Getting BP to goal:

Virginia L. Hood MB.BS, MPH, FACP

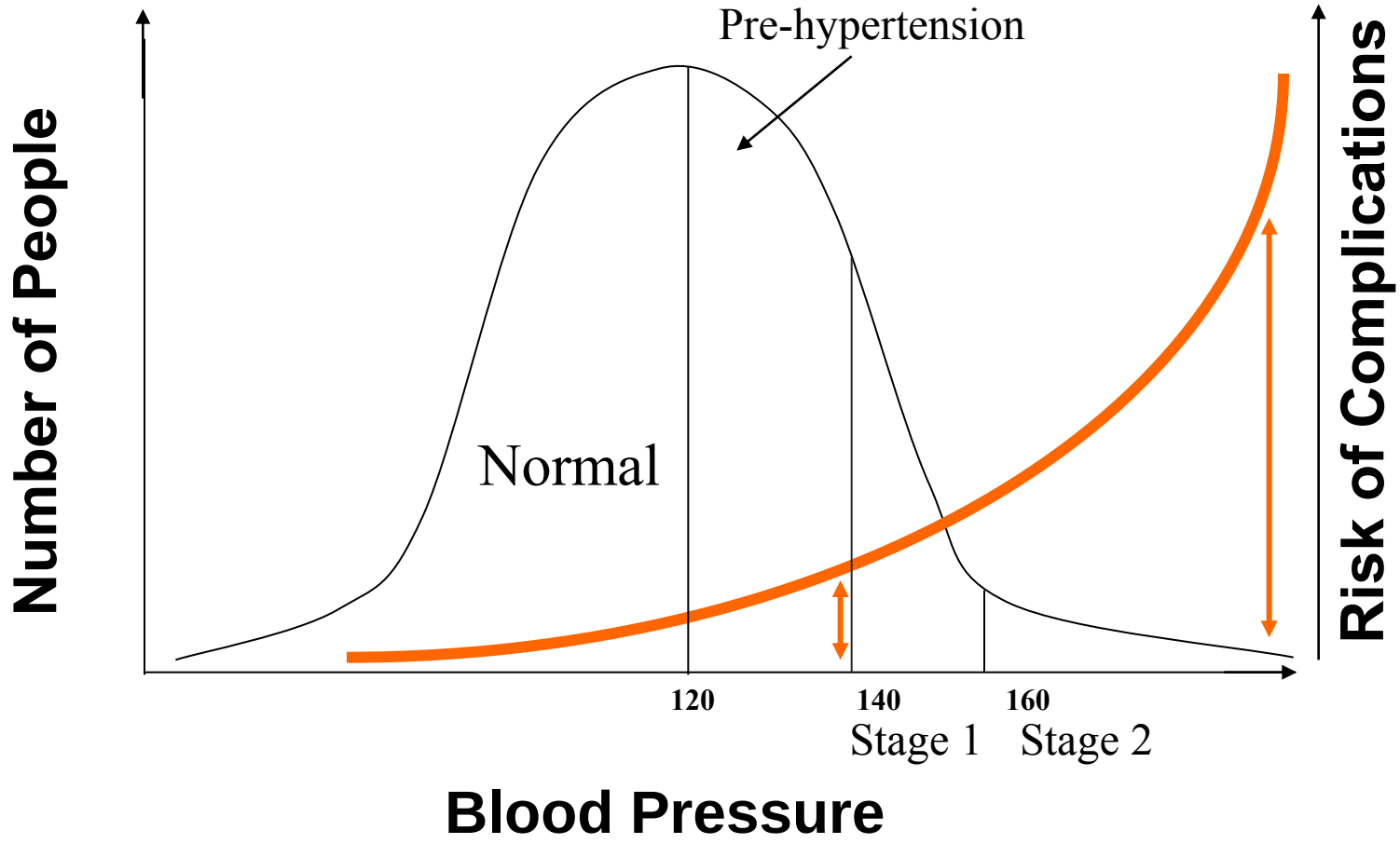
Objectives:

- **Outline pathophysiological processes that sustain high BP**
- **Design individual treatment strategies for BP not at goal**
- **Facilitate patient participation in getting BP to goal**
- **Develop systems to increase percent of patients at goal**

Developed in part for the Best Practices in Managing Hypertension Learning Collaborative with support of an educational grant from American Medical Group Association

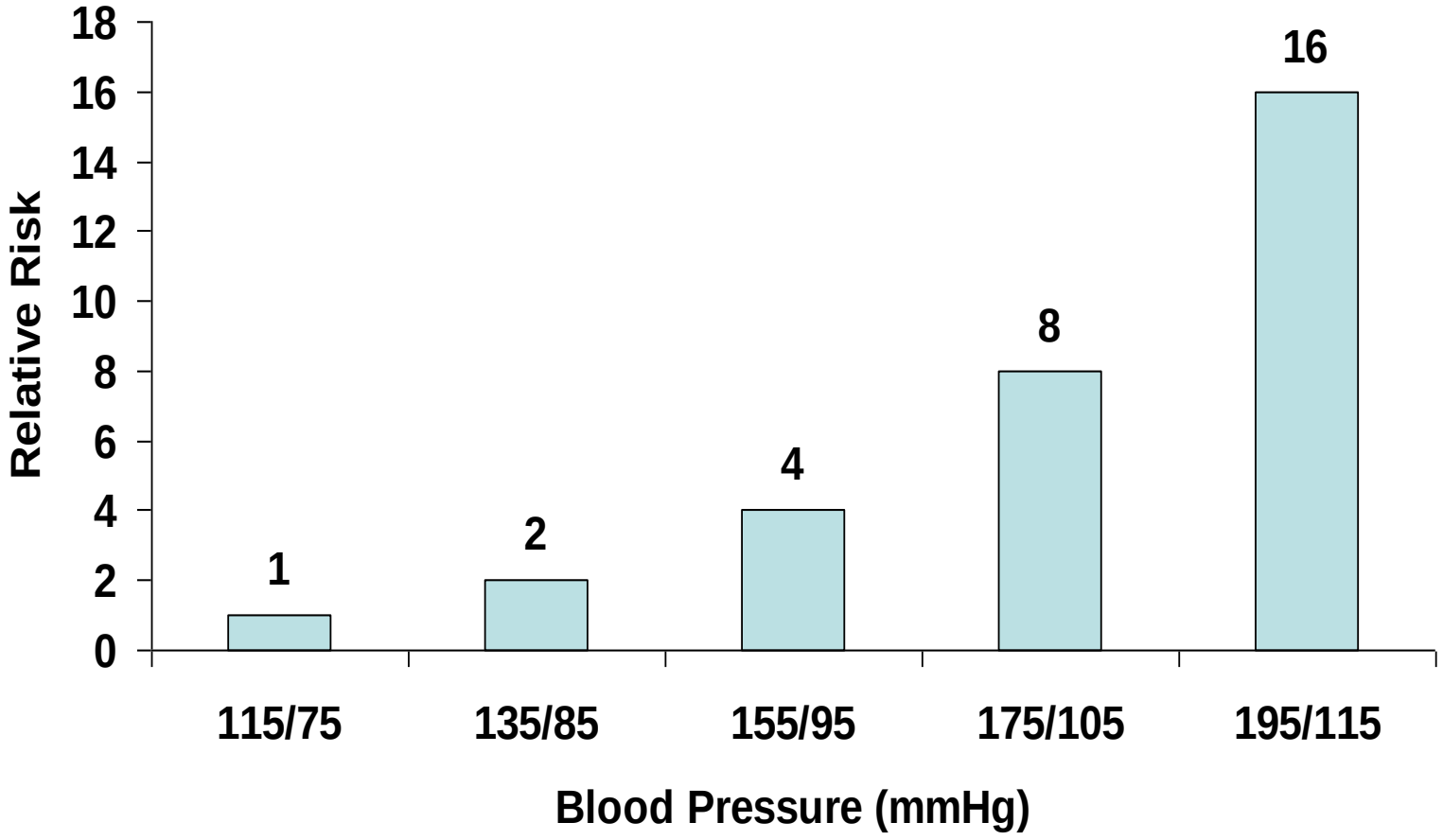
Hypertension

One end of a normally distributed variable



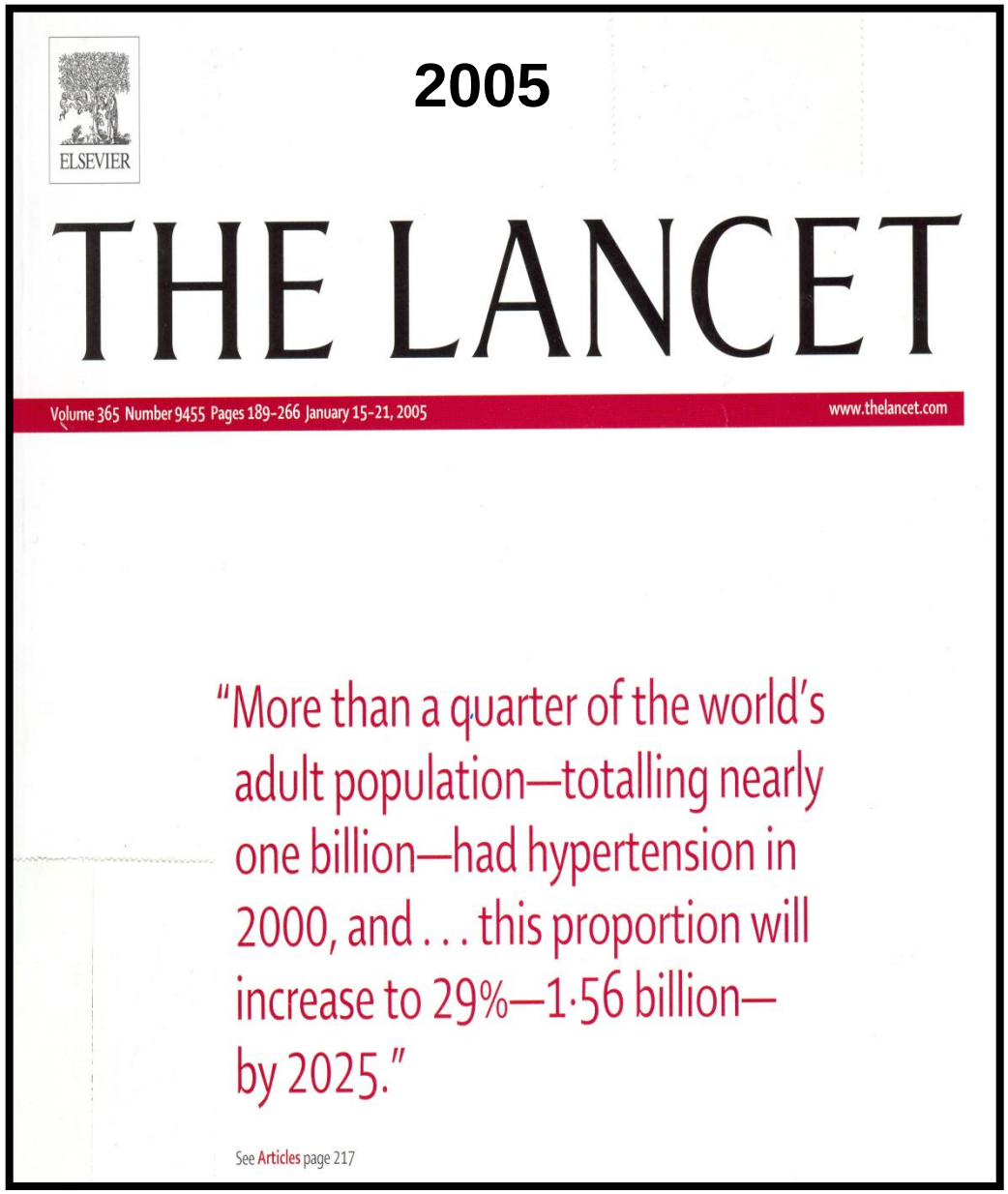
Relative Risk of Cardiovascular Mortality

data from 61 prospective studies involving > 1,000,000 individuals



Lewington et al, Lancet 2002

2005


ELSEVIER
THE LANCET
Volume 365 Number 9455 Pages 189–266 January 15–21, 2005
www.thelancet.com
"More than a quarter of the world's adult population—totalling nearly one billion—had hypertension in 2000, and . . . this proportion will increase to 29%—1·56 billion—by 2025."
See Articles page 217

Hypertension in US– “a neglected disease”

Institute of Medicine (IOM) February 2010

- **1/3 adults have it; 1/2 > 60y, 3/4 >70y**
- **1/6 die as a consequence**
- **easy to prevent,**
  simple to diagnose,
  inexpensive to treat

Hypertension in Bangladesh: a growing concern

- ↑ SBP present in 14% of > 20 y olds (n=2000)
  ↑ BP varies with ↑ age, ↑ BMI, ↑ SES, rural living

  Bang. Med Res Council Bull. 28: 7-18, 2002

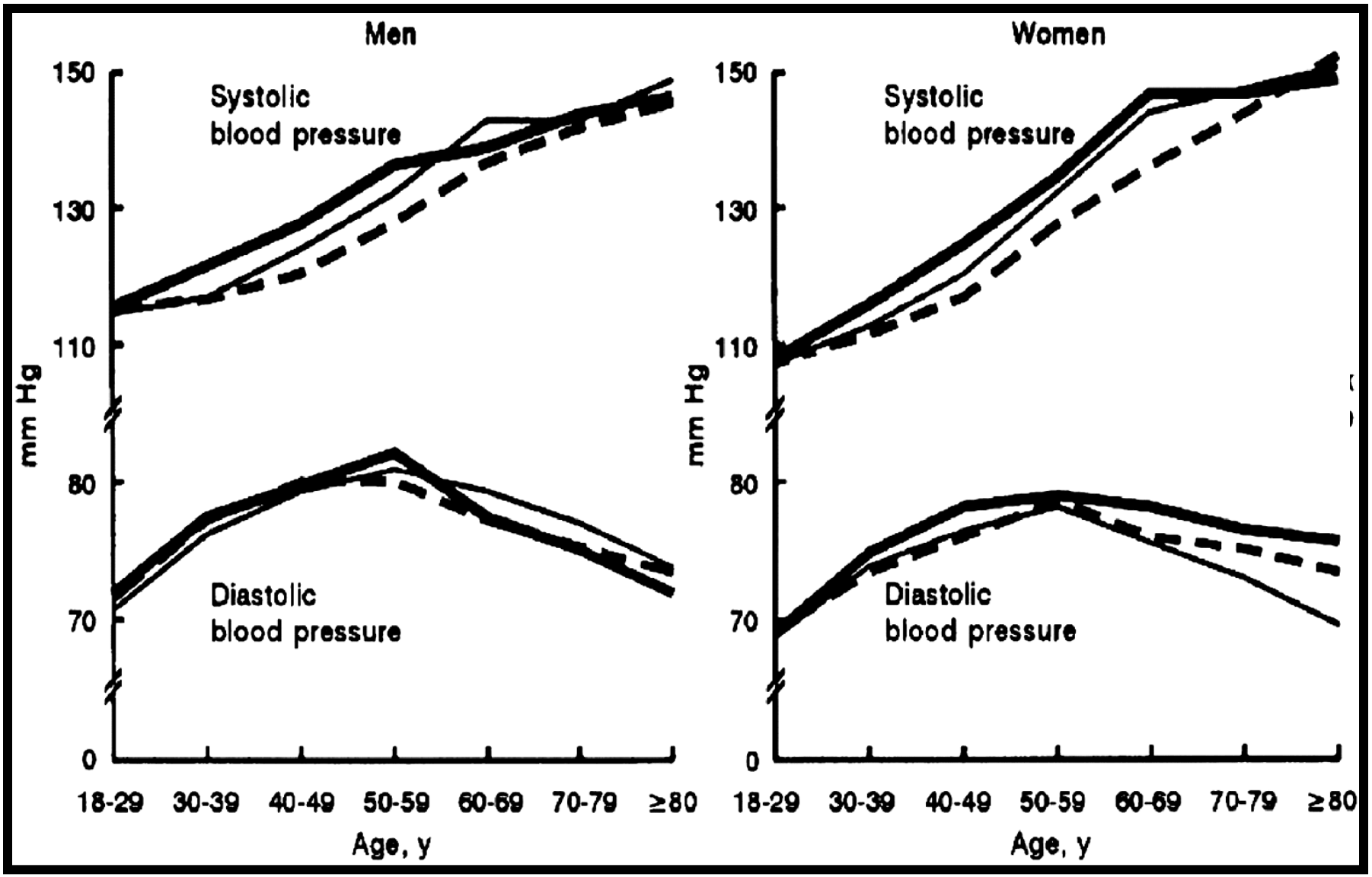
- ↑ BP associated with diet with higher animal protein

  Am J Clin Nutr. 84: 1224-32, 2006

- ↑ BP present in 75% of > 60 y olds (n=240, av BMI 20)
  awareness low, BP control poor

  Sree Chitra Tirunal Institute for Medical Sciences

Change in Blood Pressure with Age



JNC 7, Hypertension 2003

“Systolic BP is all that matters”

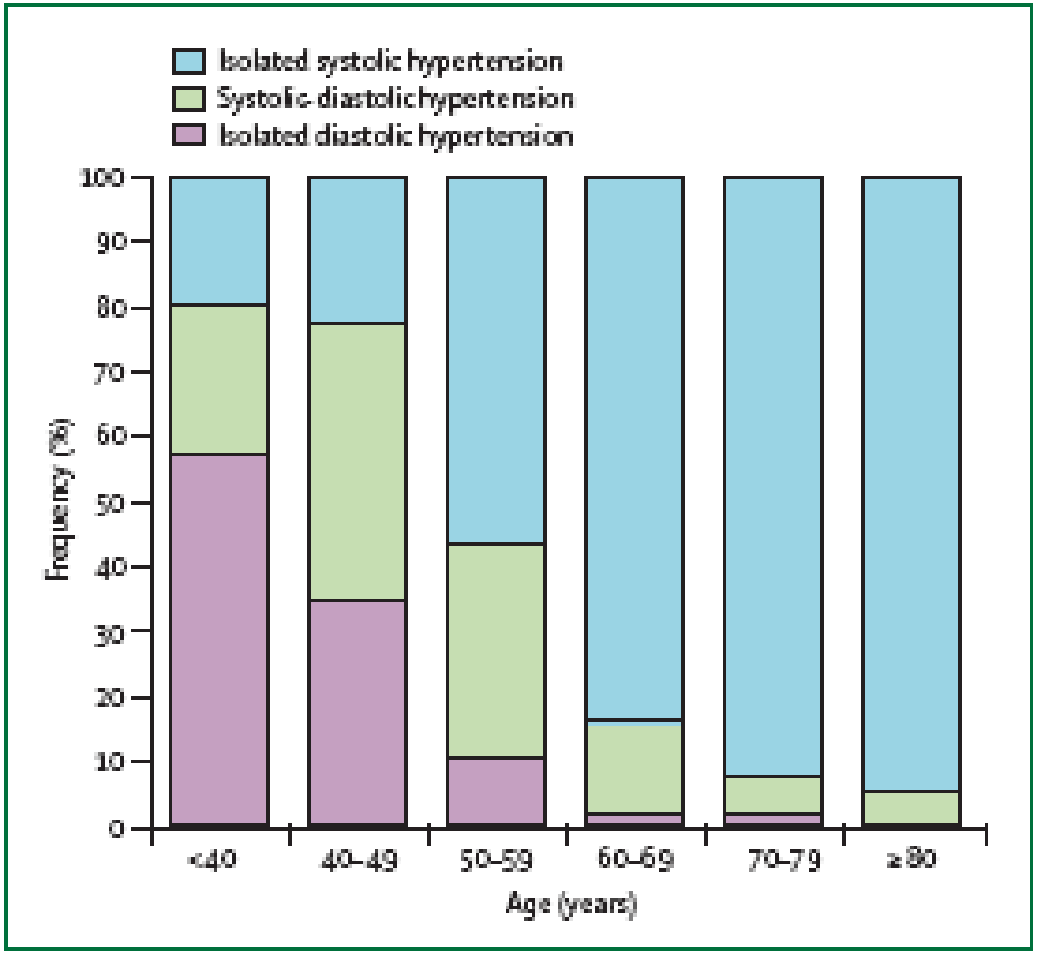
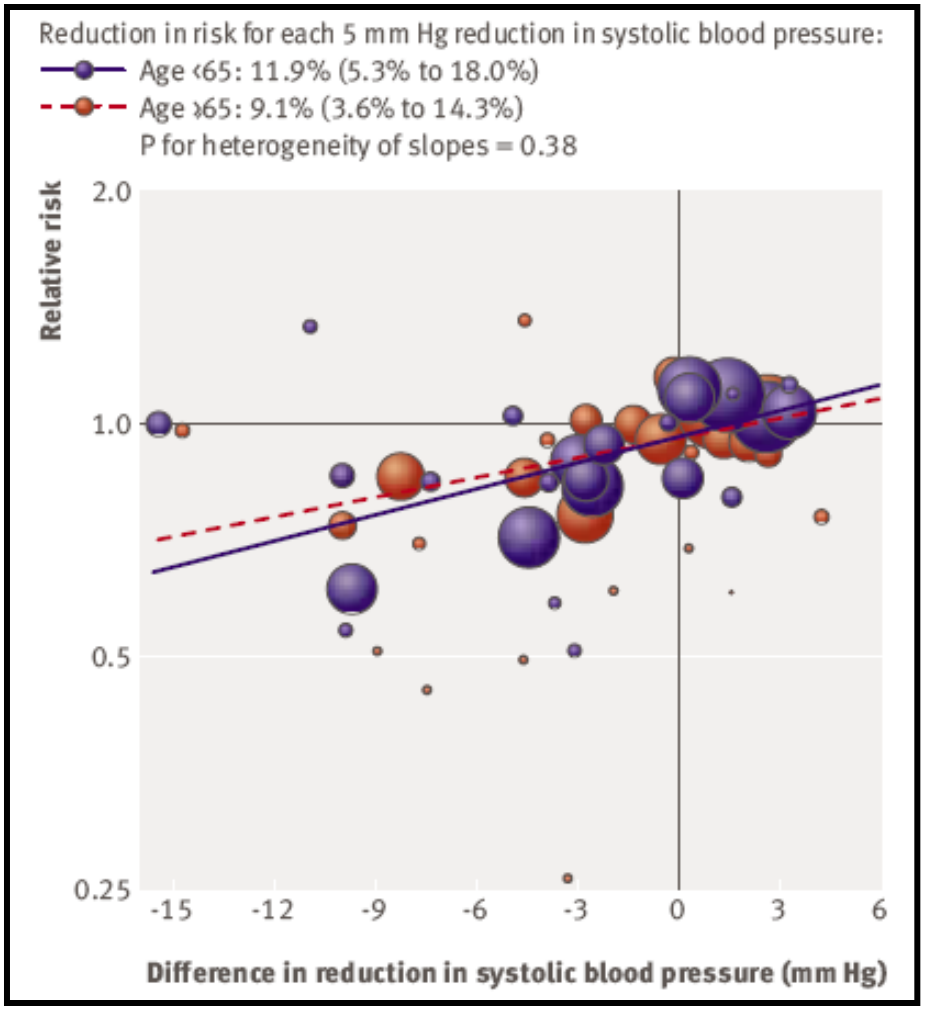


Figure: Categories of blood pressure in untreated hypertensive patients illustrating the importance of systolic blood pressure beyond age 50 years
Adapted from reference 7, with permission.

Williams et al, Lancet 371:2219-21, 2008

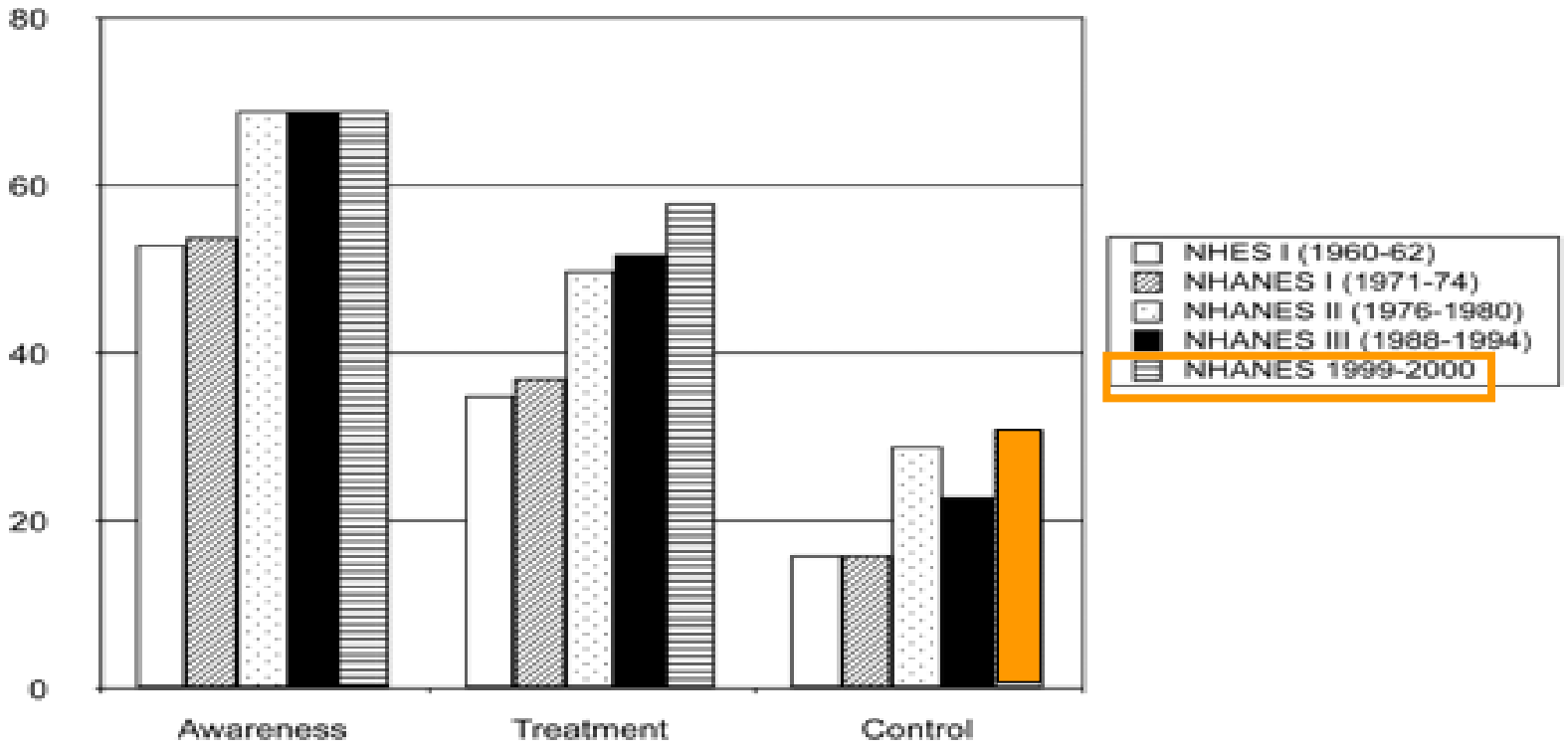
Reducing systolic BP matters

High blood pressure is the foremost modifiable risk factor for reducing stroke and preventing progression of renal and cardiovascular disease



Blood Pressure Lowering Treatment Trialists' Collaboration. *BMJ 2008;336;1121-1123;*

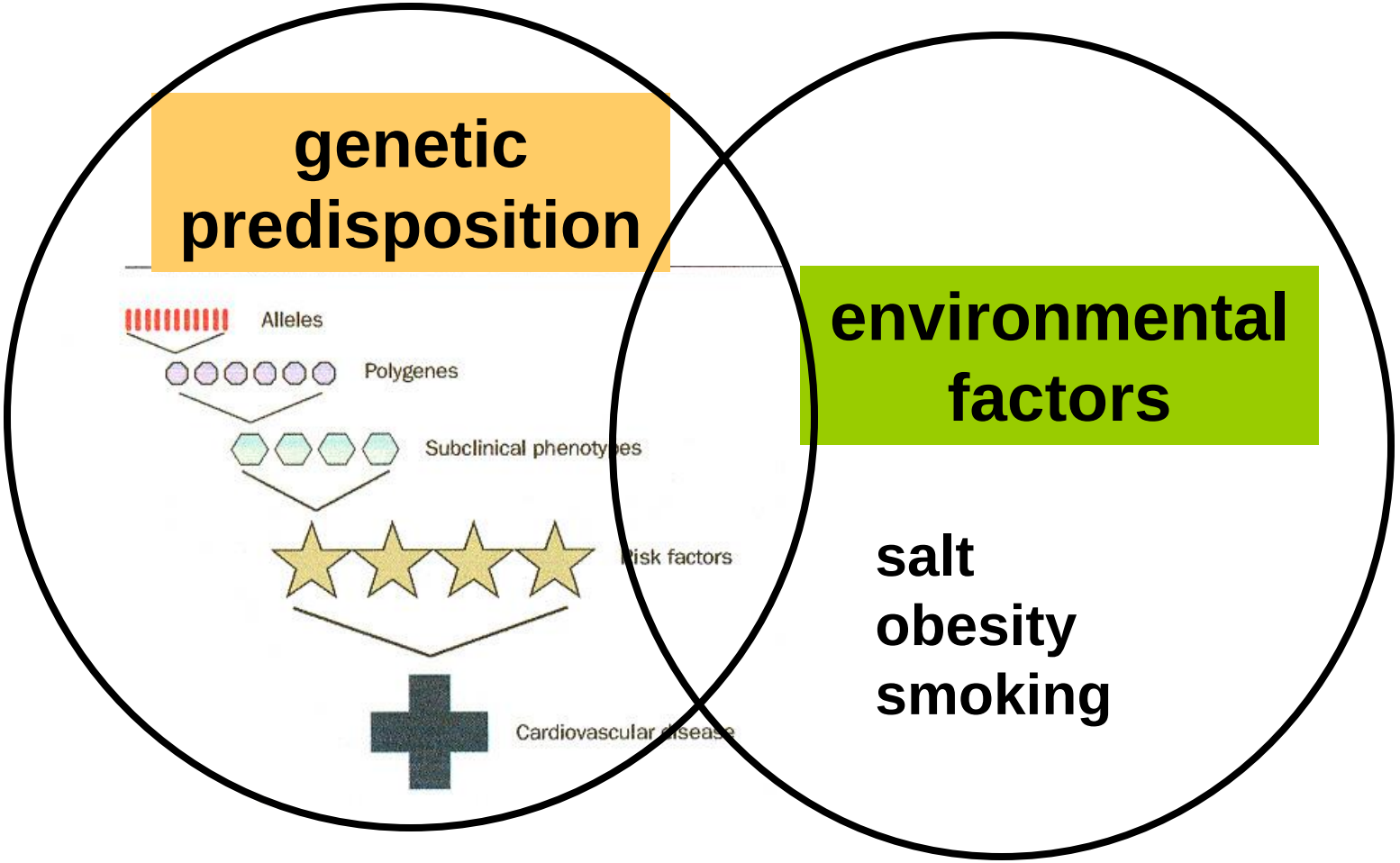
BP control in USA



Wang, Circulation 2005, 112:1651-62

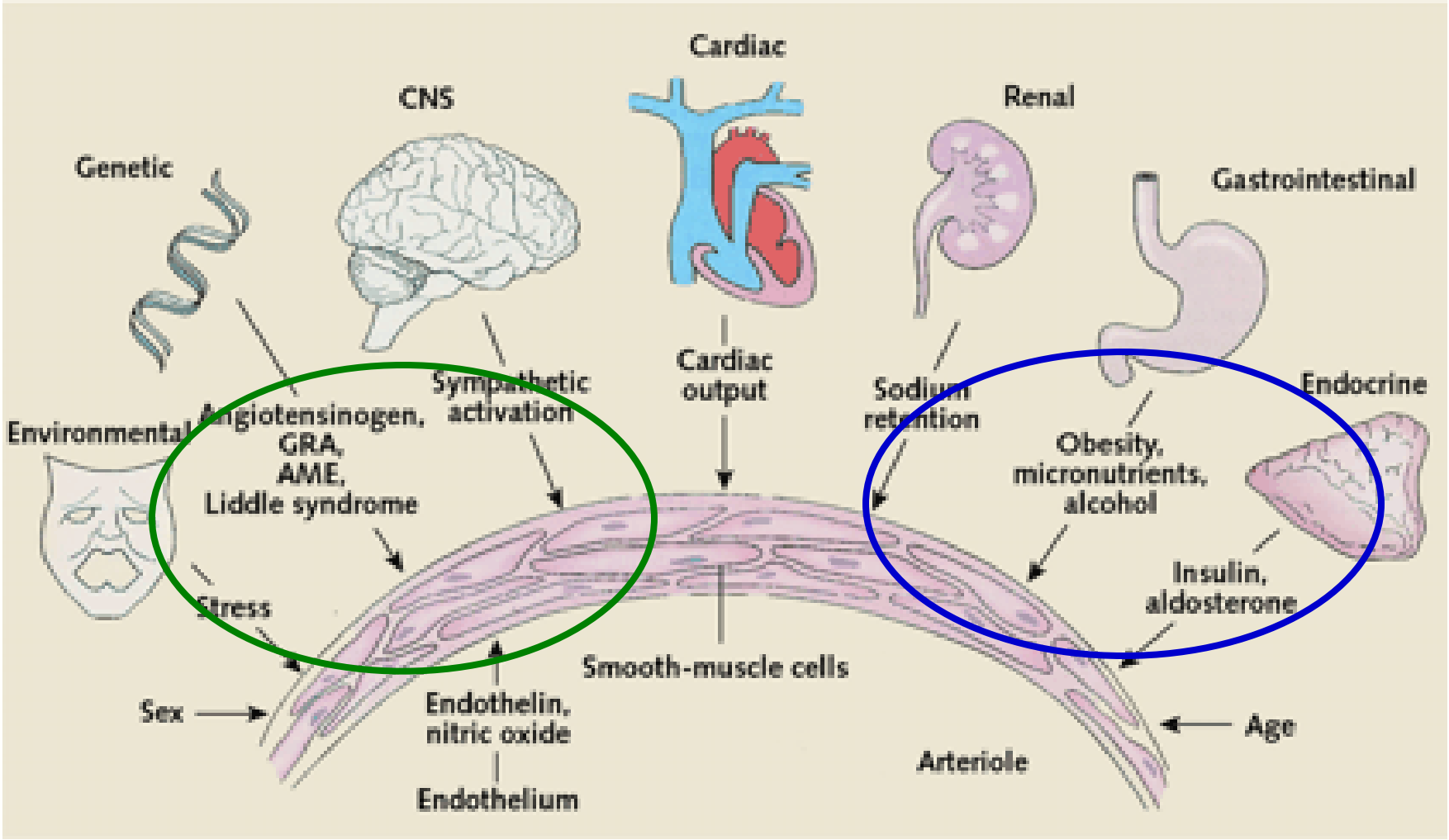
Less than 1/4 of those at high risk for CVD (diabetes, CKD, increased lipids) have BP controlled (NHANES III)

Cause of hypertension is multi-factorial



The Lancet, 361:2149-2151

BP is maintained by pressor factors and volume factors

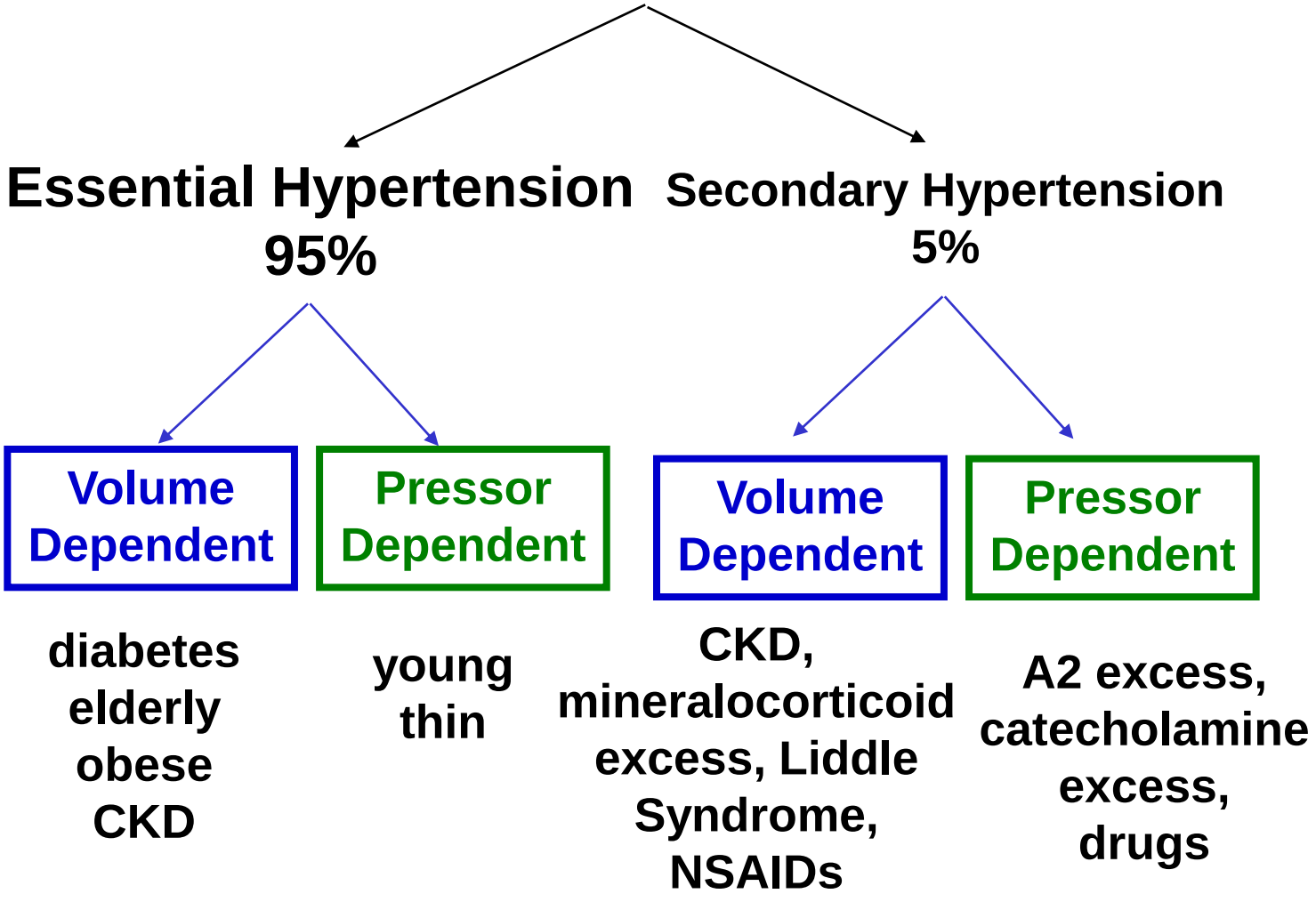


Oparil, Ann Intern Med. 2003, 139:761-776

Blood Pressure = Peripheral Resistance x Cardiac Output

Classification of Hypertension by Pathogenesis

All hypertensive individuals manifest both abnormalities, although one or the other may predominate



Management of Blood Pressure

- **Goal**
- **Individual strategy**
- **Group strategy**

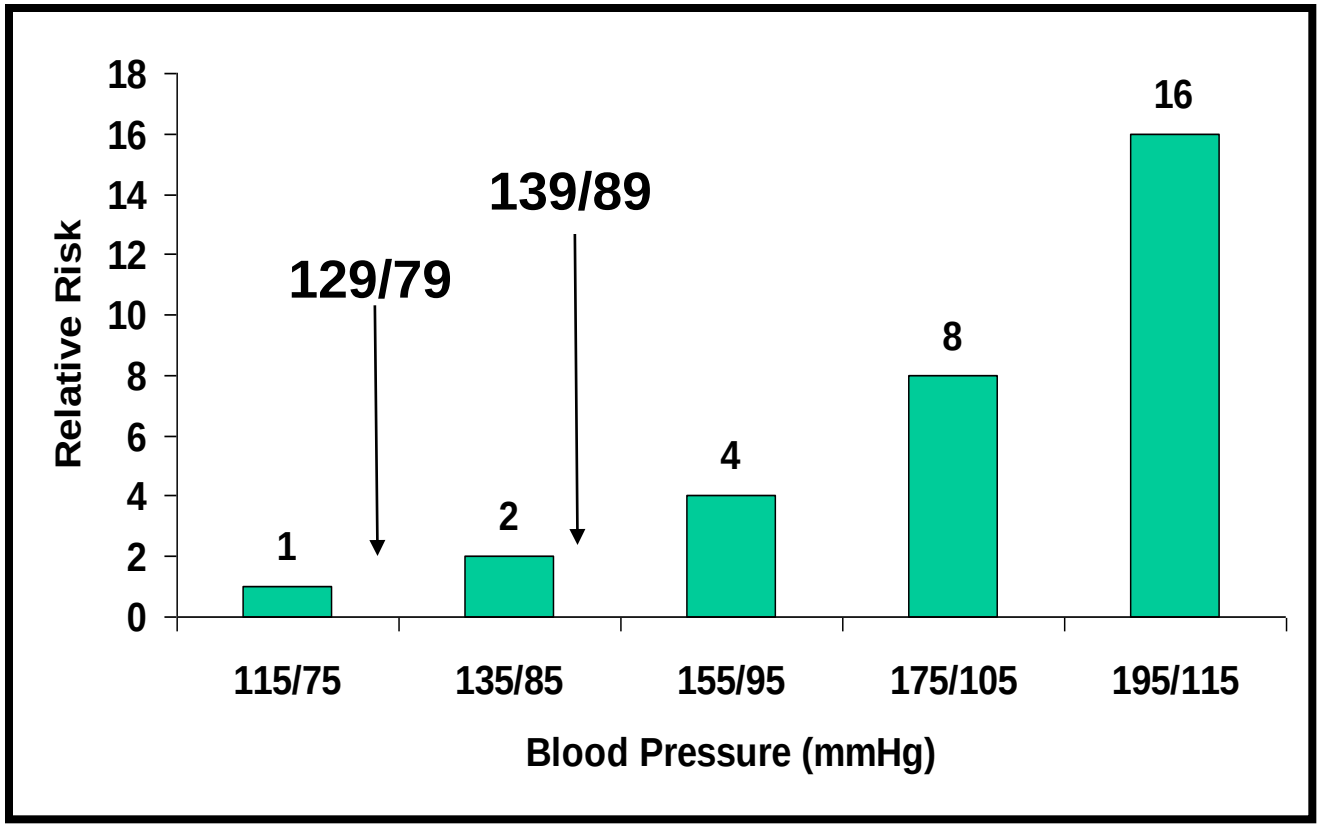
❖ **physicians, patients, systems**

Blood pressure goals JNC7

BP ≤ 139/89 mmHg for all adults

BP ≤ 129/79 mmHg for persons with diabetes, CKD, CHD ?

BP 135-150/70-79 for elderly to prevent cognitive impairment



Relative Risk of Cardiovascular Mortality data from 61 prospective studies involving > 1,000,000 individuals. ***Lewington et al, Lancet 2002***

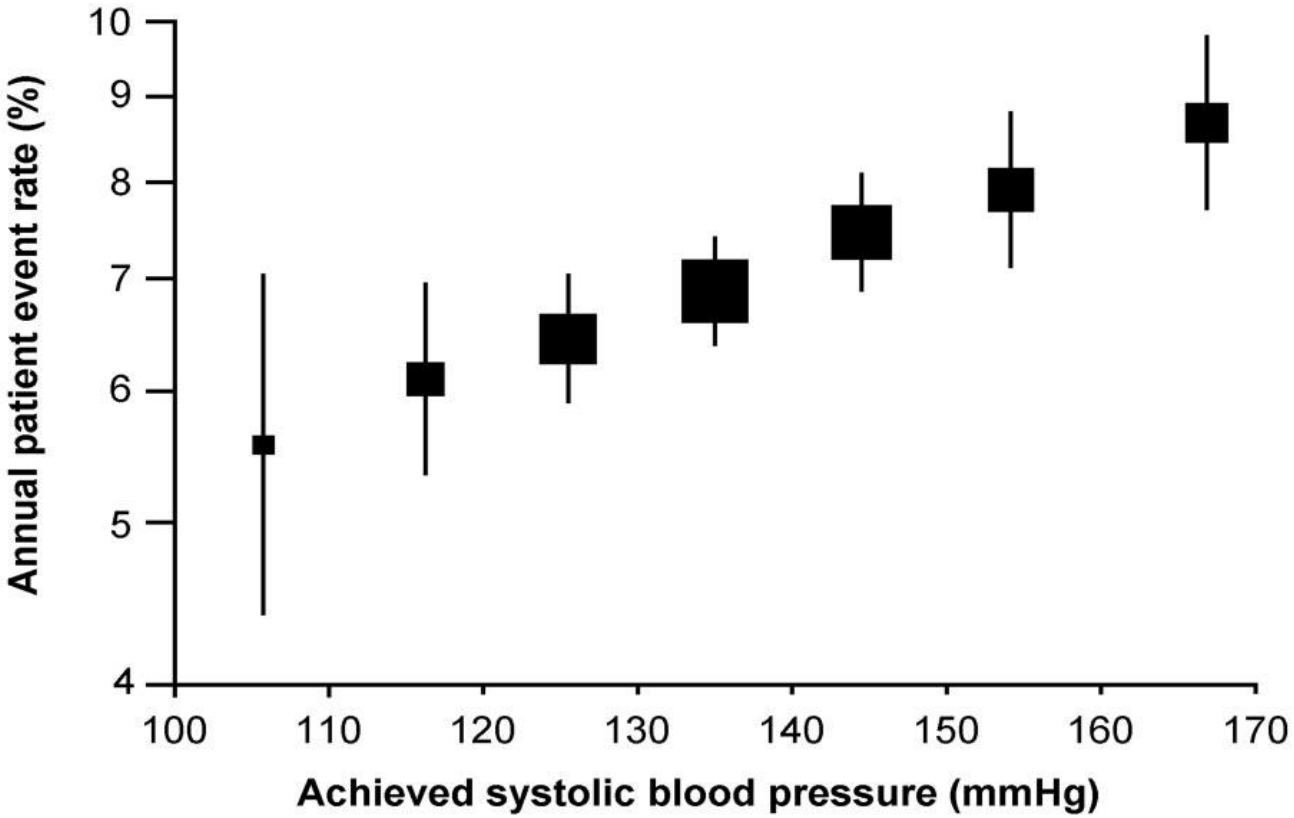
No benefit in lowering BP below 140/90 mmHg

Arguedas et al Cochrane database Syst Rev 2009; 3:CD004349

Examined MDRD, HOT, ABCD, AASK, REIN-2 studies and found that despite attempting to achieve lower targets than 140/90 and achieving average 4/3 mmHg decrease in BP in “treated” groups there was no prolonged survival

	RR
Total mortality	**0.92**
MI	**0.90**
Stroke	**0.99**
CHF	**0.88**
major CV events	**0.94**
ESRD	**1.01**

Lowering Blood Pressure Reduces Renal Events in Type 2 Diabetes

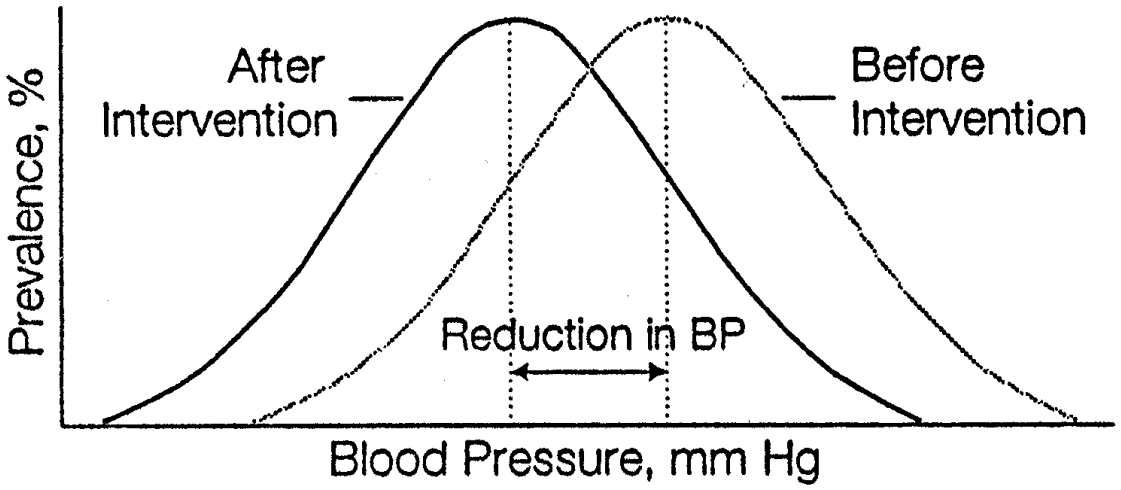


Median systolic blood pressure (mmHg)	106	116	125	135	144	154	168
No. of person-years	1431	4266	8974	11983	9138	4942	3470

ADVANCE Collaborative group J Am Soc Nephrol, 2009.

Reducing BP any amount reduces CV risk

Figure. Systolic Blood Pressure Distributions



Reduction in BP, mm Hg	% Reduction in Mortality		
	Stroke	CHD	Total
2	−6	−4	−3
3	−8	−5	−4
5	−14	−9	−7

Whelton et al, JAMA 288:1882-1888, 2002

Management of Blood Pressure

- **Goal**
- **Individual strategy**
- **Group strategy**

❖ **physicians, patients, systems**

Treatment of Hypertension by Pathogenesis

All hypertensive individuals manifest both abnormalities, although one or the other may predominate

Volume Dependant

Lifestyle:

- **low sodium diet, low insulin**

Diuretics

RAAS inhibitors

Pressor dependant

Lifestyle:

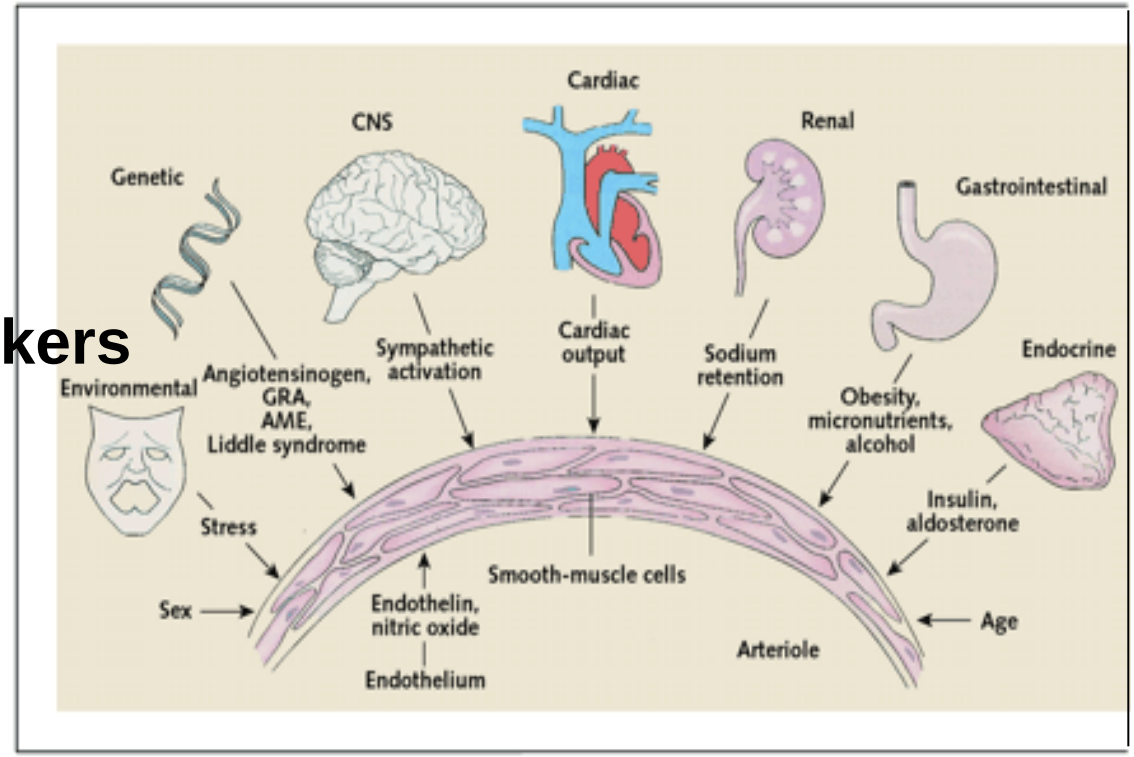
- **smoking, alcohol, stress**

Calcium channel blockers

RAAS inhibitors

SNS inhibitors

Direct vasodilators



Check list for BP *not* at goal….continued

Clinic BP >139/89 or >129/79 mm Hg (DM, CKD or CVD)

Discuss risk modification – patient specific achievable goals

- **Weight reduction (10 - 20 lbs helps) – SBP ↓5-20 mmHg**
- **Physical activity (30 minutes/day as part of ADL) – SBP ↓ 4-9mmHg**
- **Avoid excessive alcohol ingestion, stop tobacco – SBP ↓ 2-4 mmHg**
- **Avoid high sodium intake – shop around the edges of the supermarket except for the deli – SBP ↓ 4-8 mmHg**

  salt intake in US comes from 77% in processed or restaurant food, 6% added at table, 5% in cooking, 12% natural – *Source CDC*

- **DASH diet – SBP 8-14 mmHg**

Check list for BP *not* at goal….continued

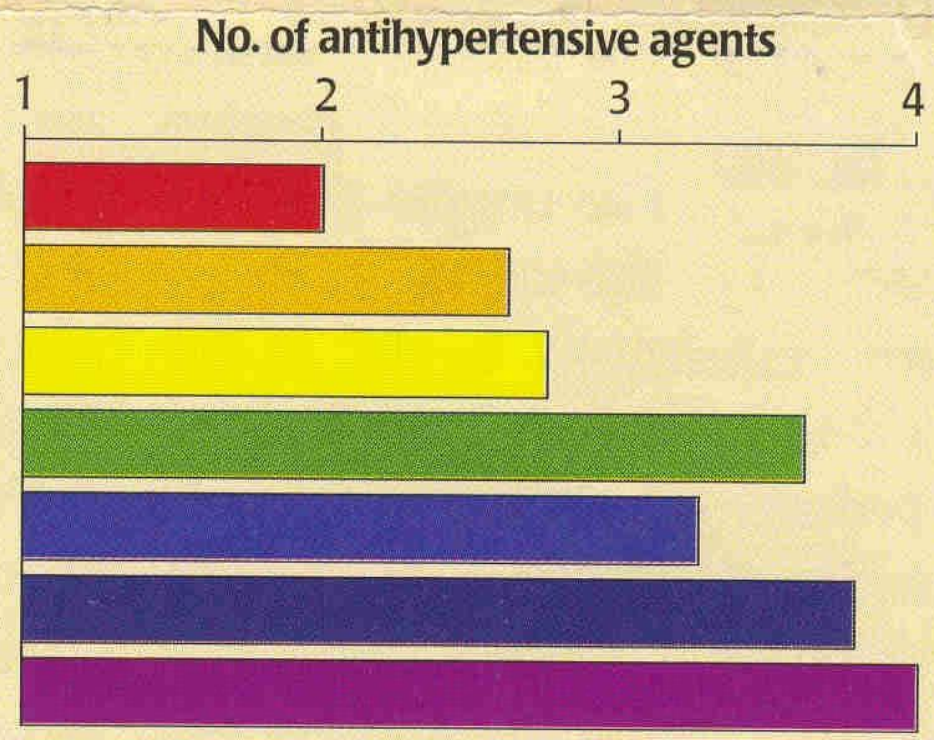
Clinic BP >139/89 or >129/79 mm Hg (DM, CKD or CVD)

Optimize medications: medication regimen should

- **Reduce volume**
  thiazide diuretic (for all unless eGFR < 30 ml/min, hyponatremia, CHF)
  K sparing diuretic (K< 4 meq/l & eGFR >30 m/min) in addition to thiazide
  loop diuretics in CKD patients (edema, eGFR < 30 m/ml)
- **Reduce renin/angiotensin effect**
  ACEi /ARB (DM, CKD, proteinuria/ microalbuminuria, CAD, LVH)
- **Reduce myocardial activity**
  Beta or Alpha/Beta blocker (titrate dose to keep HR in the 60's)
- **Vasodilate**
  CCB (dihydropyridines best for BP) or vasodilator (hydralazine, minoxidil)
- **Add central or peripheral SNS agents as fifth line**
  Clonidine, alpha methyldopa, alpha blockers
- **Use medications in multiple classes. Two to 4 are commonly needed. (e.g. Diuretics + ACEi/ARB + Beta and alpha blockers + CCB)**

Multiple antihypertensive drugs are needed to control BP

Trial	Target BP (mm Hg)
ALLHAT	SBP <140/DBP <90
UKPDS	DBP <85
ABCD	DBP <75
MDRD	MAP <92
HOT	DBP <80
AASK	MAP <92
IDNT	SBP <135/DBP <85



BP = blood pressure; ALLHAT = Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial; SBP = systolic blood pressure; DBP = diastolic blood pressure; UKPDS = United Kingdom Prospective Diabetes Study; ABCD = Appropriate Blood Pressure Control in Diabetes; MDRD = Modification of Diet in Renal Disease; MAP = mean arterial pressure; HOT = Hypertension Optimal Treatment; AASK = African American Study of Kidney Disease and Hypertension; IDNT = Irbesartan Diabetic Nephropathy Trial.

Sources: Bakris GL et al. *Am J Kidney Dis*. 2000;36:646-661. Lewis EJ et al. *N Engl J Med*. 2001;345:851-860. Cushman WC et al. *J Clin Hypertens*. 2002;4:393-404.

Resistant hypertension RH: causes

The main cause of RH in 141 patients seen at RUSH HTN Center (1993-2001) was suboptimal medication regimen

- **Cause found in …… 94%**
- **Drug related causes * ……... 58%**
- **Non-adherence…….. ……. 16%**
- **Psychological causes……..…….. … 9%**
- **High clinic readings, normal home readings..... 6%**
- **Secondary hypertension…… 5%**

***changes made in diuretics in 60%**

Garg et al Am J. Hypertension 2005, 18:619-626

Check list for BP *not* at goal

Clinic BP >139/89 or >129/79 mm Hg (DM, CKD or CVD)

Things to consider

- **Is the patient taking all medications as prescribed?**
- **Is the patient checking BP at home?**
- **Is BP at home at goal?**
- **Is ambulatory BP monitoring indicated?**
  major discordance between home and office BP readings;
  widely fluctuating office or home BP readings;
  symptoms of low/high BP without confirming BP readings
- **Is the patient taking BP raising medications?**
  NSAIDs, steroids, sympathominetics, oral contraceptives,
  calcineurin inhibitors, erythropoietin etc

Medication intolerance

AR a 52 F with HTN 4 years and BP never controlled. Intolerant of more than 20 different medications from all classes

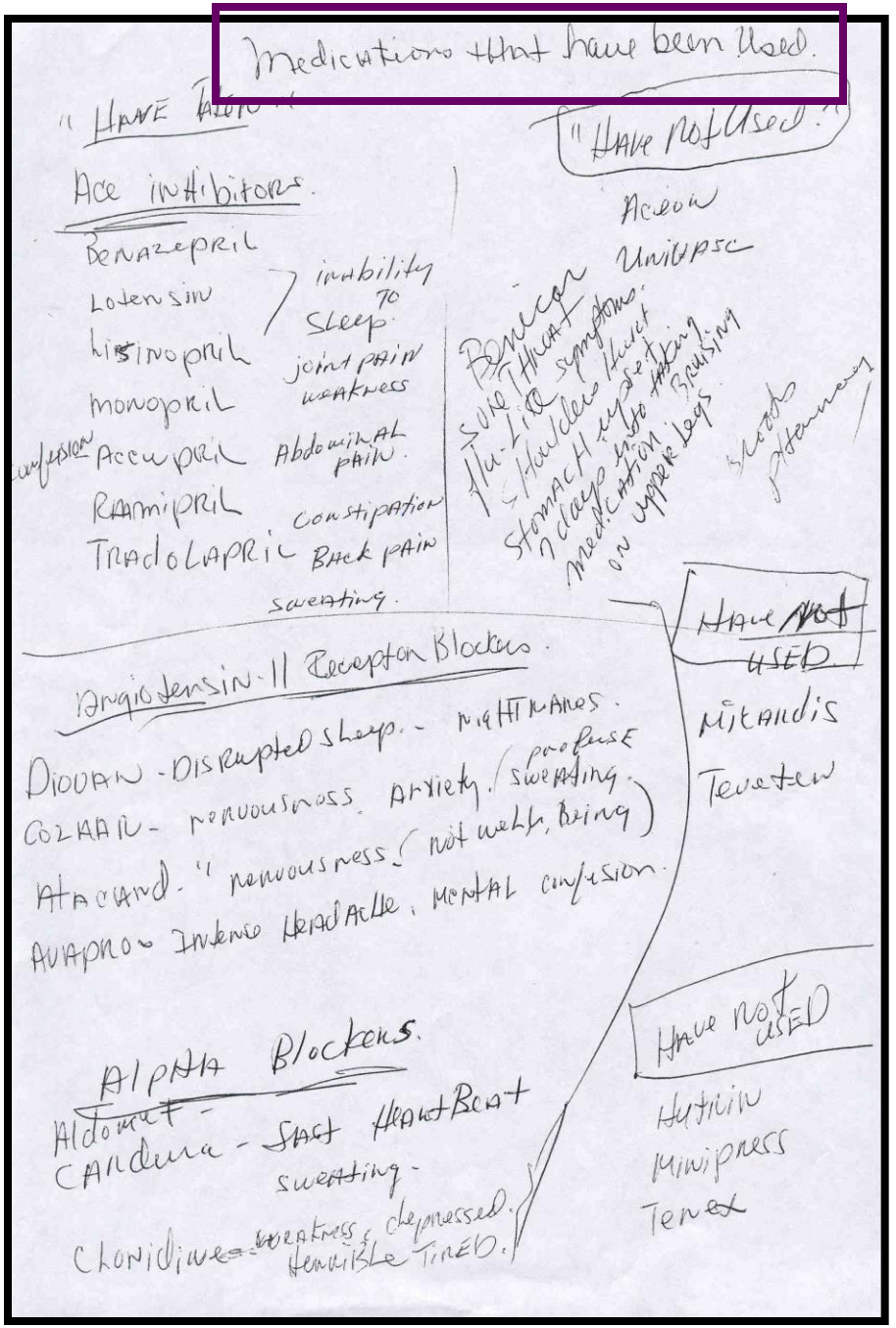
PH: urinary incontinence, depression

Meds: venlafaxine 75, zolpidem 10

FH: mother HTN at age 50

PE: BP 158/88, HR 92
home BP 180-190/90-100

Investigations: s. creat 0.9, K 4.0
aldo 15, PRA 6 - normal
Urinalysis: neg prot, tr bld
No RAS - duplex doppler



Approach: tried

- **A new drug she had not heard of ----- failed**
- **Small doses of two meds compounded ------ failed**
- **Asked her to pick a regimen ------ effective but slow**

2 years later

Clinic BP BP 130/83, pulse 80

Treatment: differed each visit but included

Valsartan 80 or lisinopril 2.5

Atenolol 12.5 or 25 mg

HCTZ 6.25 mg

Don’t dismiss secondary causes

SS is a 78 year old retired nurse with HTN for 40 years on multiple medications but with BP never controlled.

In 2005 on prinivil 20 x 2; lopressor 25 x 2; amiloride/HCTZ 5/50; terazocin 3 x 2, home BP was 148-160/80-94

PH: recurrent UTIs, 1967 R nephrectomy/ureterectomy;
1997 L renal artery duplex showed no stenosis

PE: Weight 51.6 kg, BP 164/90, HR 64, + lower leg edema

Labs: s. creat 0.7, K 4.0, CO2 27, 24h Na excretion 65mEq

PRA < 0.6, Plasma Aldosterone 24, ratio 30;

CT abdomen: adrenals L 12 mm R 5 mm, no nodule

Recommended Treatment: spironolactone 25 mg twice a day, stop amiloride/HCTZ; take home BPs

1 month later: home SBP 130-160, clinic 180/94, increase spironolactone to 50 x 2

3 month later: home SBP 120-140, clinic 136/82; stop terazocin, reduce lisinopril

6 month later: clinic BP 126/70; HR 76 on lisinopril 10 mg 3 days a week, spironolactone 50 mg am and 25 pm, metoprolol 25 am and pm

3 years later (age 81) clinic BP 126/74, HR 80, Wt 51 kg; serum creatinine 0.82, K 5.0

spironolactone 50, metoprolol 50 lisinopril 5

- **it takes time**

Management of Blood Pressure

- **Goal**
- **Individual strategy**
- **Group strategy**

❖ **physicians, patients, systems**

Approaches to improving BP Control

Target high risk groups (diabetes, CVD, CKD)

Strategies shown to work include

- clinical reminder systems
- nurse providers
- pharmacist consultants
- automated telephone monitoring
- computer assisted BP control
- ***All these require health care resources not available to most clinics or practices***

- **patient participation and ownership**

  having a goal
  knowing when not at goal (measuring BP at home)
  having a way to modify treatment to get to goal

Tools for getting BP to goal

Today's Visit:

Vital Signs: B/P_____ Pulse: _____ Weight _____

B/P Goals:

☐130/80 or less, more than half the time Take B/P at home __Yes __No

☐140/90 or less, more than half the time B/P at goal at home __Yes __No

☐ Other:

Medication Changes:
Dosage changes:

New Meds:

Stop Taking:

Diet/Exercise: ☐Low Sodium ☐Low Potassium ☐DASH Diet ☐Other (specify)_____☐ Exercise

Clinic nurse
Renal services
FAHC
Burlington, VT

IS MY BLOOD PRESSURE AT GOAL?

Record your blood pressure

Write TOP Number (systolic BP) in column 1 (green) if it is lower than 130 or in column 2 (pink) if it is 130 or higher

		Column 1	Column 2		
Date	Time	TOP BP Lower than 130	TOP BP 130 or higher	Bottom BP (Diastolic BP)	Pulse
	AM				
	PM				
	AM				
	PM				
	AM				
	PM				
	AM				
	PM				
	AM				
	PM				
	AM				
	PM				
	AM				
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	PM				
	AM				
	PM				
	AM				
	PM				
	AM				
	PM				
	AM				
	PM				

If there are more TOP BP in the 1st column (GREEN) than in the 2nd column (PINK) your BP is at goal

If your BP is not at goal, contact Given West Clinic at 802-847-4531 or mail this sheet to us

Please bring this sheet to your doctor's visit if you have not mailed it.

	CKD f/u clinic visits n	SBP mmHg <131 %	SBP mmHg <141 %	Takes BP @ Home %	Av SBP mmHg	Av DBP mmHg	SD SBP mmHg	CKD stage3-5 %
Prepilot May '04		28						
Baseline 8/05-2/06		38						
May '06		59	72	51				
June '06	164	68	79	51	128	69	20	66
July '06	143	66	77	49	126	70	22	77
Aug '06	184	55	70	46	131	70	21	77
Sept '06	146	60	77	47	128	70	21	74
Oct '06	187	42	56	50	137	71	22	78
Nov '06	171	58	74	46	131	71	22	71
Dec '06	141	64	79	50	127	70	19	77
Jan '07	186	62	83	58	125	69	21	78
Feb '07	136	64	81	50	124	72	20	75
Mar '07	182	63	80	61	127	72	21	76
April '07	177	63	84	54	126	71	17	80
May '07	177	68	81	51	126	71	19	79
June '07	209	64	81	56	126	69	19	77
July '07	179	67	80	55	126	70	21	76
August '07	185	58	70	55	131	69	23	83

PriMed Physicians - Dayton Ohio

64 internal medicine physicians in suburban and inner city practices
165,000 patients
34,000 with HTN and 7672 with HTN and DM or CKD

goal ≤ 139/89 and ≤ 129/79 mmHg
methods: group wide commitment and Six Sigma quality approach

- **concept: "every patient every visit"**

- **treatment: for anyone not at goal follow the process**
  process: follow flow chart; change meds; see in < 4 weeks
  enforcement: linked compensation to following process

- **outcomes (at goal):**
  November 2004 - 41% at goal;
  June 2005- Feb 2006 65-67% at goal
  June 2007 - 80% at goal
  July/Aug 2008 - >90% at goal (all patients/all diabetic patients)

Getting BP to goal: Summary

- **Physician factors – individual approach**

  Take your time
  Do not give up on lifestyle approaches
  Aim for SBP below the goal
  BP at home can be a legitimate goal
  Get buy in from your patient

  Use 3-4 medications – ABCD approach
  Diuretic – thiazide/K sparing/spironolactone
  get the class and doses right for CKD
  ACEi / ARB / renin inhibitor
  Beta blocker / alpha-beta blocker to keep HR 60-70
  Calcium channel blocker (dihydropyridine is best)

Getting BP to goal: Summary…..

- **Patient factors**

  participation and ownership: ensure patients know

  BP control is important
  their own goal
  when they are not at goal (monitor BP at home)
  what to do to get to goal (lifestyle, contact physician)

- **System factors – group approach**

  physicians need:

  concept: every patient every visit
  process: e.g. check list
  feed back of group results

  patients need:

  an office system that is responsive to their needs - how to measure BP, how to get advice about changing medications etc

World Kidney Day 2010 - March 11

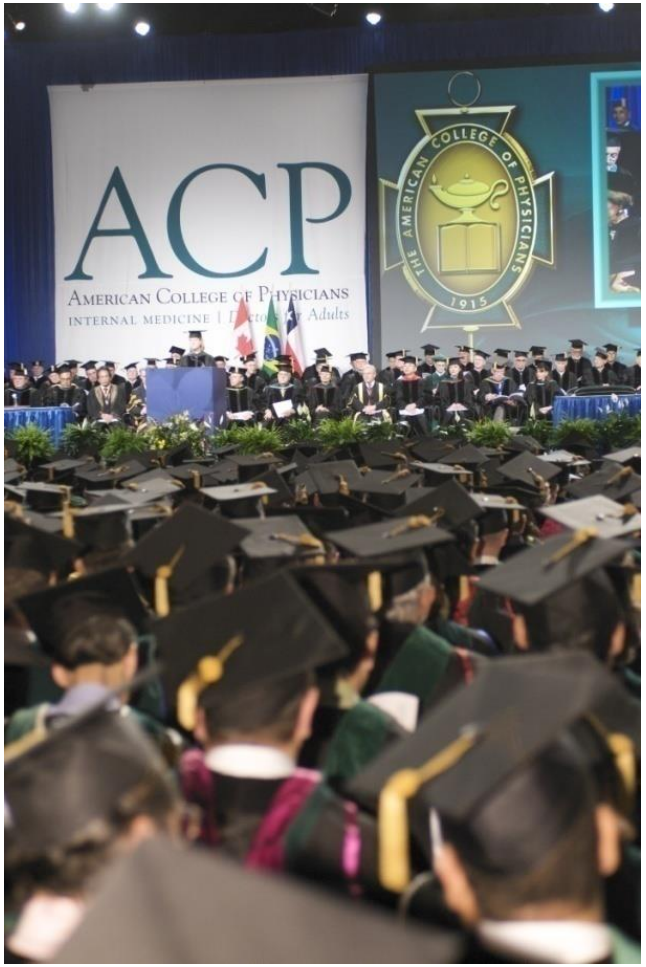
Theme: "Protect Your Kidneys: Control Diabetes."

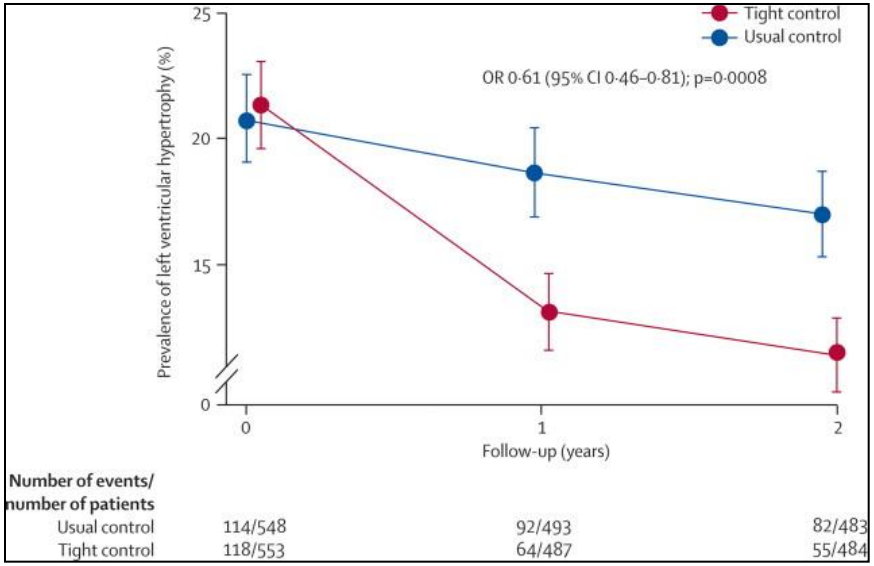
Health News
40,000 die of kidney failure annually in Bangladesh

By IANS
February 7th, 2010

Getting blood pressure to goal is the most effective strategy we have at present for preventing progression of renal disease

Thank You


ACP
American College of Physicians
INTERNAL MEDICINE
THE AMERICAN COLLEGE OF PHYSICIANS
1915

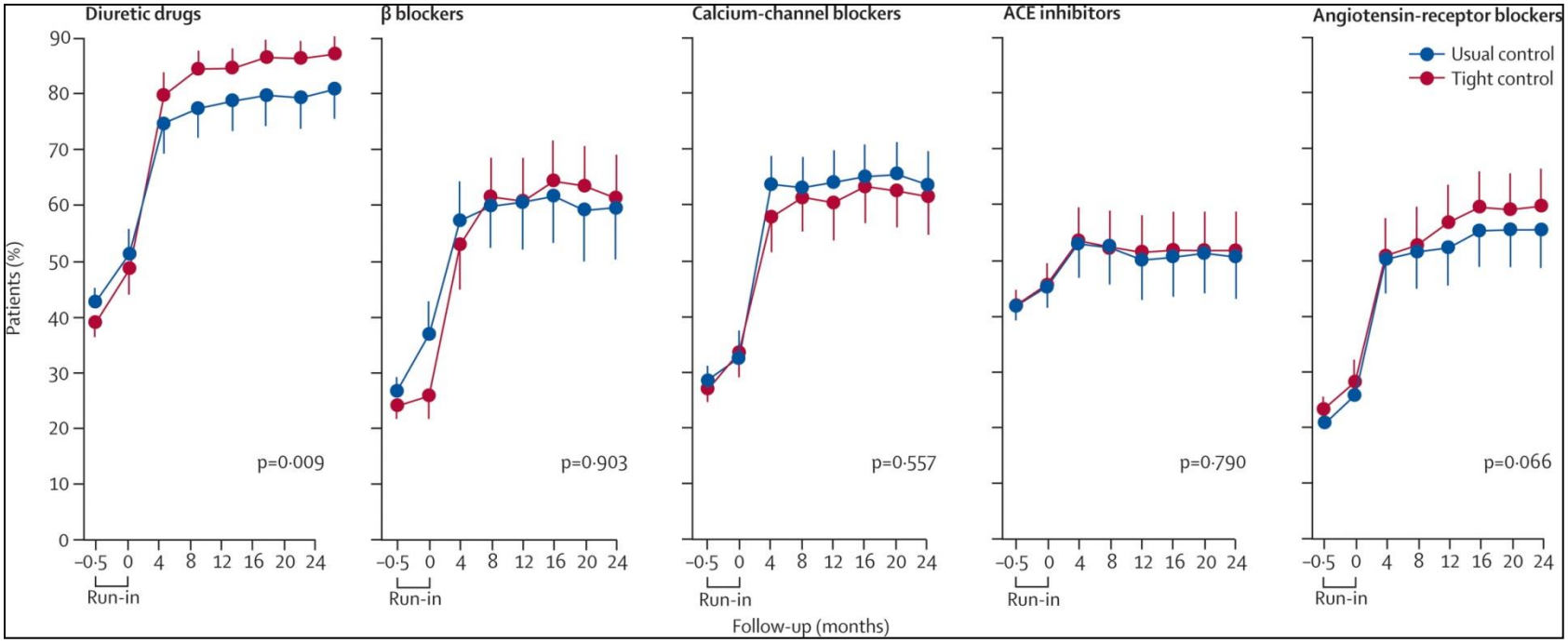


Cardio-Sis trial

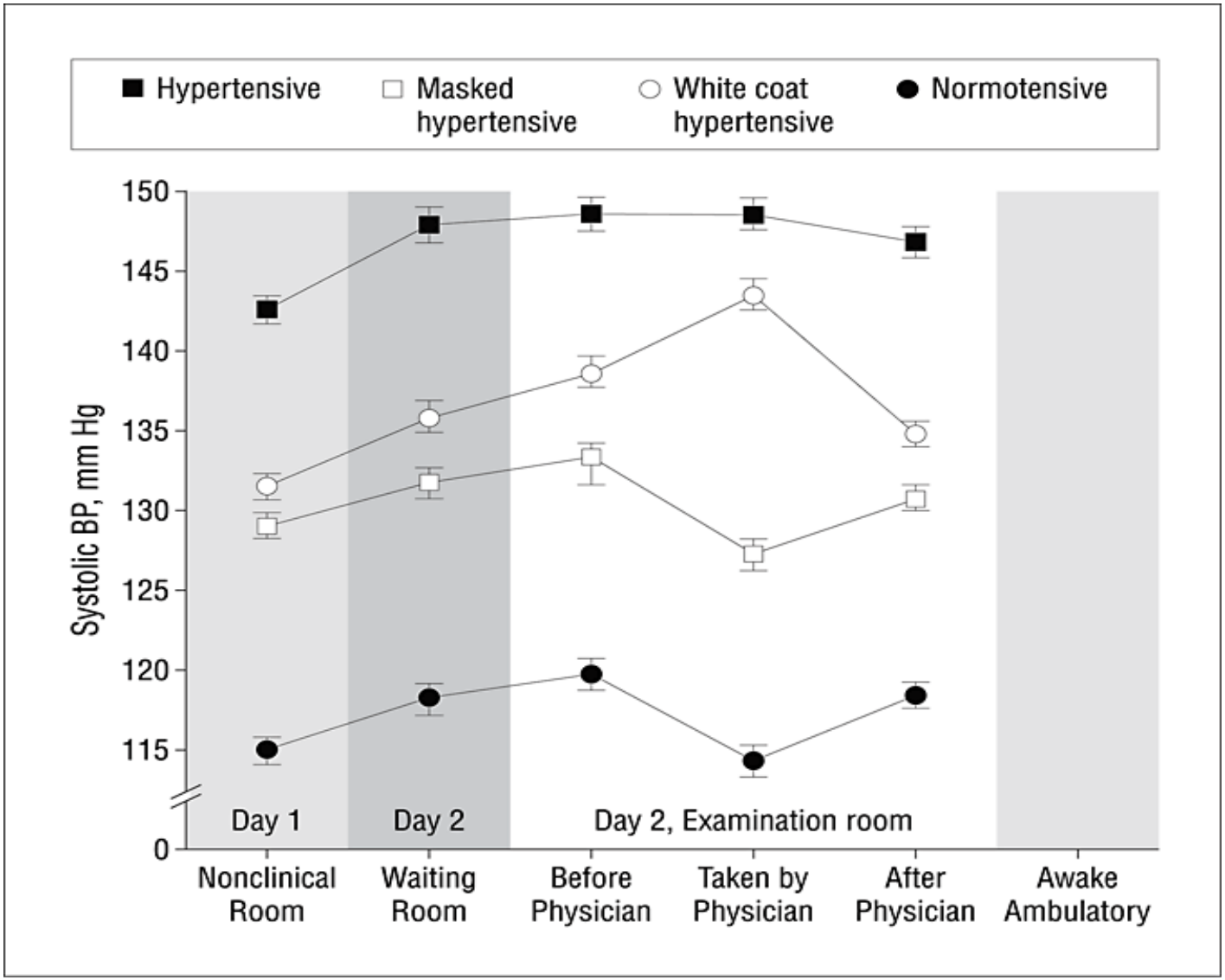
Lancet 3374:525-533,2009

Tight control SBP<130 (131)

Usual control SBP<140 (135)

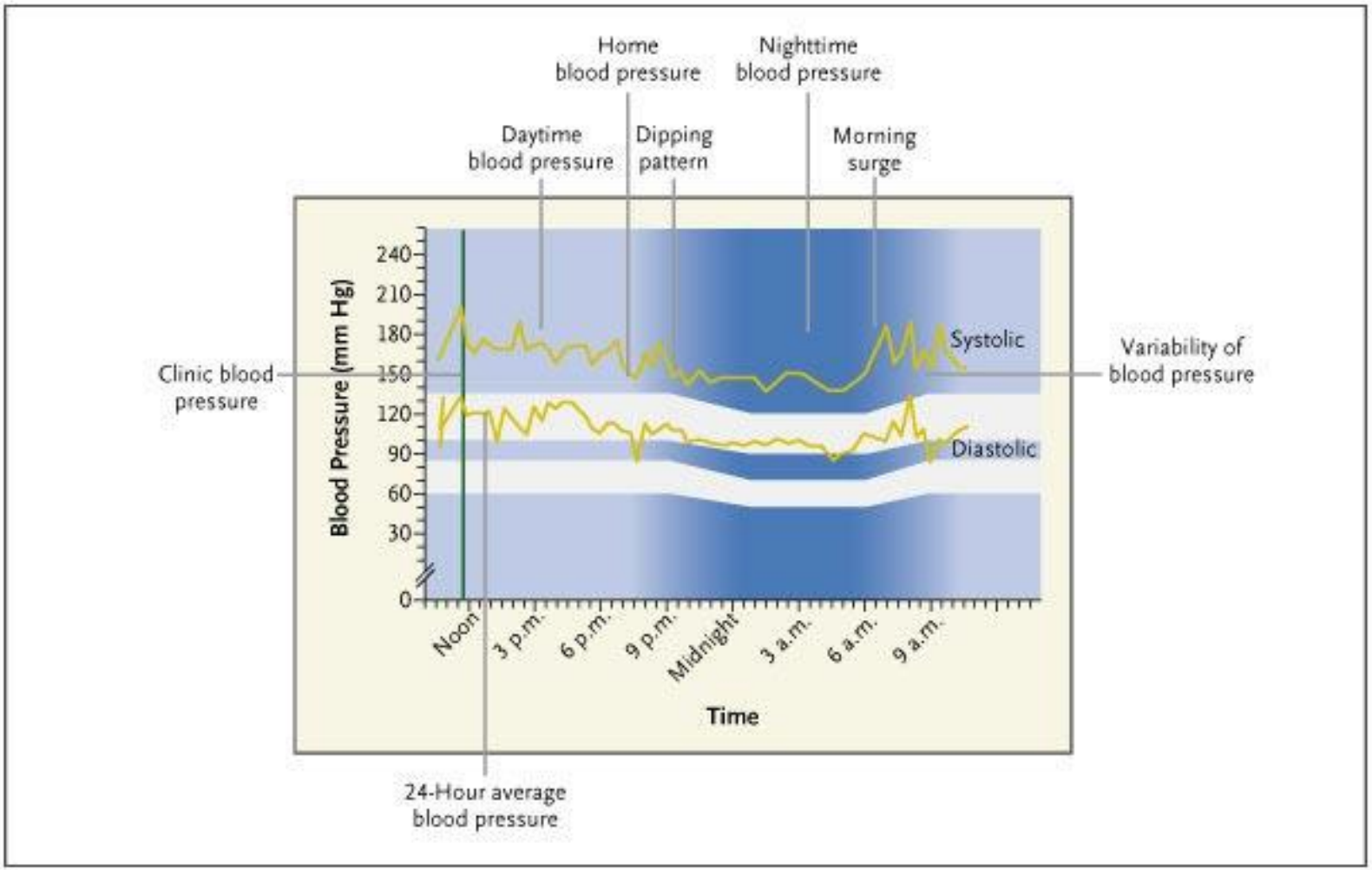


The Misdiagnosis of Hypertension The Role of Patient Anxiety



Arch Intern Med. 2008;168(22):2459-2465

24-Hour Blood-Pressure Tracing in a Patient with Hypertension.

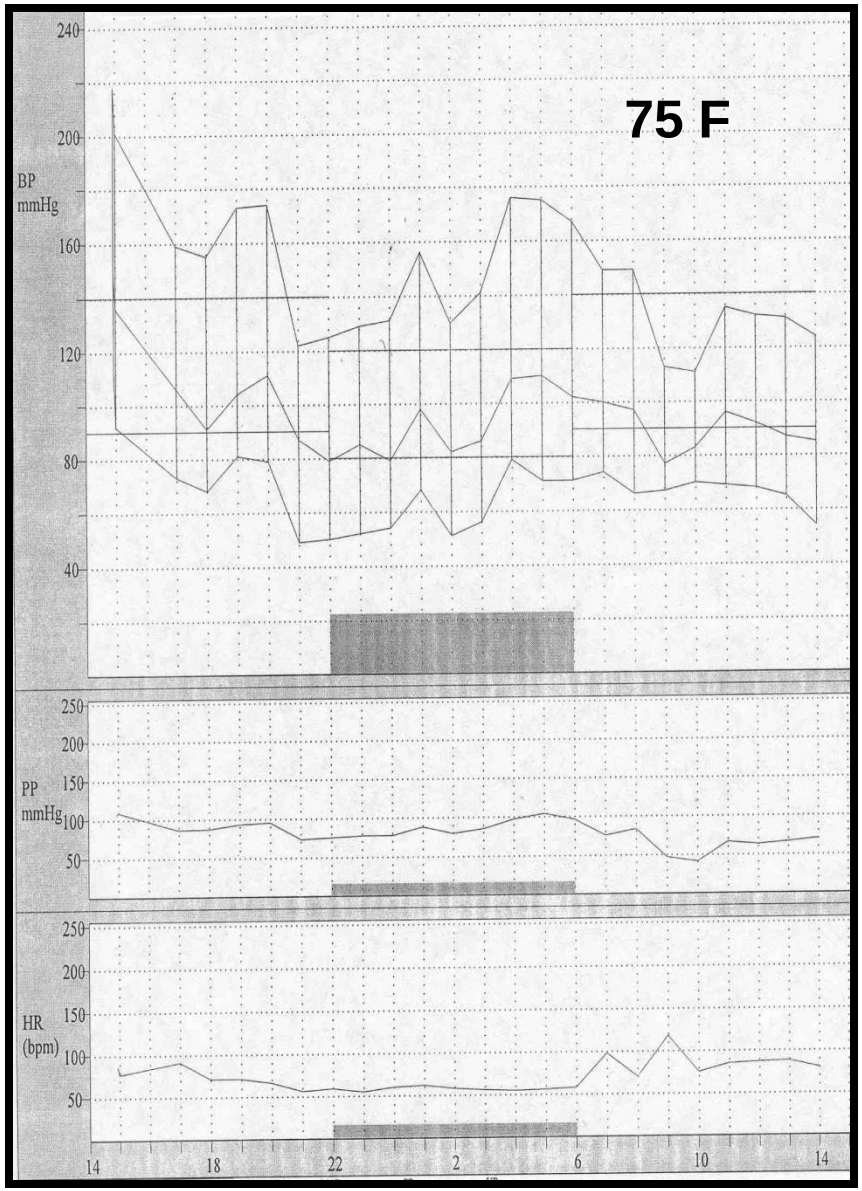


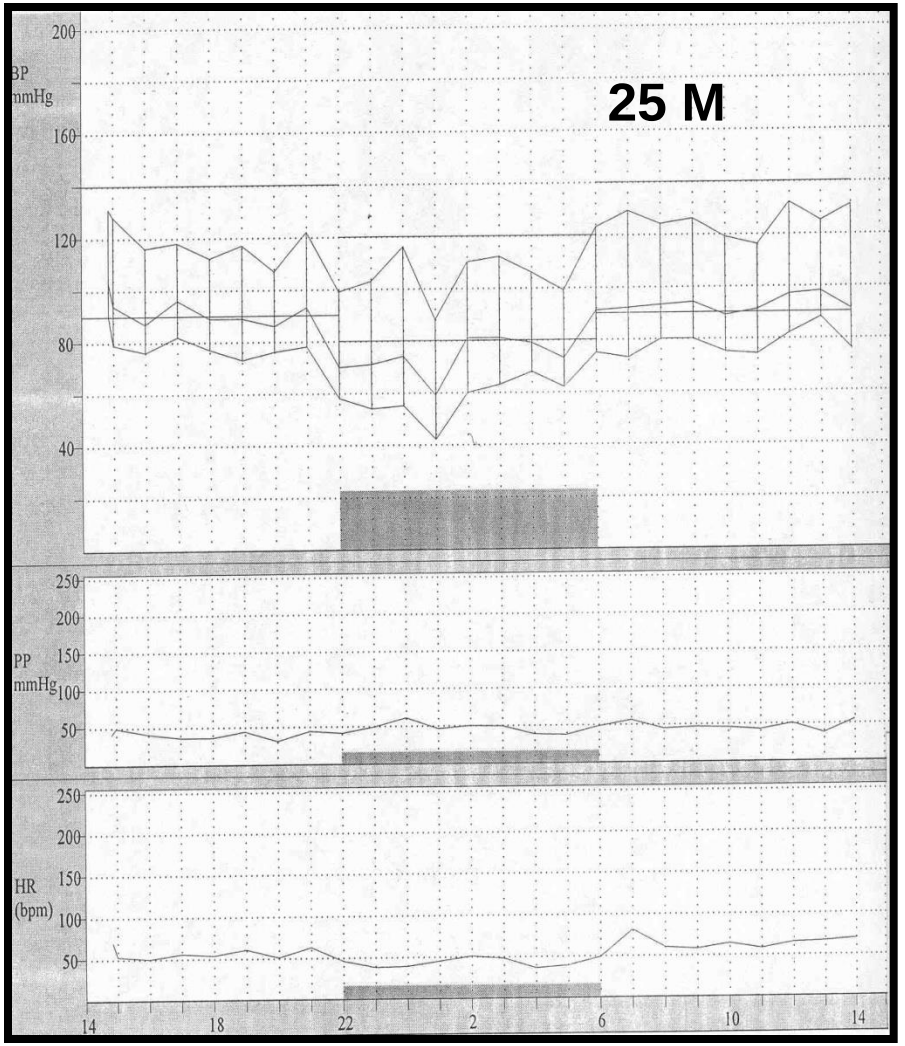
Pickering, T. G. et al. N Engl J Med 2006;354:2368-2374

The NEW ENGLAND JOURNAL of MEDICINE

Ambulatory BP monitoring

- can help and is predictive of clinical outcomes





MEH is a 63 year retired nurse with HTN for 20 years and intolerant of many medications

atenolol - asthma, diltiazem - no effect, lisinopril - cough, amlodipine - edema, nifedipine - palpitations

was seen by her PCP for SBP in 170s up from 150s a year before. Triampterine/HCTZ was inceased to 75/50 with no effect so doxacocin was added to losartan 100 and she was referred her to nephrology.

PH: psoriatic arthritis taking ibuprofen 600 mg twice a day for 3 years and other NSAIDs for many years before that; obesity with a recent 20 lb weight loss.

PE: weight 107.3 kg, BP 172/60, HR 80,

Labs: s. creatinine 1.3 eGFR 48, K 3.9, CO2 28,

Recommended Treatment: stop ibuprofen; take home BPs

1 month later: home BP 150's; atenolol 25 added/tolerated

1 month later: Aliskiren 150 then 300 added

1 month later: clinic BP 133/70; home BP 115-135

6 months later: clinic BP 118/58, HR 72, weight 107 kg,
home BP 120-130/60-70 HR 70's

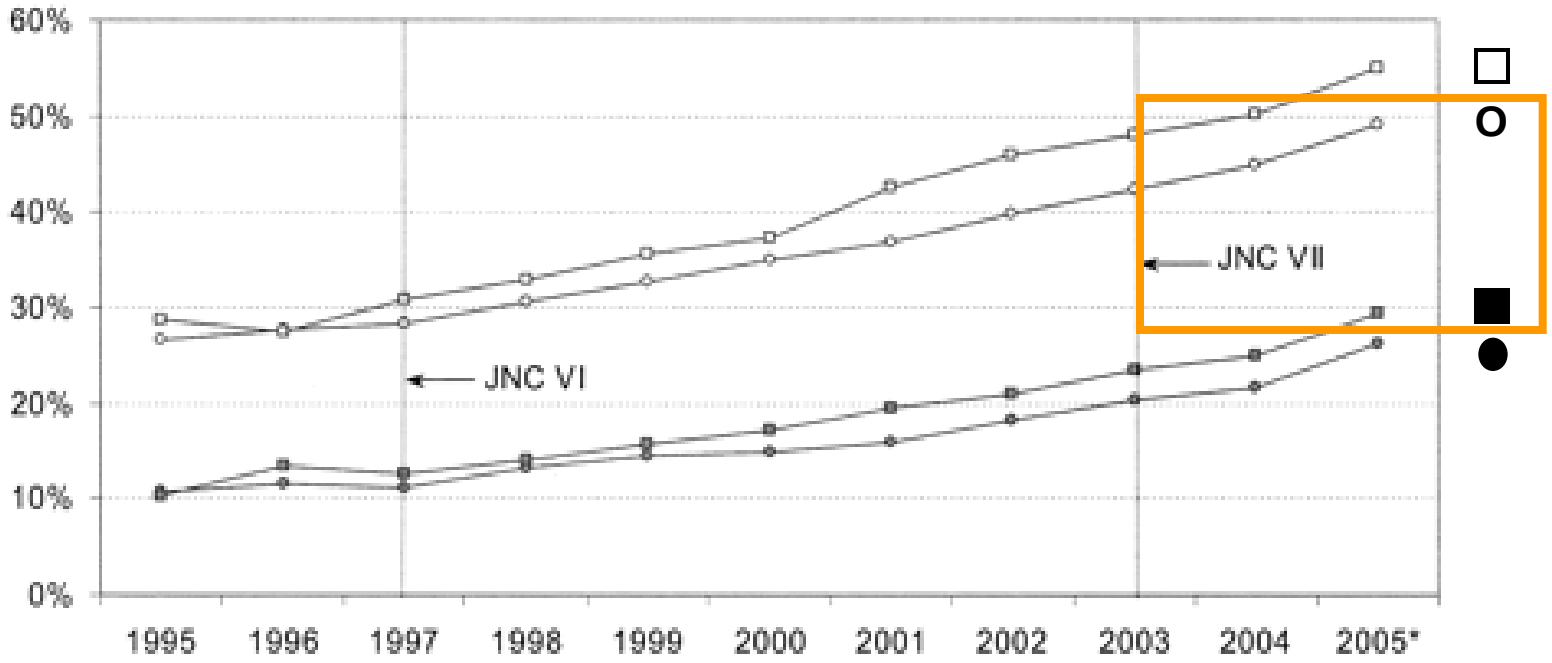
Labs: serum creatinine 1.2, K 4.7, no microalbuminuria

Treatment: losartan 100, aliskiren 300,
triamterene/HCTZ 37.5/25, atenolol 25,
methotrexate for arthritis

National Disease and Therapeutic Index

Patients seen by 3500 office based physicians on 2 days each quarter

Y.R. Wang, Diabetes Care 30:49-52, 2007



O **non-diabetic BP <140/90 mmHg;** ● **non-diabetic BP <130/85 mmHg;** ***n = 152,672 visits***

□ **diabetic BP <140/90 mmHg;** ■ **diabetic BP <130/85 mmHg;** ***n = 19,616 visits***

33% of patients with CKD seen in FAHC Renal Clinic had BP controlled
(clinic survey, 2003)

Check list for BP *not* at goal

Clinic BP >139/89 or >129/79 mm Hg (DM, CKD or CVD)

Things to consider

- **Is the patient taking all medications as prescribed?**
- **Is the patient checking BP at home?**
- **Is BP at home at goal?**

- **Is ambulatory BP monitoring indicated?**
  major discordance between home and office BP readings;
  widely fluctuating office or home BP readings;
  symptoms of low/high BP without confirming BP readings

- **Is the patient taking BP raising medications?**
  NSAIDs, steroids, sympathominetics, oral contraceptives, calcineurin inhibitors, erythropoietin etc

Check list for BP *not* at goal….continued

Clinic BP >139/89 or >129/79 mm Hg (DM, CKD or CVD)

Studies to assess secondary causes of hypertension

- Urinalysis, urine protein/creatinine,
- serum creatinine with eGFR, lytes, (CKD);
- plasma aldosterone/renin (primary hyperaldosteronism);
- plasma free catecholamines (pheochromocytoma) if indicated;
- sleep history and studies if indicated (sleep apnea);
- renal artery duplex (renovascular disease);
- 24 hour urine for sodium and creatinine
  (unrecognized high sodium intake)

Refer to Nephrologist

- **suspected or known secondary cause(s) of hypertension**
- **CKD 4 or 5**
- **uncontrolled BP after 6 months of treatment**

Clinic Process for getting BP to goal

- ask patient to get a BP device and give instructions how to take BP and why it matters
- give patient a BP goal
- give patient clinic visit summary sheet each visit with that visit's clinic BP, the goal and Rx changes
- give patient a BP monitoring sheet and envelope and ask them to return it in 2-3 weeks
- establish a clinic process to review patient BP sheet and revise Rx - Encourage patients to take the initiative to contact clinic when BP is not at goal
- monitor clinic BP in all patients and periodically report percent at goal for the group to all providers

Check list for BP *not* at goal….continued

Clinic BP >139/89 or >129/79 mm Hg (DM, CKD or CVD)

Studies to assess secondary causes of hypertension

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Refer to Nephrologist

- **suspected or known secondary cause(s) of hypertension**
- **CKD 4 or 5**
- **uncontrolled BP after 6 months of treatment**

Treatment of BP in Diabetes and CKD

Goal: BP ≤ 129/79 mmHg

My approach

- **ACEi or ARB or renin inhibitors**
- **diuretic** - low dose thiazide or loop, (*K sparing - amiloride, spironolactone)*
- **β adrenergic blockers** (α β blockers)
- **calcium channel antagonists**
  - nifedipine, amlodipine

- **α_1 adrenergic antagonists**
- **other - clonidine**