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Finding Targets for Obesity Intervention in Urban Communities: School-Based Health Centers and the Interface with Affected Youth

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ABSTRACT *Urban schools and school-based health centers (SBHCs) in low-income minority communities may be important points of intervention for overweight and obese youth. To date, little is known about the interface of overweight youth and the public health system through SBHCs. The objective of this study is to determine the prevalence, geographic distribution, sociodemographic, and comorbidity factors associated with obese status as a part of a public health system needs assessment. We conducted a cross-sectional clustered sampling utilizing prospective anthropometric measurement and chart review. Demographic, anthropometric, and medical comorbidity data were collected from 2,630 students in SBHCs in Baltimore, MD, USA. Students were geocoded to their primary residential address and assigned to a census block group using MapInfo v6.5. Demographic and comorbidity associations were analyzed using multivariable logistic regression analysis. Overall, the mean body mass index (BMI) was 25.5 (SD 6.6), and prevalence of obesity (BMI>95th percentile) and overweight (BMI 85th–95th percentile) was 26.5% and 15.7%, respectively. Obesity was distributed among all the schools without one school being significantly more affected than others. Obese status was associated with gender, poverty, and several medical comorbidities such as asthma, high blood pressure, and disordered eating. Public health practitioners in this SBHC system appear to be faced with a greater burden of obesity than predicted by Centers for Disease Control and Prevention estimates. Given the ongoing interface with affected youth, these schools and health centers may be well situated to deliver public health obesity interventions.*

KEYWORDS *Obesity, School health, Urban, Adolescents*

BACKGROUND

Obesity among children and adolescents is one of the most significant medical problems in the USA and considered to be an epidemic by many in pediatric health care. The National Center for Health Statistics has monitored the changes in anthropometric measurements of young people since the 1960s through the National Health and Nutrition Examination Survey. Currently, one in every five children and adolescents is obese, which is an almost fivefold increase in the last

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40 years.[1,2] While there are significant racial and ethnic health disparities associated with obesity among youth, recent data from the Youth Risk Behavior Surveillance System have demonstrated that obesity has also impacted the general population of youth across racial/ethnic lines.[3]

The state of Maryland has not been spared with respect to the obesity epidemic. Currently, 60% of Maryland adults have been estimated to be overweight or obese.[4] Maryland has consistently ranked in the top five states in the country with the highest rates of adult obesity in the nation. Citizens in Baltimore, MD, USA are disproportionately affected by the changes in body parameters observed in the state. In 2007, 35% of adults in Baltimore were overweight.[5,6] Further, in 2007, the Centers for Disease Control and Prevention (CDC) demonstrated that 18.5% of Baltimore high school students in the city were obese and, along with a number of other health risks, were disproportionately affected compared with their peers statewide and nationally.[3]

Research has suggested that minority status and poverty in urban communities contribute to obesity among youth because of family issues such as parental work hours and available leisure time,[7] inequalities in the built environment,[8–10] environmental influences on food choice,[10–13] and barriers to physical activity. Given this knowledge, urban schools and school-based health centers (SBHCs) in low-income minority communities may be important points of intervention for overweight and obese youth. To date, little is known about the interface between affected youth with SBHCs. The objective of this study was to determine the prevalence, geographic distribution, and sociodemographic and comorbidity factors associated with obese status among students served by SBHCs as a part of a public health system needs assessment.

METHODS

Study Design

This project utilized prospective anthropometric measurement and chart review. The medical records of students who presented for acute or routine care during the 2003–2004 academic year in SBHCs located in eight Baltimore high schools were reviewed using a standardized data extraction process. Currently, the Baltimore School-Based Health program operates 15 comprehensive school-based health centers, eight of which are in high schools. Each school-based health center has a certified pediatric nurse practitioner and/or physician assistant(s), a nurse, a clinical assistant, and a medical office assistant. A physician consultant (pediatrician and/or adolescent medicine specialist) is assigned to each school, is on-call for questions, and also provides on-site clinical service and consultation. Services at the SBHCs include health risk assessments using the American Medical Association's Guidelines for Adolescent Preventive Services (GAPS), well adolescent care, reproductive health services, acute care, immunization, and nursing support for chronic disease management, including medication delivery. Though the SBHCs are designed to supplement primary care services and provide care to the uninsured, the SBHCs provide both acute and well care to program participants, and many youth view the centers as key sources of health care. The SBHCs are well accepted by students and parents given that between 67% and 90% of the registered student population at each school was also enrolled in the SBHC program.

Clinical staff in participating SBHCs were trained in the assessment of anthropometric measurements and oriented to study methods during required group trainings at the beginning of the academic year. Research staff also attended general staff meetings periodically thereafter to address any issues related to the study protocol. The study protocol was approved by the Baltimore City Health Department Institutional Review Board and the Johns Hopkins School of Medicine Institutional Review Board.

As a part of the project, all study schools received new 400-lb capacity digital scales (Tanita Digital Professional X-TRA Capacity Scale (Model BWB800S)) and mechanical wall-mounted stadiometers (SECA Mechanical Full Telescopic Stadiometer (Model 222)) to allow for accurate and reliable anthropometric measurement. All equipment was installed and calibrated by school health personnel according to manufacturer instructions. Individual training and technical assistance regarding use of the stadiometers and scales were provided by the principal investigator (PI) for consistency across schools.

A trained research assistant (RA) identified new students seen at the SBHCs using visit logs kept by the certified nursing assistants as part of health department billing and reporting requirements. The RA conducted a detailed medical chart review using a standardized data extraction form during weekly visits to each study site. Associated medical problems were identified using the problem list populated by the school health clinician and diagnosis summaries from visit notes. The RA was asked to specifically evaluate the records for the following medical issues using the data extraction form: obesity, asthma, elevated cholesterol, hypertension, diabetes, depression, anxiety, disordered eating, family problems, joint problems, sexually transmitted infection, pregnancy, hormonal contraceptive use, irregular periods, polycystic ovary syndrome, and sleep disorder. There were also designations for other problems or none to be coded by the reviewer. The reviewer had access to the entire medical record which includes the problem lists, GAPS screening forms, and the detailed clinician notes with billing codes. The information was directly entered into an electronic database. Charts were only reviewed once by the research assistant and were tagged to prevent duplicate review.

To encourage and maintain regular data collection activity, a reward system was established for participating SBHC sites. Each quarter, the SBHC with the highest percentage of patients measured per clinic enrollment was treated to an on-site luncheon sponsored by the research study. Twenty-five randomly selected charts were selected for secondary review by a research team member familiar with SBHC charting during each quarter to ensure that the data extraction process used by the primary reviewer could be duplicated and that data were consistent with the initial extraction process. Comparisons of results were reviewed by the PI. Demographic and anthropometric data by date of entry were consistent on secondary review of the ten charts identified for re-review by PI.

Census 2000 information was utilized as an additional source of data to determine whether socioeconomic status of the neighborhood of residence of students attending the health clinics was associated with overweight status. Students were geocoded to their primary residential address and assigned to a census block group using MapInfo v6.5 (MapInfo Corporation, Troy, NY, USA). Census information on median household income and percent below the 2000 federal poverty level (for example in 2000, equal to $13,874 for a family of two adults and two children[14]) was then appended to each student's record.

Analysis

Summary statistics of selected individual- and neighborhood-level sociodemographics and health status indicators including mean body mass index (BMI) and BMI classification were calculated by school and overall using SPSS 11 (SPSS, Chicago, IL, USA). CDC software tools and sex- and age-specific recommendations were used to calculate and classify individual BMIs.[15,16] Prevalences of BMI classifications including obese (equal to or greater than the 95th percentile), overweight (85th to less than the 95th percentile), normal (5th percentile to less than the 85th percentile), and underweight (less than the 5th percentile) were calculated by school and overall using as the denominator the total number of students seen during 2003–2004 at each SBHC.[17,18] Analysis of variance was conducted to test whether there were differences between schools in mean BMI and percent obese. To show the geographic location of each school, schools were geocoded to their address location using MapInfo and Baltimore City Urban Planning Commission 2000 base maps. A figure was then created showing each school location and of students attending the SBHCs, the percent overweight.

Bivariate analyses were conducted to identify selected sociodemographics and health status indicators that were associated with overweight status. Generalized estimating equations were used to account for the clustering of the sampling by schools. Factors significantly associated using a conservative p value of <0.10 were then entered into a multivariable logistic regression. Backwards-step regression was used to identify factors significantly associated with overweight status in the model. Goodness of fit of the model was assessed using the log likelihood ratio test.

RESULTS

Data were collected on 2,757 students in the school-based health program. Of the 2,757 individuals reported, approximately 95% (2,630) were geocoded successfully and represent the final study sample size. Cases that could not be geocoded either represented an invalid residential address or were addresses located outside the bounds of Baltimore City.

Table 1 provides a breakdown of the individual- and neighborhood-level sociodemographics by school and overall. The average age of students attending the SBHCs was 16.8 (SD 1.20). The majority of students were female (65%) and African American (83%). Twenty-seven percent of students were in the ninth grade and 52% were on Medicaid. In the residential neighborhoods of the SBHC students, the average median household income was $28,201 and on average students lived in "poverty areas" with on average 26% of the neighborhood population below the federal poverty line (according to the federal definition, "poverty areas" include areas where more than 20% of persons are living below the federal poverty line).[18,19]

Table 2 shows health status indicators by school and overall. Overall, the mean BMI was 25.5 (SD 6.6) and prevalence of obese and overweight was 26.5% and 15.7%, respectively. Analysis of variance analyses suggested no significant differences by school in mean BMI and the prevalence of obesity (data not shown). Common health status indicators identified in the charts included asthma (15%), depression (11%), family problems (21%), and sexually transmitted infections (17%).

Table 3 shows the association between obesity, sociodemographics, and other health status indicators in bivariate and multivariable logistic regression. In bivariate

TABLE 1 Selected individual- and neighborhood-level sociodemographics of students attending school-based clinics at eight inner city high schools from 2003 to 2004

	High schools								
	1	2	3	4	5	6	7	8	Overall
	(*n*=117)	(*n*=362)	(*n*=364)	(*n*=293)	(*n*=344)	(*n*=284)	(*n*=458)	(*n*=408)	(*n*=2,630)
Individual-level sociodemographics									
Age, mean (SD)	16.18 (1.23)	17.23 (1.04)	16.93 (1.17)	16.77 (1.18)	17.0 (1.15)	16.30 (1.22)	16.66 (1.24)	16.65 (1.15)	16.77 (1.20)
Gender, female, *n* (%)	58 (49.57)	255 (70.44)	263 (72.25)	233 (79.52)	218 (63.37)	132 (46.48)	283 (61.79)	268 (65.69)	1,710 (65.02)
Race/ethnicity, *n* (%)									
Black	116 (99.15)	356 (98.34)	325 (89.29)	273 (93.17)	328 (95.35)	205 (72.18)	310 (67.69)	272 (66.67)	2,185 (83.08)
White	1 (0.85)	2 (0.55)	27 (7.42)	1 (0.34)	9 (2.62)	62 (21.83)	85 (18.56)	1 (0.25)	188 (7.15)
Hispanic	1 (0)	0 (0)	3 (0.82)	2 (0.68)	1 (0.29)	7 (2.46)	35 (7.64)	0 (0)	48 (1.83)
Other	0 (0)	3 (0.83)	4 (1.09)	1 (0.34)	4 (1.06)	5 (1.76)	21 (4.59)	2 (0.49)	40 (1.52)
Unknown	0 (0)	1 (0.28)	5 (1.37)	16 (5.46)	2 (0.58)	5 (1.76)	7 (1.53)	133 (32.60)	169 (6.43)
Grade, *n* (%)									
9th	49 (41.88)	61 (16.85)	92 (25.27)	57 (19.45)	75 (21.80)	124 (43.66)	167 (36.46)	92 (22.55)	717 (27.26)
10th	25 (21.37)	35 (9.67)	99 (27.20)	44 (15.02)	62 (18.02)	74 (26.02)	98 (21.40)	127 (31.13)	564 (21.44)
11th	21 (17.95)	111 (30.66)	76 (20.88)	80 (27.30)	71 (20.64)	31 (10.92)	87 (19.00)	91 (22.30)	568 (21.60)
12th	9 (7.69)	87 (24.03)	59 (16.21)	75 (25.60)	77 (22.38)	41 (14.44)	71 (15.50)	65 (15.93)	484 (18.40
Unknown	13 (11.11)	68 (18.78)	38 (10.44)	37 (12.63)	59 (17.15)	14 (4.93)	35 (7.64)	33 (8.09)	297 (11.29)
Insurance status, *n* (%)									
Medicaid	49 (41.88)	221 (61.05)	229 (62.91)	123 (41.98)	193 (56.10)	122 (42.96)	274 (59.83)	167 (40.93)	1,378 (52.40)
Self-pay	41 (35.04)	71 (19.61)	59 (16.21)	102 (34.81)	71 (20.64)	127 (44.72)	79 (17.25)	50 (12.25)	600 (22.81)
Private	26 (22.22)	68 (18.78)	75 (20.60)	55 (18.77)	80 (23.26)	34 (11.97)	103 (22.49)	50 (12.25)	491 (18.67)
Unknown	1 (0.85)	2 (0.55)	1 (0.27)	13 (4.44)	0 (0)	1 (0.35)	2 (0.44)	141 (34.56)	161 (6.12)
Neighborhood-level socioeconomic status									
Median household income, mean (SD)	$23,445.31 (10,556.83)	$29,786.92 (10,331.2)	$26,031.7 (9,077.87)	$30,453.26 (11,116.04)	$29,029.54 (9,459.31)	$28,960.75 (11,965.25)	$27,448.09 (10,765.36)	$28,096.92 (10,449.81)	$28,201.56 (10,565.75)
Percent below the federal poverty line, mean (SD)	34.80 (18.70)	24.85 (14.44)	29.21 (14.21)	23.52 (15.39)	23.56 (12.98)	26.33 (16.15)	28.55 (16.14)	25.30 (13.09)	26.45 (15.09)

TABLE 2 Selected health status indicators including BMI (mean and by BMI status) of students attending school-based clinics at eight inner city high schools from 2003 to 2004

	High schools								
	1	2	3	4	5	6	7	8	Overall
	(n=117)	(n=362)	(n=364)	(n=293)	(n=344)	(n=284)	(n=458)	(n=408)	(n=2,630)
Health status indicators									
BMI, mean (SD)	25.31 (5.91)	25.60 (6.86)	25.70 (6.43)	25.76 (6.99)	26.11 (6.82)	25.16 (6.49)	24.81 (6.08)	25.33 (6.58)	25.46 (6.56)
BMI status, *n* (%)									
Underweight	1 (0.85)	6 (1.66)	5 (1.37)	6 (2.05)	6 (1.74)	6 (2.11)	15 (3.28)	8 (1.96)	53 (2.02)
Normal weight	65 (55.56)	211 (58.29)	198 (54.40)	164 (55.97)	176 (51.16)	164 (57.75)	254 (55.46)	234 (57.35)	1466 (55.74)
Overweight	25 (21.37)	49 (13.54)	62 (17.03)	44 (15.02)	63 (18.31)	32 (11.27)	72 (15.72)	66 (16.18)	413 (15.70)
Obese	26 (22.22)	96 (26.52)	99 (27.20)	79 (26.96)	99 (28.78)	82 (28.87)	117 (25.55)	100 (24.51)	698 (26.54)
Asthma, *n* (%)	22 (18.80)	64 (17.68)	38 (10.44)	61 (20.82)	55 (15.99)	30 (10.56)	72 (15.72)	47 (11.52)	389 (14.79)
High blood pressure, *n* (%)	1 (0.85)	2 (0.55)	3 (0.82)	5 (1.71)	6 (1.74)	2 (0.70)	3 (0.66)	3 (0.74)	25 (0.95)
Diabetes, *n* (%)	0 (0)	3 (0.83)	2 (0.55)	1 (0.34)	1 (0.29)	0 (0)	3 (0.66)	4 (0.98)	14 (0.53)
Elevated cholesterol, *n* (%)	0 (0)	1 (0.28)	2 (0.55)	5 (1.71)	2 (0.58)	1 (0.35)	0 (0)	0 (0)	11 (0.42)
Depression, *n* (%)	4 (3.42)	46 (12.71)	85 (23.35)	33 (11.26)	29 (8.43)	16 (5.63)	52 (11.35)	17 (4.17)	282 (10.72)
Anxiety, *n* (%)	1 (0.85)	6 (1.66)	0 (0)	4 (1.37)	2 (0.58)	2 (0.70)	3 (0.66)	2 (0.42)	20 (0.76)
Disordered eating, *n* (%)	3 (2.56)	7 (1.93)	6 (1.65)	6 (2.05)	9 (2.62)	6 (2.11)	6 (1.31)	4 (0.98)	47 (1.79)
Family problems, *n* (%)	21 (17.95)	84 (23.20)	91 (25.0)	100 (34.13)	79 (22.97)	32 (11.27)	98 (21.40)	50 (12.25)	555 (21.10)
Sexually transmitted infection, *n* (%)	8 (6.84)	97 (26.80)	92 (25.27)	67 (22.87)	44 (22.87)	27 (9.51)	48 (10.48)	67 (16.42)	450 (17.11)

TABLE 3 The association between obesity status and sociodemographics and health status indicators in bivariate and multivariable logistic regression among students attending school-based clinics at eight inner city high schools from 2003 to 2004

	Obese (BMI>95th percentile)	Non-obese (BMI≥95th percentile)	Unadjusted odds ratio (OR)	95% CI	*p* value	Adjusted OR	95% CI	*p* value
Individual-level sociodemographics								
Age, mean (SD)	16.76 (1.22)	16.77 (1.19)	0.99	0.89, 1.11	0.91			
Gender, female, *n* (%)	493 (28.83)	1,217 (71.17)	1.43	1.17, 1.70	0.00*	1.43	1.18, 1.72	0.00
Race/ethnicity, *n* (%)								
Black	593 (27.14)	1,592 (72.86)	ref	ref	ref			
White	54 (28.72)	134 (71.28)	1.08	0.94, 1.25	0.28			
Hispanic	9 (18.75)	39 (81.25)	0.62	0.35, 1.11	0.11			
Other	10 (25.00)	30 (75.00)	0.89	0.51, 1.57	0.70			
Unknown	32 (18.93)	137 (81.07)	n/a	n/a	n/a			
Grade, *n* (%)								
9th	200 (27.89)	517 (72.11)	ref	ref	ref			
10th	143 (25.35)	421 (74.65)	0.88	0.71, 1.09	0.23			
11th	130 (22.89)	438 (77.11)	0.77	0.51, 1.15	0.20			
12th	142 (29.34)	342 (70.66)	1.07	0.74, 1.56	0.71			
Unknown	83 (27.95)	214 (72.05)	n/a	n/a	n/a			
Insurance status, *n* (%)								
Medicaid	370 (26.85)	1,008 (73.15)	ref	ref	ref			
Self-pay	174 (29.00)	426 (71.00)	1.11	0.93, 1.34	0.26			
Private	123 (15.05)	368 (74.95)	0.91	0.80, 1.04	0.17			
Unknown	31 (19.25)	130 (80.75)	n/a	n/a	n/a			
Neighborhood-level socioeconomic status								
Median household income, mean (SD)	28,836.02 (10,544.51)	27,972.34 (10,566.77)	1.00	1.00, 1.00	0.09*			
Percent below the federal poverty line, mean (SD)	25.57 (14.90)	26.77 (15.14)	0.99	0.99, 1.00	0.07*	0.99	0.99, 1.00	0.04**

TABLE 3 ***continued***

	Obese (BMI>95th percentile)	Non-obese (BMI≥95th percentile)	Unadjusted odds ratio (OR)	95% CI	*p* value	Adjusted OR	95% CI	*p* value
Health status indicators								
Asthma, *n* (%)	130 (18.62)	259 (13.41)	1.48	1.17, 1.86	0.00*	1.49	1.18, 1.89	0.00**
High blood pressure, *n* (%)	18 (2.58)	7 (0.36)	7.28	3.03, 17.50	0.00*	7.38	3.03, 17.97	0.00**
Elevated cholesterol, *n* (%)	5 (0.72)	6 (0.31)	2.32	1.30, 4.12	0.00*			
Diabetes, *n* (%)	7 (1.00)	7 (0.36)	2.79	0.73, 10.66	0.13			
Depression, *n* (%)	81 (11.60)	201 (10.40)	1.13	0.82, 1.56	0.46			
Anxiety, *n* (%)	9 (1.29)	11 (0.57)	2.28	1.05, 4.93	0.04*			
Disordered eating, *n* (%)	21 (3.01)	26 (1.35)	2.27	1.27, 4.06	0.01*	2.05	1.07, 3.53	0.03**
Family problems, *n* (%)	147 (21.06)	408 (21.12)	1.00	0.82, 1.21	0.97			
Sexually transmitted infection, *n* (%)	119 (17.05)	331 (17.13)	0.99	0.81, 1.22	0.95			

*p value<0.10; **p value<0.05

analysis, female gender ($p<0.001$), median household income ($p=0.09$), and percent below the federal poverty line ($p=0.07$) were associated with overweight status at a conservative p value of less than 0.10. Health status indicators associated with overweight status included asthma ($p<0.001$), high blood pressure ($p<0.001$), elevated cholesterol ($p<0.001$), anxiety ($p=0.04$), and disordered eating ($p=0.01$). In multiple logistic regression analyses, gender ($p=0.00$), percent below the federal poverty line ($p=0.04$), asthma ($p<0.001$), high blood pressure ($p<0.001$), and disordered eating ($p=0.03$) were retained in the final model because the factors had 95% confidence intervals that did not include 1.0 and p values significant at a 0.05 level. Due to the association of obesity with gender, we ran stratified models by gender (data not shown). Results were all in the same direction although the female model retained only two significant factors including asthma and high blood pressure. While the goal was not to identify gender-specific models or imply any causal directionality of the comorbidities, the model with both genders casts light on health status indicators that are associated with obesity in this population and demonstrates the burden of comorbidities managed by public health clinicians in SBHCs.

DISCUSSION

This study demonstrates that not only is there a high prevalence of overweight and obesity with consistent geographic distribution among this sample of high school students but also that the rates in these sites are above the overall city and national average as predicted by CDC estimates.[3] Almost 40% of students in this sample were either overweight or obese. While these findings are not surprising given the research by Jehn and colleagues demonstrating that 21% of elementary school girls and 17% of boys were obese and that an additional 15% of girls and 14% of boys were overweight in Baltimore,[20] it suggests that high school students in the city served by SBHCs may be disproportionately affected by obesity and associated complications.

The finding that there was consistently spread geographic distribution with all sites affected by obesity and related health indicators means that the targets for initiating an intervention within the system will be difficult to define and will need to be broadly applied. While there are limited data outlining the most effective long-term interventions for overweight prevention and intervention activities in high school adolescents because communities have focused on children in middle school or younger,[21–23] the school-based health program in this city is currently managing the care for thousands of high school adolescents and cannot ignore their health needs related to obesity and its associated comorbidities. Further, these youth will likely become obese adults who will in the long term create an increased burden on the public health system as they develop complications of obesity.[24–26]

While the literature on intervention is limited and focuses on early adolescents, studies have consistently shown that school-based interventions are desperately needed and can be effective.[27–31] For example, Planet Health, an interdisciplinary school intervention for early adolescents in Massachusetts, reduced television viewing hours overall in boys and girls, increased fruit and vegetable consumption and smaller increment in energy intake in girls, and decreased obesity among girls.[32] Alternatively, a randomized trial of school-based environmental and policy changes among early adolescents was successful in increasing physical activity and reduced BMI among boys.[33] The differential findings among girls and boys in these two studies also highlight the need for interventions that are both broad in scope, yet tailored to meet the needs of participants based on within-group characteristics such as gender. Gender-based intervention may be a reasonable first step given the disproportionate burden of obesity among girls in this sample and served by the clinics.

While schools appear to be a reasonable place for intervening in the lives of low-minority youth from urban neighborhoods often fraught with violent crime and decay, they have other challenges that often trump prioritization of health interventions. Schools in Baltimore (like many around the nation) are currently under pressure to improve the disparities in the educational outcomes of city youth[34] while also responding to the *No Child Left Behind Act* requirements.[35] That said, it would be unwise to ignore the epidemiological findings associated with obesity among city youth. Given the potential positive influence of healthy meals[36,37] and physical activity[38–40] on cognitive function and behavior, it seems that comprehensive wellness programs that include nutrition, physical education, and sports programming need to be integrated along with other core programs for academic development. An investment in these comprehensive wellness programs would require additional funding to (1) improve the physical plant and food options available to students in the schools, (2) increase the number of health and physical education teachers and team coaches necessary to meet national recommendations for physical activity for students in kindergarten through the 12th grade,[41] (3) address city transportation and teacher issues so that the school day can be expanded to accommodate physical education, and (4) invest in the built environment in the neighborhoods surrounding these schools and the communities in which the students who are served by these SBHCs reside. Finally, these schools are fortunate to have comprehensive nursing and medical services on site. While the literature has been silent on the potential role of these professionals and health centers in the battle against obesity, it has been well established that this model has been effective in addressing other public health needs such as immunization, family planning, primary and secondary sexually transmitted infection prevention, and coordination of care for students with chronic disease needing support from SBHC personnel. Therefore, an additional investment in public health programming with sound evaluation plans and obesity-related continuing education activities for SBHC staff may also be critical for assisting individual youth in improving their overall health.

The findings of this study should be considered in the context of several general limitations. This study utilized cross-sectional clustered convenience sampling from an SBHC program in a single community. This may have resulted in a sample that may not be generalizable to youth from dissimilar communities, be reflective of all adolescents in the Baltimore Metropolitan area, or reflect changes in individual anthropometric changes over time. These data do, however, provide insight to the problem among users of these SBHCs in Baltimore and likely the population of students attending these schools given the high participation rate in the SBHC program by school attendees. Given these findings and the amount of contact that these schools have with these youth over time, comprehensive and innovative obesity interventions that include schools and their associated health centers are warranted.

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