

THE PREVALENCE AND CHARACTERISTICS OF CHILDHOOD OVERWEIGHT IN A MULTIETHNIC, SCHOOL-BASED HEALTH SETTING

Objective: The prevalence and correlates of overweight and the risk of overweight in minority children attending urban school-based health centers remains poorly characterized. The purpose of our study was to examine the prevalence and characteristics of overweight and at risk for overweight in low socioeconomic status minority children enrolled in East Harlem school-based health centers in New York City.

Design: A retrospective cross-sectional study during the period of September 2002 to August 2003.

Setting: Four Pediatric School-based Health Centers in East Harlem.

Participants: Children and adolescents, aged 5 to 18 years.

Main Outcome Measures: We examined presence of overweight or the risk of overweight based on body mass index (BMI) percentile and other clinical characteristics. Bivariate and multivariate analyses were performed to assess the relationship between demographics and clinical characteristics with overweight and the risk of overweight.

Results: Of the 491 children enrolled, 45.8% were either overweight or at risk for overweight, with the highest risk observed in Hispanic/Latino children. This latter relation remained significant after adjusting for age, sex, and birthweight status. In addition, high screening office blood pressure was related to overweight status and higher BMI percentile.

Conclusions: A large proportion of minorities, especially Hispanic/Latino children, attending school-based health centers in an urban community sample, are overweight or at risk for overweight. Elevated screening blood pressure was also a common co-morbidity. Further research should determine the predictors and correlates of overweight, and effective targeted school-based interventions should be tested in this high-risk population. (*Ethn Dis.* 2008;18:98-103)

Key Words: Obesity, Child, Ethnic Groups, Epidemiology

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INTRODUCTION

In the United States, the prevalence of overweight in children, defined as a body mass index (BMI) ≥ 95 th percentile for age and sex,¹ is a public health problem.² Overweight is a risk factor of incident cardiovascular disease events later in life and of chronic conditions, including dyslipidemia, hypertension, asthma, obstructive sleep apnea, and steatohepatitis as well as the onset of type 2 diabetes mellitus in youth.^{3,4} Severely overweight children and adolescents may have a health-related quality of life comparable to those who have cancer.⁵ These trends create an exceptional burden to children's health and health care costs.⁶

National Health and Nutrition Examination Survey (NHANES) data indicate that $>23\%$ of Mexican American and non-Hispanic Black 12- to 19-year-olds are overweight, in comparison to 12.7% of non-Hispanic Whites. Similarly, among 6- to 11-year-olds, 21.8% of Mexican Americans and 19.8% of non-Hispanic Blacks are overweight, compared with 13.5% of non-Hispanic Whites.¹ Children of low socioeconomic status (SES) are also disproportionately represented in the overweight category.^{7,8}

Schools have been recognized as key structures for public health strategies;⁹⁻¹¹ one third of the Year 2010 national health objectives are achievable via school

health programs.^{11,12} School-based health centers (SBHCs) provide comprehensive primary and preventive health services to students and may be ideal environments to provide effective strategies to prevent overweight in children and their parents. School-based interventions have the potential to be successful because they provide initiatives that co-exist within current institutional infrastructures.¹¹ According to the State Survey of SBHC Initiatives, there are 1,500 SBHCs in the United States,¹³ 61% of which are in urban areas.¹⁴ Most SBHCs are located in New York State, 70% of which are in New York City.¹⁵

Despite the presence of SBHCs, the prevalence and characteristics of overweight among low-SES minority children who use them are poorly understood. Before recommending specific school-based strategies to prevent overweight, a policy that would have widespread economic and public health implications, the prevalence and characteristics of overweight must be better studied in this population. In the present study, we examine data from East Harlem pediatric SBHCs in New York City, which has a large population of low-SES minority children, with the aim to determine the prevalence and

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characteristics of overweight and at risk for overweight.

METHODS

Subjects

A retrospective medical record review was conducted of children and adolescents enrolled in the four Mount Sinai Medical Center's (MSMC) pediatric SBHCs in East Harlem. Subjects were enrolled after review of appointment logs or medical charts at each site for children aged 5–18 years who were seen for well child/adolescent care from September 2002 to August 2003. These four pediatric SBHCs are located in three public elementary schools and one public junior high school complex. Two of these SBHCs also provide medical care to the community. Parents had to consent for their children to access SBHC services. Previous data suggest that 71%–92% of students attending these schools are enrolled in these four SBHCs and reflect East Harlem's ethnic distribution.¹⁶ These enrollees are of low SES and are predominately Hispanic/Latino and non-Hispanic Black. Data suggest that 93%–100% of students attending these schools qualify for free/reduced-price meals through the National School Lunch Program.¹⁶

Instruments and Procedures

Medical records and registration forms of 491 subjects were extracted for data on health insurance status, family history, birthweight status, medical history, anthropometric measurements, blood pressure, presence of acanthosis nigricans (a skin finding that has been associated with surrogate markers of insulin resistance in adolescents and adults¹⁷) and total cholesterol level. The child's parent or guardian completed the registration form. To minimize data entry errors, random portions ($\approx 30\%$) of the data were rechecked. The study was approved by the institutional review board at the MSMC.

Data on race/ethnicity were obtained from parent/guardian-reported write-in responses in the registration form and were categorized as Black, Hispanic/Latino, or other. The other category included those of mixed race/ethnicity, those who responded as White, and those not reported to be Black or Hispanic/Latino. Children with missing race/ethnic data were coded Hispanic/Latino if the subject had a Hispanic surname or completed a Spanish registration form. Twenty-nine subjects had missing race/ethnicity data after this procedure. "Black" was coded as the reference category. Age was coded into three categories: 5 years, 6–11 years, and 12–18 years (reference category). Sex and health insurance status (both obtained from the medical record or the registration form) were dummy-coded, with male and uninsured (ie, lack of private or public insurance/insurance not reported) coded 1 and female and insured coded 0 (reference category).

Information on family and medical history and birth weight were collected from the medical record and registration form. For birth weight, high birth weight (HBW) was defined as ≥ 4000 g. Not high birth weight (NHBW) (< 4000 g) was used as the reference category. NHBW was entered for the 71 (14.5%) subjects that did not have birth weight documented. Presence of acanthosis nigricans was collected from medical records.

Weight and height as recorded in the medical record were used to calculate BMI. These were compared to the sex-specific BMI-for-age reference percentiles from the Centers for Disease Control and Prevention Growth Charts (2000).¹⁸ Overweight was defined as a BMI ≥ 95 th percentile for age and sex.¹⁹ At risk for overweight was defined as a BMI in the 85th–94th percentile for age and sex.¹⁹

Blood pressure from a single reading was obtained from the medical record. The standard practice is to measure blood pressure by auscultation using a

sphygmomanometer with a cuff size deemed appropriate by the SBHC pediatric healthcare professional. Subjects with a systolic blood pressure (SBP) or diastolic blood pressure (DBP) greater than the age-, sex-, and height-percentile-specific 95th percentile value as defined by The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents²⁰ were considered to have high screening blood pressure (HSBP). Prehypertension was defined as a SBP or DBP 90th to < 95 th percentile or if the BP is $\geq 120/80$ even if < 90 th percentile up to < 95 th percentile.²⁰ Mean SBP and DBP of the study sample with documented levels was entered for the 23 (4.7%) and 25 (5.1%) subjects who did not have a documented SBP or DBP levels, respectively.

High and borderline levels of total cholesterol were defined as those ≥ 200 mg/dL and 170–199 mg/dL, respectively.²¹ These generally reflected random cholesterol levels. Analyses were carried out at the Mount Sinai Hospital Laboratory using a Vitros 950 Chemistry Systems (Ortho-Clinical Diagnostics, Raritan, New Jersey). The mean cholesterol level of the study sample with documented levels was entered for the 111 (22.6%) subjects who did not have documented cholesterol levels.

Statistics

Statistical analyses were performed with Statistical Package for Social Sciences version 14.0 (SPSS Inc, Chicago, Ill). Frequency distributions of independent variables were calculated, and information was analyzed by BMI categories of overweight (≥ 95 th percentile) and combined classification of at risk for overweight or overweight (≥ 85 th percentile; combined status). Bivariate associations between BMI categories and categorical variables were examined using chi-square test. The independent *t* test was used to examine associations between BMI categories and continuous variables. Multivariate

Table 1. Sample characteristics (n=491)

Characteristic	n	%	95% CI
Age, years (mean ± standard deviation)		9.4±2.8	
Age groups			
5 years	36	7.3	5.0–9.7
6–11 years	335	68.2	64.1–72.4
12–18 years	120	24.4	20.6–28.3
Sex, female	268	54.6	50.2–59.0
Race/ethnicity			
Black	99	21.4	17.7–25.2
Hispanic/Latino	342	74.0	70.0–78.0
Other	21	4.6	2.6–6.5
Birth weight			
≥4000 g (high birth weight)	29	6.9	4.5–9.3
<4000 g (not high birth weight)	391	93.1	90.7–95.5
Insured with public or private insurance	405	82.5	79.1–85.9
Asthma	145	29.5	25.5–33.6
Diabetes mellitus	1	.2	–0.2–0.6
Acanthosis nigricans	16	3.3	1.7–4.8
Family history of diabetes	198	40.3	36.0–44.7
Family history of hypertension	183	37.3	33.0–41.6
Family history of hypercholesterolemia	54	11.0	8.2–13.8
Family history of asthma	257	52.3	47.9–56.8
Prehypertensive screening blood pressure	56	12.0	9.0–14.9
High screening blood pressure	70	15.0	11.7–18.2
Blood pressure (mean ± standard deviation)			
Systolic, mm Hg		100.13±9.7	
Diastolic, mm Hg		65.4±11.6	
Cholesterol (total) (mean ± standard deviation)		161.3±29.5	
<170 mg/dL		247 (65.0)	
170–199 mg/dL		89 (23.4)	
≥200 mg/dL		44 (11.6)	

logistic regressions were used to estimate the associations between independent variables and BMI categories as well as HSBP. A *P* value ≤.05 was used to define statistical significance.

RESULTS

Characteristics of the Population

Table 1 lists the characteristics of the study sample, which consisted of 491 subjects with a mean age of 9.4 years; most were Hispanic/Latino. The prevalence of asthma was 29.5%, and 15.0% had HSBP. Another 12.0% had screening blood pressure in the prehypertensive range.²⁰ In addition, 11.6% of the sample had high total cholesterol levels. Finally, 3.3% of the sample had acanthosis nigricans.

Prevalence of Overweight and At Risk for Overweight

The results of the following analyses were not different when unimputed data were used. The prevalence of the combined classification of at risk for and overweight in the study sample was 45.8%, with 28.3% overweight and 17.5% at risk. There was no significant difference in the prevalence of overweight or the combined status by age categories and sex (all *P*>.05). Hispanic/Latino children (51.2%) were more likely to be of combined status (*P*=.001) than either Black (32.3%) or other race/ethnicity children (36.0%). No significant difference in the prevalence of overweight by race/ethnicity (*P*=.068) was observed.

Among Hispanic children, boys had higher rates of overweight than girls (38.0% vs 25.5%, OR 1.79, 95% CI

1.13–2.83; *P*=.014). Hispanic boys had the highest prevalence of overweight among all race/ethnicity groups. Thirty-eight percent of Hispanic boys were overweight, compared with 17.1% of Black boys (OR 2.97, 95% CI 1.24–7.13; *P*=.015). The proportion of Hispanic (25.5%) and Black (27.6%) girls who were overweight was similar (*P*=.757).

Among Hispanic children, boys had higher rates of the combined status than girls (58.2% vs 45.1%; *P*=.016). Hispanic boys also had the highest race- and sex-specific rates, with 58.2% of Hispanic boys of combined status, compared with 26.8% of Black boys (OR 3.80, 95% CI 1.78–8.13; *P*=.001).

Increased birth weight was associated with a higher prevalence of the combined status (*P*=.028), our main outcome variable, and overweight status alone (*P*=.014). Sixty-six percent of those born with HBW and 45.0% of those born with NHBW were of combined status. Within the NHBW category, children with a history of normal birth weight (>2500 g and <4000 g) and children with a history of low birth weight (≤2500 g) did not differ in the prevalence of the combined status of overweight and risk of overweight (*P*=.26) or overweight status alone (*P*=.52). Neither overweight nor combined status was found to be associated with health insurance status (*P*>.05).

Multivariate logistic regression analysis was performed using the combined status of at risk for or overweight as the dependent variable and age category (5 years and 6–11 years vs 12–18 years), sex (male vs female), race/ethnicity category (Hispanic/Latino and other vs Black), and birth weight (≥4000 g vs <4000 g) as independent variables. This analysis revealed a significant association between the combined status and race/ethnicity; Hispanic/Latino children were significantly more overweight and at risk for overweight (combined status) than were

their Black counterparts (adjusted OR 2.17, 95% CI 1.34–3.51; $P=.002$). Age, sex, and birth weight were not significant predictors of combined status.

Cardiovascular Disease (CVD) Risk Factors Associated With Overweight

All relations and magnitude of the following relations remained similar when unimputed data were used. As expected, a significant association was observed for overweight status and CVD risk factors. Compared with non-overweight children, overweight children had significantly higher SBP (104.9 ± 10.1 mm Hg vs 98.2 ± 8.5 mm Hg; $P<.001$), DBP (69.5 ± 12.6 mm Hg vs 63.8 ± 10.3 mm Hg; $P<.001$), and prevalence of HSBP (23.0% vs 10.8%, OR 2.47, 95% CI 1.47–4.15; $P<.001$). More than a two-fold increase in the prevalence of HSBP was found as BMI percentile increased from ≤ 25 th percentile to ≥ 95 th percentile (9.3% vs 23.0%; overall $P=.005$).

An overall significant difference by race/ethnicity was observed in the prevalence of HSBP ($P=.036$), with a lower prevalence in Hispanic/Latino than Black children (12.6% vs 22.26%, OR .50, 95% CI .28–.89; $P=.019$). An overall significant age difference was noted in the prevalence of HSBP ($P<.001$), which was highest among 12- to 18-year-olds (39.2%), followed by 6–11 year olds (6.9%).

Subjects with a family history of hypertension, as compared to those without such family history, had a higher prevalence of HSBP (19.7% vs 11.0%; $P=.008$). There was no significant difference in prevalence of HSBP by sex, birth weight, or health insurance status.

Although no significant association between overweight status and high cholesterol was observed (10.8% of overweight vs 8.2% not overweight children, $P=.372$), significantly more overweight children (35.3%) had a combined status of either HSBP or

high cholesterol, in comparison to 17.6% of non-overweight children ($P<.001$). When adjusted for age, sex, race/ethnicity, and family history of hypertension, overweight children were more likely to have one or both CVD risk factors compared with non-overweight children (OR 3.0, 95% CI 1.8–5.0, $P<.001$).

Overweight children were significantly more likely than non-overweight children to have acanthosis nigricans (OR 42.5, 95% CI 5.55–324.77; $P<.001$). This relationship was unchanged after adjusting for age, sex, and race/ethnicity ($P<.001$).

Other Factors

A significant association between overweight status and asthma was observed ($P=.049$). None of the subjects were diagnosed with obstructive sleep apnea, steatohepatitis, or slipped capital femoral epiphyses. One child had been diagnosed with diabetes mellitus (not at risk for or overweight).

DISCUSSION

The prevalence of overweight and at risk for overweight among a minority pediatric and adolescent SBHC cohort in the community of East Harlem was exceptionally high. Overweight status for 6- to 11-year-old children in our largely minority sample attending SBHCs was 2.1 times the national prevalence for non-Hispanic White and 1.3 times the prevalence for Mexican American children aged 6–11 years.¹ For the 12- to 18-year-olds in this sample, the prevalence of overweight was 2.2 times the national prevalence for non-Hispanic White children and 1.3 times the national prevalence for Mexican American children.¹ The prevalence of overweight in our youngest age group of 5-year-olds was 3.3 times the national prevalence for non-Hispanic White 5-year-olds and

2.1 times the national prevalence for Mexican American 5-year-olds.¹ No significant difference in the prevalence of overweight or at risk for overweight in our sample was observed by sex, findings consistent with those of NHANES. A greater prevalence of the combined classification of at risk for or overweight was observed in Hispanic/Latinos than in Black children. In contrast, a very small proportion of White children were in the current study, compared to NHANES¹ and other population-based studies.

One explanation for the higher prevalence of overweight observed in the current study in comparison to national data may be due to differences in the methods used in each study. Specifically, ours was a school-based clinic sample as opposed to a non-school based, population-based sample. Additionally, various studies have demonstrated differences in prevalence of overweight among different Hispanic groups.²² For example, overweight was demonstrated to be more prevalent in Puerto Rican than in Cuban and Mexican American adolescents in the Hispanic Health and Nutrition Examination Study.^{22–24} However, The National Longitudinal Study of Adolescent Health observed the prevalence to be comparable among these three Hispanic subgroups.^{22,24,25} We were not able to specifically identify the various Hispanic subgroups in our sample. However, our sample may have over-represented Puerto Ricans because New York City is a traditional entry point for Puerto Ricans when they immigrate to the United States; Puerto Ricans represent the largest Hispanic subgroup in East Harlem.²⁶ Thus, it is plausible that Hispanics at greater risk for being overweight were included. Nonetheless, despite these possible differences, our preliminary data demonstrate that the proportion of low-SES minority children attending SBHCs at risk for or overweight is high.

Similar to our study, higher prevalences of overweight have been reported in inner-city children in the United

States. Findings from a study of 209 Baltimore City third grade public school children demonstrated a prevalence of overweight of 19.1%.²⁷ Another study of inner-city children aged 3–7 years ($n=386$) receiving primary care services at The Philadelphia Health Care Centers observed an 18% prevalence of overweight.²⁸

A study of New York City public elementary schools found the prevalence of overweight to be 24%. Hispanic children had the highest rate (31%), followed by Blacks (23%), Whites (16%), and Asians (14.4%).²⁹ Similar to our study, Hispanic boys had a higher prevalence of overweight compared to Black boys. All these estimates far surpass the Healthy People 2010 target of 5%.³⁰ The reasons for the disproportionately higher rates in Hispanic boys compared to Black boys are unknown but may include differences in SES, maternal and environmental factors, and/or prevalence of biological dysregulations.²⁹ Regardless of the explanations, our findings further substantiate that childhood overweight is a major public health concern in New York City, especially East Harlem, and emphasize the need for effective targeted intervention strategies in low-SES minority children attending SBHCs.

Our study also provides preliminary evidence to suggest that screening blood pressure may be higher in overweight minority children attending SBHCs. Prior studies in school children have indicated that hypertension is significantly associated with overweight.³¹ Given the lack of quality control in the blood pressure measurement in this school-based sample, further exploration of the prevalence of hypertension in this high risk population is warranted.

The current study demonstrates an association of high birth weight with overweight children. This confirms previous studies exhibiting a positive relationship between higher birth weight and BMI later in life.^{9,32} An association between overweight children

and asthma was also observed in the present study, corroborating prior studies.^{33–36} However, the directionality of this relation can not be ascertained since the current study is cross-sectional.

Our study has potential limitations. Selection bias is possible since not all the students who attended the schools in which these SBHCs are located enrolled in the SBHCs that we sampled. However, this potential bias is probably minimal since school data indicate a high pediatric SBHC enrollment rate.¹⁶ Our SBHCs provide care to both insured and uninsured children and offer bilingual services. While this SBHC sample is not a population-based sample, it is likely to be more representative of the community than clinic-based and hospital-based samples and fairly representative of the children of East Harlem. As with all studies involving retrospective medical record reviews, there are weaknesses that are inherent to type of study design, including lack of or suboptimal measurement of potential confounders, risk factors, and sociodemographic and outcome variables. Another limitation of the present study is missing data. We imputed data in an effort to reduce bias. All relations and the magnitude of these relations observed for the bivariate and multivariate analyses of imputed data remained very similar when unimputed data were used. Other limitations in this study include the reliability and accuracy of data based on parental or patient self-report, a nonstandard research measure, such as race/ethnicity and birth weight, and the lack of quality control in the measurement of weight, height, and blood pressure.

In summary, our data confirm the presence of an overweight epidemic in low-SES Hispanic and Black children attending SBHCs in an urban community. Further, the prevalence of HSBP is significantly higher in overweight minority children attending these SBHCs. Our findings substantiate the recently released Institute of Medicine's report

Our data confirm the presence of an overweight epidemic in low-SES Hispanic and Black children attending SBHCs in an urban community.

that recognizes prevention of childhood obesity as a “national public health priority.”³⁷ As pediatric hypertension is a cardiovascular risk factor, it is important to determine by rigorous means the prevalence of hypertension in youths as defined by the most recent guideline set forth by the NHBPEP Working Group.²⁰

Given the high prevalence of overweight and risk for overweight and HSBP in children attending multiethnic urban SBHCs, prevention and intervention strategies focusing on minority children of low SES are necessary. SBHCs may be a reasonable target site for effective overweight preventive strategies as they are closely associated with the public schools, and already provide health services to these children. Future investigations should confirm our findings and further examine the predictors and correlates of overweight in this high-risk population. Culturally appropriate, school-based preventive strategies in low-SES minority children should additionally be tested in randomized controlled trials.

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