Differences in Blood Pressure Levels Among Children by Sociodemographic Status

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Introduction
The American Academy of Pediatrics (AAP) updated its blood pressure (BP) screening guidelines in 2017 to emphasize body weight as a risk factor. We provide contemporary, nationally representative estimates of prevalence of elevated and hypertensive BP among US children and examine sociodemographic prevalence differences, accounting for the influence of weight.

Methods
We used cross-sectional data from children aged 8 to 17 years (N = 5,971; weighted N = 36,612,323) collected from 2011 through 2018 in 4 biennial cycles of the National Health and Nutrition Examination Survey (NHANES). Children’s BP was categorized as normal, elevated, or hypertensive. Sociodemographic characteristics included were sex, age, race/ethnicity, family income, and education. Log binomial regression, with and without adjustment for weight (dichotomized at the 85th body mass index percentile), determined prevalence estimates and differences for elevated and hypertensive BPs with 95% CIs.

Results
In NHANES data collected from 2011 through 2018, 7.2% (95% CI, 6.3%–8.3%) of US children had elevated BP, and 3.8% (95% CI, 3.3%–4.5%) had hypertensive BP according to 2017 AAP guidelines. Differences in prevalence of weight-adjusted elevated BP indicated higher prevalence among children aged 16 to 17 years compared with children aged 8 to 9 years (prevalence difference, +6.3%; 95% CI, 3.2%–9.4%), among males compared with females (+4.6%; 95% CI, 2.7%–6.4%), and among non-Latino Black children compared with non-Latino White children (+4.0%; 95% CI, 2.2%–5.8%). Crude hypertensive BP prevalence was highest among children aged 8 to 9 years, male children, and Mexican American children. The only difference remaining after weight adjustment was among children aged 8 to 9 years and 13 to 15 years.

Conclusion
Elevated BP was most prevalent among US children who were older, male, or non-Latino Black. Factors beyond inequalities in body weight may contribute to disparities in elevated BP.

Introduction
Hypertension affected nearly 4% of US children from 2013 through 2016 (1). The high prevalence of childhood obesity has contributed to an increase in several chronic conditions among children, including hypertension (2). Children who are overweight have higher systolic and diastolic blood pressure (BP) (3) than normal-weight children, and those with obesity have a threefold higher risk of hypertension compared with children of healthy weight (4). Given the relationship between weight and BP, the American Academy of Pediatrics (AAP) changed its clinical practice guidelines in 2017 with new normative pediatric BP
Few studies have described sociodemographic factors associated with hypertension among US children. Although prevalence in those studies appears to be higher among males and among Black, Mexican American, and other Latino children (1,5,7–9), many of those studies were based on past AAP guidelines (10) and few investigated the extent to which disparities in BP could be explained by differences in weight (7,9). Furthermore, investigation of potential associations between hypertension and socioeconomic factors has been limited (11,12).

The objective of our study was to provide nationally representative prevalence estimates of elevated and hypertensive BP among US children according to 2017 AAP guidelines. We also examined sociodemographic differences in prevalence and explored the role of weight status in relationship to differences in BP levels.

Methods

Study design and database

Our cross-sectional study used nationally representative data from the National Health and Nutrition Examination Survey (NHANES) (13), which is collected biennially by the National Center for Health Statistics to provide data on the health status of community-dwelling US residents. NHANES collects sociodemographic, dietary, and general health information by survey and medical, dental, and laboratory data by physical examination. We used data from 2011–2018, which consists of 4 biennial cycles. Unweighted survey response rates ranged from 53.6% to 78.5% for our study sample. Additional adjustments to weighting procedures were used to reduce the potential effects of response bias resulting from a lower response rate in the 2017–2018 NHANES cycle (13). NHANES data collection is approved by the National Center for Health Statistics Research and Ethics Review Board. Participant and parental consent were obtained for children aged 13 years or older. Participant assent and parental consent were obtained for children aged 7 to 12 years.

Study population

NHANES BP data comes from physical examinations (13). For our study we included children aged 8 to 17 years for whom data on BP, height, weight, race/ethnicity, and socioeconomic characteristics were available. We excluded children who were missing BP measurements (n = 338), had fewer than 3 BP readings (n = 68), were missing data on body mass index (BMI) (weight in kg/height in m²) (n = 32), or were missing data on sociodemographic characteristics (n = 702). The final sample included 5,971 children, weighted to represent 36,612,323 children. To provide binned prevalence estimates of hypertensive and elevated BP, the sample was defined by NHANES cycle. We used the entire sample for prevalence estimates of various BP parameters and differences in these end points according to sociodemographic factors.

Operational definition of pediatric elevated and hypertensive BP

Although clinical diagnosis of hypertension requires BP measurement across at least 3 occasions, NHANES is limited to physical examination on 1 occasion. Therefore, 3 BP measurements taken on a single occasion were averaged for each child in accordance with AAP guidelines for clinicians and common practice in pediatric hypertension studies (1,5,7–9). NHANES BP measurement techniques have been described previously (13). For children aged 8 to 12 years, we used age, sex, and height to determine their BP percentile according to the 2017 AAP BP tables. BP percentiles (for children aged <13 y) or average measurement (for children aged 13–17 y) were then used for categorization according to 2017 AAP guidelines. Elevated BP was defined as ranging from ≥90th percentile to <95th percentile or 120/<80 mm Hg to <95th percentile (whichever is lower) for children aged 8 to 12 years and 120/<80 to 129/<80 mm Hg for those aged 13 to 17 years. Hypertensive BP was defined as a BP percentile of ≥95 or an average BP of ≥130/80 mm Hg (whichever was lower) for children aged 8 to 12 years and ≥130/80 mm Hg for those aged 13 to 17 years.

Body mass index percentile

Children’s standing height and weight were measured by trained professionals during the NHANES physical examination, and their BMI was calculated. Methods and equipment used for anthropometric measures have been described previously (14). We determined BMI percentiles according to the Centers for Disease Control and Prevention 2000 growth charts (15). Weight status was categorized by BMI percentile to represent healthy weight (BMI percentile <85), overweight (BMI percentile ≥85 to <95), and obesity (BMI percentile ≥95). For adjusted prevalence estimates, we dichotomized weight to indicate unhealthy weight status (BMI percentile ≥85).

Sociodemographic factors associated with elevated and hypertensive BP

Age at the time of the NHANES physical exam-
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Sociodemographic differences in prevalence of hypertensive BP. Prevalence of hypertensive BP also differed by sociodemographic groups as did crude and adjusted prevalence differences. Although the unadjusted prevalence estimates were higher among children in all racial/ethnic groups compared with non-Latino White children (unadjusted prevalence difference from +0.7% [95% CI, −1.2% to 2.6%] to +2.3 [95% CI −0.4% to 5.1%]), these differences were not significant (Table 3). The unadjusted prevalence of hypertensive BP was higher among male children (prevalence, +1.7%; 95% CI, 0.2%–3.2%) than female children, but this difference was no longer significant after adjustment for the differential distribution of weight status. The prevalence of hypertensive BP was lower among children aged 13 to 15 years compared with those aged 8 to 9 years (unadjusted prevalence difference, −4.1%; 95% CI, −5.9% to −2.3%), and these differences remained significant after adjustment for weight status (adjusted prevalence difference, −3.8%; 95% CI, −5.6% to −2.0%). No differences in hypertensive BP prevalence were seen across PIR levels or parent/guardian education levels.

Discussion

Our study showed prevalence among children aged 8 to 17 years to be 7.2% for elevated BP and 3.8% for hypertensive BP according to 2017 AAP guidelines. Our findings also confirm the important relationship between body weight and BP among children aged 17 years or younger. Children who were classified as overweight or having obesity were more likely to have elevated or hypertensive BP than healthy-weight children. We identified associated sociodemographic differences and found that some, but not all, of these differences were attenuated after accounting for disparities in body weight (1,8,9). We found higher prevalence estimates of elevated BP in males, older children (16–17 y), non-Latino Black children, and children of lower socioeconomic status. After adjustment for weight status, elevated BP prevalence differences in age, sex, race/ethnicity, and parent/guardian education persisted in these groups. Hypertensive BP was highest among younger children (8–9 y), Mexican America children, and males.

The prevalence of elevated and hypertensive BP observed in our study is higher than previous estimates (7,8). These earlier estimates were based on previous guidelines where weight distribution skewed the normative tables resulting in higher BPs at lower percentiles and fewer children meeting the elevated and hypertensive percentiles (18). A previous study that used the 2017 AAP guidelines found a declining trend in hypertensive BP prevalence among children aged 8 to 17 years in NHANES data when comparing data collected in 2005–2008 with data collected in 2013–2016 (1). Focusing on more recent data and not aggregating biennial cycles, we found the prevalence of elevated and hypertensive BP to fluctuate between the study years of 2011 and 2018. However, overlapping confidence intervals suggest these differences were probably due to chance. The prevalence of elevated and hypertensive BPs was highest in the NHANES 2011–2012 cycle and lowest in 2013–2014. Past declining trends may have been misleading by not including the 2011–2012 cycle. Our prevalence estimate of 3.8% suggests that hypertensive BP among children remains an important public health issue and that the Healthy People 2020 goal of reducing this prevalence to 3.2% has thus far not been achieved (19).

Our study confirmed results of previous studies that showed overweight and obesity to be major risk factors for high BP in children (2–5,7,9,20) and supports changes in the AAP guidelines to the use of BP tables based on children of healthy body weight. In our study, adjustment for weight resulted in the attenuation of prevalence differences in elevated and hypertensive BP across the sociodemographic groups examined, emphasizing the influence of weight on observed disparities in BP. Thus, future studies that examine sociodemographic differences in children’s BP levels need to adjust for the child’s weight in further stratified or multivariable adjusted regression analyses to more systematically examine differences across any strata under study.

Consistent with the published literature, our findings suggest that in unadjusted estimates male children, children with parent/guardian with lower levels of education, and children from families with low income levels experienced a greater burden of cardiovascular risk because of disproportionate rates of unhealthy body weight (21). Sex differences in physiologic parameters, such as total cholesterol levels, and health behaviors, such as physical activity levels, have previously been highlighted in relation to childhood obesity and could contribute to the higher unadjusted prevalence of hypertensive BP observed among males (21). Disparities in the built environment, which affect patterns of physical activity, and access to healthy foods at affordable prices are acknowledged risk factors for children of low socioeconomic status who are overweight and could contribute to the higher unadjusted prevalence of elevated BP observed in children with low levels of parent/guardian education or income (22,23). Thus, through various weight-related pathways and mediators, weight-related disparities may contribute to disparities in unadjusted prevalence of BP levels across the sociodemographic factors of sex, education, and family income.
The crude racial/ethnic prevalence differences detected in our study underscore the disproportionate burden of elevated BP and unhealthy weight in non-Latino Black communities (24,25). Numerous factors across socioecological levels have been noted to contribute to disproportionate obesity prevalence across racial/ethnic groups (24,25). Here again, we see that factors contributing to weight disparities may also contribute to BP-related disparities (23). Weight-related risk factors can be systematic and range from health care access to safety and opportunity (26). Beyond describing their existence, more action needs to be taken to disentangle and prevent the factors contributing to these disparities to achieve health equity.

In our study, racial/ethnic disparities in prevalence of elevated and hypertensive BP remained after adjusting for weight status. This indicates that factors other than body weight contribute to racial/ethnic disparities in children’s BP and that other pathways to less than optimal BP levels may begin in childhood. One such pathway is psychosocial stress, which has been extensively studied in adult populations (27). Empirical investigation of pathways (obesity-related and other) to racial/ethnic disparities in elevated BP prevalence is warranted as are interventional and policy-based efforts designed to narrow these differences and lower children’s risk of subsequent cardiovascular disease. Weight disparities did not fully explain observed differences in elevated BP prevalence by sex in our study. In adult populations, sex-related BP differences are well established (28), and our findings suggest that the pathways to these sex-related BP differences may begin in childhood.

The differences we found in prevalence estimates of elevated and hypertensive BP in relation to age may be due in part to increased BP variability among young children (29) and in the use of percentile-based definitions for children aged 8 to 12 years compared with static cutoffs for children aged 13 to 17 years (30). Additionally, prevalence differences detected across age groups could be due to changes in BP associated with puberty and to the intersection of these changes with age, sex, and race/ethnicity. Further understanding is needed about how levels of BP disorders differ, and long-term follow-up data on BP levels among children are needed.

Our study highlights opportunities for reduction of elevated and hypertensive BP levels among US children. Efforts focusing on increased equity in access to care through policy changes to combat obesity in racially/ethnically and socioeconomically diverse populations should be expanded. Specific focus and efforts directed at systematic change to improve social determinants of health are also needed. Efforts to understand the causes of racial/ethnic and socioeconomic disparities and to reduce them could have short- and long-term benefits through improvements in children’s health and long-term prevention into adulthood (31). Given the well-known tracking of BP into the adult years and the strong association between elevated BP and cardiovascular and other chronic diseases, particular focus on preventing the large number of males with elevated BP from progressing to hypertension is warranted (32). Further research and risk reduction approaches should be directed to expanding BP screening in national samples of young children to improve our understanding of childhood hypertensive BP and reduce the risk of chronic diseases associated with hypertension later in life. Clinicians should be aware of socioeconomic disparities and the role of overweight highlighted in our study.

Strengths of the present study come from its use of contemporary nationally representative data and current BP screening guidelines. Although assessing subgroup differences in children’s elevated and hypertensive BP may be difficult because of low case counts, we were able to combine the 4 most recent NHANES data cycles to obtain contemporary estimates across sociodemographic groups. The data analyzed in our study were collected by trained professionals who used standardized methods under controlled conditions and with quality control measures. This is important because collecting accurate BP measurements among children can be challenging (5).

Our study also has limitations. Despite the strengths inherent in the use of NHANES data, the study was limited by the data collected in that survey. Although declining response rates are of concern, NHANES has taken steps to mitigate the potential for nonresponse bias (13). Blood pressure measurements were limited to a single occasion rather than a series on 3 occasions, as is necessary for clinical diagnosis. However, previous childhood hypertension studies also used readings from a single occasion, including those providing national prevalence estimates (1,5). No single measure accurately reflects socioeconomic status, and we were unable to evaluate food insecurity as a marker of socioeconomic status, or low birthweight as a potential confounder, because NHANES assesses these measures only in children aged 16 years or older. Data on other important, potentially confounding variables, including family history of hypertension, chronic kidney disease, and chronic sleep disturbance were not available.

Elevated and hypertensive BP affects US children disproportionately in various sociodemographic groups, and body weight influences these health disparities. The burden of this cardiovascular risk is higher in children who are male, non-Latino Black, or of low socioeconomic status. Age, sex, and race/ethnicity may influence BP independently of weight status. Efforts are needed to better understand and intervene on the mechanisms through which these factors interact with BP in children. Obesity and hyperten-
sion are preventable disorders that potentially cause lifelong harm. Continued and amplified efforts are needed related to elevated and hypertensive BP among children aimed at lowering the prevalence, decreasing disparities, and ultimately achieving health equity.

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### Table 1. Characteristics of Noninstitutionalized US Children Aged 8 to 17 Years, National Health and Nutrition Examination Survey (NHANES) 2011–2018

| Characteristic                  | Children (Unweighted, N = 5,971; Weighted, N = 36,612,323)⁸ |
|--------------------------------|-----------------------------------------------------------------|
| **Age, y**                      |                                                                 |
| 8–9                            | 18.9                                                            |
| 10–12                          | 29.2                                                            |
| 13–15                          | 31.1                                                            |
| 16–17                          | 20.9                                                            |
| **Female**                     | 49.7                                                            |
| **Race/ethnicity**             |                                                                 |
| Non-Latino White               | 55.4                                                            |
| Non-Latino Black               | 13.8                                                            |
| Mexican American               | 14.1                                                            |
| Other Latino                   | 7.1                                                             |
| Non-Latino Asian               | 4.1                                                             |
| Other ⁹                        | 5.5                                                             |
| **Highest level parent/guardian education** |                                       |
| ≥College graduate              | 28.8                                                            |
| High school diploma/GED/some college | 52.6                                                            |
| <High school diploma           | 18.5                                                            |
| **Family Income⁶**             |                                                                 |
| High                           | 30.1                                                            |
| Medium                         | 39.2                                                            |
| Low                            | 30.7                                                            |
| **Weight status**              |                                                                 |
| BMI percentile, median (IQR)   | 73.3 (42.7-93.0)                                                |
| Healthy weight (BMI percentile <85) | 62.5                                                            |
| Overweight (BMI percentile ≥85 to <95) | 17.0                                                            |
| Obesity (BMI percentile ≥95)   | 20.6                                                            |

Abbreviation: BMI, body mass index; IQR, interquartile range.

⁸ Values are weighted percentage unless otherwise indicated.

⁹ Includes American Indian or Alaska Native, Native Hawaiian or Pacific Islander, and mixed race.

⁶ Determined by family poverty income ratio (PIR): family income divided by Department of Health and Human Services poverty guidelines (specific to family size, year, and state of residence). High = PIR >3.5, medium = PIR ≥1.3, < 3.5; low = PIR <1.3.
Table 2. Prevalence of Elevated and Hypertensive Blood Pressure\(^a\) Among US Children Aged 8 to 17 Years (N = 36,612,323)\(^b\), by Biennial Cycle, National Health and Nutrition Examination Survey (NHANES) 2011–2018

| NHANES cycle | Elevated Blood Pressure Prevalence, % (95% CI) | Hypertensive Blood Pressure Prevalence %, (95% CI) |
|--------------|-----------------------------------------------|-----------------------------------------------|
| 2011–2012    | 8.3 (6.4–10.7)                                | 4.6 (3.5–6.1)                                |
| 2013–2014    | 6.0 (4.6–8.0)                                 | 2.6 (1.7–3.8)                                |
| 2015–2016    | 8.2 (6.6–10.3)                                | 4.3 (2.9–6.3)                                |
| 2017–2018    | 6.2 (4.2–9.3)                                 | 3.9 (2.9–5.3)                                |

\(^a\) Hypertensive and elevated blood pressure determined by 2017 American Academy of Pediatrics guidelines. Hypertensive: blood pressure percentile ≥95 or average blood pressure ≥130/80 mm Hg (whichever was lower) for children aged 8–12 years and ≥130/80 mm Hg for children aged ≥13 years. Elevated blood pressure: ≥90th percentile to <95th percentile or 120/<80 mm Hg to <95th percentile (whichever is lower) for children aged 8–12 years and 120/<80 to 129/<80 mm Hg for children aged 13 to 17 years.

\(^b\) Unweighted, N = 5,971.
### Table 3. Prevalence of Elevated and Hypertensive Blood Pressure by Sociodemographic Characteristics, US Children Aged 8 to 17 Years (N = 36,612,323), National Health and Nutrition Examination Survey (NHANES) 2011–2018

| Characteristic | Elevated blood pressure | Hypertensive blood pressure |
|----------------|--------------------------|-----------------------------|
|                | Prevalence, % (95% CI)   | Crude Prevalence Difference (95% CI) | Adjusted Prevalence Difference for Overweight/Obesity, % (95% CI) | Prevalence, % (95% CI)   | Crude Prevalence Difference (95% CI) | Adjusted Prevalence Difference for Overweight/Obesity, % (95% CI) |
| BMI percentile<sup>c</sup> | | | | | | |
| Healthy weight, <85 | 4.9 (4.1 to 5.9) | Reference | NA | 2.2 (1.7 to 2.8) | Reference | NA |
| Overweight, ≥85 to <95 | 9.2 (7.1 to 12.0) | 4.3 (1.8 to 6.8) | 4.1 (2.7 to 6.1) | 1.9 (0.3 to 3.5) |
| Obesity, ≥95 | 12.7 (10.7 to 15.1) | 7.8 (5.7 to 9.9) | 8.6 (6.9 to 10.9) | 6.4 (4.3 to 8.6) |
| Age, y | | | | | | |
| 8–9 | 5.9 (4.4 to 8.0) | Reference | Reference | 6.0 (4.6 to 8.0) | Reference | Reference |
| 10–12 | 4.3 (3.2 to 6.0) | −1.6 (−3.6 to 0.5) | −1.7 (−3.6 to 0.3) | 4.0 (3.0 to 5.3) | −2.1 (−4.1 to 0.02) | −1.5 (−3.6 to 0.7) |
| 13–15 | 7.0 (5.6 to 8.8) | 1.1 (−1.2 to 3.4) | 0.7 (−1.5 to 2.8) | 2.0 (1.4 to 2.8) | −4.1 (−5.9 to −2.3) | −3.8 (−5.6 to −2.0) |
| 16–17 | 12.8 (10.4 to 15.8) | 6.9 (3.7 to 10.2) | 6.3 (3.2 to 9.4) | 4.5 (3.2 to 6.3) | −1.6 (−3.9 to 0.8) | −1.4 (−3.6 to 0.7) |
| Sex | | | | | | |
| Female | 4.9 (3.9 to 6.1) | Reference | Reference | 3.0 (2.2 to 4.1) | Reference | Reference |
| Male | 9.6 (8.1 to 11.2) | 4.6 (2.8 to 6.5) | 4.6 (2.7 to 6.4) | 4.7 (3.7 to 5.9) | 1.7 (0.2 to 3.2) | 1.3 (−0.2 to 2.8) |
| Race/ethnicity | | | | | | |
| Non-Latino White | 6.3 (5.1 to 7.9) | Reference | Reference | 3.2 (2.4 to 4.3) | Reference | Reference |
| Non-Latino Black | 10.4 (8.8 to 12.1) | 4.0 (2.1 to 5.9) | 4.0 (2.2 to 5.8) | 4.4 (3.3 to 5.8) | 1.2 (−0.3 to 2.7) | 0.5 (−0.8 to 1.9) |
| Mexican American | 8.4 (6.8 to 10.5) | 2.1 (−0.1 to 4.3) | 1.6 (−0.5 to 3.7) | 5.2 (3.9 to 6.8) | 2.0 (0.1 to 3.9) | 1.3 (−0.4 to 2.9) |
| Other Latino<sup>d</sup> | 8.0 (6.0 to 10.6) | 1.7 (−0.9 to 4.3) | 1.7 (−0.7 to 4.1) | 3.9 (2.4 to 6.2) | 0.7 (−1.2 to 2.6) | 0.3 (−1.5 to 2.0) |
| Non-Latino Asian<sup>d</sup> | 4.6 (2.9 to 7.4) | −1.7 (−4.5 to 1.0) | −0.2 (−2.8 to 2.5) | 4.3 (2.8 to 6.4) | 1.1 (−0.7 to 2.9) | 1.5 (−0.2 to 3.1) |
| Other<sup>d</sup>e | 6.7 (4.2 to 10.7) | 0.4 (−2.9 to 3.7) | 0.2 (−2.7 to 3.1) | 5.5 (3.5 to 8.6) | 2.3 (−0.4 to 5.1) | 1.9 (−0.6 to 4.4) |
| Family education | | | | | | |
| ≥College graduate | 5.4 (4.0 to 7.4) | Reference | Reference | 3.9 (2.7 to 5.5) | Reference | Reference |
| High school diploma/GED/some college | 8.0 (6.8 to 9.4) | 2.5 (0.6 to 4.5) | 1.6 (−0.3 to 3.5) | 3.8 (3.0 to 4.9) | −0.02 (−1.7 to 1.7) | −0.7 (−2.4 to 0.9) |
| <High school diploma | 8.0 (6.5 to 9.9) | 2.6 (0.4 to 4.8) | 2.1 (0.0 to 4.3) | 3.8 (2.8 to 5.2) | −0.06 (−1.8 to 1.7) | −0.5 (−2.3 to 1.3) |
| Family income<sup>f</sup> | | | | | | |
| High | 5.8 (4.2 to 7.9) | Reference | Reference | 3.1 (2.1 to 4.5) | Reference | Reference |

Abbreviation: NA, not applicable.
<sup>a</sup> Hypertensive and elevated blood pressure determined by 2017 American Academy of Pediatrics guidelines. Hypertensive: blood pressure percentile ≥95 or average blood pressure ≥130/80 mm Hg (whichever was lower) for children aged 8–12 years and ≥130/80 mm Hg for children aged ≥13 years. Elevated blood pressure: ≥90th percentile to <95th percentile or 120/<80 mm Hg to <95th percentile (whichever is lower) for children aged 8–12 years and 120/<80 to 129/<80 mm Hg for children aged 13 to 17 years.
<sup>b</sup> Unweighted, N = 5,971.
<sup>c</sup> BMI (weight in kg/height in m<sup>2</sup>) as percentile according to the Centers for Disease Control and Prevention 2000 growth charts.
<sup>d</sup> Had fewer than 30 participants; therefore, did not meet NHANES reporting standards in the hypertensive category.
<sup>e</sup> Includes American Indian or Alaska Native, Native Hawaiian or Pacific Islander, and mixed race.
<sup>f</sup> Determined by family poverty income ratio; family income divided by Department of Health and Human Services poverty guidelines (specific to family size, year and state of residence). High PIR = >3.5, medium PIR = ≥1.3 to <3.5, low PIR = <1.3.
Table 3. Prevalence of Elevated and Hypertensive Blood Pressure\(^a\) by Sociodemographic Characteristics, US Children Aged 8 to 17 Years (N = 36,612,323)\(^b\), National Health and Nutrition Examination Survey (NHANES) 2011–2018

| Characteristic | Elevated blood pressure | Hypertensive blood pressure |
|---------------|-------------------------|-----------------------------|
|               | Prevalence, % (95% CI) | Prevalence Difference Adjusted for Overweight/Obesity, % (95% CI) |
| Medium        | 7.8 (6.5 to 9.2)       | 2.0 (−0.3 to 4.2)          | 4.0 (3.1 to 5.2) |
| Low           | 8.4 (7.3 to 9.6)       | 2.2 (0.4 to 4.0)           | 4.6 (3.6 to 5.8) |

Abbreviation: NA, not applicable.

\(^a\) Hypertensive and elevated blood pressure determined by 2017 American Academy of Pediatrics guidelines. Hypertensive: blood pressure percentile ≥95 or average blood pressure ≥130/80 mm Hg (whichever was lower) for children aged 8–12 years and ≥130/80 mm Hg for children aged ≥13 years. Elevated blood pressure: ≥90th percentile to <95th percentile or 120/<80 mm Hg to <95th percentile (whichever is lower) for children aged 8–12 years and 120/<80 to 129/<80 mm Hg for children aged 13 to 17 years.

\(^b\) Unweighted, N = 5,971.

\(^c\) BMI (weight in kg/height in m\(^2\)) as percentile according to the Centers for Disease Control and Prevention 2000 growth charts.

\(^d\) Had fewer than 30 participants; therefore, did not meet NHANES reporting standards in the hypertensive category.

\(^e\) Includes American Indian or Alaska Native, Native Hawaiian or Pacific Islander, and mixed race.

\(^f\) Determined by family poverty income ratio: family income divided by Department of Health and Human Services poverty guidelines (specific to family size, year and state of residence). High PIR = >3.5, medium PIR = ≥1.3 to <3.5, low PIR = <1.3.