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Racial Differences in Rates of Change of Childhood Body Mass Index and Blood Pressure Percentiles

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Abstract

Objective—To assess whether racial differences in rates of change of body mass index (BMI) and blood pressure percentiles emerge during distinct periods of childhood.

Study design—In this retrospective cohort study, we included children aged 5–20 years who received regular outpatient care at a large academic medical center between January 1996 and April 2016. BMI was expressed as age- and sex-specific percentiles and blood pressure as age-, sex- and height-specific percentiles. Linear mixed models incorporating linear spline functions with 2 break points at 9 and 12 years were used to estimate the changes in BMI and blood pressure percentiles over time during age periods: <9, 9–<12, and 12+ years.

Results—Among 5703 children (24.8% black, 10.1% Hispanic), Hispanic females had an increased rate of change in BMI percentile/year relative to white females during ages 5–9 (+2.94% [0.24, 5.64] $P = .033$). Black and Hispanic males also had an increased rate of change in BMI percentile/year relative to white males that occurred during ages 5–9 (+2.35% [0.76, 3.94], $p = 0.004$; +2.63% [0.31, 4.95], $p = 0.026$, respectively). There were no significant racial differences in the rate of change of blood pressure percentiles, though black females had higher hypertension rates compared with white females (10.0% vs 5.7%, $p < 0.001$).

Conclusions—Childhood patterns in BMI percentiles differ by race. Racial differences in rates of change in BMI percentile emerge early in childhood. Further study of early patterns could help identify critical periods during childhood where disparities begin to emerge.

Keywords

obesity; hypertension; disparities

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Obesity and hypertension in adults are well-known risk factors for cardiovascular disease (CVD).¹ Black and Hispanic adults are disproportionately affected by obesity, and blacks have a higher prevalence of hypertension than any other ethnic group in the US. Adult obesity and hypertension are rooted in childhood, and racial/ethnic differences are also evident in childhood.^{1–6} The overall prevalence of obesity is higher in Hispanic (22%) and black (20%) compared with white (15%) youth.² By adolescence, a greater proportion of black and Mexican-American children already have a non-ideal weight and more black children have a non-ideal blood pressure (BP) compared with whites.^{7,8} Previous studies have suggested that unfavorable body mass index (BMI) and BP track from childhood into young adulthood and that higher-risk groups can be identified early in life.^{9–14} However, racial differences in the childhood trajectories of BMI and BP *percentiles* are not well characterized. Tracking percentiles may offer additional information about a population as a whole, rather than only those exceeding categorical thresholds for abnormal weight and BP. We sought to investigate the utility of this approach in characterizing whether there is a critical period when racial/ethnic differences emerge—which remains unclear. Therefore, we studied a contemporary urban cohort of black, Hispanic and white children to test the hypothesis that racial differences in the rates of change of BMI and BP percentiles emerge during distinct periods of childhood.

METHODS

This was a retrospective cohort study of children who received regular outpatient care between January 1996 and April 2016 at the pediatric practices affiliated with the Northwestern Memorial Healthcare System based in Chicago, Illinois. Data were obtained from the Northwestern Medicine Enterprise Data Warehouse, which is an integrated database of electronic health record (EHR) data for all patients seen throughout the health system. The study was deemed exempt from review by the Northwestern University Institutional Review Board as only de-identified data were utilized.

Because the upper age for standardized BMI (20 years) and BP (17 years) percentiles differ, we derived separate cohorts for the BMI and BP percentile analyses. For the BMI cohort, we included children aged 5–20 years who had ≥3 visits at least one year apart along with valid BMI measurements at ≥3 visits—including the index visit (n=8977), which we define as the initial visit of record. We excluded individuals with a history of congenital CV disease, cardiac surgery, renal disease, organ transplantation, cirrhosis, diseases affecting the adrenal gland, pituitary gland disease, any congenital disorders affecting the endocrine system, or diseases affecting the autonomic nervous system (n=166). Individuals missing race/ethnicity data at the index visit were also excluded (n=3108). The final BMI cohort consisted of 5,703 individuals (Figure 1; available at www.jpeds.com). The derivation of the BP cohort which included children 5–17 years and had similar exclusion criteria is described separately. (Figure 2; available at www.jpeds.com)

Age- and sex-specific childhood BMI percentiles and z-scores were calculated according to the Centers for Disease Control and Prevention BMI growth charts for children ages 2–20

years.¹⁵ Weight categories were defined as: underweight (<5th percentile), normal (5th-<85th), overweight (85th-<95th), and obese (>95th percentile).

Age-, sex-, and height-specific systolic (SBP) and diastolic BP percentiles and z-scores were calculated according to the American Academy of Pediatrics 2017 guidelines' methodology.^{16,17} Elevated BP and HTN categories were defined according to guidelines (Table I; available at www.jpeds.com). For individuals with multiple BMI or BP measurements available within a given year, the mean of the values were used to calculate the percentiles.

Statistical Analyses

We categorized the cohort by sex and race/ethnicity as follows: non-Hispanic blacks, non-Hispanic whites and Hispanics. Index visit characteristics were compared using the chi-squared test for categorical, analysis of variance (ANOVA) for continuous, and Kruskal-Wallis test for non-parametric variables. Linear mixed models were used to quantify BMI and BP percentiles over time and regression models were fitted including a random intercept and random slopes to account for the correlation among repeated observations from each participant. Time, the exposure variable, was defined as a continuous variable as a function of years after index age. Although we did not expect changes in BMI and BP percentiles from childhood to adolescence to be strictly linear, we deemed it reasonable to assume that changes are approximately linear over short intervals of time. We calculated the magnitude of change in BMI and BP percentiles by dividing the time from childhood to adolescence into three time periods: 5–9, 9–<12, and 12+ years to proxy the effect of different developmental periods and for fitting a linear model in each segment. A linear spline approach with 2 knots at 9 and 12 years was used among the fixed effect of years after index age, which allowed for a linear slope with increased or decreased mean trend in each of the three segments individually. Interaction terms with race were added to assess whether the magnitude of these changes in BMI and BP percentiles over time differed between ethnic groups in each segment. Separate parameters were fit to estimate slopes for each segment separately by race, with comparisons made using whites as the referent group.

Multivariable models adjusted for covariates determined a priori. Model 1 adjusted for index age. Model 2 additionally adjusted for health insurance (commercial insurance as the referent). Model 3 included model 2 variables and additionally adjusted for BP when BMI percentile was the outcome of interest or BMI percentile in models where BP percentile was the outcome. For models with BMI percentile as the outcome, to adjust for BP continuously without losing any observations (given the upper age for SBP percentiles of age 17 but the BMI cohort including ages 5–20), we converted both SBP percentile (for those with index age < 17 years) and SBP (for index age ≥ 18) into z-scores and adjusted model 3 for the SBP z-score. Statistical interactions between race/ethnicity and covariates over time were also investigated. Model-estimated means were then produced over a 5-year follow-up period including model-estimated changes between each of the 3 segments to visualize the observed changes in slopes. Plots based on predicted means were generated for male and female children to display the tracking of BMI percentiles over time. Similar models were fitted for change in SBP. In additional analyses, we limited both BMI and BP models to individuals having BMI and BP data (respectively) across ≥ 2 age periods to account for

potential differences in participants with longer follow-up. We present these data graphically. All statistical analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC). P values <0.05 were deemed statistically significant. We do not present Model 2 results as they generally were similar to fully adjusted models.

RESULTS

The baseline demographics of the primary BMI study cohort at the index visit stratified by sex and race/ethnicity are presented in Table 2. Overall, 3274 (57.4%) were female. Among females, 67.4% were white, 23.0% were black and 9.6% were Hispanic. Among males, 62.0% were white, 27.2% were black and 10.8% were Hispanic. The mean age at the index visit was 10.7 years (± 5.2) for females and 8.5 years (± 4.3) for males. Within each sex, the mean age did not differ significantly by race. Fewer black and Hispanic females had commercial health insurance coverage compared with white females [69.1% and 74.8% vs 82.8% respectively, $p < 0.001$ for both] as did fewer black and Hispanic compared with white males [76.0% and 82.1% vs 88.7%, respectively, $p < 0.001$ for both]. The mean follow-up time after the index visit was 4.6 years (± 2.6) for females and 5.2 years (± 2.7) for males. The mean number of BMI measurements was 5 (± 2) for both females and males. Baseline demographics of those excluded from the cohort due to missing race data or being of racial groups with smaller numbers had some differences in age and BMI category distribution (Table 3; available at www.jpeds.com).

At the index visit, 20.4% of females and 27.5% of males were obese (Table 2). Compared with whites, more black and Hispanic females were obese (23.0% vs 18.9% and 24.9% vs 18.9% respectively, $p < 0.01$ for both). Among males, there was no statistically significant differences in the proportions of obesity by race, but all groups had an obesity prevalence exceeding 27%.

At the index visit, 16.7% of females and 20.7% of males had a BP value in the hypertensive range (Table 2). Over the follow-up period, 6.7% of females and 10.3% of males met criteria for the diagnosis of hypertension. There was a statistically significantly higher proportion of black females with hypertension compared with white females (10.0% vs 5.7%, $p < 0.001$).

The estimated change in BMI percentile/year (trajectory slope) among female children stratified by race are presented in Table 4. For all female racial/ethnic groups, BMI percentiles at the index visit for 5-year olds were generally similar. There was a significant yearly increase in mean BMI percentile during the 5–9 age period among Hispanic females of 2.71%/year [Confidence Interval: (0.35, 5.06), $p = 0.024$] in fully adjusted models. In age adjusted models, the BMI percentile/year for Hispanics increased at a greater rate relative to whites during ages 5–9 [+2.42% relative to whites (0.05, 4.79), $p = 0.045$] but this association was attenuated in fully adjusted models [+2.33% (–0.04, 4.70), $p = 0.054$]. However, in models restricted to participants with follow-up through 2 age periods, the association persisted in fully adjusted models (Table 5 [available at www.jpeds.com]; +2.94% (0.24, 5.64), $p = 0.033$). The adjusted difference between the change in BMI percentile/year for blacks relative to whites during the 9–12 age period did not reach statistical significance in fully adjusted models (Table 4: +1.70 [–0.09, 3.49], $p = 0.062$) or models restricted to

participants with follow-up through 2 age periods (Table 5; +1.92 [0.00, 3.85], $p=0.051$). The mean BMI percentiles for each age and predicted BMI percentiles for female children over time stratified by race are presented graphically in Figure 3. For females, the mean BMI percentile in Hispanic children diverged from white children in the 5–9 age period, and for both Hispanic and black females, mean BMI percentiles were generally higher compared with white females after age 12.

For male children, mean index BMI percentile at age 5 was lower in Hispanic compared with white males (Table 4). There were statistically significant yearly increases in BMI percentile during the 5–9 age period of 2.77%/year in blacks [(1.21, 4.33), $p<0.001$] and 3.05%/year in Hispanics [(0.78, 5.32), $p=0.009$] in models fully adjusted for age, BP and insurance status. For both blacks and Hispanics, the change in BMI percentile/year during this age period increased at a significantly greater rate relative to whites [black vs white +2.35% (0.76, 3.94), $p=0.004$; Hispanic vs white +2.63% (0.31, 4.95), $p=0.026$, respectively]. There was a yearly decline in mean BMI percentile for black and white males during the 9–12 age periods but no differences in the change in BMI percentile/year in black and Hispanic relative to white males during this period or after age 12. (Figure 3 and Table 4). Findings of mean BMI percentile for Hispanic and black males in the 5–9 age period diverging from white males were similar in mixed model analyses limited to participants with follow-up through 2 age periods (Table 6; available at www.jpeds.com).

For the 5–17 year-old cohort used for the BP percentile analyses, there were 3705 patients, of whom 1883 (50.8%) were female. The mean age at the index visit was 7.6 (± 3.2) years for females and 7.2 (± 2.9) years for males. In general, compared with the BMI cohort, there were a greater proportion of individuals in the 5–9 age group and index obesity and hypertensive rates were lower—otherwise findings were generally similar (Table 7; available at www.jpeds.com). Baseline demographics of those excluded from the cohort due to missing race data or racial groups with smaller numbers were overall comparable (Table 3).

For all female race/ethnic groups, mean SBP percentiles at the index visit for 5-year-olds were generally similar. There were no statistically significant differences in the yearly change in mean SBP percentile for black and Hispanic children relative to white children in fully adjusted models (Table 8 and Figure 4 [available at www.jpeds.com]) or in models limited to participants with follow-up through 2 age periods (Table 9; available at www.jpeds.com).

For all males, mean SBP percentiles at the index visit for 5 year olds were generally similar. The statistically significant difference in the change in mean SBP percentile/year for black relative to white children during the 9–12 age period in adjusted mixed models (Table 8) was not present in models limited to participants with follow-up through 2 age periods. (Table 10 [available at www.jpeds.com] and Figure 4).

DISCUSSION

In this study of patterns in childhood BMI and BP percentiles by race/ethnicity, we found that despite similar baseline BMI percentiles, the BMI percentiles of black and Hispanic

children followed trajectories distinct from those of white children. In Hispanic females, the mean BMI percentiles diverged from white females during ages 5–9 leading to higher mean BMI percentiles later in childhood. In the case of black and Hispanic males, the BMI percentiles also diverged significantly from those of white children during the age 5–9 years period, leading to higher mean BMI percentiles later in childhood. It is notable that in the analyses limited to participants with values across 2 age periods that the differences in BMI percentiles in black and Hispanic compared with white children appeared more prominent after age 12. In addition, the mean BMI percentile trajectories no longer seemed to trend back toward the 50th percentile. This difference in pattern might reflect that although nearly all children are more apt to receive consistent care early in childhood, fewer may return as consistently as they get older. In particular the less healthy may be less likely to return routinely during adolescence. In any case, the differences in rates of change of black and Hispanic BMI percentiles early in childhood compared with whites were evident.

In nationally representative samples, the prevalence of obesity is higher in Hispanic and black compared with white youth.² Although these data also suggest the prevalence of obesity in youth may have plateaued in recent years, disparities persist.^{2,5} In a recent study of a large nationally representative cohort followed from kindergarten to eighth grade, black and Hispanic children had a higher cumulative incidence of obesity compared with whites and although the prevalence of obesity increased with age in all groups, the incidence was highest at the youngest ages and then declined thereafter.¹⁸ A study of a primarily underserved and Hispanic cohort examined BMI z-score trajectories for children ages 3–12 years and suggested racial differences relative to whites were present by age 6.¹⁹ Our study adds to the current literature by uniquely examining racial differences in the rates of change of population-level BMI percentiles during certain periods of childhood. In comparison with categorical obesity prevalence, mean percentile trajectories offer additional information about the whole population, rather than only those above a threshold. This is relevant as higher adolescent BMI percentiles even within normal range may be associated with increased CV and overall mortality in adulthood.²⁰ Our findings further support the concept that racial/ethnic disparities in BMI emerge early in childhood. Further study is necessary to examine if unfavorable trajectories in BMI percentiles are present for Hispanics and blacks relative to whites prior to age 5 years.

We did not identify racial differences in BP percentile patterns in this study. Nevertheless we noted significant prevalence of elevated BP under new guidelines among all races with higher prevalence in black compared with white female children. It is notable that the proportion of individuals with an elevated BP at the index visit was higher than the proportion who meet criteria for a hypertension diagnosis based on 3 abnormal values. This finding is consistent with previous data and illustrates the importance of this consideration when interpreting hypertension prevalence based only on single BP measurements.⁸ BP measurement in children can be neither accurate nor precise, with data suggesting that substantial misclassification can result from reliance on single values.²¹ That we did not identify clear differences in BP percentile patterns may not be surprising given these issues. Further study is necessary to determine whether tracking SBP percentiles could help identify critical periods when racial differences emerge.

Our study findings have implications for efforts to better define when racial differences may emerge in childhood. Tracking percentiles may have utility in detecting the early emergence of such differences on a population level beyond the use of threshold values. There is substantial evidence that children with abnormal weight and BP are at increased risk of having these and other CV risk factors as adults.^{1,9–14,18,22} In addition, the long term cumulative burden of excess weight and elevated BP starting in childhood appear to be predictive of the presence of subclinical markers of CVD in young adulthood, which in turn are known to be associated with a higher risk of future CV events.^{23–26} Early emergence of racial differences during childhood could increase the cumulative burden of risk factors in certain groups and drive future disparities in prevalence and CV outcomes. Further study is necessary to elucidate how racial differences in percentile trajectories relate to expected changes in these measures and in turn how abnormal trajectories relate to future risk.

Strengths of our study include a large, contemporary and diverse pediatric cohort and the use of a novel statistical approach to examine racial differences in BMI and BP during childhood. However, our study has limitations. This was a retrospective study using EHR data, so our findings are subject to sampling bias and confounding by factors we may not have accounted for. Another inherent limitation to EHR data is missing data. We had to exclude patients with missing race and vital sign data; these excluded patients differed in some ways from our sample cohorts. Data on puberty were not available and thus we could not directly account for this period in our study. BP measurements performed in the clinic setting were analyzed retrospectively so variation introduced by non-uniform protocols and any secular trends in BP measurement is a possibility, which in turn could have masked any differences and biased our results toward the null. Additionally, there were fewer Hispanic children in our cohort, which may have limited detection of small differences. Finally, this was a single center study so our findings may not be generalizable to the entire U.S. pediatric population. Mean BMI and BP percentiles were generally near the 50th percentile. In addition, the proportion of our population with commercial health insurance exceeds both current and past estimates for the general pediatric population.²⁷ Our population may be healthier than other pediatric populations and have overall better access to care. Thus, the racial/ethnic differences in this study may underestimate those in the general population.

In a contemporary urban pediatric cohort of children ages 5–20 years, childhood patterns in BMI percentiles differed by race/ethnicity. Further study of these early patterns could help identify critical periods during childhood when public health interventions to reduce future disparities might be most effective.

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Abbreviations

BMI	body mass index
BP	blood pressure
CVD	cardiovascular disease
SBP	systolic blood pressure

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Figure 1.

Body Mass Index (BMI) Study Cohort Derivation. Review of all children aged 5–20 with available records from 1996–2016 and composition of final study cohort. Index visit refers to the first visit of record.

Figure 2.

Blood Pressure (BP) Study Cohort Derivation. Review of all children aged 5–17 with available records from 1996–2016 and composition of final study cohort. Index visit refers to the first visit of record.

Figure 3. Predicted Body Mass Index (BMI) Percentile Before and After Predefined Age Periods in Female and Male Children

Panel A: All females. **Panel B:** Limited to females with BMI measurements across 2 age-periods. Regression of BMI percentiles toward the 50th percentile after age 12 was no longer seen and racial differences were more apparent. **Panel C:** all males. **Panel D:** Limited to males with BMI measurements across 2 age-periods. Predicted BMI percentiles regressed less toward the 50th percentile after age 12 and racial differences in BMI percentile were more apparent.

Figure 4. Predicted Systolic Blood Pressure (SBP) Percentile Before and After Predefined Age Periods in Female and Male Children

Panel A: All females. **Panel B:** Limited to females with SBP measurements across 2 age periods. Patterns were similar in both analyses. **Panel C:** All males. **Panel D:** Limited to males with SBP measurements across 2 age periods. Patterns from both analyses were similar.

Table 1

Algorithm for Classification of Blood Pressure Using Definitions Derived from 2017 American Academy of Pediatrics Blood Pressure Guidelines for Children and Adolescents^a

Classification	Criteria
Normal Blood Pressure	No antihypertensive treatment, no diagnosis of hypertension and SBP and DBP <90 th percentile and SBP <120 mmHg and DBP <80 mmHg
Elevated Blood Pressure	No antihypertensive treatment, no diagnosis of hypertension and either 1) SBP <i>or</i> DBP 90 th percentile but SBP and DBP <95 th percentile or 2) SBP 120 mmHg but SBP <i>and</i> DBP <95 th percentile
Hypertension	Antihypertensive treatment, diagnosis of hypertension or either 1) SBP <i>or</i> DBP 95 th percentile or 2) SBP 130 mmHg or DBP 80 mmHg

^a a diagnosis of hypertension using blood pressure values required meeting criteria with at least 3 measurements from separate visits

Table 2

Demographic Characteristics at Index Visit among Children and Adolescents Aged 5 to 20 Years by Gender: Body Mass Index Study Cohort

	Female				Male			
	All N=3274	White N=2208	Black N=753	Hispanic N=313	All N=2429	White N=1505	Black N=662	Hispanic N=262
Age, yrs	10.7 (5.2)	10.8 (5.3)	10.5 (4.9)	10.4 (5.0)	8.5 (4.3)	8.5 (4.5)	8.5 (3.9)	8.9 (4.4)
Age group								
<9 yrs	1454 (44.4)	996 (45.1)	317 (42.1)	141 (45.0)	1505 (62.0)	970 (64.4)	385 (58.2) ^b	150 (57.3) ^c
9–< 12 yrs	349 (10.7)	188 (8.5)	123 (16.3) ^a	38 (12.2) ^c	315 (13.0)	155 (10.3)	119 (18.0) ^a	41 (15.6) ^b
12 yrs	1471 (44.9)	1024 (46.4)	313 (41.6) ^c	134 (42.8)	609 (25.0)	380 (25.3)	158 (23.8)	71 (27.1)
Commercial insurance	2582 (78.9)	1828 (82.8)	520 (69.1) ^a	234 (74.8) ^a	2053 (84.5)	1335 (88.7)	503 (76.0) ^a	215 (82.1) ^a
BMI, kg/m ²	19.7 (4.9)	19.4 (4.6)	20.2 (5.6) ^a	20.1 (4.9) ^c	18.9 (4.6)	18.9 (4.6)	18.8 (4.3)	19.0 (5.0)
BMI category								
Underweight	333 (10.2)	240 (10.9)	65 (8.6)	28 (8.9)	218 (9.0)	126 (8.4)	60 (9.1)	32 (12.2) ^c
Normal	1772 (54.1)	1240 (56.2)	388 (51.5) ^c	144 (46.0) ^a	1158 (47.7)	723 (48.0)	310 (46.8)	125 (47.7)
Overweight	500 (15.3)	310 (14.0)	127 (16.9) ^c	63 (20.1) ^a	384 (15.8)	241 (16.0)	110 (16.6)	33 (12.6)
Obese	669 (20.4)	418 (18.9)	173 (23.0) ^b	78 (24.9) ^b	669 (27.5)	415 (27.6)	182 (27.5)	72 (27.5)
SBP, mmHg	103.5 (12.6)	103.5 (12.5)	103.8 (12.9)	103.0 (13.0)	102.8 (13.3)	103.0 (13.3)	101.9 (13.4)	104.4 (12.7)
DBP, mmHg	65.3 (8.3)	65.3 (8.3)	65.3 (8.4)	65.2 (8.3)	64.5 (8.8)	64.7 (8.8)	63.9 (8.5)	65.4 (9.5)
BP category ^d								
Normal	2224 (67.9)	1495 (67.7)	512 (68.0)	217 (69.3)	1470 (60.5)	897 (59.6)	418 (63.1)	155 (59.2)
Elevated	282 (8.6)	192 (8.7)	72 (9.6)	18 (5.7)	281 (11.6)	184 (12.2)	69 (10.4)	28 (10.7)
Hypertensive	545 (16.7)	354 (16.0)	132 (17.5)	59 (18.9)	502 (20.7)	313 (20.8)	131 (19.8)	58 (22.1)
Missing	223 (6.8)	167 (7.6)	37 (4.9) ^c	19 (6.1)	176 (7.2)	111 (7.4)	44 (6.7)	21 (8.0)
Diagnosed HTN ^e	221 (6.7)	125 (5.7)	75 (10.0) ^a	21 (6.7)	250 (10.3)	151 (10.0)	76 (11.5)	23 (8.8)

Values are n (%) for categorical or mean (SD) for continuous measures. BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HTN, hypertension. The index visit refers to the first visit of record for each child

^a p<0.001

^b p<0.01

Diagnosis required 3 or more separate visits with a blood pressure in hypertensive range, physician diagnosis of hypertension or anti-hypertensive medication

^dBased on index visit blood pressure

^c_p<0.05 compared to white (referent) within gender.

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Table 3

Demographic Characteristics of Included Population versus Population Excluded for Inadequate Race Data

Index Visit Characteristics	BMI Analysis Cohort		BP Analysis Cohort	
	Included	Excluded	Included	Excluded
N	5703 (64.7)	3108 (35.3)	3705 (62.2)	2252 (37.8)
Age, yrs	9.8 (5.0)	9.1 (4.5) ^a	7.4 (3.1)	7.3 (2.9)
Age group				
<9 yrs	2959 (51.9)	1762 (56.7) ^a	2569 (69.3)	1568 (69.6)
9-<12 yrs	664 (11.6)	453 (14.6) ^a	602 (16.3)	407 (18.1)
12 yrs	2080 (36.5)	893 (28.7) ^a	534 (14.4)	277 (12.3)
Female sex	3274 (57.4)	1634 (52.6) ^a	1883 (50.8)	1092 (48.5)
Commercial insurance	4635 (81.3)	2454 (79.0) ^a	3165 (85.4)	1854 (82.3) ^a
BMI, kg/m ²	19.3 (4.8)	19.1 (4.6) ^a	17.7 (3.8)	17.6 (3.9)
BMI category				
Underweight	551 (9.6)	282 (9.1)	334 (9.0)	231 (10.3)
Normal	2930 (51.4)	1516 (48.8) ^a	1947 (52.5)	1167 (51.8)
Overweight	884 (15.5)	547 (17.6) ^a	699 (18.9)	395 (17.5)
Obese	1338 (23.5)	763 (24.5) ^a	718 (19.4)	457 (20.3)
Missing	0.0	0.0	7 (0.2)	2 (0.1)
SBP, mmHg	103.2 (12.9)	102.6 (12.8) ^a	100.4 (11.9)	100.0 (11.8)
DBP, mmHg	65.0 (8.5)	64.9 (8.5)	63.3 (8.1)	63.7 (8.0)
BP category ^b				
Normal	3694 (64.8)	2010 (64.7)	2686 (72.5)	1625 (72.1)
Elevated	563 (9.8)	298 (9.6)	364 (9.8)	220 (9.8)
HTN	1047 (18.3)	567 (18.2)	655 (17.7)	407 (18.1)

Values are n (%) for categorical or mean (SD) for continuous measures. BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HTN, hypertension. Index visit refers to the first visit of record.

^aP<0.05 compared to included group

^bBased on index visit blood pressure only.

Mixed-Model Parameter Estimates of Mean Body Mass Index Percentiles Over Time by Race/Ethnicity among Female and Male Children Ages 5 to 20 Years^a

Table 4

FEMALE (N=3059)				MALE (N=2257)			
Age-Adjusted		Fully Adjusted		Age-Adjusted		Fully Adjusted	
Mean (CI)	P value	Mean (CI)	P value	Mean (CI)	P value	Mean (CI)	P value
Mean BMI percentiles for 5 year olds at index visit ^b							
White (ref)	54.22 (51.74, 56.70)	Ref	55.32 (52.83, 57.80)	Ref	57.92 (55.47, 60.36)	Ref	58.39 (55.94, 60.85)
Black	54.03 (49.67, 58.4)	0.941	55.19 (50.63, 59.75)	0.961	55.49 (51.5, 59.48)	0.307	55.96 (51.75, 60.16)
Hispanic	53.64 (47.14, 60.13)	0.869	55.06 (48.52, 61.61)	0.943	50.13 (43.7, 56.55)	0.026	50.21 (43.74, 56.67)
Segment-specific slope (/year)							
White							
Age <9 yrs	1.38 (0.52, 2.24)	0.002	0.38 (-0.74, 1.50)	0.507	1.15 (0.32, 1.98)	0.007	0.41 (-0.67, 1.50)
Age 9–12 yrs	-1.78 (-2.77, -0.80)	<0.001	-2.04 (-3.32, -0.75)	0.002	-2.34 (-3.39, -1.28)	<0.001	-1.92 (-3.27, -0.58)
Age 12+ yrs	0.35 (-0.41, 1.12)	0.368	1.38 (0.43, 2.33)	0.004	0.16 (-0.75, 1.07)	0.734	0.81 (-0.32, 1.94)
Black							
Age <9 yrs	2.55 (1.09, 4.01)	0.001	1.50 (-0.18, 3.19)	0.080	3.32 (1.99, 4.65)	<0.001	2.77 (1.21, 4.33)
Age 9–12 yrs	0.02 (-1.45, 1.49)	0.977	-0.34 (-2.09, 1.42)	0.708	-3.00 (-4.48, -1.52)	<0.001	-2.74 (-4.5, -0.98)
Age 12+ yrs	-0.9 (-1.93, 0.14)	0.089	0.33 (-0.88, 1.53)	0.596	-0.45 (-1.6, 0.69)	0.439	0.24 (-1.13, 1.6)
Hispanic							
Age <9 yrs	3.80 (1.59, 6.01)	<0.001	2.71 (0.35, 5.06)	0.024	3.59 (1.43, 5.76)	0.001	3.05 (0.78, 5.32)
Age 9–12 yrs	-2.18 (-4.56, 0.20)	0.072	-2.44 (-4.97, 0.09)	0.059	-0.33 (-2.82, 2.15)	0.792	-0.01 (-2.64, 2.62)
Age 12+ yrs	0.36 (-1.24, 1.95)	0.661	1.44 (-0.25, 3.12)	0.095	-1.45 (-3.35, 0.45)	0.136	-0.73 (-2.76, 1.3)
Difference in segment-specific slope (/year) between races							
Black vs White							
Age <9 yrs	1.17 (-0.51, 2.86)	0.173	1.13 (-0.59, 2.84)	0.198	2.17 (0.61, 3.73)	0.006	2.35 (0.76, 3.94)

	FEMALE (N=3059)			MALE (N=2257)		
	Age-Adjusted		Fully Adjusted		Age-Adjusted	
	Mean (CI)	P value	Mean (CI)	P value	Mean (CI)	P value
Age 9–12 yrs	1.8 (0.06, 3.55)	0.043	1.7 (–0.09, 3.49)	0.062	–0.66 (–2.45, 1.13)	0.467
Age 12+ yrs	–1.25 (–2.46, –0.03)	0.045	–1.05 (–2.29, 0.18)	0.093	–0.61 (–2.03, 0.81)	0.400
Hispanic vs White						
Age <9 yrs	2.42 (0.05, 4.79)	0.045	2.33 (–0.04, 4.70)	0.054	2.44 (0.13, 4.76)	0.039
Age 9–12 yrs	–0.40 (–2.96, 2.15)	0.758	–0.40 (–2.97, 2.16)	0.757	2.00 (–0.68, 4.68)	0.143
Age 12+ yrs	0.01 (–1.71, 1.72)	0.995	0.06 (–1.66, 1.77)	0.948	–1.61 (–3.68, 0.47)	0.129
					–1.54 (–3.62, 0.54)	0.147

BMI, body mass index; CI, confidence interval; , change

^aModel 1 adjusted for index visit age. Fully adjusted model adjusted for index visit age, health insurance status (commercial insurance as referent), and index visit blood pressure.

^bThe index visit refers to the first visit of record for each child

Table 5

Mixed-Model Parameter Estimates of Mean BMI Percentiles over Time by Race/Ethnicity among Female Children with BMI Values across Two or More Age Periods^a

N = 1290	Age-Adjusted		Fully Adjusted Model	
	Mean (CI)	P value	Mean (CI)	P value
Mean BMI percentiles for 5 year olds at index visit^b				
White (ref), n=804	52.56 (49.37, 55.75)	Ref	54.00 (50.83, 57.17)	Ref
Black, n=400	54.53 (49.27, 59.8)	0.527	55.77 (50.27, 61.28)	0.577
Hispanic, n=137	49.60 (41.75, 57.45)	0.492	50.94 (43.00, 58.88)	0.480
Segment-specific slope (/year)				
White				
Age <9 yrs	1.93 (0.91, 2.95)	<0.001	0.95 (−0.36, 2.27)	0.156
Age 9–12 yrs	−2.24 (−3.29, −1.19)	<0.001	−2.58 (−3.95, −1.21)	<0.001
Age 12+ yrs	0.47 (−0.58, 1.52)	0.378	1.18 (−0.14, 2.51)	0.08
Black				
Age <9 yrs	2.35 (0.69, 4.01)	0.006	1.34 (−0.59, 3.27)	0.173
Age 9–12 yrs	−0.37 (−1.93, 1.19)	0.642	−0.66 (−2.53, 1.22)	0.493
Age 12+ yrs	−0.12 (−1.5, 1.26)	0.862	0.64 (−1.02, 2.3)	0.452
Hispanic				
Age <9 yrs	4.91 (2.4, 7.41)	<0.001	3.89 (1.22, 6.57)	0.004
Age 9–12 yrs	−1.47 (−4.06, 1.12)	0.265	−1.72 (−4.46, 1.02)	0.219
Age 12+ yrs	0.53 (−1.72, 2.79)	0.642	1.1 (−1.26, 3.46)	0.361
Difference in segment-specific slope (/year) between races				
Black vs White				
Age <9 yrs	0.42 (−1.51, 2.35)	0.670	0.39 (−1.58, 2.36)	0.698
Age 9–12 yrs	1.87 (0.00, 3.74)	0.050	1.92 (0.00, 3.85)	0.051
Age 12+ yrs	−0.59 (−2.31, 1.13)	0.499	−0.55 (−2.3, 1.21)	0.542
Hispanic vs White				
Age <9 yrs	2.98 (0.29, 5.67)	0.030	2.94 (0.24, 5.64)	0.033
Age 9–12 yrs	0.77 (−2.02, 3.56)	0.589	0.86 (−1.94, 3.66)	0.546
Age 12+ yrs	0.06 (−2.41, 2.54)	0.959	−0.09 (−2.57, 2.4)	0.947

BMI, body mass index; BP, blood pressure; CI, confidence interval; , change

^aModel 1 adjusted for index visit age. Fully adjusted model adjusted for index visit age, health insurance status (commercial insurance as referent), and index visit blood pressure.

^bThe index visit refers to the first visit of record for each child

Table 6

Mixed-Model Parameter Estimates of Mean BMI Percentiles over Time by Race/Ethnicity among Male Children with BMI Values across Two or More Age Periods^a

N = 1341	Age-Adjusted		Fully Adjusted Model	
	Mean (CI)	P value	Mean (CI)	P value
Mean BMI percentiles for 5 year olds at index visit^b				
White (ref), n=801	57.99 (55, 60.98)	Ref	58.72 (55.75, 61.69)	Ref
Black, n=351	54.6 (49.88, 59.32)	0.231	55.61 (50.62, 60.59)	0.283
Hispanic, n=138	48.24 (40.23, 56.24)	0.025	48.49 (40.39, 56.59)	0.019
Segment-specific slope (/year)				
White				
Age <9 yrs	0.91 (−0.04, 1.87)	0.06	−0.08 (−1.31, 1.14)	0.895
Age 9–12 yrs	−2.2 (−3.31, −1.08)	<0.001	−2.08 (−3.51, −0.66)	0.004
Age 12+ yrs	−0.34 (−1.44, 0.77)	0.551	0.26 (−1.14, 1.66)	0.713
Black				
Age <9 yrs	3.51 (2.03, 5)	<0.001	2.69 (0.94, 4.44)	0.003
Age 9–12 yrs	−2.54 (−4.1, −0.98)	0.002	−2.72 (−4.57, −0.87)	0.004
Age 12+ yrs	−0.38 (−1.76, 1.01)	0.596	0.22 (−1.43, 1.87)	0.792
Hispanic				
Age <9 yrs	3.43 (0.91, 5.96)	0.008	2.71 (0.08, 5.35)	0.044
Age 9–12 yrs	0.09 (−2.57, 2.75)	0.947	−0.02 (−2.83, 2.79)	0.991
Age 12+ yrs	−0.86 (−3.18, 1.47)	0.471	−0.27 (−2.74, 2.19)	0.827
Difference in segment-specific slope (/year) between races				
Black vs White				
Age <9 yrs	2.6 (0.85, 4.35)	0.004	2.77 (0.98, 4.57)	0.002
Age 9–12 yrs	−0.34 (−2.25, 1.57)	0.728	−0.64 (−2.59, 1.32)	0.523
Age 12+ yrs	−0.04 (−1.8, 1.72)	0.965	−0.04 (−1.84, 1.76)	0.965
Hispanic vs White				
Age <9 yrs	2.52 (−0.17, 5.21)	0.066	2.79 (0.1, 5.49)	0.042
Age 9–12 yrs	2.29 (−0.59, 5.17)	0.12	2.06 (−0.84, 4.97)	0.163
Age 12+ yrs	−0.52 (−3.08, 2.05)	0.691	−0.54 (−3.12, 2.05)	0.684

BMI, body mass index; BP, blood pressure; CI, confidence interval; , change

^aModel 1 adjusted for index visit age. Fully adjusted model adjusted for index visit age, health insurance status (commercial insurance as referent), and index visit blood pressure.

^bThe index visit refers to the first visit of record for each child

Demographic Characteristics at Index Visit among Children and Adolescents Aged 5 to 17 Years by Gender: Blood Pressure Study Cohort

Table 7

	Female				Male			
	All N=1883	White N=1229	Black N=465	Hispanic N=189	All N=1822	White N=1100	Black N=535	Hispanic N=187
Age, yrs	7.6 (3.2)	7.5 (3.3)	7.9 (3.1) ^a	8.0 (3.3) ^a	7.2 (2.9)	6.8 (2.8)	7.8 (3.1) ^c	7.5 (3.0) ^b
Age group								
<9 yrs	1255 (66.7)	861 (70.1)	278 (59.8) ^c	116 (61.4) ^b	1314 (72.1)	853 (77.5)	337 (63.0)	124 (66.3)
9 – <12 yrs	317 (16.8)	172 (14.0)	113 (24.3) ^c	32 (16.9)	285 (15.7)	135 (12.3)	111 (20.7)	39 (20.9)
12 yrs	311 (16.5)	196 (15.9)	74 (15.9)	41 (21.7) ^a	223 (12.2)	112 (10.2)	87 (16.3)	24 (12.8)
Commercial insurance	1599 (84.9)	1101 (89.6)	343 (73.8) ^c	155 (82.0) ^b	1566 (85.9)	995 (90.4)	412 (77.0) ^c	159 (85.0) ^a
BMI, kg/m ²	17.9 (3.9)	17.8 (3.9)	18.1 (3.9)	18.0 (3.8)	17.5 (3.8)	17.3 (3.6)	17.7 (3.8) ^a	18.1 (4.5) ^b
BMI category								
Underweight	162 (8.6)	107 (8.7)	40 (8.6)	15 (7.9)	172 (9.5)	102 (9.3)	55 (10.3)	15 (8.0)
Normal	1019 (54.1)	662 (53.9)	256 (55.0)	101 (53.5)	928 (50.9)	566 (51.4)	268 (50.1)	94 (50.3)
Overweight	363 (19.3)	241 (19.6)	84 (18.1)	38 (20.1)	336 (18.4)	197 (17.9)	107 (20.0)	32 (17.1)
Obese	336 (17.8)	216 (17.6)	85 (18.3)	35 (18.5)	382 (21.0)	231 (21.0)	105 (19.7)	46 (24.6)
Missing	3 (0.2)	3 (0.2)	0	0	4 (0.2)	4 (0.4)	5 (0.9)	0
SBP, mmHg	100.6 (11.7)	100.6 (11.6)	100.3 (11.9)	101.4 (11.3)	100.2 (12.1)	100.4 (12.3)	99.3 (11.7)	101.2 (11.5)
DBP, mmHg	63.3 (8.1)	63.3 (8.1)	63.2 (8.3)	63.7 (7.2)	63.2 (8.2)	63.2 (8.3)	63.0 (8.0)	63.8 (8.5)
BP category ^d								
Normal	1409 (74.8)	923 (75.1)	348 (74.8)	138 (73.0)	1277 (70.1)	756 (68.7)	389 (72.7)	132 (70.6)
Elevated	162 (8.6)	109 (8.9)	32 (6.9)	21 (11.1)	202 (11.1)	124 (11.3)	53 (9.9)	25 (13.4)
HTN	312 (16.6)	197 (16.0)	85 (18.3)	30 (15.9)	343 (18.8)	220 (20.0)	93 (17.4)	30 (16.0)
Diagnosed HTN ^e	114 (6.0)	66 (5.4)	37 (8.0) ^a	11 (5.8)	137 (7.5)	91 (8.3)	36 (6.7)	10 (5.3)

Values are n (%) for categorical or mean (SD) for continuous measures. BMI, Body Mass Index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HTN, hypertension. The index visit refers to the first visit of record for each child.

^a p<0.05,

^b p<0.01,

^eDiagnosis required 3 or more separate visits with a blood pressure in hypertensive range, physician diagnosis of hypertension or anti-hypertensive medication

^dBased on index visit blood pressure

^cp<0.001, compared to white (referent) within gender.

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Mixed-Model Parameter Estimates of Mean Systolic Blood Pressure Percentiles over Time by Race/Ethnicity among Female and Male Children Ages 5 to 17 years^a

Table 8

FEMALE (N=1871)						MALE (N=1804)					
Age-Adjusted			Fully Adjusted			Age-Adjusted			Fully Adjusted		
Mean (CI)	P value		Mean (CI)	P value		Mean (CI)	P value		Mean (CI)	P value	
Mean systolic BP percentiles for 5 year olds at index visit ^b											
White (ref)	44.58 (42.30, 46.85)	Ref	44.19 (41.93, 46.45)	Ref		47.29 (45.02, 49.57)	Ref		47.36 (45.1, 49.63)	Ref	
Black	47.14 (43.12, 51.17)	0.274	46.90 (42.69, 51.11)	0.256		43.05 (39.27, 46.83)	0.058		43.96 (39.99, 47.92)	0.133	
Hispanic	45.24 (38.97, 51.5)	0.846	45.31 (39.01, 51.6)	0.742		44.91 (38.79, 51.04)	0.474		45.38 (39.25, 51.52)	0.550	
Segment-specific slope (/year)											
White											
Age <9 yrs	2.62 (1.78, 3.46)	<0.001	2.61 (1.76, 3.45)	<0.001		1.75 (0.92, 2.58)	<0.001		1.68 (0.84, 2.52)	<0.001	
Age 9–12 yrs	−0.60 (−1.68, 0.47)	0.272	−0.61 (−1.71, 0.48)	0.272		−0.61 (−1.75, 0.53)	0.292		−0.69 (−1.84, 0.47)	0.242	
Age 12+ yrs	−1.65 (−2.51, −0.8)	<0.001	−1.59 (−2.47, −0.72)	<0.001		−1.43 (−2.36, −0.49)	0.003		−1.44 (−2.38, −0.49)	0.003	
Black											
Age <9 yrs	1.25 (−0.17, 2.67)	0.085	1.15 (−0.36, 2.65)	0.136		3.17 (1.83, 4.51)	<0.001		2.96 (1.54, 4.38)	<0.001	
Age 9–12 yrs	−0.43 (−2.08, 1.22)	0.610	−0.39 (−2.17, 1.38)	0.663		−2.67 (−4.31, −1.03)	0.001		−2.92 (−4.65, −1.19)	0.001	
Age 12+ yrs	−1.82 (−3.00, −0.65)	0.002	−1.71 (−2.96, −0.45)	0.008		−1.56 (−2.72, −0.40)	0.009		−1.57 (−2.81, −0.34)	0.013	
Hispanic											
Age <9 yrs	2.78 (0.52, 5.04)	0.016	2.60 (0.32, 4.88)	0.026		2.64 (0.44, 4.83)	0.019		2.50 (0.28, 4.71)	0.027	
Age 9–12 yrs	−0.03 (−2.74, 2.68)	0.983	0.04 (−2.71, 2.78)	0.98		−3.08 (−5.83, −0.33)	0.028		−3.20 (−5.99, −0.41)	0.025	
Age 12+ yrs	−2.26 (−4.09, −0.42)	0.016	−2.18 (−4.04, −0.32)	0.022		0.20 (−1.78, 2.17)	0.843		0.05 (−1.95, 2.06)	0.960	
Difference in segment-specific slope (/year) between races											
Black vs White											
Age <9 yrs	−1.37 (−3.01, 0.27)	0.102	−1.46 (−3.14, 0.22)	0.088		1.42 (−0.15, 2.98)	0.077		1.28 (−0.32, 2.88)	0.117	

FEMALE (N=1871)					MALE (N=1804)				
Age-Adjusted			Fully Adjusted		Age-Adjusted		Fully Adjusted		
	Mean (CI)	P value	Mean (CI)	P value	Mean (CI)	P value	Mean (CI)	P value	
Hispanic vs White									
Age 9–12 yrs	0.17 (–1.77, 2.12)	0.860	0.22 (–1.78, 2.22)	0.830	–2.05 (–4.03, –0.08)	0.041	–2.23 (–4.24, –0.22)	0.029	
Age 12+ yrs	–0.17 (–1.58, 1.24)	0.811	–0.11 (–1.55, 1.32)	0.877	–0.13 (–1.59, 1.33)	0.858	–0.14 (–1.61, 1.34)	0.855	
Hispanic vs White									
Age <9 yrs	0.16 (–2.24, 2.56)	0.895	–0.01 (–2.42, 2.4)	0.994	0.88 (–1.46, 3.23)	0.460	0.82 (–1.52, 3.16)	0.493	
Age 9–12 yrs	0.57 (–2.32, 3.47)	0.697	0.65 (–2.26, 3.56)	0.662	–2.47 (–5.43, 0.49)	0.102	–2.51 (–5.48, 0.46)	0.098	
Age 12+ yrs	–0.60 (–2.60, 1.39)	0.552	–0.58 (–2.58, 1.41)	0.565	1.63 (–0.54, 3.79)	0.141	1.49 (–0.68, 3.66)	0.179	

BP, blood pressure; CI, confidence interval; , change

^aModel 1 adjusted for index visit age. Fully adjusted model adjusted for index visit age, health insurance status (commercial insurance as referent), and index visit body mass index.

^bThe index visit refers to the first visit of record for each child

Table 9

Mixed-Model Parameter Estimates of Mean Systolic Blood Pressure Percentiles over Time by Race/Ethnicity among Female Children with Blood Pressure Values Across at Two or More Age Periods^a

N = 1284	Age-Adjusted		Fully Adjusted Model	
	Mean (CI)	P value	Mean (CI)	P value
Mean systolic BP percentiles for 5 year olds at index visit^b				
White (ref), n=807	43.16 (40.41, 45.91)	Ref	42.75 (40.05, 45.45)	Ref
Black, n=345	46.46 (41.86, 51.06)	0.224	45.24 (40.41, 50.06)	0.370
Hispanic, n=132	44.19 (37.2, 51.17)	0.788	43.84 (36.79, 50.89)	0.776
Segment-specific slope (/year)				
White				
Age <9 yrs	2.69 (1.75, 3.62)	<0.001	2.67 (1.73, 3.61)	<0.001
Age 9–12 yrs	−0.40 (−1.54, 0.74)	0.496	−0.37 (−1.53, 0.78)	0.526
Age 12+ yrs	−1.63 (−2.63, −0.62)	0.002	−1.55 (−2.57, −0.54)	0.003
Black				
Age <9 yrs	1.39 (−0.14, 2.92)	0.076	1.5 (−0.13, 3.13)	0.071
Age 9–12 yrs	−0.57 (−2.3, 1.17)	0.521	−0.57 (−2.44, 1.31)	0.553
Age 12+ yrs	−1.80 (−3.16, −0.45)	0.009	−1.53 (−2.98, −0.09)	0.037
Hispanic				
Age <9 yrs	2.90 (0.51, 5.29)	0.018	2.79 (0.36, 5.21)	0.024
Age 9–12 yrs	0.56 (−2.37, 3.48)	0.709	0.68 (−2.29, 3.64)	0.654
Age 12+ yrs	−2.52 (−4.84, −0.2)	0.033	−2.42 (−4.76, −0.09)	0.042
Difference in segment-specific slope (/year) between races				
Black vs White				
Age <9 yrs	−1.30 (−3.08, 0.48)	0.153	−1.17 (−3, 0.67)	0.212
Age 9–12 yrs	−0.17 (−2.24, 1.89)	0.87	−0.19 (−2.33, 1.94)	0.859
Age 12+ yrs	−0.18 (−1.85, 1.5)	0.834	0.02 (−1.69, 1.73)	0.981
Hispanic vs White				
Age <9 yrs	0.21 (−2.35, 2.76)	0.874	0.12 (−2.45, 2.69)	0.929
Age 9–12 yrs	0.95 (−2.18, 4.09)	0.551	1.05 (−2.1, 4.2)	0.514
Age 12+ yrs	−0.90 (−3.41, 1.62)	0.486	−0.87 (−3.39, 1.65)	0.499

BMI, body mass index; BP, blood pressure; CI, confidence interval; , change

^aModel 1: adjusted for index visit age; Fully adjusted model adjusted for index visit age, health insurance status (commercial insurance as referent), and index visit body mass index.

^bThe index visit refers to the first visit of record for each child

Table 10

Mixed-Model Parameter Estimates of Mean Systolic Blood Percentiles over Time by Race/Ethnicity among Male Children with Blood Pressure Values across at Two or More Age Periods^a

N = 1315	Age-Adjusted		Fully Adjusted Model	
	Mean (CI)	P value	Mean (CI)	P value
Mean systolic BP percentiles for 5-years-old at index visit^b				
White (ref), n=792	46.79 (44.12, 49.46)	Ref	46.78 (44.14, 49.41)	Ref
Black, n=389	42.59 (38.26, 46.92)	0.102	43.6 (39.03, 48.16)	0.227
Hispanic, n=134	42.21 (34.85, 49.57)	0.249	43.06 (35.66, 50.47)	0.351
Segment-specific slope (/year)				
White				
Age <9 yrs	1.75 (0.83, 2.66)	<0.001	1.70 (0.78, 2.62)	<0.001
Age 9–12 yrs	−0.38 (−1.58, 0.82)	0.538	−0.43 (−1.64, 0.78)	0.483
Age 12+ yrs	−1.76 (−2.80, −0.72)	<0.001	−1.71 (−2.76, −0.67)	0.001
Black				
Age <9 yrs	3.17 (1.70, 4.63)	<0.001	2.92 (1.36, 4.47)	<0.001
Age 9–12 yrs	−2.12 (−3.85, −0.38)	0.017	−2.32 (−4.17, −0.48)	0.013
Age 12+ yrs	−1.66 (−3.02, −0.31)	0.016	−1.45 (−2.88, −0.03)	0.046
Hispanic				
Age <9 yrs	3.35 (0.89, 5.82)	0.008	3.13 (0.63, 5.62)	0.014
Age 9–12 yrs	−3.16 (−6.09, −0.23)	0.035	−3.31 (−6.29, −0.34)	0.029
Age 12+ yrs	−0.58 (−2.79, 1.64)	0.610	−0.43 (−2.69, 1.83)	0.709
Difference in segment-specific slope (/year) between races				
Black vs White				
Age <9 yrs	1.42 (−0.29, 3.13)	0.104	1.22 (−0.54, 2.97)	0.174
Age 9–12 yrs	−1.74 (−3.84, 0.36)	0.104	−1.89 (−4.04, 0.25)	0.084
Age 12+ yrs	0.10 (−1.60, 1.79)	0.912	0.26 (−1.47, 1.98)	0.770
Hispanic vs White				
Age <9 yrs	1.61 (−1.02, 4.23)	0.230	1.43 (−1.20, 4.06)	0.287
Age 9–12 yrs	−2.78 (−5.94, 0.38)	0.084	−2.88 (−6.06, 0.3)	0.076
Age 12+ yrs	1.18 (−1.26, 3.62)	0.342	1.28 (−1.18, 3.74)	0.307

BMI, body mass index; BP, blood pressure; CI, confidence interval; , change

^aModel 1: adjusted for index visit age; Fully adjusted model adjusted for index visit age, health insurance status (commercial insurance as referent), and index visit body mass index.

^bThe index visit refers to the first visit of record for each child