Abstract—Large differences in blood pressure (BP) by ethnic group are apparent among adults. There is uncertainty as to whether similar differences by ethnic group exist among children and, if so, the age of onset. BP measurements were obtained from 58,698 children at 78,556 visits using Pediatric Task Force data, a collection of 11 studies with BP data from children and adolescents age 1 to 17 years. Generalized estimating equation methods were used to identify sex-specific differences in body mass index (BMI)-adjusted rates of BP elevation and prehypertension by ethnic group. Significant BMI-adjusted differences in rates of BP elevation were found between Hispanic boys versus white boys (odds ratio: 1.21; 95% CI: 1.07 to 1.37; \(P=0.002\)). No overall significant differences were found between black boys versus white boys (odds ratio: 1.03; 95% CI: 0.95 to 1.12; \(P=0.49\)); however, there was significant effect modification (\(P=0.01\)) with significant differences found for normal-weight boys (BMI: <85th percentile; OR black versus white: 1.14; 95% CI: 1.03 to 1.27; \(P=0.01\)) but not for overweight boys (BMI: \(\geq\)85th percentile; OR black versus white: 0.90; 95% CI: 0.78 to 1.05; \(P=0.20\)). No overall ethnic group differences in BMI-adjusted rates of hypertension were found for girls. Ethnic differences in prevalence rates of pediatric BP elevation that are not explained by obesity are present, primarily in boys. Whether these differences are attributable to genetic or environmental factors is unknown. (Hypertension. 2009;54:502-508.)

Key Words: blood pressure ■ hypertension ■ pediatrics ■ Pediatric Task Force ■ prehypertension

We have recently published blood pressure (BP) percentiles in normal-weight children that are adjusted for age, sex, and height.\(^1\) The analyses were based on children in the Pediatric Task Force database with body mass index (BMI) <85th percentile for a given age-sex group. Percentiles were obtained using quantile regression methods that were to find the data better than the previously used polynomial regression methods. The percentiles are slightly lower than previously published task force levels,\(^2\) which included both normal-weight and overweight children in the normative database. We define a prehypertensive child as one whose systolic BP (SBP) or diastolic BP (DBP) is <95th percentile and either \(\geq\)90th percentile or at or more than the adult threshold for prehypertension, which is \(\geq\)120/80 mm Hg. BP elevation in children is defined as SBP and/or DBP \(\geq\)95th percentile.

An important issue in pediatric hypertension is whether prevalence varies by ethnic group. There are clear differences in the prevalence of hypertension by ethnic group in adults,\(^3\) but results in children are more equivocal. A previous article by our group\(^4\) compared black and white children using task force data based on polynomial regression methods. Slight differences in mean BP were found between adolescent black girls versus white girls that were mediated by BMI differences; no differences in mean BP were found between white and black boys. In the present report, we revisit these analyses using quantile regression methods, because these were shown to be more accurate than polynomial regression methods. The latter assume that the effect of height \(z\) score is the same for all ages and that distributions of pediatric BP are normally distributed, neither of which appear to be true for pediatric BP data. We use quantile regression methods with effects of age, height, and age×height represented by cubic splines to estimate percentiles, and we expanded the investigation by including Hispanic children as well. These methods provide for a more flexible response function relating BP to age and height and do not make assumptions of normality of residuals because separate sex-specific functions are used for each percentile. More details concerning these methods are provided elsewhere.\(^1\)

Methods

The data set used for this analysis consisted of all of the children in the Pediatric Task Force database.\(^3\) Normative data for BP as a function of age, sex, and height have been determined for normal-weight children. Normal-weight children are defined as children whose BMI is <85th percentile for their age and sex on the basis of 2000 Centers for Disease Control and Prevention growth charts.\(^5\) BP percentiles as a function of age, sex, and height for normal-weight...
children are available elsewhere (http://www.geocities.com/bearmosner/Pediatrics.html).

The goal of the present article was to compare rates of prehypertension and BP elevation among white, black and Hispanic children in the Pediatric Task Force database. Ethnic group was obtained by self-report. These analyses included both normal-weight (BMI: <85th percentile) and overweight (BMI: ≥85th percentile) children with BP standards based on normal-weight children. We defined SBP elevation as SBP ≥95th percentile for a child's age, sex, and height. A similar criterion was used with DBP (K5 [5th Korotkoff sound]) for DBP elevation. In addition, we defined overall BP elevation as ≥95th percentile for either SBP or DBP. We defined systolic prehypertension as <95th percentile and either ≥90th percentile or ≥120 mm Hg. We defined diastolic prehypertension as <95th percentile and either ≥90th percentile or ≥80 mm Hg. We defined overall prehypertension as either systolic prehypertension or diastolic prehypertension and no overall BP elevation.

All of the analyses were performed separately for boys and girls. Because there were systematic differences among studies even after accounting for age, sex, height, and BMI, we used study-corrected BPs in the analyses, as described previously. Because some subjects had BP measured at multiple visits, we used generalized estimating equations with a logit link based on PROC GENMOD (SAS Institute) to relate the presence of prehypertension or BP elevation at a particular visit to an ethnic group with and without adjusting for BMI using the following model:

$$\log[p_i/(1-p_i)] = \alpha + \beta_1 x_{i1} + \beta_2 x_{i2} + \gamma z_{ij}$$

(1)

where $p_i =$ probability of BP elevation (or prehypertension) for the ith child at the jth visit; $x_{i1} =$ 1 if subject i is black or $x_{i1} =0$ otherwise; $x_{i2} =$ 1 if subject i is Hispanic or $x_{i2} =0$ otherwise; and $z_{ij} =$ BMI for the ith subject at the jth visit. To assess effect modification of ethnicity by BMI, we also considered generalized estimating equation models of BP elevation (or prehypertension) on ethnicity, BMI, and ethnicity × BMI given as follows:

$$\log[p_i/(1-p_i)] = \alpha + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_{12} x_{i1} x_{i2} + \beta_{13} x_{i1} v_{ij} + \beta_{23} x_{i2} v_{ij} + \gamma z_{ij}$$

(2)

where $v_{ij} =$ 1 if the ith subject is overweight at the jth visit and $v_{ij} = 0$ otherwise. $\beta_{12}$ and $\beta_{13}$ represent interaction effects of overweight by black and Hispanic ethnicity, respectively. To assess effects of ethnicity within (overweight/normal weight) subgroups we fit the model as follows:

$$\log[p_i/(1-p_i)] = \alpha + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_{12} x_{i1} x_{i2} + \beta_{13} x_{i1} v_{ij} + \beta_{23} x_{i2} v_{ij} + \gamma z_{ij}$$

(3)

The coefficients $\beta_{12}$, $\beta_{13}$ and $\beta_{23}$ represent effects of black and Hispanic ethnicity versus white ethnicity for overweight and normal-weight children, respectively.

To assess differences in overweight prevalence by ethnic group we fit the following model:

$$\log[p_i^s/(1-p_i^s)] = \alpha_c + \delta_1 x_{i1} + \delta_2 x_{i2}$$

(4)

where $p_i^s =$ probability (overweight) for the ith subject at the jth visit.

To assess the effect of overweight status on the prevalence of BP elevation or prehypertension within specific ethnic groups we fit the following model:

$$\log[p_i/(1-p_i)] = \alpha_0 + \beta_{10} x_{i1} + \beta_{20} x_{i2} + \gamma_{10} v_{ij} (1-x_{i1})(1-x_{i2}) + \gamma_{20} v_{ij} x_{i1} + \gamma_{21} v_{ij} x_{i2} + \gamma_{22} v_{ij} x_{i1} x_{i2}$$

(5)

Results

The demographic data for the database used in this study are presented in Table 1. A total of 58 698 children ages 1 to 17 years provided data at 78 556 visits over 11 studies, of whom 29 868 (51%) were boys and 28 830 (49%) were girls. A total of 34 396 (59%) of the children were white, 18 016 (31%) were black, and 6288 (11%) were Hispanic. Diastolic BP was available for 43 152 (74%) of the children at 53 626 visits. Prevalence of BP elevation and prehypertension within specific ethnic groups we fit the following model:

$$\log[p_i/(1-p_i)] = \alpha_0 + \beta_{10} x_{i1} + \beta_{20} x_{i2} + \gamma_{10} v_{ij} (1-x_{i1})(1-x_{i2}) + \gamma_{20} v_{ij} x_{i1} + \gamma_{21} v_{ij} x_{i2} + \gamma_{22} v_{ij} x_{i1} x_{i2}$$

(5)

The data in Table 2 demonstrate that, for SBP, the odds of BP elevation were 2.9 to 3.6 times higher, and the odds of prehypertension were 1.8 to 2.2 times higher among overweight children versus normal-weight children for all of the ethnic and sex groups. The odds ratio (OR) for BP elevation was slightly higher among overweight adolescents (ages 13 to
Table 2. Percentage of Prehypertensive and Hypertensive Children for SBP by BMI Percentile, Ethnic Group, and Sex

<table>
<thead>
<tr>
<th>Ethnic Group</th>
<th>Normal-Weight Children*</th>
<th>Overweight Children†</th>
<th>Total</th>
<th>Unadjusted</th>
<th>BMI Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Visits</td>
<td>No. Elevated</td>
<td>%</td>
<td>No. of Visits</td>
<td>No. Elevated</td>
</tr>
<tr>
<td>SBP hypertension boys</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>18 001</td>
<td>870</td>
<td>4.8</td>
<td>4784</td>
<td>684</td>
</tr>
<tr>
<td>Black</td>
<td>10 919</td>
<td>528</td>
<td>4.8</td>
<td>2328</td>
<td>328</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2673</td>
<td>174</td>
<td>6.5</td>
<td>1075</td>
<td>193</td>
</tr>
<tr>
<td>SBP hypotension boys</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>18 001</td>
<td>2 074</td>
<td>11.5</td>
<td>4784</td>
<td>891</td>
</tr>
<tr>
<td>Black</td>
<td>10 919</td>
<td>1 590</td>
<td>14.6</td>
<td>2328</td>
<td>495</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2673</td>
<td>368</td>
<td>13.8</td>
<td>1075</td>
<td>213</td>
</tr>
<tr>
<td>SBP hypotension girls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>17 691</td>
<td>856</td>
<td>4.8</td>
<td>4164</td>
<td>556</td>
</tr>
<tr>
<td>Black</td>
<td>10 174</td>
<td>542</td>
<td>5.3</td>
<td>3131</td>
<td>452</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2540</td>
<td>124</td>
<td>4.9</td>
<td>1076</td>
<td>172</td>
</tr>
</tbody>
</table>

Prehypertension is defined as ≥90th percentile or ≥120 mm Hg and <95th percentile; hypertensive, ≥95th percentile based on quantile regression methods. ref indicates reference group.

*Normal-weight children have a BMI <85th percentile.
†Overweight children have a BMI ≥85th percentile.
‡OR is for SBP hypertension (prehypertension) for overweight vs normal-weight children.
§Data are based on Proc GENMOD (SAS Institute).

17 OR: 3.1 to 3.5) than among overweight children (ages 1 to 12 OR: 2.4 to 3.2). The OR for prehypertension was similar for children and adolescents (data not shown). Also, overweight prevalence was significantly higher among Hispanic boys (OR: 1.60; 95% CI: 1.47 to 1.75; P < 0.001) and girls (OR: 1.80; 95% CI: 1.65 to 1.96; P < 0.001) than white peers (data not shown). Results for blacks differed by sex, with a lower overweight prevalence for black boys (OR: 0.83; 95% CI: 0.78 to 0.88; P < 0.001) and a higher prevalence for black girls (OR: 1.30; 95% CI: 1.23 to 1.39; P < 0.001) than their white peers. The prevalence of SBP elevation ranged from 7% to 10% among boys and 7% to 8% among girls. The prevalence of systolic prehypertension ranged from 13% to 16% among boys and 8% to 9% among girls.

There were some differences in the prevalence of systolic prehypertension and BP elevation by ethnic group. For boys, the crude prevalence of SBP elevation was not significantly different between black and white boys (OR: 0.96; P = 0.39). However, Hispanic boys had significantly higher prevalent SBP elevation rates than white boys (OR: 1.49; P < 0.001). Both black and Hispanic girls had a significantly higher crude prevalence of SBP elevation than white girls (P = 0.003). After adjusting for BMI, Hispanic boys continued to have a significantly higher prevalence of SBP elevation (OR: 1.29; 95% CI: 1.14 to 1.47; P < 0.001), whereas black boys had a slightly lower prevalence of SBP elevation (OR: 0.91; 95% CI: 0.83 to 1.00; P = 0.06) than white boys. For systolic prehypertension, significant BMI-adjusted differences were found between black and white boys (OR: 1.21; 95% CI: 1.13 to 1.30; P < 0.001) but not between Hispanic and white boys. For girls, no significant differences in SBP elevation or prehypertension prevalence among ethnic groups remained after adjusting for BMI. Results for DBP are presented in Table 3.

For DBP, the BMI-adjusted prevalence of BP elevation was significantly higher for both black boys (OR: 1.13; 95% CI: 1.01 to 1.26; P = 0.04) and Hispanic boys (OR: 1.19; 95% CI: 1.01 to 1.40; P = 0.04) compared with white boys. For girls, no significant difference between ethnic-specific prevalence of DBP elevation was found after adjusting for BMI. For diastolic prehypertension, significant BMI-adjusted differences were found for black versus white boys (OR: 1.15; 95% CI: 1.03 to 1.29; P = 0.01) but not between Hispanic and white boys. Hispanic girls had a slightly lower BMI-adjusted prevalence of diastolic prehypertension than white girls (OR: 0.82; 95% CI: 0.68 to 0.99; P = 0.04). Results for overall BP elevation and prehypertension are given in Table 4.

For boys, the crude prevalence of BP elevation was significantly higher for Hispanics versus whites (OR: 1.41; 95% CI: 1.25 to 1.59; P < 0.001). After adjusting for BMI, Hispanic boys still had a higher prevalence of BP elevation (OR: 1.21; 95% CI: 1.07 to 1.37; P = 0.002). The BMI-adjusted ethnic differences persisted when children (ages 1 to 12 years; OR Hispanic versus white boys: 1.39; 95% CI: 1.13 to 1.72; P = 0.002) and adolescents (ages 13 to 17 years; OR
Hispanic versus white boys: 1.16; 95% CI: 1.00 to 1.35; \( P = 0.06 \) were analyzed separately (data not shown). No significant differences were seen between black and white boys either before or after adjusting for BMI. For girls, black girls had a significantly higher prevalence of BP elevation than white girls (OR: 1.32; 95% CI: 1.17 to 1.49; \( P = 0.001 \)) and girls (OR: 1.23; 95% CI: 1.11 to 1.37; \( P = 0.001 \)). No significant differences were found between Hispanic and white boys, but a slightly decreased risk of prehypertension was found for Hispanic versus white girls (OR: 0.80; 95% CI: 0.67 to 0.95; \( P = 0.01 \)).

An assumption made in Tables 2 to 4 is that the differences between the prevalence of BP elevation and prehypertension by ethnic group are the same for all levels of BMI. In Table 5, we assess effect modification of ethnicity \( \times \) overweight status, and we estimate effects of ethnicity separately for normal-weight and overweight children (see the Methods section for details of modeling).

For boys, there was significant effect modification of black ethnicity by BMI for both BP elevation (\( P = 0.01 \)) and prehypertension (\( P = 0.05 \)). No significant effect modification was found for Hispanic ethnicity by BMI. For normal-weight boys (BMI <85th percentile), the prevalence of BP elevation was significantly elevated for both black boys (OR: 1.14; 95% CI: 1.03 to 1.27; \( P = 0.01 \)) and Hispanic boys (OR: 1.18; 95% CI: 1.00 to 1.39; \( P = 0.05 \)). For overweight boys (BMI ≥85th percentile), significant effects were seen for Hispanic boys (OR: 1.23; 95% CI: 1.02 to 1.48; \( P = 0.03 \)) but not for black boys (OR: 0.90; 95% CI: 0.78 to 1.05; \( P = 0.20 \)). Similar results were seen for prehypertension. For girls, no significant effect modification of ethnicity by BMI was found for BP elevation; however, for prehypertension, significant effects were seen for normal-weight black girls versus white girls (OR: 1.32; 95% CI: 1.17 to 1.49; \( P < 0.001 \)) but not for overweight girls (OR: 0.99; 95% CI: 0.82 to 1.21; \( P = 0.93 \); \( P \) for interaction = 0.01).

Discussion

For overweight children (BMI ≥85th percentile), the odds of prehypertension increased ~50%, and the odds of BP elevation increased 2- to 3-fold in all of the race/ethnic groups compared with normal-weight children. Ethnic differences in the prevalence of both BP elevation and prehypertension were identified even after controlling for BMI. Hispanic boys, both normal weight and overweight, had a significantly higher prevalence of BP elevation (SBP and/or DBP ≥95th percentile) compared with white boys. Hispanic boys also had a significantly higher prevalence of BP elevation when SBP and DBP were considered separately. The prevalence of BP elevation was significantly higher in normal-weight black girls.
boys than their white counterparts but was similar in overweight black and white boys. These results persisted when children (ages 1 to 12 years) and adolescents (ages 13 to 17 years) were considered separately. Results for prehypertension differed somewhat, with a higher prevalence observed for black boys (but not Hispanic boys) as compared with white boys, especially among normal-weight boys. The race/ethnic disparity in BP was much less apparent among girls. Because BMI was higher on average in both black and Hispanic girls, after adjusting for BMI there was no difference in the prevalence of BP elevation among the 3 race/ethnic groups.

<table>
<thead>
<tr>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hypertension</strong></td>
<td><strong>Hypertension</strong></td>
</tr>
<tr>
<td>White</td>
<td>1.0 (ref)</td>
</tr>
<tr>
<td>Black</td>
<td>1.14 (1.03 to 1.27)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.18 (1.00 to 1.39)</td>
</tr>
<tr>
<td><strong>Prehypertension</strong></td>
<td><strong>Prehypertension</strong></td>
</tr>
<tr>
<td>White</td>
<td>1.0 (ref)</td>
</tr>
<tr>
<td>Black</td>
<td>1.28 (1.17 to 1.39)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.06 (0.92 to 1.23)</td>
</tr>
</tbody>
</table>

Table 4. Percentage of Hypertensive and Prehypertensive Children by BMI Percentile, Ethnic Group, and Sex

<table>
<thead>
<tr>
<th>Ethnic Group</th>
<th>Normal Weight*</th>
<th>Overweight†</th>
<th>Total</th>
<th>Unadjusted</th>
<th>BMI Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Visits</td>
<td>No. Elevated</td>
<td>%</td>
<td>No. of Visits</td>
<td>No. Elevated</td>
</tr>
<tr>
<td>Hypertension, boys</td>
<td>2011</td>
<td>209</td>
<td>10.4</td>
<td>876</td>
<td>222</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2887</td>
<td>431</td>
<td>14.9</td>
<td>1.41 (1.25 to 1.59)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 5. Effect Modification of the Association Among Hypertension, Prehypertension, and Ethnicity by BMI, Pediatric Task Force Data

<table>
<thead>
<tr>
<th>Ethnic Group</th>
<th>Normal Weight*</th>
<th>Overweight†</th>
<th>P‡</th>
<th>Normal Weight*</th>
<th>Overweight†</th>
<th>P‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>1.0 (ref)</td>
<td>1.0 (ref)</td>
<td>1.0 (ref)</td>
<td>1.0 (ref)</td>
<td>1.0 (ref)</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>1.14 (1.03 to 1.27)</td>
<td>0.01</td>
<td>0.90 (0.78 to 1.05)</td>
<td>0.20</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.18 (1.00 to 1.39)</td>
<td>0.05</td>
<td>1.23 (1.02 to 1.48)</td>
<td>0.03</td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td>Prehypertension</td>
<td>1.0 (ref)</td>
<td>1.0 (ref)</td>
<td>1.0 (ref)</td>
<td>1.0 (ref)</td>
<td>1.0 (ref)</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>1.28 (1.17 to 1.39)</td>
<td>&lt;0.001</td>
<td>1.02 (0.83 to 1.25)</td>
<td>0.83</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.06 (0.92 to 1.23)</td>
<td>0.41</td>
<td>0.83 (0.64 to 1.08)</td>
<td>0.17</td>
<td>0.11</td>
<td></td>
</tr>
</tbody>
</table>

Hypertension is defined as ≥95th percentile for either SBP or DBP based on quantile regression methods; prehypertension, either systolic or diastolic prehypertension and not hypertensive.

*Normal-weight children have a BMI <85th percentile.
†Overweight children have a BMI ≥85th percentile.
§Data are based on Proc GENMOD (SAS Institute).
‡OR is for hypertension (prehypertension) for overweight vs normal-weight children.
obesity. In addition to the obesity-hypertension relationship in adults, there appears to be an added effect of race or ethnicity. Similarly, fat patterning, as characterized by waist:hip ratio, does not explain the racial differences in hypertension among adults. A limitation of the current study is that waist:hip ratio was not available for the task force database. Data on adults from the National Health and Nutrition Examination Survey show that blacks have the highest prevalence of hypertension at 37.8% in men and 40.3% in women; the prevalence of hypertension in Hispanic men (22.1%) is somewhat lower than in white men at 26.0%. The prevalence of hypertension is nearly equivalent in white (21%) and Hispanic (21.6%) adult women.

Although adult blacks, both men and women, have the highest prevalence of hypertension, our data show that, in children, Hispanic boys had the highest prevalence of elevated BP, although black boys had the highest rate of prehypertension. Overweight prevalence was highest among Hispanic boys and girls compared with the other race/ethnic groups. However, even among the normal-weight children the rates of BP elevation were highest among Hispanic boys compared with other race/ethnicity (and sex) groups. When the rates of BP elevation were compared in boys, the rates were only slightly higher in black boys, and this is because of somewhat greater rates of DBP elevation. Although the explanation for this race/ethnicity difference between childhood and adulthood is uncertain, these findings could indicate an emerging trend toward increasing risk for hypertension and subsequent cardiovascular disease among Hispanic children as they age into adulthood.

Because the 95th percentile of the BP distribution is used to define BP elevation, the prevalence of high BP is expected to be ∼5% among normal-weight children on the basis of a single measurement in this group. Our results on the prevalence of both SBP and DBP elevation in normal-weight children are close to the expected 5%. The prevalences of both BP elevation and prehypertension clearly increased among the overweight groups in all 3 of the ethnic groups, both boys and girls. One limitation of our study is that the data were drawn from several epidemiological surveys on healthy children mostly from the 1970s and 1980s. Thus, the data used in this analysis were obtained before the current childhood obesity epidemic that is now well established. Considering the increasing overall prevalence of obesity in the childhood population and the evidence that the prevalence of BP elevation is higher in obese children, it would be expected that the current prevalence of BP elevation would be higher than the prevalence for the earlier sample that was used in this analysis.

The results reported here are similar to the results of a study to determine the effect of increasing BMI on BP among children in primary care pediatric practices. In that study, electronic medical chart data were analyzed on >18,000 children between 2 and 19 years of age. The effect of increasing BMI on both BP level and the prevalence of BP elevation was significant in both boys and girls, although no analysis by ethnic group was reported. The prevalence of BP elevation among normal-weight boys and girls was also close to 5%, with a substantially higher prevalence of BP elevation in the overweight groups. An analysis of the trends in childhood BP from 2 sequential national cross-sectional studies identified a significant increase in both SBP and DBP. The BP increase was most significant among minority groups, which also have the highest rates of childhood obesity.

A second limitation of this study is that the ascertainment of prehypertension and BP elevation is based on only 1 BP measurement session. A designation of hypertension or prehypertension that uses a single BP measurement generally overestimates the prevalence, because BP tends to decrease in subsequent visits because of an accommodation effect and regression to the mean. In clinical practice, an average SBP or DBP ≥95th percentile obtained on ≥3 separate visits is required for the clinical diagnosis of hypertension in childhood. Recent reports have demonstrated that, using these criteria, the prevalence of childhood hypertension is from 3.2% to 3.6%. Considering a prevalence of 3.2% to 3.6%, hypertension can be considered one of the most common chronic diseases in childhood. Moreover, BP data from other studies indicate that a single BP measurement does provide important information regarding the risk of future BP elevation and cardiovascular disease. A recent systematic review and analysis of 50 cohort studies that examined BP tracking documented significant BP tracking correlation coefficients from childhood into adulthood. The strength of the tracking increased with baseline age and decreased with follow-up length. The analysis concluded that data from diverse populations show that the evidence for BP tracking from childhood into adulthood is strong and that early intervention is important. The population evidence is substantial that BP measured in childhood predicts future BP with a tracking coefficient of ∼0.4 for SBP.

Perspectives
Racial disparities in the prevalence of hypertension and prehypertension have been identified in adults and are also detectable in children. Some of the observed differences appear to be associated with population differences in overweight and obesity between the pediatric and adult populations. Data in this study demonstrate differences in BP elevation by race/ethnicity, particularly for boys after controlling for the effect of BMI, which appear to be different than data observed for adults. These differences may portend a different epidemiology of hypertension when these children and adolescents reach adulthood. As the prevalence of childhood obesity increases, the prevalence of high BP in childhood is expected to increase, especially among Hispanics, and to contribute to rising rates of premature cardiovascular disease.

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Disclosures

None.

References


Blood Pressure Differences by Ethnic Group Among United States Children and Adolescents
Bernard Rosner, Nancy Cook, Ron Portman, Steve Daniels and Bonita Falkner

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