Hypertension: What Does the Expert Say and What Should I Do?

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Disclosure

Relevant Financial Relationships
None

Off-Label/Investigational Uses
None
Learning Objectives

• To review the health impact of HTN.

• To review the different methods of measurement of blood pressure.

• To review the multiple recent guidelines regarding goal blood pressure control.

• To discuss specific treatment options including pharmacologic and non pharmacologic including in special populations.
Clinical case

• 56 yo woman presenting for evaluation of high blood pressure noted during a job-site screening.

• She has gained 20 lbs over the past 5 y, take naproxen 220 mg daily for joint pain.

• She has never smoked. She drinks 1 to 2 alcoholic drinks per day. No drug use. FH: positive for HTN.

• On examination: BP 163/94 mmHg in both arms while seated and 150/96 mmHg while standing.

• Na: 138, K: 3.8, Creatinine: 0.8 mg/dl. UA normal.
Clinical case: questions

• What are the implications of high blood pressure on the patient?
• What work-up is required for this new finding?
• What is the goal blood pressure to target?
• How do you reach the goal blood pressure?
• How do you advise patient to monitor blood pressure?
Learning Objectives

• To review the health impact of HTN.

• To review the different methods of measurement of blood pressure.

• To review the multiple recent guidelines regarding goal blood pressure control.

• To discuss specific treatment options including pharmacologic and non pharmacologic including in special populations.
Target-organ damage

Brain
- Stroke sequelae
- Multi-infarct dementia

Eye
- Retinopathy including cotton-wool exudates
- Hemorrhage
- Papilledema

Heart
- Diastolic dysfunction
- Left ventricular hypertrophy
- Obstructive cardiomyopathy
- Heart failure with preserved ejection fraction
- Accelerated coronary atherosclerosis
- Myocardial infarction
- Heart failure with reduced ejection fraction

Kidney
- Chronic kidney disease
- Albuminuria
- Reduced GFR
- End-stage kidney failure

Vascular
- Aortic aneurysm — ascending or descending
- Atherosclerotic occlusive disease with limb or organ ischemia
- Arterial or aortic dissection

Causes
- Genetic predisposition
- Lifestyle (high sodium intake, weight gain, excess alcohol intake)
- Medications (prescription or over-the-counter NSAIDs, stimulants, and decongestants) or illicit drugs
- Secondary causes (renal, renovascular, endocrine, urologic)

Effects
- Hypertension (systolic, diastolic, or both)

Figure 1. Pathophysiology of Hypertension.
GFR denotes glomerular filtration rate, and NSAIDs nonsteroidal anti-inflammatory drugs.

Sandra Taler. Initial Treatment of Hypertension. NEJM Feb 2018
Hypertension: health impact

• In the Global Burden of Disease Study 2010, high BP was the leading cause of death and disability-adjusted life years worldwide\(^1\).

• In the United States, hypertension accounted for more CVD deaths than any other modifiable CVD risk factor and was second only to cigarette smoking as a preventable cause of death for any reason\(^2\).

• In a follow-up study of 23,272 US NHANES (National Health and Nutrition Examination Survey) participants, >50% of deaths from coronary heart disease (CHD) and stroke occurred among individuals with hypertension\(^3\).

• In 2012, hypertension was the second leading assigned cause of ESRD, behind diabetes mellitus (DM), and accounted for 34% of incident ESRD cases in the US population\(^4\).

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Hypertension: Cumulative Incidence of Cardiovascular Events

Optimal blood pressure: SBP < 120 mm Hg and DBP < 80 mm Hg.

Normal blood pressure: SBP 120 to 129 mm Hg or DBP 80 to 84 mm Hg.

High-normal blood pressure: SBP 130 to 139 mm Hg or DBP 85 to 89 mm Hg.

Hazard Ratio for CVD of 2.5 among women and 1.6 among men

N= 6859 participants in the Framingham Heart Study

HTN coexists frequently with other CVD risk factors

<table>
<thead>
<tr>
<th>Modifiable Risk Factors*</th>
<th>Relatively Fixed Risk Factors†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current cigarette smoking, secondhand smoking</td>
<td>CKD</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>Family history</td>
</tr>
<tr>
<td>Dyslipidemia/hypercholesterolemia</td>
<td>Increased age</td>
</tr>
<tr>
<td>Overweight/obesity</td>
<td>Low socioeconomic/educational status</td>
</tr>
<tr>
<td>Physical inactivity/low fitness</td>
<td>Male sex</td>
</tr>
<tr>
<td>Unhealthy diet</td>
<td>Obstructive sleep apnea</td>
</tr>
<tr>
<td></td>
<td>Psychosocial stress</td>
</tr>
</tbody>
</table>

* 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[82.4-12]), 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.
Learning Objectives

• To review the health impact of HTN.

• To review the different methods of measurement of blood pressure.

• To review the multiple recent guidelines regarding goal blood pressure control.

• To discuss specific treatment options including pharmacologic and non pharmacologic including in special populations.
AHA Scientific Statement

Measurement of Blood Pressure in Humans
A Scientific Statement From the American Heart Association

Paul Muntner, PhD, MHS, FAHA, Chair; Daichi Shimbo, MD, Vice Chair;
Robert M. Carey, MD, FAHA; Jeanne B. Charleston, PhD; Trudy Gaillard, PhD;
Sanjay Misra, MD, FAHA; Martin G. Myers, MD; Gbenga Ogedegbe, MD, FAHA;
Joseph E. Schwartz, PhD; Raymond R. Townsend, MD, FAHA;
Elaine M. Urbina, MD, MS, FAHA; Anthony J. Viera, MD, MPH, FAHA;
William B. White, MD, FAHA; Jackson T. Wright Jr, MD, PhD, FAHA; on behalf of the American
Heart Association Council on Hypertension; Council on Cardiovascular Disease in the Young; Council
on Cardiovascular and Stroke Nursing; Council on Cardiovascular Radiology and Intervention; Council
on Clinical Cardiology; and Council on Quality of Care and Outcomes Research

Hypertension. 2019;73:e35–e66
accurate reading possible.

"This is a big deal. A lot of people have blood pressure that are on the borderline of having hypertension, and these small errors can sway you one way or the other in a diagnosis and treatment with medication you might not need."

— Michael Rakotz

7 SIMPLE TIPS TO GET AN ACCURATE BLOOD PRESSURE READING

- Use correct cuff size: Cuff too small adds 2–10 mm Hg
- Don't have a conversation: Talking or active listening adds 10 mm Hg
- Put cuff on bare arm: Cuff over clothing adds 5–50 mm Hg
- Empty bladder first: Full bladder adds 10 mm Hg
- Support arm at heart level: Unsupported arm adds 10 mm Hg
- Keep legs uncrossed: Crossed legs add 2–8 mm Hg
- Support back/feet: Unsupported back and feet adds 6.5 mm Hg

The common positioning errors can result in inaccurate blood pressure measurement. Figures shown are estimates of how improper positioning can potentially impact blood pressure readings.

Sources:
2. Hamler, J. The importance of accurate blood pressure measurement. The Permanente Journal 2008; Volume 13 No. 3 51

This 7 simple tips to get an accurate blood pressure reading was adopted with permission of the American Medical Association and The Johns Hopkins University. The original copyrighted content can be found at https://www.ama-assn.org/ama-johns-hopkins-blood-pressure-resource

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Measurement of Blood Pressure in Humans
A Scientific Statement From the American Heart Association

- Fully automated oscillometric devices capable of taking multiple readings even without an observer being present may provide a more accurate measurement of BP than auscultation.

- Ambulatory BP monitoring is considered the reference standard for out-of-office BP assessment, with home BP monitoring being an alternative when ambulatory BP monitoring is not available or tolerated.

Hypertension. 2019;73:e35–e66
Measurement of Blood Pressure in Humans
A Scientific Statement From the American Heart Association

• Initial and ongoing training of technicians and healthcare providers and the use of validated and calibrated devices are critical for obtaining accurate BP measurements.

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Key Components for Training in BP Measurement

Observers should be aware of the need to do the following:

- Use only validated devices that are well maintained (including regular recalibration)
- Choose a quiet location with adequate room temperature (=72°F)
- Correctly position the person whose BP is being measured
- Ensure that the person does not talk or move during the rest and measurement periods
- Ensure that the person does not have a full bladder when BP is measured

The skills of the technician or provider should be demonstrated by assessing the following:

- Positioning the patient
- Selecting the appropriate size cuff
- Obtaining a valid and reliable measurement
- Recording the measurement accurately
- Reporting of abnormal levels

Observers should also know how to interpret and how and when to communicate BP readings to healthcare providers and patients.

Questionnaires or interviews can be used to assess knowledge of the BP measurement methodology.

Retraining of healthcare professionals every 6 mo to 1 y should be considered.

Hypertension. 2019;73:e35–e66
Ambulatory Blood Pressure Monitoring: advantages

• Noninvasive, fully automated technique in which BP is recorded over an extended period of time, typically 24 hours.

• Substantial data have demonstrated that BP measured by ABPM has a stronger association with hypertension-related target-organ damage and clinical cardiovascular outcomes compared with office-based BP measurements.

Hypertension. 2019;73:e35–e66
Ambulatory Blood Pressure Monitor

Office BP

<table>
<thead>
<tr>
<th>Time</th>
<th>Blood Pressure</th>
<th>Time</th>
<th>Blood Pressure</th>
<th>Time</th>
<th>Blood Pressure</th>
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<tbody>
<tr>
<td>11 a</td>
<td>126/80</td>
<td>12 n</td>
<td>116/78</td>
<td>1 p</td>
<td>114/78</td>
</tr>
<tr>
<td></td>
<td>Left arm Sitting</td>
<td></td>
<td>Left arm Sitting</td>
<td></td>
<td>Left arm Standing</td>
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<tr>
<td></td>
<td>Regular</td>
<td></td>
<td>Regular</td>
<td></td>
<td>Regular 68</td>
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### Ambulatory Blood Pressure Monitor

#### SUMMARY STATISTICS

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<th>Min</th>
<th>Med</th>
<th>Max</th>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Active:</td>
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<td>128</td>
<td>9</td>
<td>106</td>
<td>130</td>
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<tr>
<td>Total:</td>
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<td>128</td>
<td>9</td>
<td>106</td>
<td>130</td>
<td>151</td>
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<tr>
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<td>Total:</td>
<td>80</td>
<td>82</td>
<td>8</td>
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<tr>
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<tr>
<td>Total:</td>
<td>80</td>
<td>73</td>
<td>17</td>
<td>53</td>
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#### 18 hr summary

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<td></td>
<td></td>
</tr>
<tr>
<td>Awake:</td>
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<td>131</td>
<td>9</td>
<td>115</td>
<td>133</td>
<td>149</td>
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<td>Nocturnal:</td>
<td>15</td>
<td>118</td>
<td>6</td>
<td>106</td>
<td>119</td>
<td>128</td>
</tr>
</tbody>
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<tr>
<td><strong>Diastolic</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Awake:</td>
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<td>69</td>
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<td>113</td>
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<th>sd</th>
<th>Min</th>
<th>Med</th>
<th>Max</th>
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</thead>
<tbody>
<tr>
<td><strong>HeartRate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Awake:</td>
<td>26</td>
<td>83</td>
<td>18</td>
<td>64</td>
<td>80</td>
<td>129</td>
</tr>
<tr>
<td>Nocturnal:</td>
<td>15</td>
<td>57</td>
<td>4</td>
<td>53</td>
<td>58</td>
<td>69</td>
</tr>
</tbody>
</table>

#### Active Period

- Systolic: $\geq 135$: 31% of 80 Readings
- Systolic: $\geq 130$: 46% of 80 Readings
- Diastolic: $\geq 80$: 59% of 80 Readings

#### InActive Period

- Systolic: $\geq 120$: 0% of 0 Readings
- Systolic: $\geq 110$: 0% of 0 Readings
- Diastolic: $\geq 65$: 0% of 0 Readings

**Diagnosis:** Elevated blood pressure -- Elevated nocturnal systolic blood pressure, Normal nocturnal fall in systolic blood pressure
Ambulatory Blood Pressure Monitor
Ambulatory Blood Pressure Monitoring Compared to Home and Office Reading

**Table 11.** Corresponding Values of SBP/DBP for Clinic, HBPM, Daytime, Nighttime, and 24-Hour ABPM Measurements (Table view)

<table>
<thead>
<tr>
<th>Clinic</th>
<th>HBPM</th>
<th>Daytime ABPM</th>
<th>Nighttime ABPM</th>
<th>24-Hour ABPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>120/80</td>
<td>120/80</td>
<td>120/80</td>
<td>100/65</td>
<td>115/75</td>
</tr>
<tr>
<td>130/80</td>
<td>130/80</td>
<td>130/80</td>
<td>110/65</td>
<td>125/75</td>
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<tr>
<td>140/90</td>
<td>135/85</td>
<td>135/85</td>
<td>120/70</td>
<td>130/80</td>
</tr>
<tr>
<td>160/100</td>
<td>145/90</td>
<td>145/90</td>
<td>140/85</td>
<td>145/90</td>
</tr>
</tbody>
</table>

ABPM indicates ambulatory blood pressure monitoring; BP, blood pressure; DBP, diastolic blood pressure; HBPM, home blood pressure monitoring; and SBP, systolic blood pressure.

2017 ACC/AHA Guidelines for HTN Management
Ambulatory Blood Pressure Monitoring: advantages

- Allows the diagnosis of masked HTN and white coat HTN.

Figure 1. Cross-classification of office and out-of-office hypertension. Out-of-office hypertension is defined on the basis of home blood pressure (BP) monitoring or ambulatory BP monitoring. Reprinted from Pickering et al\[6\] with permission. Copyright © 2008, Wolters Kluwer Health.

Hypertension. 2019;73:e35–e66
White Coat Hypertension

- Among patients with office BP in the hypertensive range, the prevalence of white-coat hypertension using awake or 24-hour BP to define out-of-office BP is 15% to 30%.

- In many cases are attributable to the effect of the observer (e.g., clinician or medical staff taking the BP reading), using automated BP monitor in the office setting without an observer present may help lessen the prevalence of these phenotypes.

- Most studies, have shown that white-coat hypertension by itself confers minimal excess cardiovascular risk.
Masked Hypertension

- Refers to a mean out-of-office BP in the hypertensive range with BP not in the hypertensive range when measured in the office.
- Present in ≈15% to 30% (estimated at 17 millions in USA).
- More common among those with diabetes mellitus, chronic kidney disease, and obstructive sleep apnea.
- Multiple cohort studies and meta-analyses have also reported that masked hypertension is associated with an incidence of CVD events similar to that seen among their counterparts with sustained hypertension.

Hypertension. 2019;73:e35–e66
Masked HTN vs White Coat HTN

Hypertension. 2019;73:e35–e66
## Home Blood Pressure Reading

### Guidance to Patients

<table>
<thead>
<tr>
<th>Best practices for the patient</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preparation</strong></td>
</tr>
<tr>
<td>Have an empty bladder</td>
</tr>
<tr>
<td>Rest quietly in seated position for at least 5 min</td>
</tr>
<tr>
<td>Do not talk or text</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Position</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sit with back supported</td>
</tr>
<tr>
<td>Keep both feet flat on the floor</td>
</tr>
<tr>
<td>Legs should not be crossed</td>
</tr>
<tr>
<td>BP cuff should be placed on a bare arm (not over clothes)</td>
</tr>
<tr>
<td>BP cuff should be placed directly above the antecubital fossa (bend of the arm)</td>
</tr>
<tr>
<td>Center of the bladder of the cuff (commonly marked on the cuff by the manufacturer) should be placed over the arterial pulsation of the patient’s bare upper arm</td>
</tr>
<tr>
<td>Cuff should be pulled taut, with comparable tightness at the top and bottom edges of the cuff, around the bare upper arm</td>
</tr>
<tr>
<td>The arm with the cuff should be supported on a flat surface such as a table</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Number of readings</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Take 2 readings at least 1 min apart in the morning before taking antihypertensive medications and 2 readings at least 1 min apart in the evening before going to bed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Duration of monitoring</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred monitoring period is $\geq 7$ d (ie, 28 readings or more scheduled readings); a minimum period of 3 d (ie, 12 readings) may be sufficient, ideally in the period immediately before the next appointment with provider</td>
</tr>
</tbody>
</table>

Hypertension. 2019;73:e35–e66
When to Suspect Secondary HTN

**Screening for Secondary Hypertension**

**New Onset or Uncontrolled Hypertension in Adults**

**Conditions:**
- Drug-resistant/induced hypertension
- Abrupt onset of hypertension
- Onset of hypertension at <30 y
- Exacerbation of previously controlled hypertension
- Disproportionate TOD for degree of hypertension
- Accelerated/malignant hypertension
- Onset of diastolic hypertension in older adults (≥ 65 y)
- Unprovoked or excessive hypokalemia

**Diagram:**
- If **Yes** to screening, refer to clinician with specific expertise (Class I; see Table 13).
- If **No** to screening, no benefit.
- If **Positive screening test**:
  - If **Yes**, refer to clinician with specific expertise (Class I).
  - If **No**, no benefit.

**Figure 3**

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Learning Objectives

• To review the health impact of HTN.

• To review the different methods of measurement of blood pressure.

• To review the multiple recent guidelines regarding goal blood pressure control.

• To discuss specific treatment options including pharmacologic and non pharmacologic including in special populations.
Common Theme: Emphasis on accuracy of Blood Pressure measurements

• Guidelines recommend office blood pressure (BP) measurement on repeated visits and ambulatory blood pressure monitoring (ABPM) or home blood pressure monitoring (HBPM) to confirm the diagnosis of hypertension (Class I).
### Table 1. Classification of Blood Pressure in Adults.*

<table>
<thead>
<tr>
<th>Blood-Pressure Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Systolic pressure of &lt;120 mm Hg and diastolic pressure of &lt;80 mm Hg</td>
</tr>
<tr>
<td>Elevated</td>
<td>Systolic pressure of 120–129 mm Hg and diastolic pressure of &lt;80 mm Hg</td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
</tr>
<tr>
<td>Stage 1</td>
<td>Systolic pressure of 130–139 mm Hg or diastolic pressure of 80–89 mm Hg</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Systolic pressure of ≥140 mm Hg or diastolic pressure of ≥90 mm Hg</td>
</tr>
</tbody>
</table>

* Definitions are derived from the 2017 American College of Cardiology–American Heart Association Hypertension Guideline.\(^2\) Persons with systolic blood pressure and diastolic blood pressure in different categories should be designated in the higher blood-pressure category. Diagnosis is based on the average of two or more readings taken on two or more occasions.
**2017 ACC/AHA Guidelines Compared to JNC 7**

Individuals with systolic (SBP) and diastolic (DBP) blood pressure in 2 categories are designated to the higher blood pressure category.

<table>
<thead>
<tr>
<th>SBP (mmHg)</th>
<th>DBP (mmHg)</th>
<th>JNC 7</th>
<th>ACC/AHA 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;120</td>
<td>&lt;80</td>
<td>NORMAL BP</td>
<td>NORMAL BP</td>
</tr>
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<td>120-129</td>
<td>&lt;80</td>
<td>Prehypertension</td>
<td>Elevated BP</td>
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<td>80-89</td>
<td>Prehypertension</td>
<td>Stage 1 Hypertension</td>
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<tr>
<td>140-159</td>
<td>90-99</td>
<td>Stage 1 Hypertension</td>
<td>Stage 2 Hypertension</td>
</tr>
<tr>
<td>≥160</td>
<td>≥100</td>
<td>Stage 2 Hypertension</td>
<td>Stage 2 Hypertension</td>
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</tbody>
</table>

SBP: Systolic blood pressure; DBP: Diastolic blood pressure; JNC 7: Seventh Report of the Joint National Committee on prevention, detection, evaluation, and treatment of high Blood Pressure; ACC/AHA: American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines

Figure- uploaded by Theodore Papaioannou
2017 ACC/AHA vs JNC 7 Guidelines for HTN Management

CENTRAL ILLUSTRATION: Prevalence of Hypertension, Recommendation for Pharmacological Antihypertensive Treatment, and Blood Pressure Above Goal Among U.S. Adults According to the 2017 ACC/AHA and the JNC7 Guidelines

Compared with the JNC7 guideline, the 2017 ACC/AHA guideline results in a substantial increase in the prevalence of hypertension, a small increase in the percentage of U.S. adults recommended for antihypertensive medication, and more intensive BP lowering for many adults taking antihypertensive medication.
SPRINT TRIAL

The NEW ENGLAND JOURNAL of MEDICINE

A Randomized Trial of Intensive versus Standard Blood-Pressure Control

The SPRINT Research Group"
SPRINT: Trial Design

• 9361 persons (>50yo) with a systolic blood pressure of 130 mmHg or higher and an increased cardiovascular risk, but without diabetes, to a systolic blood-pressure target:

  Less than 120 mm Hg (intensive treatment)
  or
  Less than 140 mm Hg (standard treatment).

• The primary composite outcome was myocardial infarction, other acute coronary syndromes, stroke, heart failure, or death from cardiovascular causes.

**SPRINT: Trial Design**

- **Inclusion criteria:**

  50 yo with SBP 130-180 mmHg with Increased cardiovascular risk defined by one or more of the following:

  - Clinical or subclinical cardiovascular disease other than stroke.
  - Chronic kidney disease, excluding polycystic kidney disease (eGFR 20-60ml/min).
  - 10-year risk of cardiovascular disease of 15% or greater on the basis of the Framingham risk score.
  - Age of 75 years or older.
Exclusion criteria were:

- Diabetes mellitus.
- History of stroke.
- >1 g proteinuria.
- Heart failure.
- Estimated glomerular filtration rate <20 mL/min or dialysis.
At 1 year, the mean systolic blood pressure was 121.4 mmHg in the intensive treatment group and 136.2 mmHg in the standard-treatment group.
SPRINT TRIAL

The intervention was stopped early after a median follow-up of 3.26 years owing to a significantly lower rate of the primary composite outcome in the intensive-treatment group.

Rates of serious adverse events of hypotension, syncope, electrolyte abnormalities, and acute kidney injury or failure, but not of injurious falls, were higher in the intensive treatment group.

# SPRINT TRIAL: Benefit of Intensive Therapy

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Relative Risk Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composite primary endpoint</td>
<td>-25%</td>
</tr>
<tr>
<td>Secondary endpoints</td>
<td></td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>-17%</td>
</tr>
<tr>
<td>Heart failure</td>
<td>-38%</td>
</tr>
<tr>
<td>Death from cardiovascular causes</td>
<td>-43%</td>
</tr>
<tr>
<td>Death from all causes</td>
<td>-27%</td>
</tr>
</tbody>
</table>


In community-dwelling persons aged 75 years or older, treatment goal for SBP of less than 120 mm Hg reduced incident cardiovascular disease by 33% (from 3.85% to 2.59% per year) and total mortality by 32% (from 2.63% to 1.78% per year).

The overall SAE rate was comparable by treatment group, including among the most frail participants.

JAMA June 28, 2016 Volume 315, Number 24
Potential Impact of Implementation of SPRINT

Clinical Perspective

What Is New?

- In this population-based study, if fully implemented in eligible US adults, intensive blood pressure treatment was projected to prevent $\approx 107,500$ deaths per year and give rise to $\approx 56,100$ episodes of hypotension, $34,400$ episodes of syncope, $43,400$ serious electrolyte disorders, and $88,700$ cases of acute kidney injury per year compared with standard blood pressure treatment.

What Are the Clinical Implications?

- If fully implemented in eligible US adults with raised blood pressure and at high risk for cardiovascular disease, intensive blood pressure treatment has the potential to prevent $\approx 107,500$ deaths per year compared with standard blood pressure treatment.

- Careful patient selection and implementation are important because intensive treatment is associated with increased risk of hypotension, syncope, electrolyte abnormalities, and acute kidney injury.

Blood Pressure (BP) Thresholds and Recommendations for Treatment and Follow-Up

BP Thresholds and Recommendations for Treatment and Follow-up

Normal BP (BP <120/80 mm Hg)
- Promote optimal lifestyle habits
- Reassess in 1 y (Class Ia)

Elevated BP (BP 120-129/80 mm Hg)
- Nonpharmacologic therapy (Class I)
- Reassess in 3-6 mo (Class I)

Stage 1 Hypertension (BP 130-139/90-99 mm Hg)
- Nonpharmacologic therapy (Class I)
- Reassess in 3-6 mo (Class I)

Stage 2 Hypertension (BP ≥140/90 mm Hg)
- Nonpharmacologic therapy and BP-lowering medication (Class I)
- Reassess in 1 mo (Class I)

Clinical ASCVD or estimated 10-y CVD risk ≥10%*

No

Yes

BP goal met

Assess and optimize adherence to therapy

Consider intensified therapy

Reassess in 3-6 mo (Class I)

* Using the ACOA/HFA Pooled Cohort Equations. Note that patients with DM or CVD are automatically placed in the high-risk category. For initiation of RAS inhibitor or diuretic therapy, assess blood tests for electrolytes and renal function 2 to 4 weeks after initiating therapy.

† Consider initiation of pharmacological therapy for stage 2 hypertension with 2 antihypertensive agents of different classes. Patients with stage 2 hypertension and BP ≥160/100 mm Hg should be promptly treated, carefully monitored, and subject to upward modification dose adjustment as necessary to control BP. Reassessment includes BP measurement, detection of orthostatic hypotension in selected patients (e.g., older or with postural symptoms), identification of white coat hypertension, or a white coat effect, documentation of adherence, monitoring of the response to therapy, reinforcement of the importance of adherence, reinforcement of the importance of treatment, and assistance with treatment to achieve BP target.
Note that patients with DM and CKD are automatically in the high CVD risk category.
http://tools.acc.org/ASCVD-Risk-Estimator
2017 ACC/AHA Guidelines: Summary

• **Elevated BP (120-129/80):**
  - Non pharmacological therapy, recheck in 3-6 months

• **Stage 1 HTN (130-139/80-89):**
  - If ASCVD > 10% or DM or CKD: start drug therapy
  - If ASCVD <10%: non pharmacological therapy

• **Stage 2 HTN (>140/90):**
  - Start drug therapy regardless of ASCVD
  - Consider starting 2 agents combination.
Compared with the JNC7 guideline, the 2017 ACC/AHA guideline results in a substantial increase in the prevalence of hypertension, a small increase in the percentage of U.S. adults recommended for antihypertensive medication, and more intensive BP lowering for many adults taking antihypertensive medication.
## European Society of Cardiology/European Society of Hypertension 2018 Guidelines

### Table 1: Comparison of ACC/AHA and ESC/ESH Blood Pressure Thresholds

<table>
<thead>
<tr>
<th></th>
<th>ACC/AHA</th>
<th>ESC/ESH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition of Hypertension (mm Hg)</td>
<td>≥ 130/80</td>
<td>≥ 140/90</td>
</tr>
<tr>
<td>Normal Blood Pressure ranges (mm Hg)</td>
<td>Normal: &lt; 120/80</td>
<td>Optimal: &lt; 120/80</td>
</tr>
<tr>
<td></td>
<td>Elevated: 120-129/&lt;80</td>
<td>Normal: 120-129/80-84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High normal: 130-139/85-89</td>
</tr>
<tr>
<td>Hypertension Stages (mm Hg)</td>
<td>Stage 1: 130-139/80-89</td>
<td>Grade 1: 140-159/90-99</td>
</tr>
<tr>
<td></td>
<td>Stage 2: ≥ 140/90</td>
<td>Grade 2: 160-179/100-109</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grade 3: ≥ 180/110</td>
</tr>
<tr>
<td>Age Specific Blood pressure targets (mm Hg)</td>
<td>&lt; 65 years: &lt; 130/80</td>
<td>&lt; 65 years &lt; 120-129/70-79</td>
</tr>
<tr>
<td></td>
<td>≥ 65 years: &lt; 130/80</td>
<td>≥ 65 years &lt; 130-139/70-79</td>
</tr>
</tbody>
</table>

Learning Objectives

• To review the health impact of HTN.

• To review the different methods of measurement of blood pressure.

• To review the multiple recent guidelines regarding goal blood pressure control.

• To discuss specific treatment options including pharmacologic and non pharmacologic including in special populations.
## Non Pharmacologic Therapy

### Best Proven Nonpharmacological Interventions for Prevention and Treatment of Hypertension*

<table>
<thead>
<tr>
<th>Nonpharmacological Intervention</th>
<th>Dose</th>
<th>Approximate Impact on SBP Hypertension</th>
<th>Normotension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight loss</td>
<td>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.</td>
<td>-5 mm Hg</td>
<td>-2/3 mm Hg</td>
</tr>
<tr>
<td>Healthy diet</td>
<td>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.</td>
<td>-11 mm Hg</td>
<td>-3 mm Hg</td>
</tr>
<tr>
<td>Reduced intake of dietary sodium</td>
<td>Dietary sodium Optimal goal is &lt;1500 mg/d, but aim for at least a 1000-mg/d reduction in most adults.</td>
<td>-5/6 mm Hg</td>
<td>-2/3 mm Hg</td>
</tr>
<tr>
<td>Enhanced intake of dietary potassium</td>
<td>Dietary potassium Aim for 3500–5000 mg/d, preferably by consumption of a diet rich in potassium.</td>
<td>-4/5 mm Hg</td>
<td>-2 mm Hg</td>
</tr>
</tbody>
</table>

*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? Available at: [https://www.nhlbi.nih.gov/health/resources/heart/hbp-dash-how-to](https://www.nhlbi.nih.gov/health/resources/heart/hbp-dash-how-to).

Pharmacological Therapy

- **First Line therapy:**
  - Thiazide diuretic.
  - Ace Inhibitor or ARB.
  - Calcium channel blockers.

- Do not combine Ace Inh with ARB or Renin Blockers
- Ok to combine dihydropyridine with non dihydropyridine calcium channel blockers
# Heart Failure with Reduced Ejection Fraction (HFrEF)

**Recommendations for Treatment of Hypertension in Patients with Heart Failure with Reduced Ejection Fraction (HFrEF)**

Referenced studies that support recommendations are summarized in online Data Supplement 34.

<table>
<thead>
<tr>
<th>COR</th>
<th>LOE</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>C-E0</td>
<td>1. Adults with HFrEF and hypertension should be prescribed GDMT* titrated to attain a BP less than 130/80 mm Hg.</td>
</tr>
<tr>
<td>III No Benefit</td>
<td>B-R</td>
<td>2. Nondihydropyridine CCBs are not recommended in the treatment of hypertension in adults with HFrEF.</td>
</tr>
</tbody>
</table>

# Heart Failure with Preserved Ejection Fraction (HFpEF)

**Recommendations for Treatment of Hypertension in Patients with Heart Failure with Preserved Ejection Fraction (HFpEF)**

Referenced studies that support recommendations are summarized in online Data Supplement 35, 36.

<table>
<thead>
<tr>
<th>COR</th>
<th>LOE</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>C-E0</td>
<td>1. In adults with HFpEF who present with symptoms of volume overload, diuretics should be prescribed to control hypertension.</td>
</tr>
<tr>
<td>I</td>
<td>C-LD</td>
<td>2. Adults with HFpEF and persistent hypertension after management of volume overload should be prescribed ACE inhibitors or ARBs and beta blockers titrated to attain systolic BP less than 130 mm Hg.</td>
</tr>
</tbody>
</table>
Hypertension in Diabetic Population

### Recommendations for Treatment of Hypertension in Patients With DM

<table>
<thead>
<tr>
<th>COR</th>
<th>LOE</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>B-R&lt;sup&gt;SR&lt;/sup&gt;</td>
<td>SBP: B-R&lt;sup&gt;SR&lt;/sup&gt;</td>
</tr>
<tr>
<td>I</td>
<td>C-EO</td>
<td>DBP: C-EO</td>
</tr>
<tr>
<td>I</td>
<td>A&lt;sup&gt;SR&lt;/sup&gt;</td>
<td>In adults with DM and hypertension, all first-line classes of antihypertensive agents (i.e., diuretics, ACE inhibitors, ARBs, and CCBs) are useful and effective.</td>
</tr>
<tr>
<td>IIb</td>
<td>B-NR</td>
<td>In adults with DM and hypertension, ACE inhibitors or ARBs may be considered in the presence of albuminuria.</td>
</tr>
</tbody>
</table>

SR indicates systematic review.

---

2017 ACC/AHA vs JNC 7 Guidelines for HTN Management

Definition of Hypertension
After kidney transplantation, it is reasonable to treat patients with hypertension with a calcium antagonist on the basis of improved GFR and kidney survival.
Hypertension in Black Patients

- In black adults with hypertension but without HF or CKD, including those with DM, initial antihypertensive treatment should include a thiazide-type diuretic or CCB.

- Two or more antihypertensive medications are recommended to achieve a BP target of less than 130/80 mm Hg in most adults with hypertension, especially in black adults with hypertension.

2017 ACC/AHA vs JNC 7 Guidelines for HTN Management
Definition of Hypertension
Medication adherence Strategies

- Up to 25% of patients do not fill the first prescription of anti-hypertensive medication.

- During the first year of treatment, the average patient has possession of antihypertensive medications only 50% of the time.

- Only 1 in 5 patients has sufficiently high adherence to achieve the benefits observed in clinical trials.
Medication adherence Strategies

• In adults with hypertension, dosing of antihypertensive medication once daily rather than multiple times daily is beneficial to improve adherence.

• Use of combination pills rather than free individual components can be useful to improve adherence to antihypertensive therapy.
Summary

**KEY CLINICAL POINTS**

**INITIAL TREATMENT OF HYPERTENSION**

- The 2017 ACC–AHA Hypertension Guideline redefines hypertension as a systolic blood pressure of 130 mm Hg or more or a diastolic blood pressure of 80 mm Hg or more and lowers the blood-pressure target to less than 130/80 mm Hg.
- This blood-pressure target is supported by the SPRINT trial, which showed lower hypertension-associated morbidity and all-cause mortality with a systolic blood-pressure target of less than 120 mm Hg than with a target of less than 140 mm Hg; electrolyte abnormalities, syncope, and acute kidney injury were more common in the lower-target group.
- The initial assessment should consider coexisting conditions, including cardiovascular disease, diabetes mellitus, chronic kidney disease, and elevated risk of cardiovascular disease, in determining when to start blood-pressure–lowering medication.
- Recommended lifestyle modifications include restriction of dietary sodium intake, weight loss if the patient is overweight, exercise, moderation of alcohol intake, and increased consumption of potassium-rich foods.
- The initial antihypertensive agent should generally be selected from one of four drug classes shown to reduce cardiovascular events: ACE inhibitors, angiotensin-receptor blockers, calcium-channel blockers, and thiazide-type diuretics.
- Repeat visits are required to ensure ongoing hypertension control.
Clinical Case

• Primary hypertension, with a positive family history and contributing lifestyle factors, including weight gain and NSAID use.
• Her alcohol intake, at more than one drink per day, may be a contributor.
• Initiate single-agent therapy for her stage 2 hypertension.
• Encourage lifestyle changes, including sodium restriction, weight reduction, and discontinuation of contributing medications.

Sandra Taler. Initial Treatment of Hypertension. NEJM Feb 2018
Clinical Case

• A thiazide-type diuretic or ACE inhibitor is a reasonable first agent to prescribe, with follow-up blood-pressure and electrolyte measurements in 3 to 4 weeks.

• Recommend regular visits during dose adjustment, combined with home blood-pressure measurements; lifestyle factors and medication adherence.

• Once her blood pressure is at goal (<130/80 mm Hg), follow-up at 6-month intervals.
THANK YOU

elters.mireille@mayo.edu
ACC/AHA 2017 Guidelines for HTN Management

**Table 2. Systematic Review Questions on High BP in Adults (Table view)**

<table>
<thead>
<tr>
<th>Question Number</th>
<th>Question</th>
<th>Section Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Is there evidence that self-directed monitoring of BP and/or ambulatory BP monitoring are superior to office-based measurement of BP by a healthcare worker for 1) preventing adverse outcomes for which high BP is a risk factor and 2) achieving better BP control?</td>
<td>4.2</td>
</tr>
<tr>
<td>2</td>
<td>What is the optimal target for BP lowering during antihypertensive therapy in adults?</td>
<td>8.1.59.39.6</td>
</tr>
<tr>
<td>3</td>
<td>In adults with hypertension, do various antihypertensive drug classes differ in their comparative benefits and harms?</td>
<td>8.1.68.2</td>
</tr>
<tr>
<td>4</td>
<td>In adults with hypertension, does initiating treatment with antihypertensive pharmacological monotherapy versus initiating treatment with 2 drugs (including fixed-dose combination therapy), either of which may be followed by the addition of sequential drugs, differ in comparative benefits and/or harms on specific health outcomes?</td>
<td>8.1.6.1</td>
</tr>
</tbody>
</table>

BP indicates blood pressure.