Epidemiology of Hypertension

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Agenda: epidemiology of hypertension

1 BP measurement
2 Defining hypertension
3 Important public health problem
4 Global risk assessment
5 Intervention trials
6 Management strategies
7 Barriers to treatment
8 Prevention strategies
1. How to measure blood pressure?
Ascultatory method of blood pressure measurement

Nokolai Korotkoff, 1905
Auscultatory clinic/office errors:

- Measurement error
- Small number of readings
- White coat effect
- No measure of the diurnal changes of BP
<table>
<thead>
<tr>
<th>Method</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-office</td>
<td>Two readings, 5 minutes apart, sitting in chair. Confirm elevated reading in contralateral arm.</td>
</tr>
<tr>
<td>Ambulatory BP monitoring</td>
<td>Indicated for evaluation of “white-coat” HTN. Absence of 10–20% BP decrease during sleep may indicate increased CVD risk.</td>
</tr>
<tr>
<td>Self-measurement</td>
<td>Provides information on response to therapy. May help improve adherence to therapy and evaluate “white-coat” HTN.</td>
</tr>
</tbody>
</table>
24-hour ambulatory monitoring (ABM)

Clinic Pressure

140/90

Ambulatory Pressure

135/85

White Coat Hypertension

Sustained Hypertension

True Normotension

Masked Hypertension
Self-Measurement of BP

- Provides information useful for:
  1. assessing response to antihypertensive Rx
  2. improving adherence with therapy
  3. evaluating white-coat HTN & masked HTN

- Home BP is more strongly related to target organ damage and has better prognostic accuracy than office BP.
Schema for Evaluating Need for Treatment

AHA/ASH Scientific Statement

- **Office BP Raised**
  - 150/90
  - 140/85
  - 130/80

- **Target organ Damage**
  - Present
  - Absent

**Home BP**

- <125/76
- >135/85
- >125/76 <135/85

**24 Hr BP**

- <130/80
- >130/80

(<135/85) Day-time ambulatory BP (>135/85)

Continue To Monitor

Start Treatment
2. Defining Hypertension:

(a) By the numbers?

- ≥95 DBP
- 160/95
- 140/90
- 130/85
- >120/80

“A number at which the benefits of intervention exceed those of inaction”
CV Mortality Risk Doubles with Each 20/10 mm Hg BP Increment*

*Individuals aged 40-70 years, starting at BP 115/75 mm Hg.
CV, cardiovascular; SBP, systolic blood pressure; DBP, diastolic blood pressure
### JNC Reclassification of BP Based on Risk

<table>
<thead>
<tr>
<th>JNC VI</th>
<th>JNC 7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
<td><strong>SBP (mm Hg)</strong></td>
</tr>
<tr>
<td>Optimal</td>
<td>&lt;120</td>
</tr>
<tr>
<td>Normal</td>
<td>120-129</td>
</tr>
<tr>
<td>Hi-normal</td>
<td>130-139</td>
</tr>
</tbody>
</table>

**Hypertension**

| Stage 1 | 140-159 | or | 90-99 | Stage 1 | 140-159 | or | 90-99 |
| Stage 2 | 160-179 | or | 100-109 | Stage 2 | ≥160 | or | ≥100 |
| Stage 3 | ≥180 | or | ≥110 |

Adapted with permission from Chobanian AV et al. Hypertension. 2003;42:1206-1252.
<table>
<thead>
<tr>
<th>BP Category</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>38%</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>31%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>31%</td>
</tr>
</tbody>
</table>

Prevalence of Blood Pressure Categories in US Adults \( \geq 20 \) Years of Age
(NHANES 1999-2000)

Risk Pyramid: SBP and CHD Mortality for Men Screened in MRFIT

<table>
<thead>
<tr>
<th>SBP (mm Hg)</th>
<th>Excess CHD deaths (%)</th>
<th>Men (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥180</td>
<td>7.2</td>
<td>0.9</td>
</tr>
<tr>
<td>170-179</td>
<td>6.8</td>
<td>1.2</td>
</tr>
<tr>
<td>160-169</td>
<td>10.1</td>
<td>2.7</td>
</tr>
<tr>
<td>150-159</td>
<td>19.5</td>
<td>6.2</td>
</tr>
<tr>
<td>140-149</td>
<td>23.4</td>
<td>12.8</td>
</tr>
<tr>
<td>130-139</td>
<td>20.7</td>
<td>22.8</td>
</tr>
<tr>
<td>120-129</td>
<td>9.9</td>
<td>28.4</td>
</tr>
<tr>
<td>110-119</td>
<td>1.3</td>
<td>19.0</td>
</tr>
<tr>
<td>&lt;110</td>
<td>0.0</td>
<td>6.1</td>
</tr>
</tbody>
</table>

Defining Hypertension:

(b) By hemodynamic mechanism?

Increased peripheral vascular resistance

versus

Increased large artery stiffness
The Arterial Pulse Wave

- **Systolic pressure**
- **Diastolic pressure**
- **Mean pressure** = \( \frac{1}{3} \text{SBP} + \frac{2}{3} \text{DBP} \)
- **Diastolic decay curve**
- **Pulse pressure**
- **Dicrotic notch** (aortic valve closes)

Pressure (mm Hg) vs. Time
Hemodynamic Components of BP

- **MAP - STEADY COMPONENT** (due to CO and SVR)

- **PP – PULSATILE COMPONENT** (due to LV ejection and elastic artery stiffness)

- **SBP** – rises with increased resistance and stiffness

- **DBP** – rises with increased resistance and decreases with increased stiffness

160/110

‘Essential hypertension’

Increased resistance

Small arteries

MAP

160/80

‘Isolated systolic hypertension’

Arterial stiffening

Large arteries

Pulse Pressure
Defining Hypertension:

(c) By subtype?

IDH, SDH, ISH
Age Distribution of Hypertensives in US Population (NHANES III and the 1991 Census)

Distribution of Hypertension Subtype in the Untreated Hypertensive Population by Age *(NHANES III)*

- **ISH (SBP ≥140 mm Hg and DBP <90 mm Hg)**
- **SDH (SBP ≥140 mm Hg and DBP ≥90 mm Hg)**
- **IDH (SBP <140 mm Hg and DBP ≥90 mm Hg)**

An Analysis of NHANES III Blood Pressure Data

Summary: Hypertensives fall into one of two categories:

1. A smaller (26%), younger (age <50 years), predominantly male (63%) with diastolic hypertension out of proportion to systolic hypertension (primarily IDH and SDH)

2. A larger (74%), older (age ≥50 years), predominantly female (58%) with systolic hypertension out of proportion to diastolic hypertension (primarily ISH).

Franklin et al. Hypertension 2001;37: 869-874
Individuals who are normotensive at age 55 have a 90% lifetime risk of developing hypertension.

Evolution of BP over the life course and constellation of factors influencing BP

Vasan, R. S. Hypertension 2009;54:454-456
3. Why is hypertension considered a major public health problem in the United States?

Firstly, hypertension is very common in the adult population.

Nearly 1 in 3 Adults (31%) in the US Has Hypertension


* *p<0.01, **p<0.001, compared to Non-Hispanic Whites within given time period; no significant trends across time periods within gender; analyses are age-adjusted to 2000 US population. Data from Hajjar I, Kotchen TA. Trends in prevalence, awareness, treatment, and control of hypertension in the United States, 1988-2000. JAMA 2003; 290: 199-206.

Rate of control: 27% to 35%

Colors of Salt

- White
- Black
- Red
- Yellow
- Green
- Brown
- Clear

Table salt
Soy sauce
Catsup
Mustard
Pickles
Soups & gravies
Saline
The connection between salt, obesity, hypertension and CVD mortality

- During the past 25 years salt intake has increased by 1/3 to 150-170 mmol/day (3.5 to 4.0 g sodium/day).
- This has contributed to the growing obesity epidemic and increased prevalence of hypertension by causing increased intake of high-calorie soft drinks containing corn sugar.
- Recent studies suggest that a decrease of 50 mmol/day below the current level (a reduction of 1/3) would decrease BP by 4.0/2.5 mm Hg in hypertensives and reduce CVD mortality in the US by more than 100,000/yr.
3. Why is hypertension considered a major public health problem in the United States?

Secondly, hypertension is associated with considerable cardiovascular risk.
"Pull out, Betty! Pull out!...
He has hypertension!"
Global Mortality 2000: Impact of Hypertension and Other Health Risk Factors

Attributable Mortality
(In thousands; total 55,861,000)

- High blood pressure
- Tobacco
- High cholesterol
- Underweight
- Unsafe sex
- High BMI
- Physical inactivity
- Alcohol
- Indoor smoke from solid fuels
- Iron deficiency

- High mortality, developing region
- Lower mortality, developing region
- Developed region

Is it a true risk factor or a risk marker?

A true risk factor is suspected of being causative of the disease process.

A risk marker is associated with the disease process without being in the causal pathway.
Complications of Hypertension:

Hypertension is a risk factor for:

- TIA, stroke
- Retinopathy
- Peripheral vascular disease
- LVH, CHD, HF
- Renal failure

TIA = transient ischemic attack; LVH = left ventricular hypertrophy; CHD = coronary heart disease; HF = heart failure.

Elevated pulse pressure, an indirect (but important) measure of increased vascular stiffness

Associated with:

- Cardiac complications:
  - LVH
  - Atrial fibrillation
  - Systolic and diastolic dysfunction
  - Heart failure
- Large artery complications:
  - Myocardial infarction
  - Stroke
- Microvascular complications:
  - White matter lesions, cognitive impairment, dementia
  - Renal disease
The shape of things to come: “Diabesity”
Association of Systolic BP and CV Death in Type 2 Diabetes

# Stages of Chronic Kidney Disease

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>GFR mL/min/1.73 m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kidney damage with normal or increased GFR</td>
<td>≥ 90</td>
</tr>
<tr>
<td>2</td>
<td>Kidney damage with mild decreased GFR</td>
<td>60-89</td>
</tr>
<tr>
<td>3</td>
<td>Moderate decreased GFR</td>
<td>30-59</td>
</tr>
<tr>
<td>4</td>
<td>Severe decreased GFR</td>
<td>15-29</td>
</tr>
<tr>
<td>5</td>
<td>Kidney failure</td>
<td>&lt; 15 (or dialysis)</td>
</tr>
</tbody>
</table>
Proteinuria Is an Independent Risk Factor for Mortality in Type 2 Diabetes

P < 0.01, normo- vs micro- and macroalbuminuria.
P < 0.05, micro- vs macroalbuminuria.

Diabetes:
The Most Common Cause of ESRD

Primary Diagnosis for Patients Who Start Dialysis

- Diabetes: 50.1%
- Hypertension: 27%
- Glomerulonephritis: 13%
- Other: 10%

No. of dialysis patients (thousands)

- 1984: 243,524
- 1988: 281,355
- 1992: 520,240
- 1996: 281,355
- 2000: 281,355
- 2004: 281,355
- 2008: 281,355

$r^2$=99.8%

ESRD in the USA 2002

- ↓ Mortality from MI & stroke over past 30 years
- ↑ Life expectancy contributed to ↑ ESRD
- Currently in USA > 300,000 patients on dialysis
- The cost exceeds $ 60,000 per patient per year
- Twenty one billion $ projected cost in 2002
- First year mortality ~ 20%
- ~ 50% of deaths are cardiac (USRDS)
Life Expectancy for Selected U.S. Populations

Expected remaining years

- U.S.
- Prostate cancer
- Colon cancer
- ESRD
- Lung cancer

USRDS 1993 Annual Data Report
3. Why is hypertension considered a major public health problem in the United States?

Thirdly, there is considerable reduction in cardiovascular risk with effective lowering of blood pressure with therapy.
Long-Term Antihypertensive Therapy Significantly Reduces CV Events

<table>
<thead>
<tr>
<th>Condition</th>
<th>Average Reduction in Events (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>35%-40%</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>20%-25%</td>
</tr>
<tr>
<td>Heart failure</td>
<td>&gt;50%</td>
</tr>
</tbody>
</table>

3. Why is hypertension considered a major public health problem in the United States?

Fourthly, there is insufficient awareness, treatment and control of hypertension.
Hypertension Awareness, Treatment, and Control: US 1976 to 2000*

4. Global Risk Assessment
Risk factor clustering with hypertension, ages 18–74 years. Framingham offspring.

BP is a *risk marker* for “The Metabolic Syndrome”

**NCEP-ATP III Definition: ≥3 of the Following**

- **Abdominal obesity** (waist circumference)
  - Men: >102 cm (>40 in)
  - Women: >88 cm (>35 in)

- **Triglycerides**
  - ≥150 mg/dL

- **HDL-C**
  - Men: <40 mg/dL
  - Women: <50 mg/dL

- **Blood pressure**
  - ≥130/≥85 mmHg (risk marker)

- **Fasting glucose**
  - ≥100 mg/dL

*Diagnosis is established when ≥3 of these risk factors are present.*

Other CVD Risk Factors: JNC 7

- Physical inactivity
- Cigarette smoking
- Age (older than 55 for men, 65 for women)
- Family history of premature CVD
  (men under age 55 or women under age 65)

*Components of the metabolic syndrome in blue*  
Chobanian et al. JAMA. 2003;289:2560-2572
Framingham Heart Study (1983)

CV Risk Profile

8 Year Probability Per 1,000

Systolic BP: 105 >>> 185
Cholesterol: 185
Glucose Intol.: 0
Cigarettes: 0
ECG-LVH: 0

Kannel, 1983
**ATP-III: Framingham Point Scores**

**Estimate of 10-Year Risk for Men**

<table>
<thead>
<tr>
<th>Age, y</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-34</td>
<td>-9</td>
</tr>
<tr>
<td>35-39</td>
<td>-4</td>
</tr>
<tr>
<td>40-44</td>
<td>0</td>
</tr>
<tr>
<td>45-49</td>
<td>3</td>
</tr>
<tr>
<td>50-54</td>
<td>6</td>
</tr>
<tr>
<td>55-59</td>
<td>8</td>
</tr>
<tr>
<td>60-4</td>
<td>10</td>
</tr>
<tr>
<td>65-69</td>
<td>11</td>
</tr>
<tr>
<td>70-74</td>
<td>12</td>
</tr>
<tr>
<td>75-79</td>
<td>13</td>
</tr>
</tbody>
</table>

**Systolic BP**

<table>
<thead>
<tr>
<th>Systolic BP mm Hg</th>
<th>If Untreated</th>
<th>If Treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;120</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>120-129</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>130-139</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>140-159</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>≥160</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**HDL mg/dL**

<table>
<thead>
<tr>
<th>HDL mg/dL</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥60</td>
<td>-1</td>
</tr>
<tr>
<td>50-59</td>
<td>0</td>
</tr>
<tr>
<td>40-49</td>
<td>1</td>
</tr>
<tr>
<td>&lt;40</td>
<td>2</td>
</tr>
</tbody>
</table>

**Total Cholesterol**

<table>
<thead>
<tr>
<th>Total Cholesterol</th>
<th>Age 20-39</th>
<th>Age 40-49</th>
<th>Age 50-59</th>
<th>Age 60-69</th>
<th>Age 70-79</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;160</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>160-199</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>200-239</td>
<td>7</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>240-279</td>
<td>9</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>≥280</td>
<td>11</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Points Total**

<table>
<thead>
<tr>
<th>Nonsmoker</th>
<th>Age 20-39</th>
<th>Age 40-49</th>
<th>Age 50-59</th>
<th>Age 60-69</th>
<th>Age 70-79</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Systolic BP Untreated**

<table>
<thead>
<tr>
<th>Systolic BP mm Hg</th>
<th>If Untreated</th>
<th>If Treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;120</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>120-129</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>130-139</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>140-159</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>≥160</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Systolic BP Treated**

<table>
<thead>
<tr>
<th>Systolic BP mm Hg</th>
<th>If Treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;120</td>
<td>0</td>
</tr>
<tr>
<td>120-129</td>
<td>1</td>
</tr>
<tr>
<td>130-139</td>
<td>2</td>
</tr>
<tr>
<td>140-159</td>
<td>2</td>
</tr>
<tr>
<td>≥160</td>
<td>3</td>
</tr>
</tbody>
</table>

**HDL mg/dL Points**

<table>
<thead>
<tr>
<th>HDL mg/dL</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥60</td>
<td>-1</td>
</tr>
<tr>
<td>50-59</td>
<td>0</td>
</tr>
<tr>
<td>40-49</td>
<td>1</td>
</tr>
<tr>
<td>&lt;40</td>
<td>2</td>
</tr>
</tbody>
</table>

**Point Total**

<table>
<thead>
<tr>
<th>Point Total</th>
<th>10-Year Risk, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0</td>
<td>&lt;1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
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<td>4</td>
<td>1</td>
</tr>
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<td>5</td>
<td>2</td>
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<td>6</td>
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</tr>
<tr>
<td>7</td>
<td>3</td>
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<td>5</td>
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<td>15</td>
<td>20</td>
</tr>
<tr>
<td>16</td>
<td>25</td>
</tr>
<tr>
<td>≥17</td>
<td>30</td>
</tr>
</tbody>
</table>

There's no such thing as a sudden heart attack. It requires years of preparation.
Advice from Woody Allen

“If I knew I would live this long I would have taken better care of myself”

“Sudden Death is nature’s way of telling you to slow down”
5. Intervention Trials
• “Hypertension may be an important compensatory mechanism which should not be tampered with, even were it certain that we could control it.”

Paul Dudley White, 1931 Textbook of Cardiology.
## Hypertension Intervention Trials: 1959-1970

<table>
<thead>
<tr>
<th>Trial</th>
<th>Severity of Hypertension</th>
<th>CV events/yr. In CTRL Group</th>
<th>CV events/yr: CTRL vs Ther. Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harrington, et al (1959)</td>
<td>Malignant Hypertension</td>
<td>90% Mortality</td>
<td>90% vs 50% (Mortality / Yr)</td>
</tr>
<tr>
<td>VA Coop. Study (1967)</td>
<td>Severe (DBP ≥ 115 mmHg)</td>
<td>29%</td>
<td>10:1 (1.5 Yr.)</td>
</tr>
<tr>
<td>VA Coop. Study (1970)</td>
<td>Moderate (DBP 105-114 mmHg)</td>
<td>5.5%</td>
<td>3.5:1 (4.5 Yr.)</td>
</tr>
</tbody>
</table>
Clinical Trials in Hypertension

Should we treat diastolic HBP?

What is the goal of treatment?

Should we treat DBP in older persons?

What is the best way to treat HBP?

Should we treat ISH in older persons?

Can we prevent hypertension?


HDFP

VA Cooperative Studies

EWPHE MRC-1 ANHBP-1

SHEP MRC-2 STOP-1

HAPPHY MAPHY

TOMHS VA MONORx

HOT UKPDS

Syst-Eur Syst-China

CAPPP STOP-2

INSIGHT NORDIL

SCOPE CONVINCE ALLHAT ANBP2 LIFE

VALUE ASCOT ACCOMPLISH TROPHY

SHEP Trial: Design

- **N:** 4736; 43% male
- **Age:** >60
- **BP:** SBP 160-219 and DBP <90
- **Design:** Placebo control, double blind
- **Active Rx:** Chlorthalidone (atenolol as step 2)
- **SBP difference:** 12 mm Hg
- **Duration:** 4.5 years

*JAMA 1991;265:3255*
SHEP Trial: Cardiovascular Disease Endpoints

JAMA 1991;265:3255
**HYVET**  
Results All Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>HR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All stroke</td>
<td>-34%</td>
<td>0.46 - 0.95</td>
<td>0.025</td>
</tr>
<tr>
<td>Total mortality</td>
<td>-28%</td>
<td>0.59 - 0.88</td>
<td>0.001</td>
</tr>
<tr>
<td>Fatal stroke</td>
<td>-45%</td>
<td>0.33 - 0.93</td>
<td>0.021</td>
</tr>
<tr>
<td>Cardiovascular mortality</td>
<td>-27%</td>
<td>0.55 - 0.97</td>
<td>0.029</td>
</tr>
<tr>
<td>Heart failure</td>
<td>-72%</td>
<td>0.17 - 0.48</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cardiovascular events</td>
<td>-37%</td>
<td>0.51 - 0.71</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

6. Management of Hypertension
National Heart, Lung, and Blood Institute
National High Blood Pressure Education Program

Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) EXPRESS
JNC 7: Appropriate BP Targets

- For both CVD and kidney disease, systolic BP is far more important than diastolic BP.

- Systolic BP should be $<140$ mm Hg in all patients, and ideally between 120-130 mm Hg in patients with complications (diabetes, heart failure, kidney disease).

- Only a small fraction of hypertensives are achieving appropriate BP control.

- Multiple antihypertensive agents are needed for most patients.

- Those with SBP 120–139 mmHg or DBP 80–89 mmHg should be considered pre-hypertensive who require health-promoting lifestyle modifications to prevent CVD.
JNC 7: Considerations for older persons with hypertension

- This population has the lowest rates of BP control and the greatest absolute benefit with effective therapy.

- Lower initial drug doses may be indicated to avoid symptoms; standard doses and multiple drugs will be needed to reach BP targets.

- More than two-thirds of people over 65 have HTN, i.e. ISH (Isolated systolic hypertension).
JNC 7: Considerations for special populations with hypertension

- Treatment generally similar for all demographic groups
- Socioeconomic factors and lifestyle important barriers to BP control
- Prevalence, severity of hypertension increased in blacks

## Lifestyle Interventions for Prevention or Treatment of Hypertension

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Blood Pressure Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise</td>
<td>5-10 mm Hg (≥30 min ≥3x/wk)</td>
</tr>
<tr>
<td>Weight reduction</td>
<td>1-2 mm Hg/Kg</td>
</tr>
<tr>
<td>Alcohol intake reduction</td>
<td>1 mm Hg/drink/d</td>
</tr>
<tr>
<td>Sodium intake reduction</td>
<td>2-3 mm Hg/40 mmol/d</td>
</tr>
<tr>
<td>DASH diet</td>
<td>3-10 mm Hg</td>
</tr>
</tbody>
</table>

Adapted from Cushman et al. Endocrine Practice 1997;3:106 & Sacks, et al. NEJM 2001;334:3
Sodium Reduction, the DASH Diet, and Changes in Systolic Blood Pressure

Effects of a Low-Sodium DASH Diet on Systolic Blood Pressure with Increasing Age

We modified the four basic food groups

1. Good for you but tastes bad
2. Bad for you but tastes good
3. Makes you fat and ugly
4. Eat it and die
Lifestyle Treatment Measures

Nonpharmacologic treatments are used for:

- Lowering blood pressure
- Reducing need for antihypertensive agents
- Minimizing associated risk factors
- Primary prevention of hypertension
Development of Hypertension Guidelines: the JNCs and Drug Therapy

Earliest Guidelines

1972
28 drugs Diuretics
DBP ≥105
NHBPEP STARTS

1973
34 drugs Diuretics

1976

1980
43 drugs Diuretics, β-blockers Added

1984
50 drugs ACEI, CAs added

1988
68 drugs Diuretics/β-blockers

1993

1997
84 drugs 7 options

2003
> 125 drugs Diuretics

JNCs I-7.
Not at Goal Blood Pressure (<140/90 mm Hg)
(<130/80 mm Hg for those with diabetes or chronic kidney disease)

Initial Drug Choices

Without Compelling Indications

Stage 1 Hypertension
(SBP 140-159 or DBP 90-99 mm Hg)
Thiazide-type diuretics for most
May consider ACEI, ARB, BB, CCB, or combination

Stage 2 Hypertension
(SBP ≥160 or DBP ≥100 mm Hg)
2-drug combination for most (usually thiazide-type diuretic and ACEI, or ARB, or BB, or CCB)

With Compelling Indications

Drug(s) for the compelling indications
Other antihypertensive drugs (diuretics, ACEI, ARB, BB, CCB) as needed

Not at Goal Blood Pressure

Optimize dosages or add additional drugs until goal blood pressure is achieved
Consider consultation with hypertension specialist

### Number of Medications to Achieve Goal BP in 5 Trials of DM &/or Renal Disease

<table>
<thead>
<tr>
<th>Trial</th>
<th>Number of BP Meds</th>
</tr>
</thead>
<tbody>
<tr>
<td>UKPDS (&lt;150/85 mm Hg)</td>
<td>2.7</td>
</tr>
<tr>
<td>ABCD (&lt; 75 mm Hg DBP)</td>
<td>2.8</td>
</tr>
<tr>
<td>MDRD (&lt;92 mm Hg MAP)</td>
<td>3.6</td>
</tr>
<tr>
<td>HOT (&lt;80 mm Hg DBP)</td>
<td>3.3</td>
</tr>
<tr>
<td>AASK (&lt;92 mm Hg MAP)</td>
<td>3.8</td>
</tr>
</tbody>
</table>

7. Barriers to Treatment
Barriers to Controlling Hypertension

Patients

Providers

Healthcare System
“Well, now that you have it, you can stop worrying about getting it.”
“What they want is for me to make them feel good enough to go back to doing the things that make them feel bad.”
The Initial Confrontation of the HTN Problem

- Upon making a diagnosis of HTN, tell patient the BP reading and what it should be (provide a written copy).
- Prepare patient for the probable necessity for polypharmacy to control BP with a minimum of side effects.
- Advise Home BP measurement (135/85 mmHg is considered to be hypertensive).

8. Prevention Strategy:

General Population Strategy Versus Targeted Intensive Strategy
Life’s Simple 7

Primordial Prevention

- Get active
- Control cholesterol
- Eat better
- Manage blood pressure
- Lose weight
- Reduce blood sugar
- Stop smoking

AHA 2010
Primordial, primary and secondary prevention of atherosclerotic disease

Nilsson PM, Lurbe E, Laurent S, J Hypertens 2008;26:1049-1057
**Natural history of CVD: a 3-act tragedy**

- First act: Introduces the main characters  
  -- Risk factors *(primordial prevention)*.
- Second act: Takes place over decades  
  -- Villains attack the arterial walls  
  *(Primary prevention)*
- Third act: Can be tragically brief  
  -- plaque rupture & arterial thrombosis  
  -- patient survives *(2ndary prevention)*

Sniderman AD. Lancet 2008;371:1547-1549
Total CV prediction: an elusive goal?

"You're going to meet a tall, dark stranger."
Lifetime risks of CV disease

- **Optimal RF:** cholesterol <180 mg/dl, BP <120/80 mm Hg, non-smoker, no diabetes

- **Not optimal RF:** cholesterol 180-199 mg/dl, SBP 120-139 mm Hg, DBP 80-89 mm Hg

- **Elevated RF:** Cholesterol 200-239 mg/dl, SBP 140-159 mm Hg, DBP 90-99 mm Hg

- **Major RF:** Cholesterol \( \geq 240 \) mg/dl, BP \( \geq 160/100 \) mm Hg, current smoker, + diabetes

Lifetime Risk of Death from Cardiovascular Disease among Black Men and White Men at 55 Years of Age, According to the Aggregate Burden of Risk Factors and Adjusted for Competing Risks of Death.

Lifetime risks of CV disease

- Risk factor burden related to lifetime CVD risk
- RFs: HTN, cholesterol, smoking, DM
- Consistent across race and birth cohorts
- RFs differences affect racial risk differentially
- **Primordial prevention** is 3-5X > primary prevention in decreasing lifetime CVD risk.

• Epidemiology Summary:
  – Increasing prevalence; world wide problem
  – Blood pressure as a moving target
  – ↑ PVR in the young, ↑ stiffness in the elderly
  – Predominantly isolated systolic hypertension
  – Consider special populations at increased risk
  – Hypertension as a part of absolute global CV risk
  – Population vs. high risk approaches for prevention