No Pressure
Understanding the 2017 AAP Hypertension Guidelines

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Disclosures

Consulting editor for DynaMed Plus

I do not intend to discuss this product in the course of the presentation.
Objectives

• Review major recommendations of the 2017 AAP Guidelines on Hypertension
• Highlight the key differences and changes between the 2004 and 2017 guidelines
• Highlight practical and logistical issues for primary care practitioners as it relates to new recommendations
Case

• Kara is an adorable and energetic 8 year old who presents with her mom for evaluation of nasal congestion and ear pain. After doing a cartwheel into the triage room to get her vitals per office protocol her BP is documented as 115/75. She is 134 cm (75th %ile) for height and weight is 27.7 kg (50th %ile) with BMI 15.3 (25th %ile).

• You masterfully manage her URI symptoms and otalgia. As you are doing a final review before sending her on her way, your eye catches the BP and your gut thinks this seems high and warrants a little more thought.
Clinical Questions

- Is her blood pressure “high?”
- Should she have had her BP checked at this acute care visit?
- Was her BP taken appropriately?
- What are the next steps in follow up?
## Blood Pressure Categories

### 2004

<table>
<thead>
<tr>
<th>BP Category</th>
<th>Blood Pressure percentile (Children)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I Hypertension</td>
<td>≥ 95th to &lt; 99th + 5 mmHg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BP Category</th>
<th>Blood Pressure percentile (Adolescents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I Hypertension</td>
<td>≥ 95th to &lt; 99th + 5 mmHg (regardless if &lt; 90th)</td>
</tr>
</tbody>
</table>

### 2017

<table>
<thead>
<tr>
<th>BP Category</th>
<th>Blood Pressure percentile/value mmHG (Age 1-13 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 90th</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BP Category</th>
<th>Blood Pressure mmHG (Age &gt; 13 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 120/&lt;80</td>
</tr>
</tbody>
</table>

| Stage I Hypertension | 130-139/80-89             |

*Whichever is lower*
### 2004

<table>
<thead>
<tr>
<th>BP Category</th>
<th>Blood Pressure percentile (Age 1-13 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 90&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>90&lt;sup&gt;th&lt;/sup&gt; to &lt; 95&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Stage I Hypertension</td>
<td>≥ 95&lt;sup&gt;th&lt;/sup&gt; to 99&lt;sup&gt;th&lt;/sup&gt; +5 mmHg</td>
</tr>
<tr>
<td>Stage II Hypertension</td>
<td>&gt; 99&lt;sup&gt;th&lt;/sup&gt; + 5 mmHg</td>
</tr>
<tr>
<td><strong>BP Category</strong></td>
<td><strong>Blood Pressure percentile (Adolescents)</strong></td>
</tr>
<tr>
<td>Normal</td>
<td>&lt; 90&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Prehypertension</td>
<td>90&lt;sup&gt;th&lt;/sup&gt; to &lt; 95&lt;sup&gt;th&lt;/sup&gt; or &gt;120/80 (regardless if &lt; 90&lt;sup&gt;th&lt;/sup&gt;)</td>
</tr>
<tr>
<td>Stage I Hypertension</td>
<td>≥ 95&lt;sup&gt;th&lt;/sup&gt; to &lt; 99&lt;sup&gt;th&lt;/sup&gt; +5 mmHg</td>
</tr>
<tr>
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<td>&gt; 99&lt;sup&gt;th&lt;/sup&gt; + 5 mmHg</td>
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</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 90&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Elevated</td>
<td>90&lt;sup&gt;th&lt;/sup&gt; or 120/80* to &lt; 95&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
<tr>
<td>Stage I Hypertension</td>
<td>≥ 95&lt;sup&gt;th&lt;/sup&gt; to &lt; 99&lt;sup&gt;th&lt;/sup&gt; +12 mmHg OR 130-139/80-89*</td>
</tr>
<tr>
<td>Stage II Hypertension</td>
<td>&gt; 99&lt;sup&gt;th&lt;/sup&gt; + 12 mmHG OR ≥140/90*</td>
</tr>
<tr>
<td><strong>BP Category</strong></td>
<td><strong>Blood Pressure mmHG (Age &gt; 13 years)</strong></td>
</tr>
<tr>
<td>Normal</td>
<td>&lt; 120/&lt;80</td>
</tr>
<tr>
<td>Elevated</td>
<td>120-129/&lt;80</td>
</tr>
<tr>
<td>Stage I Hypertension</td>
<td>130-139/80-89</td>
</tr>
<tr>
<td>Stage II Hypertension</td>
<td>≥ 140/90</td>
</tr>
</tbody>
</table>

*Whichever is lower*
New Normative BP Tables

• New tables do not include data from overweight and obese children (BMI > 85th %ile)
• Result is a lowering of BP table values of several millimeters from 2004 report
• Actual heights in addition to height percentiles on charts
• 95th %ile + 12 mmHG added as category with removal of 99th %ile
### Table 1: Blood Pressure Percentiles for a 12-Year-Old Boy

<table>
<thead>
<tr>
<th>Age (y)</th>
<th>BP Percentile</th>
<th>SBP, mm Hg</th>
<th>DBP, mm Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5th</td>
<td>10th</td>
<td>25th</td>
</tr>
<tr>
<td></td>
<td>5th</td>
<td>10th</td>
<td>25th</td>
</tr>
<tr>
<td>12</td>
<td>101</td>
<td>102</td>
<td>104</td>
</tr>
<tr>
<td>25th % ile height: 117/74</td>
<td>118</td>
<td>120</td>
<td>121</td>
</tr>
<tr>
<td>50th % ile height: 121/79</td>
<td>123</td>
<td>125</td>
<td>127</td>
</tr>
<tr>
<td>75th % ile height: 137/89</td>
<td>133</td>
<td>134</td>
<td>135</td>
</tr>
</tbody>
</table>

### Blood Pressure Trends

- **2004**
  - Normotensive
  - Prehypertension
  - Stage I HTN
  - 25th % ile height: 117/74
  - 50th % ile height: 121/79
  - 75th % ile height: 137/89

- **2017**
  - Elevated BP
  - Stage I HTN
  - Stage II HTN

### Table 2: Blood Pressure Percentiles by Height Percentile or Measured Height

<table>
<thead>
<tr>
<th>Age (y)</th>
<th>SBP (mm Hg)</th>
<th>DBP (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Height (in)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>12</td>
<td>55.2</td>
<td>56.3</td>
</tr>
<tr>
<td>50th</td>
<td>101</td>
<td>101</td>
</tr>
<tr>
<td>90th</td>
<td>113</td>
<td>114</td>
</tr>
<tr>
<td>95th</td>
<td>116</td>
<td>117</td>
</tr>
<tr>
<td>95th + 12 mm Hg</td>
<td>128</td>
<td>129</td>
</tr>
</tbody>
</table>
Back to our Case

Kara 8 yo 75th % ile height with BP 115/75
Case Continued

Kara *appears* to have a BP in the Stage I HTN range. Before your blood pressure elevates trying to remember the next steps, you think about her savvy and enthusiastic entrance and wonder about the validity and appropriateness of the initial reading.
Blood Pressure Screening and Measurement

- 2004 Guidelines recommended screening BP be performed in all healthy children ≥ 3 years old at every medical encounter.
- 2017 Guidelines recommend BP screening in all healthy children ≥ 3 years old annually.
- Children with obesity, diabetes, chronic kidney disease, and aortic arch obstruction/coarctation, or on medication which can raise BP should have BP performed at every encounter.
Measuring BP

Cuff Size and Placement

- Take BP in the right arm
- Measure mid-arm circumference (MAC)
- Bladder length should be 80%-100% of MAC
- Cuff width should be 40% of the MAC
- Lower end of cuff should be 2-3 cm above antecubital fossa
Measuring BP

- Oscillometric Readings may be used for screening but need to be confirmed by auscultation if abnormal
- Patient should be seated and quiet for 2-3 minutes
- Arm passively resting at heart level
- For auscultation cuff inflated to 20-40 mmHg above loss of radial pulse and then deflated at 2-3 mmHg/second
- Readings taken at onset and disappearance of Korotkoff sounds while auscultating with the bell of the stethoscope
### Simplified BP Screening Table

<table>
<thead>
<tr>
<th>Age, y</th>
<th>Boys</th>
<th>BP, mm Hg</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BP, mm Hg</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Systolic</td>
<td>DBP</td>
<td>Systolic</td>
</tr>
<tr>
<td>1</td>
<td>98</td>
<td>52</td>
<td>98</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
<td>55</td>
<td>101</td>
</tr>
<tr>
<td>3</td>
<td>101</td>
<td>58</td>
<td>102</td>
</tr>
<tr>
<td>4</td>
<td>102</td>
<td>60</td>
<td>103</td>
</tr>
<tr>
<td>5</td>
<td>103</td>
<td>63</td>
<td>104</td>
</tr>
<tr>
<td>6</td>
<td>105</td>
<td>66</td>
<td>105</td>
</tr>
<tr>
<td>7</td>
<td>106</td>
<td>68</td>
<td>106</td>
</tr>
<tr>
<td>8</td>
<td>107</td>
<td>69</td>
<td>107</td>
</tr>
<tr>
<td>9</td>
<td>107</td>
<td>70</td>
<td>108</td>
</tr>
<tr>
<td>10</td>
<td>108</td>
<td>72</td>
<td>109</td>
</tr>
<tr>
<td>11</td>
<td>110</td>
<td>74</td>
<td>111</td>
</tr>
<tr>
<td>12</td>
<td>113</td>
<td>75</td>
<td>114</td>
</tr>
<tr>
<td>≥13</td>
<td>120</td>
<td>80</td>
<td>120</td>
</tr>
</tbody>
</table>
Recording BP

• An elevated initial reading should be followed by 2 additional measurements and averaged

• If still elevated and the BP was measured by auscultation, the measurement can be used to classify the degree of elevation

• If initial elevated measurements were by oscillometry, 2 additional measurements should be performed by auscultation and averaged to derive the BP used to classify the degree of elevation
Case Resolution

You re-check Kara’s BP twice at the end of the visit after she is calm, using the right size cuff and technique and, thankfully, her BP is normal. As she and her mom depart after taking the last sticker, you make a note to ask your nurse manager to

1. Change the intake protocol to screen BP in children without chronic conditions only at annual Well Checks
2. Perform an in-service on appropriate BP measurement with the clinical staff
3. Use the screening BP table until IT has the bandwidth to get the new normative BP values into the EMR.
4. Buy more COOL stickers, not the LAME ones like last time!
Next Case

Sam is an 11 YO precocious young man presenting for his Well Child Check. He’s great other than failing his hearing and vision – no doubt from his self-reported on-line gaming addiction. As you counsel him on cutting back screen time to less than 2 hours/day, you note his BP (taken appropriately multiple times by auscultation in triage) to be 119/78. You identify this as being in the Stage I HTN range by percentile. He has a normal BMI and benign history and physical.
Clinical Questions

• What are the next steps in evaluating abnormally elevated blood pressure?
• What is required to make the diagnosis of Hypertension?
• What is the work up of persistent elevated BP and Hypertension?
• How do overweight/obesity and other chronic illnesses alter workup?
Elevated BP range

Follow-up #1
- Confirm BP still elevated
- Upper and lower extremity BPs
- Lifestyle counseling

Follow-up #2
- Confirm BP still elevated
- Diagnostic eval
- Lifestyle counseling
- ABPM recommended

Stage 1 HTN Range

Follow-up #1
- Confirm BP still elevated
- Upper and lower extremity BPs
- Lifestyle counseling

Follow-up #2
- Confirm BP still elevated
- Diagnostic eval
- Lifestyle counseling
- ABPM recommended/referral
- Initiate treatment
- Dx of “PedHTN” made

Stage 2 Htn Range
- Upper and lower extremity BPs

Follow-up #1
- Confirm BP still elevated in stage 2 range
- Diagnostic eval
- Referral to nephrology
- Initiate tx (or wait for neph appt if soon)
- Dx of ”Ped HTN” made

Follow-up #2
- Confirm BP still elevated
- Diagnostic eval
- Lifestyle counseling
- ABPM recommended/referral
- Initiate treatment
- Dx of “PedHTN” made

6 months

2 weeks

3 months

1 week or urgent referral
<table>
<thead>
<tr>
<th>BP Category (see Table 3)</th>
<th>BP Screening Schedule</th>
<th>Lifestyle Counseling (Weight, Nutrition)</th>
<th>Check Upper and Lower Extremity BP</th>
<th>ABPM¹</th>
<th>Diagnostic Evaluation²</th>
<th>Initiate Treatment³</th>
<th>Consider Subspecialty Referral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Annual</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elevated BP</td>
<td>Initial measurement</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Second measurement: Repeat in 6 months</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Third measurement: Repeat in 6 months</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Stage 1 HTN</td>
<td>Initial measurement</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Second measurement: Repeat in 1-2 weeks</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Third measurement: Repeat in 3 months</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Stage 2 HTN¹</td>
<td>Initial measurement</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Second measurement: Repeat/refer to specialty care within 1 week</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Ambulatory Blood Pressure Monitoring (ABPM)

- Now officially recommended (if available) for all patients with office diagnosed elevated BP or HTN
- More accurate for diagnosis than office
- More predictive of future BP
- Can assist in detection of secondary hypertension
- Can avoid unnecessary evaluation and treatment of patients with white coat hypertension
- Not readily available
- Limited to children > 5 years at least 120 cm tall due to lack of reference data
- More predictive of future BP
- Limited to children who can tolerate the procedure
- Can assist in detection of secondary hypertension
- No data for hard CV outcomes in children
Diagnostic Evaluation

- Focuses on determining causes and assessing for comorbidities of HTN
- Comprehensive History and Physical assessing for secondary causes and risk factors
- Extent of testing directed by results of H&P
Characteristics Suggestive of Primary HTN

- Age $\geq 6$ years
- Overweight/Obesity
- Family history in first or second degree relative
- Severity of HTN does NOT reliably distinguish between primary and secondary in most studies

An extensive evaluation is not required for children $\geq 6$ years with overweight/obesity, a positive family history, and a normal exam
Universal Tests for Confirmed HTN

- Urinalysis (UA)
- Basic Metabolic Panel (including electrolytes, BUN, Creatinine)
- Lipid Profile (fasting or non-fasting)
- Renal Ultrasound if < 6 years of age or abnormal UA or renal function
- If Obese (BMI > 95th %ile) also obtain
  - HBA1C
  - AST and ALT (Screening for Fatty Liver)
  - Lipid panel should be done fasting
Tests No Longer Universally Recommended for HTN at Time of Diagnosis

- Renal Ultrasonography
- CBC
- Retinal Exam
- Echocardiography
- For young children or with stage II HTN (not mentioned in new guideline)
  - Plasma Renin
  - Plasma and urine steroid levels
  - Plasma and urine catecholamines
Directed Testing

• Based on findings from the history and/or physical additional tests may include
  – Fasting Glucose (if at high risk for DM)
  – Complete Blood Count
  – TSH
  – Drug Screen
  – Sleep Study
  – Renal US +/- Doppler
  – CTA or MRA of kidneys

Consultation with a subspecialist is recommended to help decide which patients warrant further investigation.
Tests Not Recommended Routinely

- ECG - Not sensitive
- Uric Acid – No clear evidence yet of causal role
- Microalbuminuria
Sam returned 2 weeks later and then 3 months after that, at which time review of his workup revealed Stage I Hypertension with normal upper/lower extremity difference in BP, normal UA, chemistries, renal function, and Lipid Profile. You were unable to get ABPM. He has made lifestyle changes including active outdoor exercise even though it cuts into his computer game time!
Clinical Questions

• What are the next steps in evaluation and management?
• What are the BP treatment goals?
• What are the recommended treatments for Hypertension?
• How often should a patient with Hypertension be followed up?
Actions Upon Diagnosis

• For patients with elevated BP or HTN lifestyle interventions should be recommended
  – DASH diet
  – Moderate to vigorous physical activity 3-5 days/week for 30-60 minutes/session
  – Consider complementary medicine such as stress reduction and yoga
Actions Upon Diagnosis

• Stage I Hypertension
  – Consider referral to a specialist
  – If has failed trial of lifestyle interventions initiate pharmacologic therapy
  – Obtain an echocardiogram to assess for LVH prior to initiating pharmacologic therapy

• Stage II Hypertension
  – Initiate treatment or refer to specialist within 1 week
  – Obtain an echocardiogram
Treatment Goal

- Reduce both SBP and DBP to < 90th %ile and < 130/80 in children > 13 years
Medications

• First agent should be one of
  – ACEI/ARB (not if risk of becoming pregnant)
  – Long-acting Calcium Channel Blocker
  – Thiazide diuretic
Follow up

• See patient every 4-6 weeks for reassessment and drug titration until at goal
• Once at goal, follow-up every 3-4 months
• If a decision to proceed with lifestyle changes only, follow up in 3-6 months
• Home BP measurement can be used to help assess treatment effectiveness and adherence
• ABPM can be used as well, especially when clinic and home measurements are insufficient
Considerations for “Treatment Resistant” HTN

• Assess understanding of medications and dosing
• Assess adherence (consider reviewing pharmacy fill dates)
• Assess for use of substances or medications which may increase BP or interfere with prescribed medications
• Consider further sodium restriction
• Consider an aldosterone receptor antagonist such as Spironolactone
Take Home Points

• New Definitions of elevated BP and HTN with more detail on making the diagnosis
• New normative BP tables which will lead to more patients being classified as having elevated BP and HTN
• Emphasis on using ABPM to confirm the diagnosis
• Less extensive testing for most, with a focus on lifestyle changes, medication management, and follow up
• Refer patients with stage 2 HTN and consider referral in patients with stage 1 HTN to specialist for consideration of additional testing modalities and initial management of HTN
Questions?
