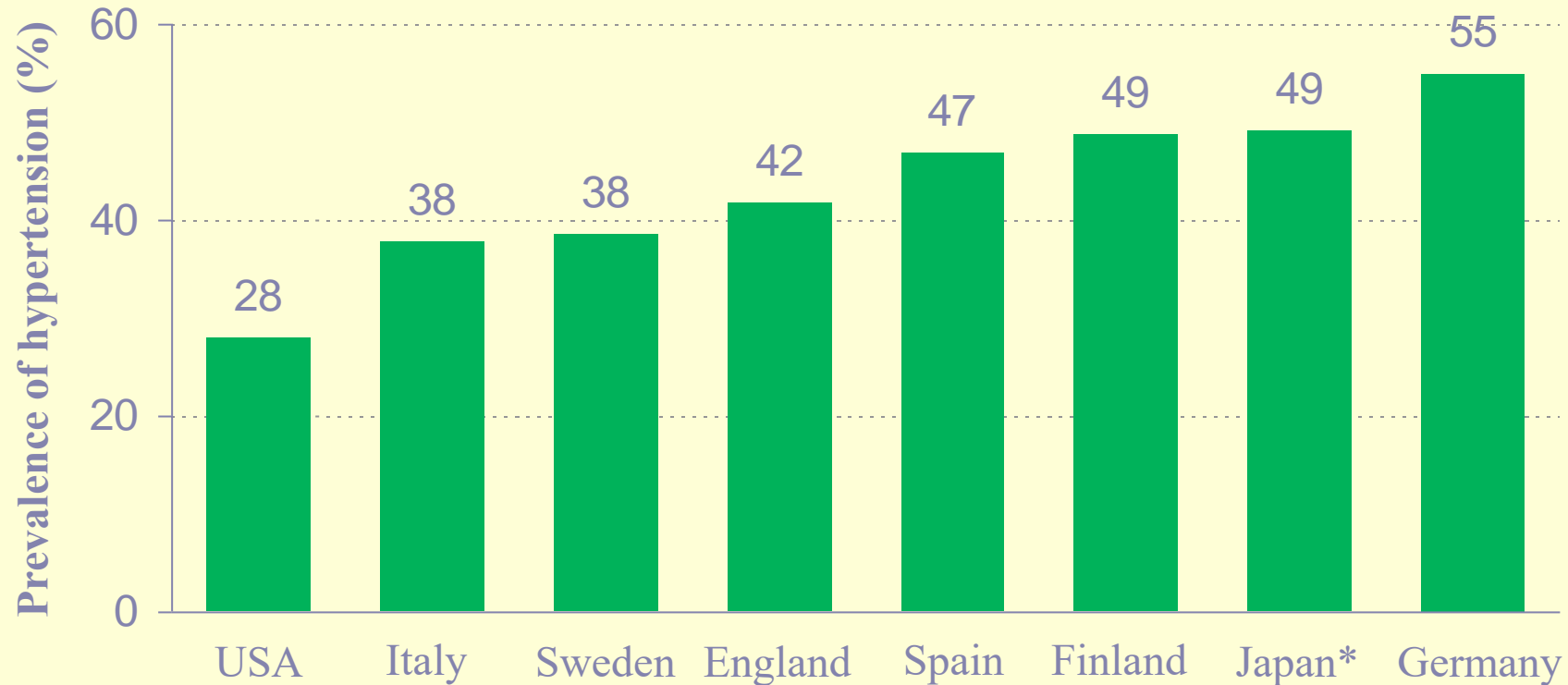
CKD indicates chronic kidney disease; and CVD, cardiovascular disease.



Prevalence of Hypertension in USA

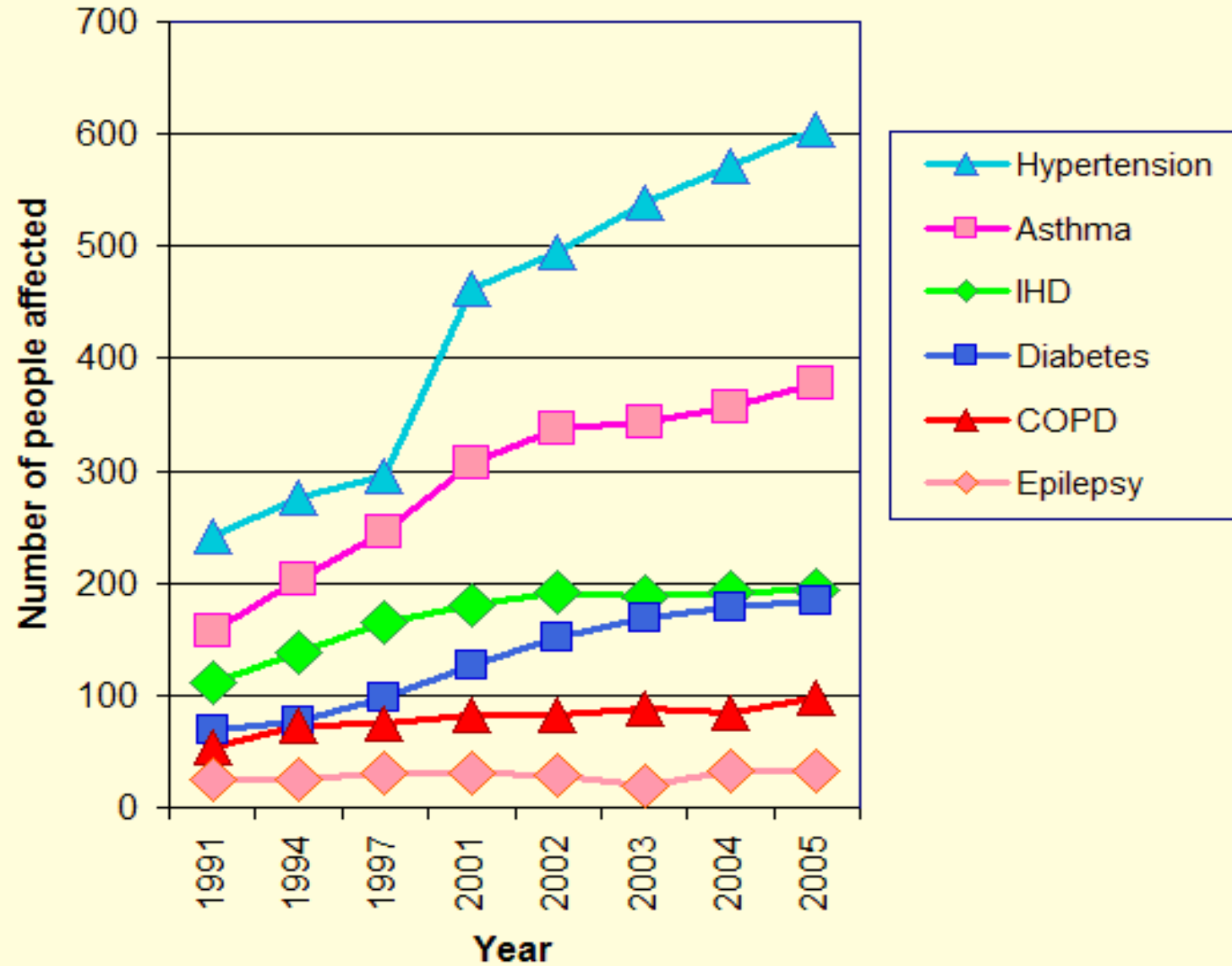
- **>100 million Americans have hypertension (HTN)**
- **Of those diagnosed with HTN < 50% have their blood pressure under control**
- **Lack of or inadequate treatment leads to serious complications**

High Prevalence of Hypertension Worldwide



Adults aged 35–64 y (data are age- and sex-adjusted), except* (adults aged ≥ 30 y)
Hypertension defined as BP $\geq 140/90$ mmHg or on treatment

Prevalence of Hypertension



Awareness, Treatment and Control of Hypertension is Rather Low Worldwide

Proportion of patients in the population (%)			
Country	Aware	Treated	Controlled*
Japan	16.0	–	4.1
England	35.8	24.8	10.0
Germany	36.5	26.1	7.8
Spain	38.9	26.8	5.0
Sweden	48.0	26.2	5.5
Italy	51.8	32.0	9.0
USA	69.3	52.5	28.6

* BP < 140/90 mmHg

Are We Loosing The War Against Hypertension? Why?

Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013



GBD 2013 Risk Factors Collaborators*

Summary

Background The Global Burden of Disease, Injuries, and Risk Factor study 2013 (GBD 2013) is the first of a series of annual updates of the GBD. Risk factor quantification, particularly of modifiable risk factors, can help to identify emerging threats to population health and opportunities for prevention. The GBD 2013 provides a timely opportunity to update the comparative risk assessment with new data for exposure, relative risks, and evidence on the appropriate counterfactual risk distribution.

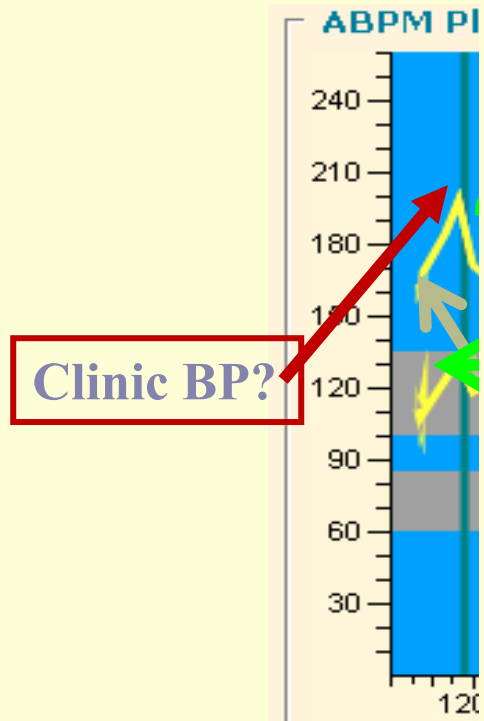
Lancet 2015; 386: 2287–323
Published Online
September 11, 2015
[http://dx.doi.org/10.1016/S0140-6736\(15\)00128-2](http://dx.doi.org/10.1016/S0140-6736(15)00128-2)
See [Comment](#) page 2235

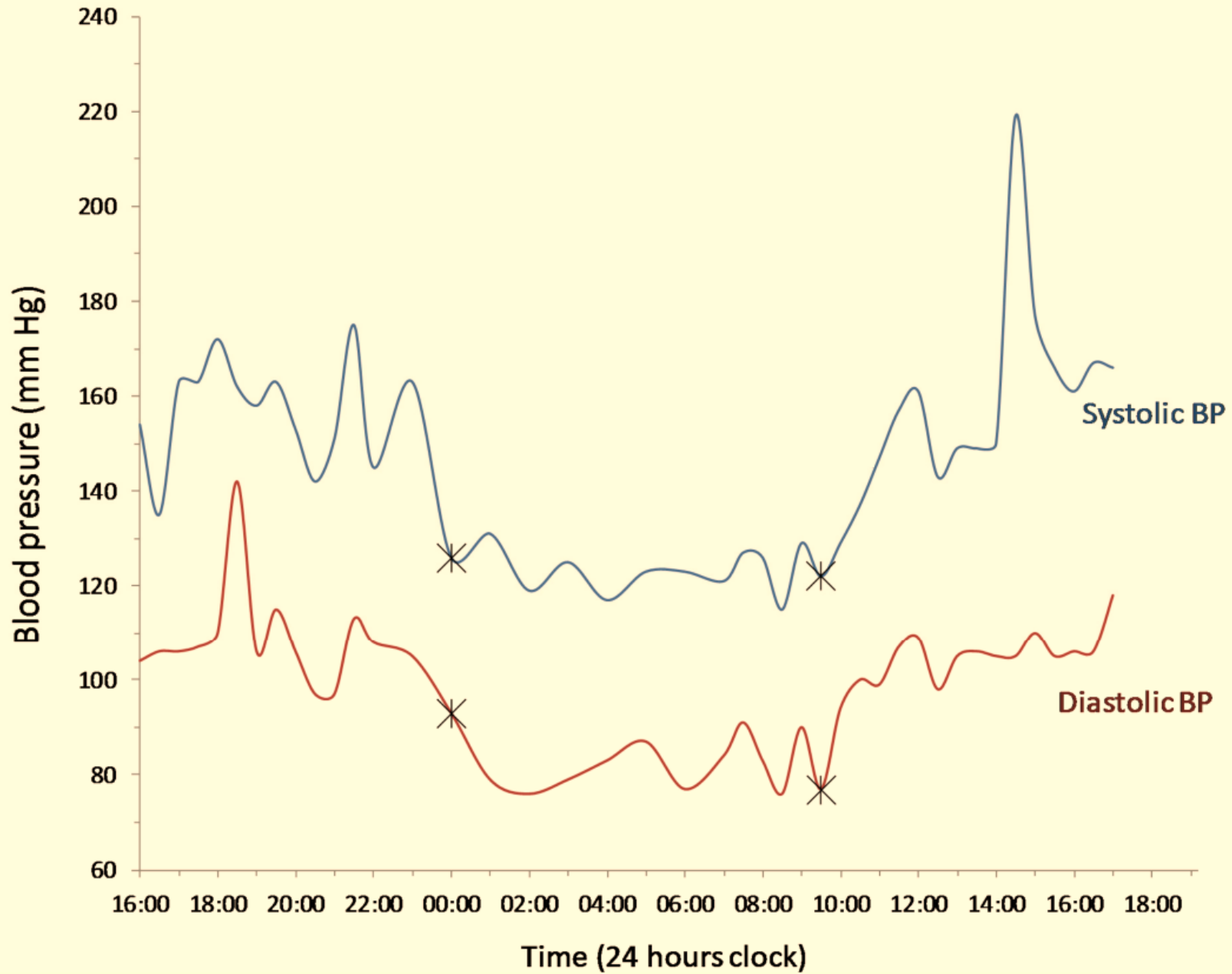
Almost a 50% increase in deaths due to high blood pressure

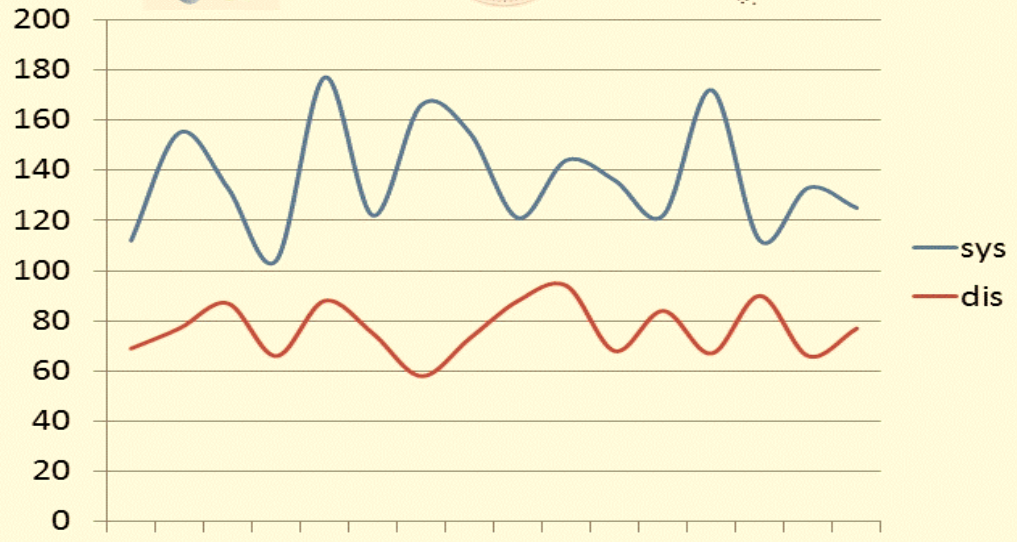
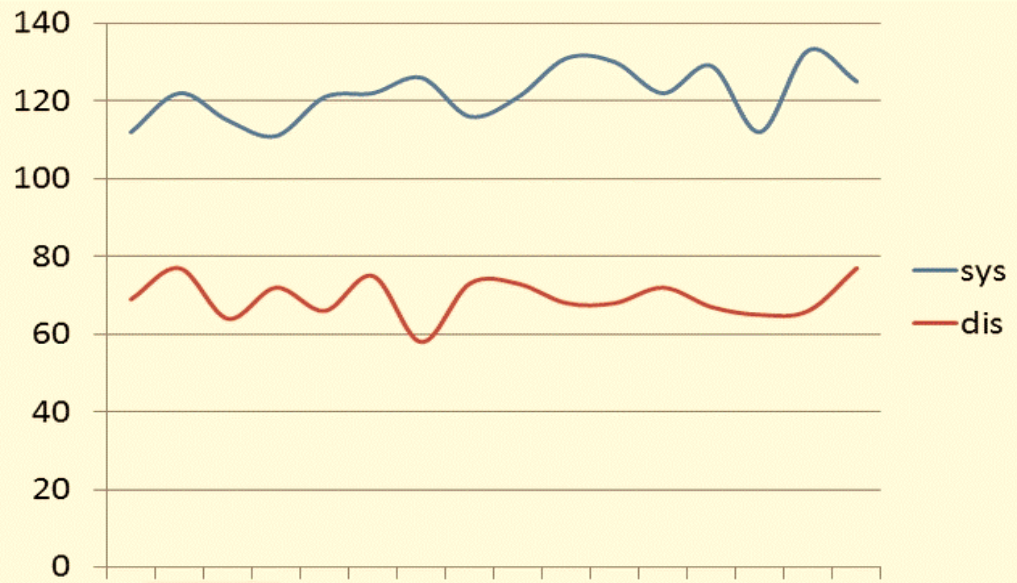
In total, the modifiable risk factors assessed accounted for 30.8 million deaths in 2013, increasing from 25.1 million in 1990.

The team found that high blood pressure, or hypertension, was the greatest mortality risk factor for both men and women. The number of deaths attributable to high blood pressure increased by almost 50% between 1990 and 2013, according to the results.

What is really blood pressure?







Definitions of hypertension by office and out-of-office blood pressure levels

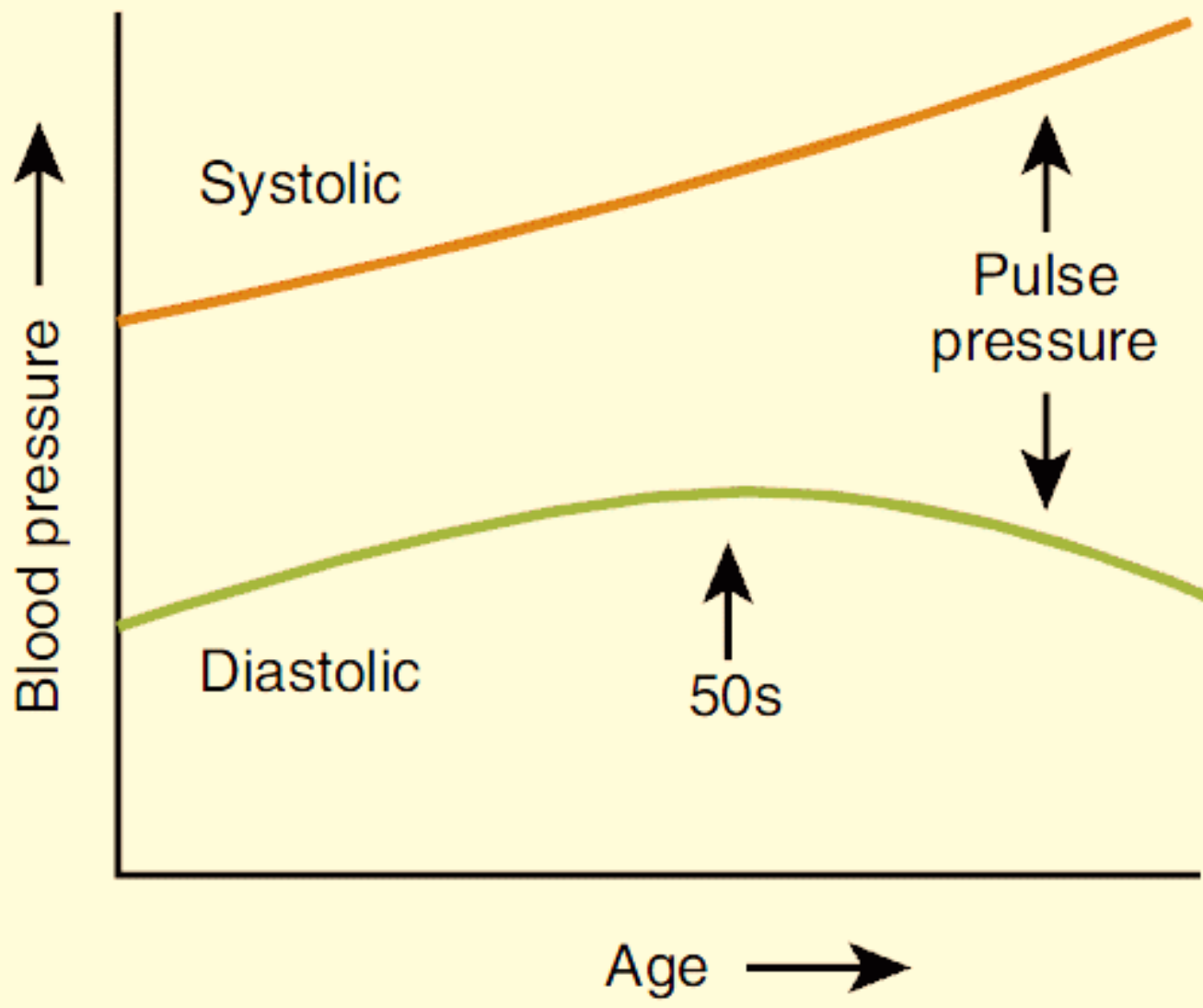
Category	Systolic BP (mmHg)		Diastolic BP (mmHg)
Office BP	≥140	and/or	≥90
Ambulatory BP			
Daytime (or awake)	≥135	and/or	≥85
Nighttime (or asleep)	≥120	and/or	≥70
24-h	≥130	and/or	≥80
Home BP	≥135	and/or	≥85



Pulse Pressure

$$PP = SBP - DBP$$

- Increase in *pulse pressure* (PP) indicates greater stiffness in large conduit arteries, primarily the thoracic aorta.
- PP, therefore, is a surrogate measure of dynamic, cyclic stress during systole.
- PP may be a better marker of increased CV risk than either systolic BP or diastolic BP alone in older persons.



180/110 vs. 180/60 ??

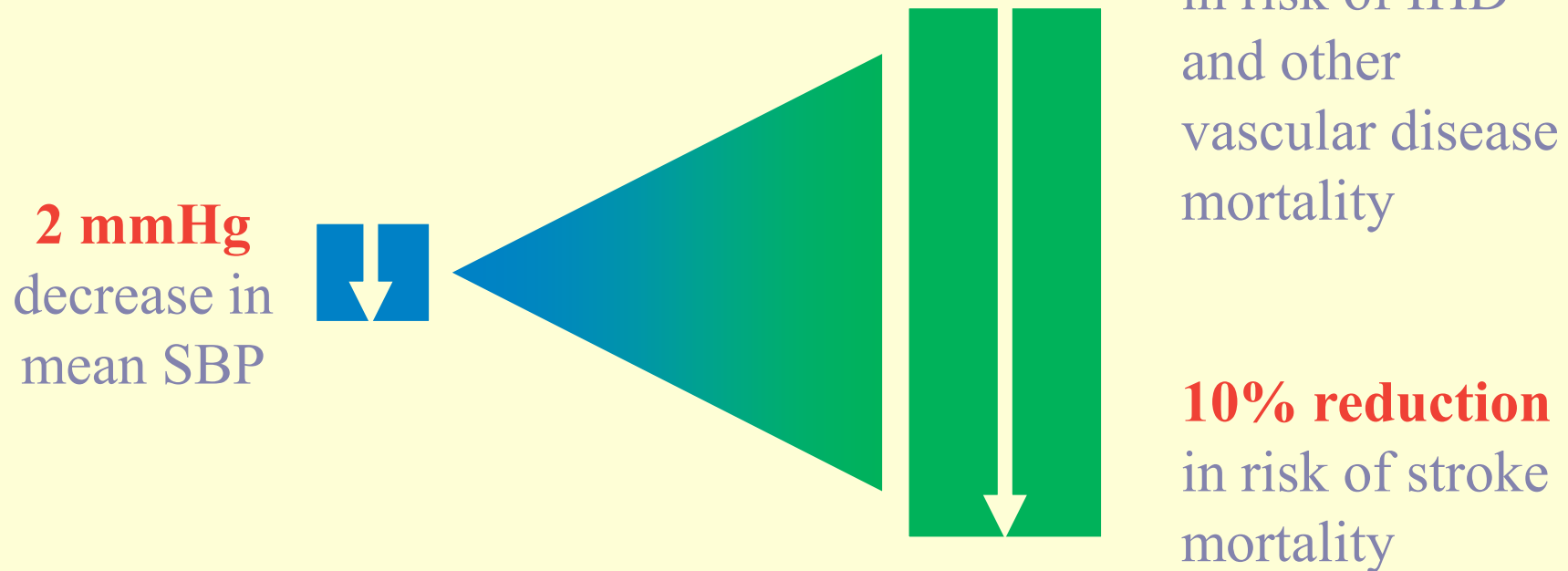


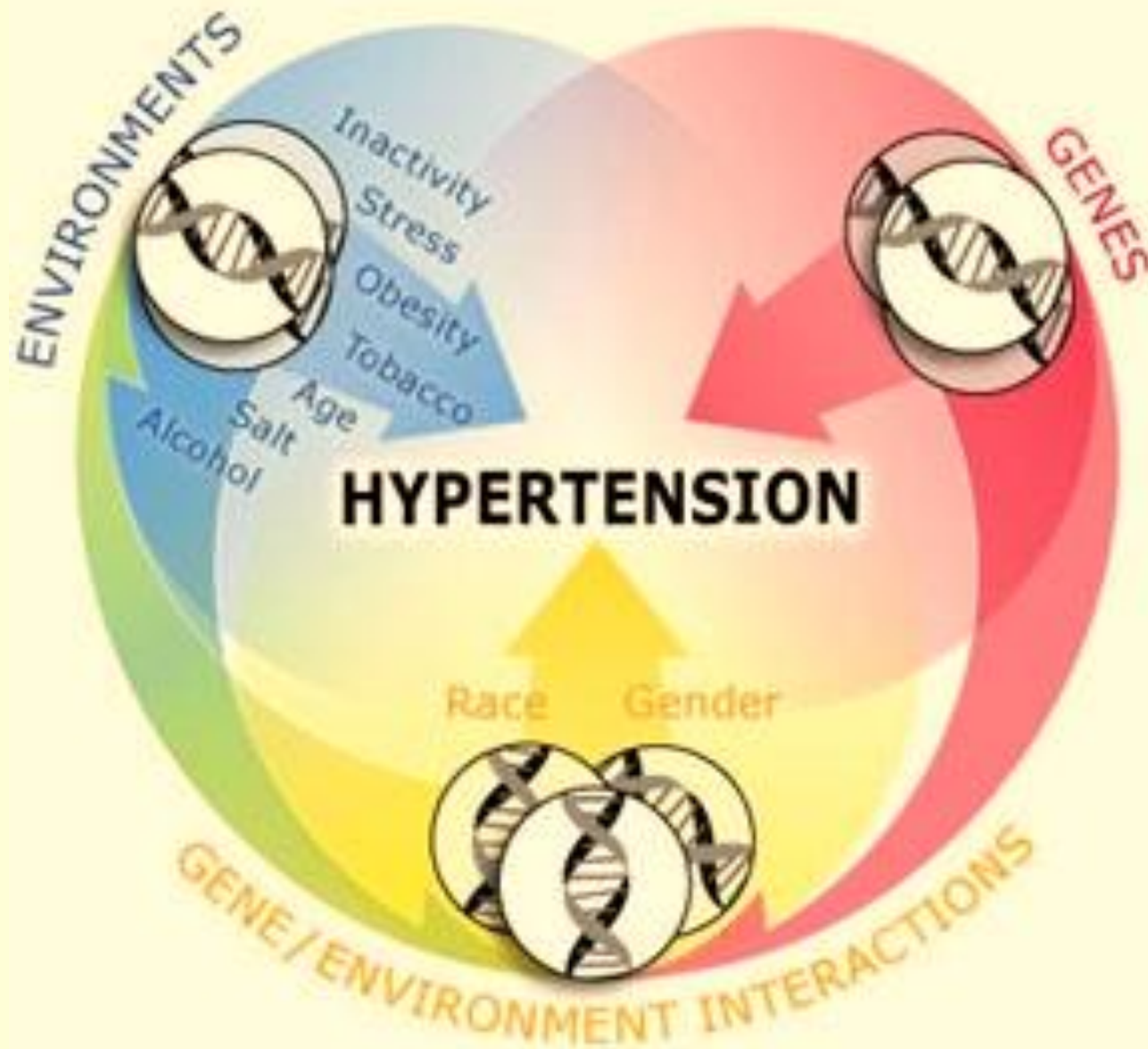
Benefits of Lowering BP

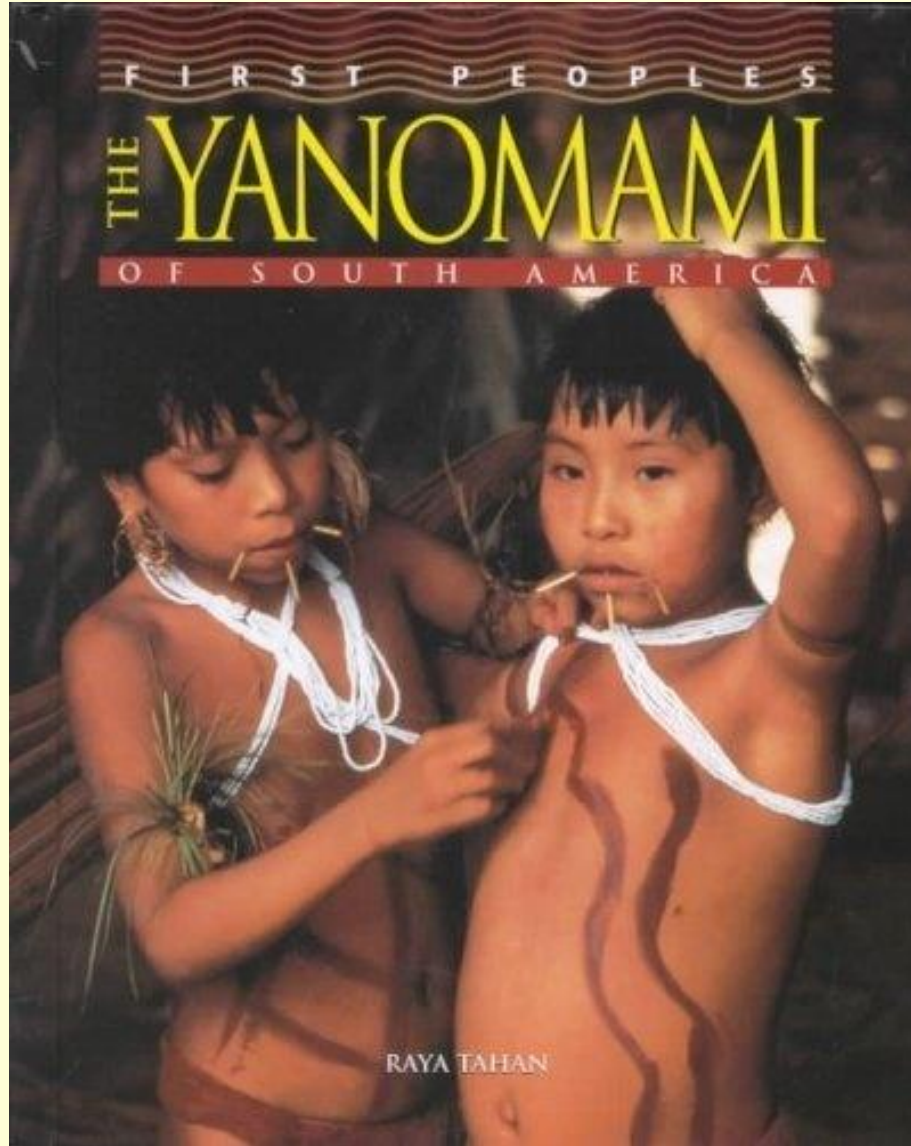
	Average Percent Reduction
Stroke incidence	35–40%
Myocardial infarction	20–25%
Heart failure	50%

Each 2 mmHg Decrease in SBP Reduces CV Risk by 7–10%

- Meta-analysis of 61 prospective, observational studies
- 1 million adults aged 40–69 y with BP > 115/75 mmHg
- 12.7 million person-years







Causes of Secondary Hypertension With Clinical Indications

Common causes
Renal parenchymal disease
Renovascular disease
Primary aldosteronism
Obstructive sleep apnea
Drug or alcohol induced
Uncommon causes
Pheochromocytoma/paraganglioma
Cushing's syndrome
Hypothyroidism
Hyperthyroidism
Aortic coarctation (undiagnosed or repaired)
Primary hyperparathyroidism
Congenital adrenal hyperplasia
Mineralocorticoid excess syndromes other than primary aldosteronism
Acromegaly



What are the Symptoms?



- **Symptoms may or may not be present**

- Dizziness (unsteadiness)
- Early morning headache
- ↓ activity tolerance
- Malaise, fatigue
- Blurring of vision
- Spontaneous nosebleed
- Palpitations, angina, dyspnea
- Early signs/symptoms are often missed

health

THE SILENT KILLER

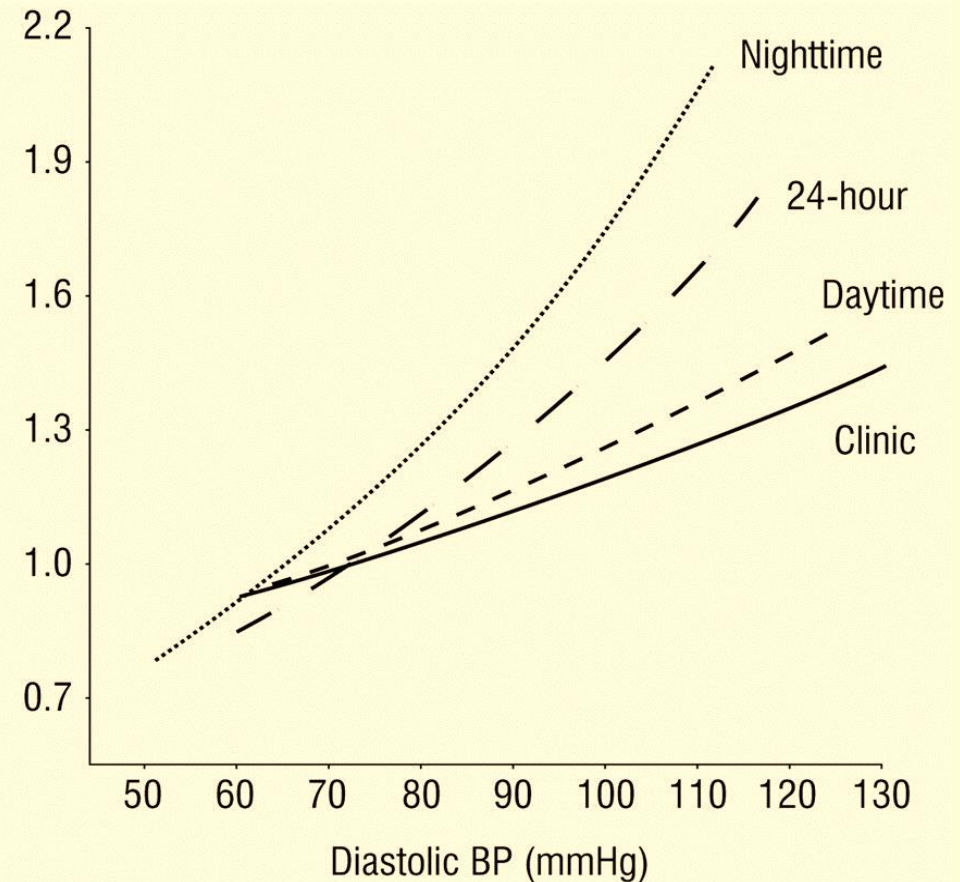
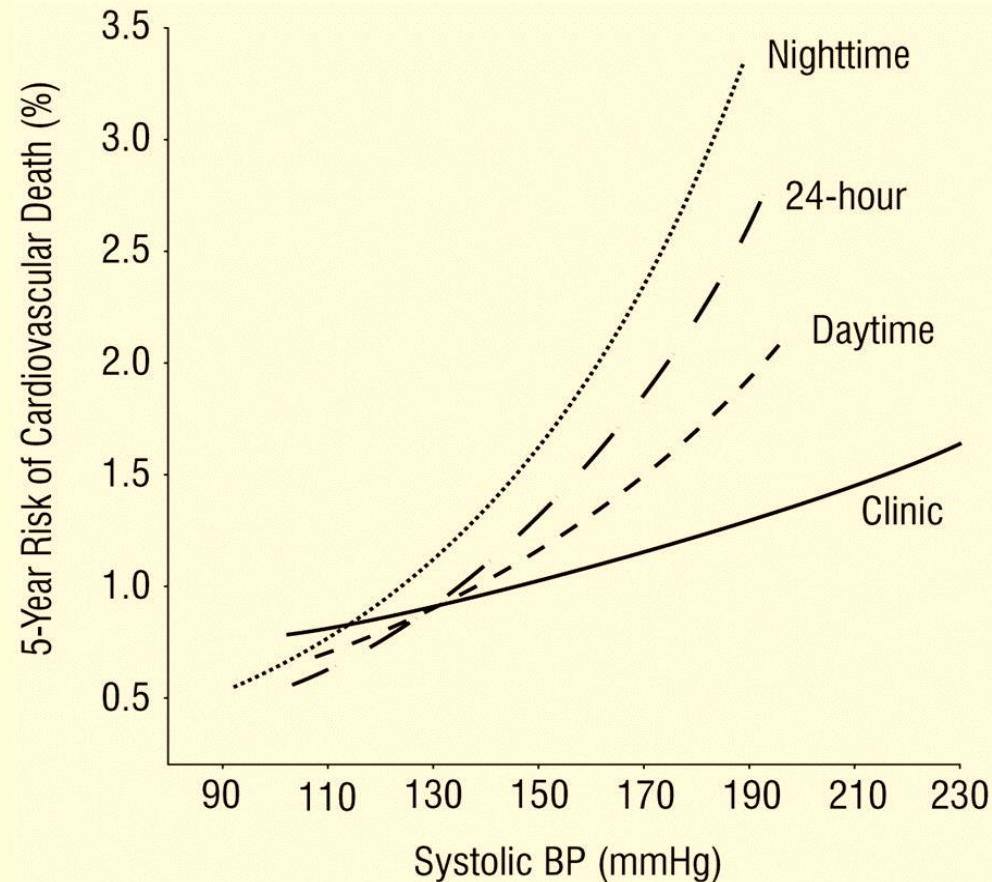
DEALING WITH HYPERTENSION

 NEW AMERICA
MEDIA  KAISER PERMANENTE.





Superior predictive value of nocturnal BP on CV mortality





BP measurement

● **Physical assessment**

- Height & weight
- Blood pressure

● **Measuring BP accurately:**

- No smoking or caffeine 30 minutes before
- Rest for 5 minutes prior to BP
- Apply cuff to bare arm

- Proper size cuff applied 1 inch above brachial artery
- Inflate cuff to 30 mmHg above initial radial pulse check If BP elevated, wait 2 minutes, recheck
- Check BP in other arm



BP Measurement Techniques

Method	Brief Description
In-office	Two readings, 5 minutes apart, sitting in chair. Confirm elevated reading in contralateral arm. 140/90
Ambulatory BP monitoring	Indicated for evaluation of “white-coat” HTN. Absence of 10–20% BP decrease during sleep may indicate increased CVD risk. 130/80
Self-measurement	Provides information on response to therapy. May help improve adherence to therapy and evaluate “white-coat” HTN. 135/85

Types of HTN?

■ Primary

- ?? ‘essential’ idiopathic
- Most common type found in 90-95% of those with HTN
- Cause not well understood
 - Salt sensitive
 - RAAS dependent

■ Secondary

- Caused by some other medical problem or condition:
 - High-dose estrogen
 - Renal artery stenosis
 - Pregnancy (PET)
 - Cushing’s syndrome
 - pheochromocytoma
 - Others?

EVALUATION OF NEWLY DIAGNOSED HYPERTENSIVES



Blood Chemistries

- Serum Potassium
- Creatinine
- Cholesterol
- Blood Glucose
- Uric Acid

Electrocardiogram



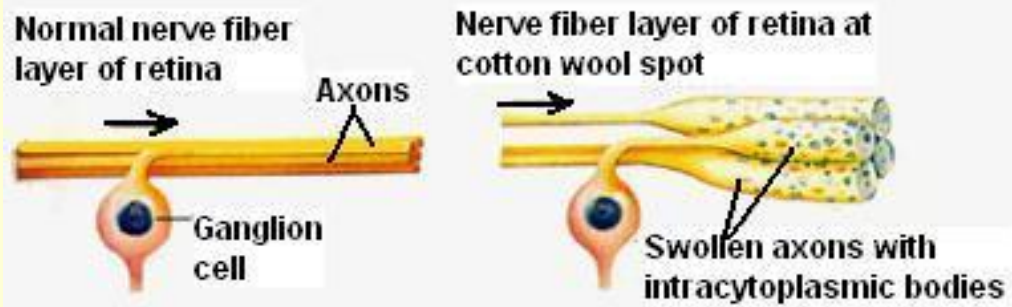
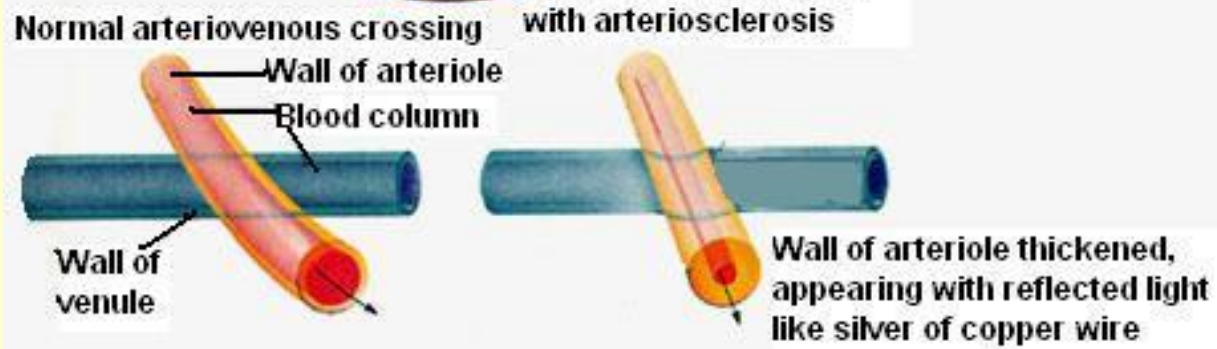
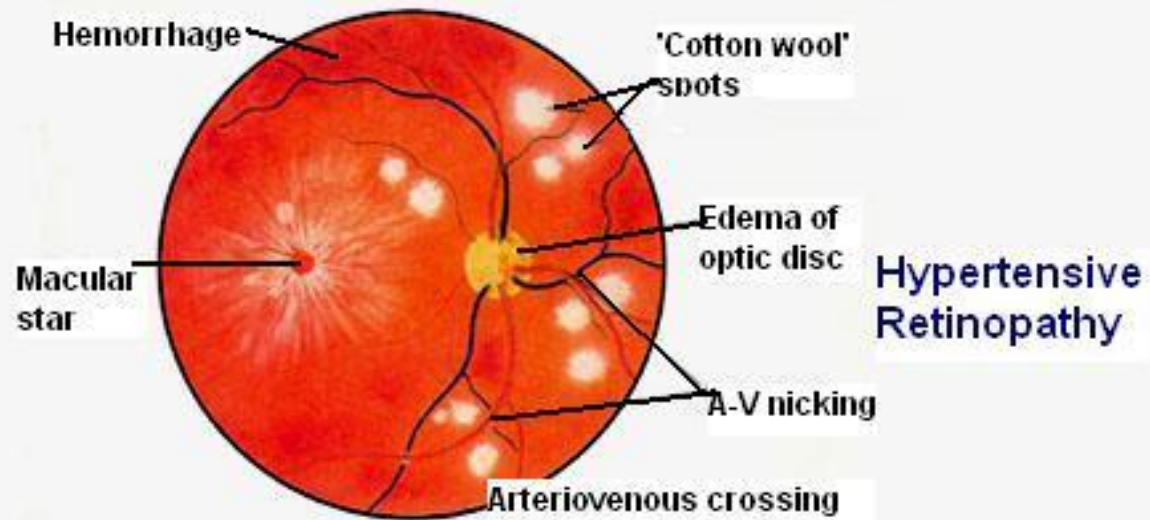
CBC



Urinalysis

Chest X-Ray





Basic and Optional Laboratory Tests for Primary Hypertension

Basic testing	Fasting blood glucose*
	Complete blood count
	Lipid profile
	Serum creatinine with eGFR*
	Serum sodium, potassium, calcium*
	Thyroid-stimulating hormone
	Urinalysis
	Electrocardiogram
Optional testing	Echocardiogram
	Uric acid
	Urinary albumin to creatinine ratio

*May be included in a comprehensive metabolic panel.
eGFR indicates estimated glomerular filtration rate.

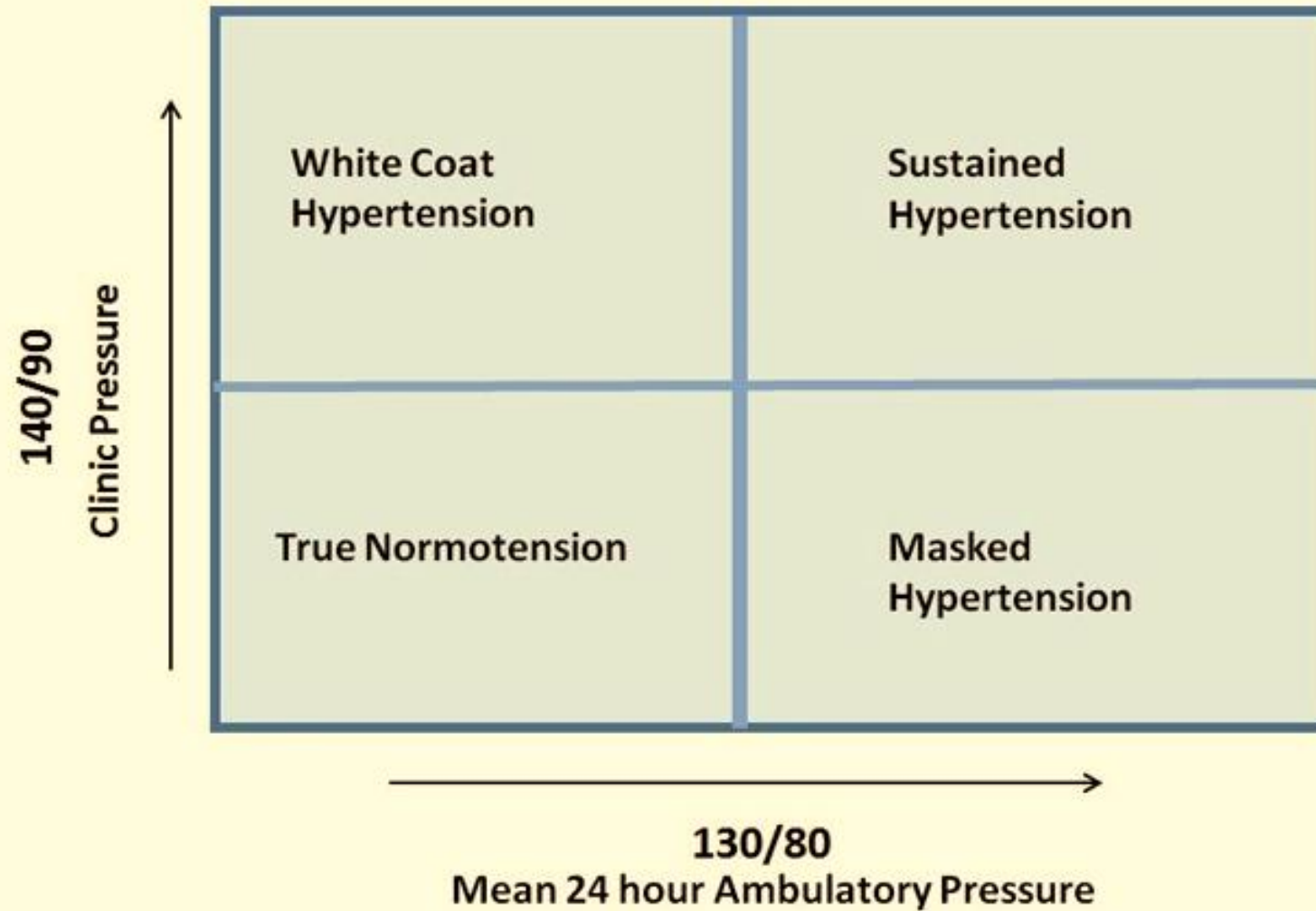


ABPM ?



Renin level ??

Patterns of Blood pressure





Complications of HTN

- **The higher the BP and the longer an individual has hypertension, the higher the risk of complications which include:**
 - Hypertensive heart disease
 - Cerebrovascular disease
 - Peripheral vascular disease
 - Kidney disease
 - Retinal damage

Acute Complications

- **Hypertensive Crisis:**
- Severe and abrupt elevation of BP
- Diastolic over 120mm hg
- High Mortality

- Sx: papilledema, progressive renal failure, encephalopathy
- Most common cause is untreated hypertension
- Goal: slowly decrease BP

Classifications Hypertensive Crisis

- Hypertensive crisis is categorized by the degree of organ damage
- Hypertensive emergency:
- BP is severely elevated and there is evidence of target organ damage
 - Especially brain
- Hypertensive urgency:
- BP is elevated but there is no evidence of target organ damage



GOALS of Treatment ?

Symptoms??

Numbers??

Prevent Complications?



What Reduces Risk of Complications?

REDUCING MODIFIABLE RISK FACTORS IS A KEY INTERVENTION

- Goal = Patient teaching to reduce risk factors
- Drug therapy is initiated if lifestyle changes are not effective to control BP



Management of Hypertension

- **Depends on risk group**
- **Lifestyle modifications**
- **Drug therapy is initiated if lifestyle modifications do not achieve goal**
- **Add or change drugs if goal not achieved**



Lifestyle Modification

- **Lose excess weight**
- **Cut back on salt**
- **Exercise regularly**
- **Cease alcohol intake**
- **Adopt the DASH eating plan to decrease cholesterol intake**
- **STOP smoking**

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?



DASH Diet

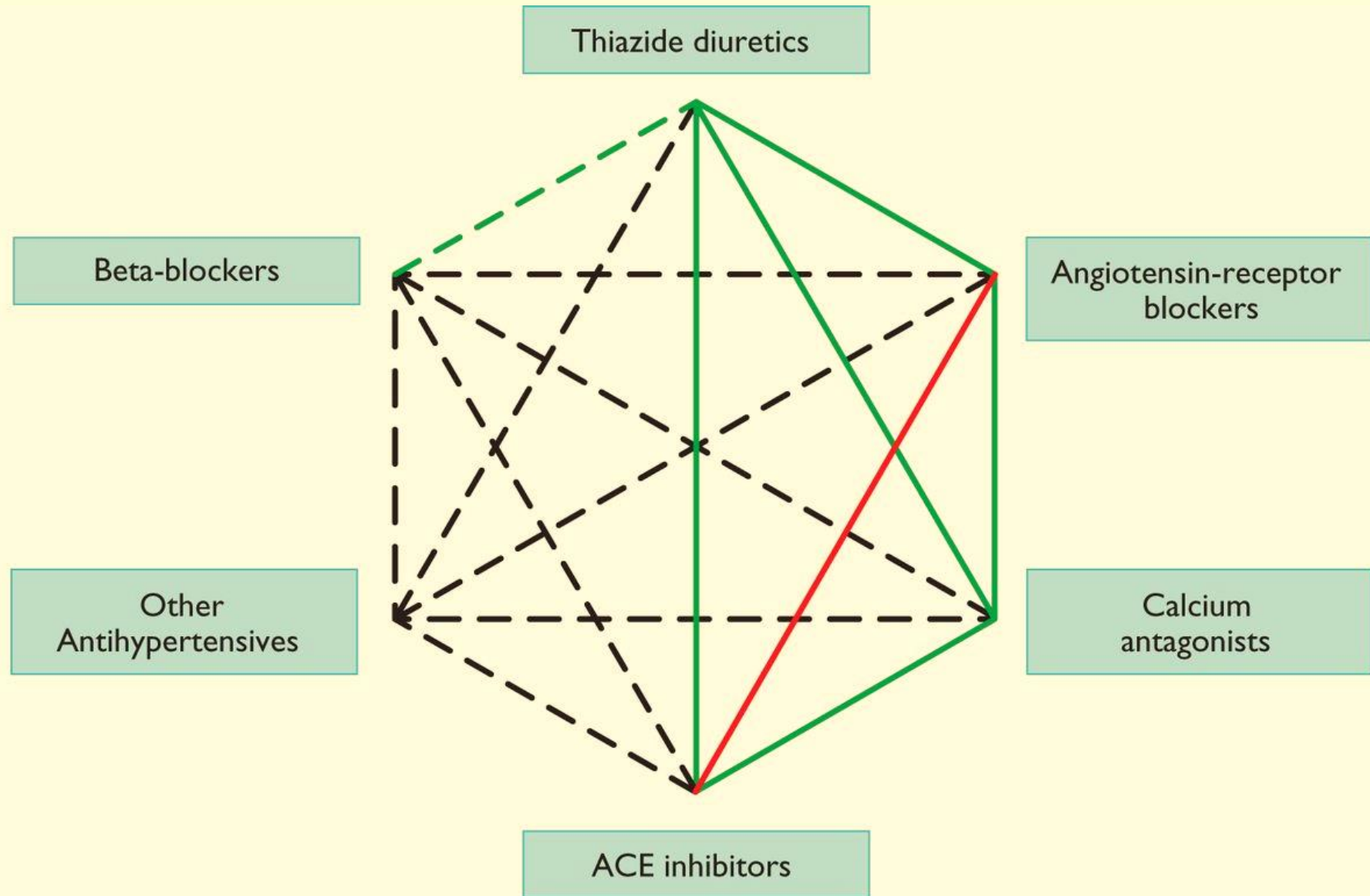
- <http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/>
- **Dietary Approaches to Stop Hypertension = DASH**
 - A diet rich in fruits, vegetables and low-fat dairy products with reduced fat content
 - Limits sodium intake to 2.4 g/day

Non-pharmacologic Management of Hypertension

Follow the DASH diet to potentially lower your blood pressure.



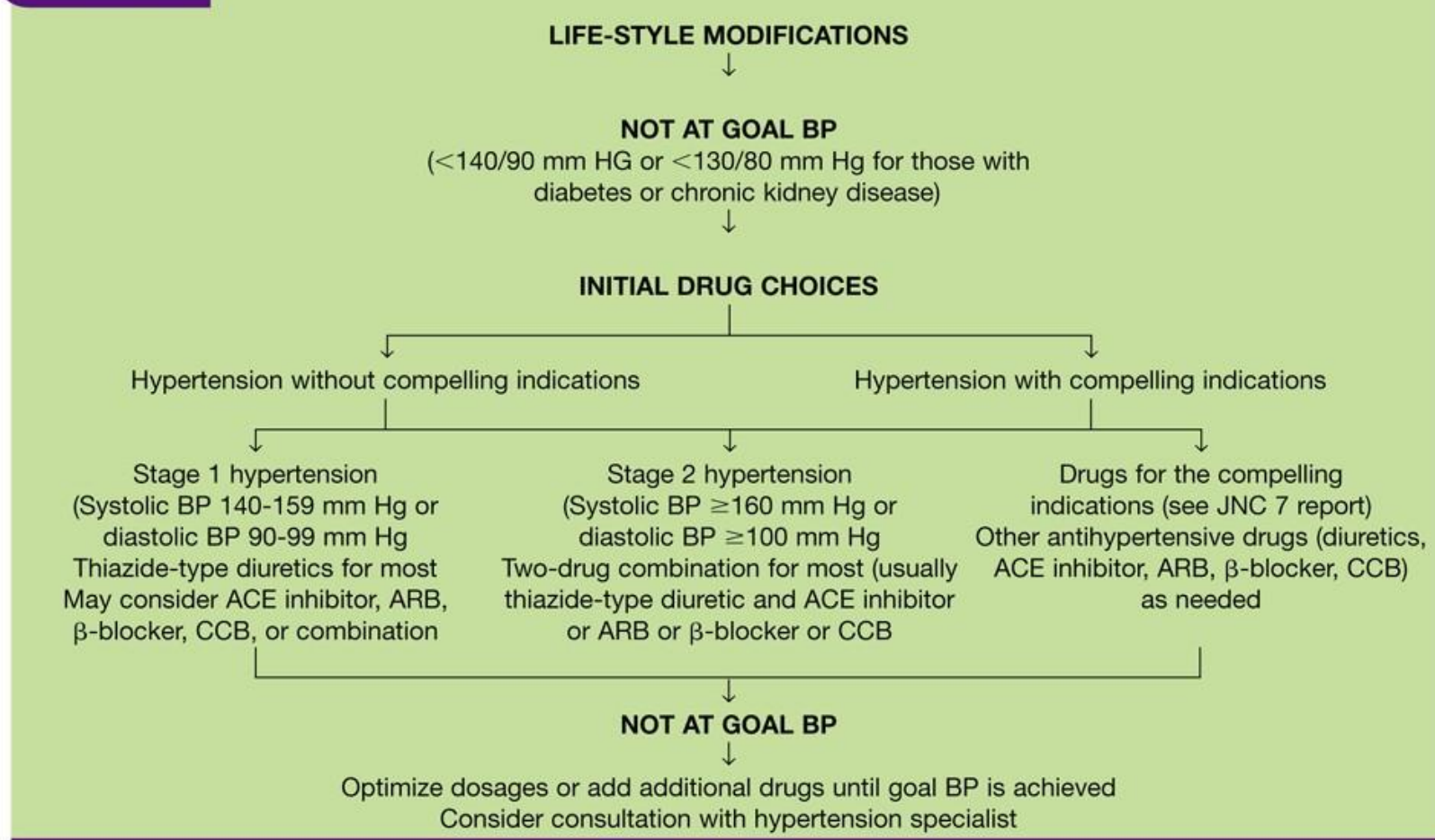
- **Weight management**
 - DASH
- **Low sodium-low fat diet**
- **Smoking cessation**
- **Restrict alcohol and caffeine**
- **Regular aerobic exercise**
- **Stress management**
 - bio-feedback, relaxation



ACE = angiotensin-converting enzyme.

BOX 23-1

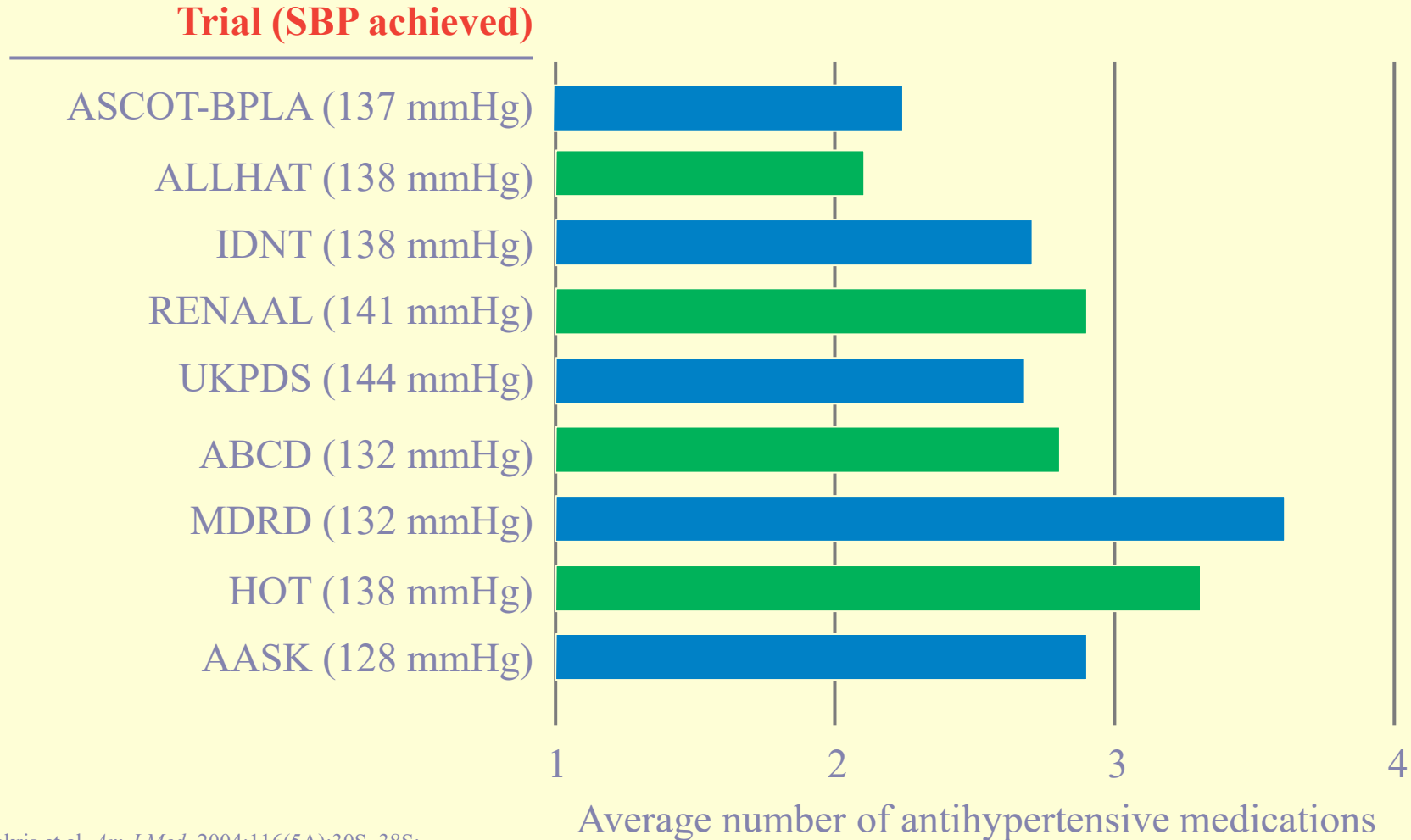
SUMMARY OF TREATMENT RECOMMENDATIONS FOR HYPERTENSION



Data from Chobanian AV et al: The JNC 7 Report, *JAMA* 289(19):2560-2572, 2003.

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The Majority of Hypertensive Patients Need Combination Therapy to Achieve BP Goals



Drug Therapy for HTN

● Diuretics

- *Flush excess water and sodium from the body*
- Thiazide diuretics
- Loop diuretics: furosemide (Lasix)
- Potassium sparing: Aldactone

● Beta adrenergic blockers

● Three classes:

- Cardioselective
- Non-selective
- Combined alpha-beta-blockers





Pharmacologic Management of Hypertension

● **Angiotensin converting enzyme (ACE) inhibitors**

- Decrease effect of RAA system: Capoten, Lisinopril
- Diabetes mellitus w/proteinuria, heart failure

● **Angiotensin II receptor blockers (ARB)**

- Prevent action of angiotensin II and produce vasodilation
- losartan (Cozaar)



Pharmacologic Management of Hypertension

● **Alpha-adrenergic blockers**

- Suppress nerve impulses to blood vessels, which allows blood to pass more easily so BP goes ↓
 - prazosin (Minipress)

● **Calcium channel blockers**

- decrease the influx of Ca^{++} into muscle cells
 - Act on vascular smooth muscles (primary arteries) to decrease spasm and promote vasodilation
 - Amlodipine (Norvasc); felodipine (Plendil)



Pharmacologic Management of Hypertension

● Vasodilators

- **Direct arterial vasodilation**
 - Sodium nitroprusside (Nipride)
 - Often used in hypertensive crisis

● Alpha-receptor agonists

- **Clonidine**
 - Acts on central nervous system
 - Lowers peripheral vascular resistance



Why don't some patients respond to therapy?

● Non-adherence to therapy

- Patients don't take their HTN meds → complications!!!
- Cost, inadequate teaching, side effects, inconvenient dosing

● Drug related causes

● Other conditions

● Secondary hypertension

● Volume overload



Causes of Resistant Hypertension

- Improper BP measurement
- Excess sodium intake
- Inadequate diuretic therapy
- Medication
 - Inadequate doses
 - Drug actions and interactions (e.g., nonsteroidal anti-inflammatory drugs (NSAIDs), illicit drugs, sympathomimetics, oral contraceptives)
 - Over-the-counter (OTC) drugs and herbal supplements
- Excess alcohol intake
- Identifiable causes of HTN

Hill-Bone HBP compliance scale

No.	Item	Response: 1. All of the time 2. Most of the time 3. Some of the time 4. None of the time
1	How often do you forget to take your HBP medicine?	
2	How often do you decide NOT to take your HBP medicine?	
3	How often do you eat salty food?	
4	How often do you shake salt on your food before you eat it?	
5	How often do you eat fast food?	
6	How often do you make the next appointment before you leave the doctor's office?*	
7	How often do you miss scheduled appointments?	
8	How often do you forget to get prescriptions filled?	
9	How often do you run out of HBP pills?	
10	How often do you skip your HBP medicine before you go to the doctor?	
11	How often do you miss taking your HBP pills when you feel better?	
12	How often do you miss taking your HBP pills when you feel sick?	
13	How often do you take someone else's HBP pills?	
14	How often do you miss taking your HBP pills when you are careless?	

* Reverse coding