High Prevalence of Overweight Among Pediatric Users of Community Health Centers

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ABSTRACT. ***Objective.*** **With the increasing prevalence of pediatric obesity, it is important to identify high-risk populations of children to direct limited resources for prevention and treatment to those who are most vulnerable. The objectives of this study were to determine the prevalence of overweight in children who are clients of community health centers in medically underserved areas of the Health Resources and Service Administration regions II and III (Mid-Atlantic and Puerto Rico), compare this prevalence to nationally representative data, and contrast prevalence data between geographic areas and racial/ethnic groups.**

Methods. **The charts from a representative sample of 2474 children using 30 community health centers in 2001 were abstracted to collect clinically measured weight and height. Overweight was defined as a body mass index of ≥95th percentile of a reference population. To generate an unbiased estimate of overweight, multiple imputations were used for missing data. These data were compared with the 1999–2002 National Health and Nutrition Examination Survey.**

Results. **The prevalence of overweight was elevated in this sample of children aged 2 to 5 years (21.8%; 95% confidence interval [CI]: 19.1–24.8) and 6 to 11 years (23.8%; 95% CI: 16.9–27.7) compared with the 1999–2002 National Health and Nutrition Examination Survey (10.3% and 15.8%, respectively). No significant differences in prevalence were observed between Asian American (18.2%; 95% CI: 11.2–28.3), Hispanic (24.6%; 95% CI: 21.3–28.2), non-Hispanic black (25.6%; 95% CI: 20.8–30.9), and non-Hispanic white (22.8%; 95% CI: 19.0–27.0) children. Furthermore, no differences in prevalence were observed between children using community health centers in continental urban (23.7%; 95% CI: 20.6–27.2), suburban (24.0%; 95% CI: 20.0–28.5), or rural (22.9%; 95% CI: 19.3–26.9) areas.**

Conclusions. **The present study identified a population of children at particularly high risk for obesity based on the type of health care delivery system they use regardless of race/ethnicity or geographic characteristics. Because community health centers are experienced in prevention and serve >4.7 million children in the United States, they may be a particularly promising point of access and setting for pediatric obesity prevention.** ***Pediatrics*** **2005;116:e381–e388. URL: www.pediatrics.org/cgi/doi/10.1542/peds.2005-0104;** ***African Americans, Asian Americans, child, community health centers, delivery of health care, European Continental Ancestry Group, Hispanic Americans, medically underserved area, obesity, primary health care, Puerto Rico, rural health, suburban health, urban health.***

ABBREVIATIONS. HRSA, Health Resources and Service Administration; NHANES, National Health and Nutrition Examination Survey; CDC, Centers for Disease Control and Prevention; CI, confidence interval.

Pediatric obesity has increased two- to threefold in the past thirty years in the United States and continues to rise.[1,2] As one of the most frequent pediatric chronic conditions, it is important to define populations of children at higher risk for obesity to direct limited resources for treatment, prevention, and research. Individual risk factors such as parental overweight or television viewing[3,4] have been well described but are not particularly useful to direct resources to the most vulnerable children. Nationally representative surveys show that Mexican American and non-Hispanic black children are at higher risk for obesity than are non-Hispanic white children.[1,2] Data on the prevalence of overweight in Asian American and non-Mexican American Latino children, particularly children from Puerto Rico, are scarce.[5–9] Among non-Hispanic white adolescents, overweight is more frequent with lower socioeconomic status, whereas in non-Hispanic black and Mexican American adolescents this association is less clear or may be in the opposite direction.[10] Although the associations of ethnicity, race, and socioeconomic factors with pediatric overweight are relatively well defined, other important social health determinants are less well understood. For example, it is unclear if children living in medically underserved areas and using community health centers are at increasing risk for overweight or if urban, suburban, or rural US areas have the highest prevalence of pediatric overweight. These are important questions to answer to adequately plan public health and research efforts and train health professionals.

Community health centers are community-based organizations partially funded by the federal government (through the Health Resources and Service Ad-

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ministration [HRSA] under Title III) to deliver health care in medically underserved areas. More than 4.7 million children are clients of these centers,[11] mainly located in inner-city and rural areas, and they may be at increased risk for obesity, because medically underserved communities are also often areas in which access to healthy foods and physical activity opportunities are limited,[12,13] creating a particularly "obesogenic" environment. Because community health centers respond directly to the communities that they serve, depend less on funding from private insurers, and are successful in reducing health care–access disparities,[14–17] they may constitute a particularly promising setting for pediatric obesity prevention and treatment if it is confirmed that they serve a high-risk population.

The aims of this study were to describe the prevalence of overweight in children who are clients of community health centers in medically underserved areas of HRSA regions II and III, compare this prevalence to nationally representative data, and contrast prevalence data between geographic areas and racial/ethnic groups.

METHODS

Design and Sampling

This is a cross-sectional survey of a representative sample of all children using the 141 HRSA-supported community health centers in regions II (New Jersey, New York, Puerto Rico, and US Virgin Islands) and III (Delaware, Washington, DC, Maryland, Pennsylvania, Virginia, and West Virginia) during 2001. To obtain prevalence estimates among 2- to 11-year-old clients of these community health centers, a 2-stage stratified sampling scheme was designed to provide stable prevalence estimates by age group (2–5 and 6–11 years) and, within each age group, according to gender, race/ethnicity (Asian American, Hispanic, non-Hispanic black, and non-Hispanic white), and geographic areas (continental urban, continental suburban, continental rural, urban Puerto Rico, nonurban Puerto Rico, and Chinatown, NY). Community health centers were classified as urban if they were located in a county in a large (population of ≥1 million) metropolitan area that included all or part of the largest central city of the metropolitan area, as defined by the National Center for Health Statistics.[18] They were classified as suburban if they were located in a county in a large metropolitan area but did not include part of the largest central city of the metropolitan area or if they were located in a county located in a small (population of <1 million) metropolitan area. Community health centers were classified as rural if they were located in a county not included in a metropolitan area. Stable prevalence estimates according to age within the sampled centers were also required so that each center could use the collected data for their own planning purpose. This information feedback was seen as one of the incentives for the centers to participate to the study. Thus, at the first stage, 30 centers were sampled (Table 1): 10 from continental urban areas (except Chinatown, NY), 7 continental suburban, 7 continental rural, 1 Puerto Rico urban, 4 Puerto Rico nonurban, and the Chinatown, NY, center. To reduce inequalities in the probability of selection, these geographic strata were stratified further by size (number of pediatric users), with 1 to 3 centers sampled from each geographic-by-size stratum. Thirty-nine centers were solicited to participate to obtain 30 participating centers, yielding a first-stage response rate of 77%. The 9 centers that did not participate were replaced by centers randomly selected in the same geographic-by-size stratum. At the second stage of sampling, simple random samples of children aged 1 to 4 and 5 to 12 years (HRSA data age grouping) who had consulted the center in the year of 2001 were drawn at each of the sampled centers by using centralized chart numbers grouped within these age categories. Children <2 and >11 years old were then removed from the study sample to allow comparisons with nationally representative samples of children from the National Health and Nutrition Examination Survey (NHANES). Sample sizes were designed to yield ~100 children aged 2 to 11 years for each sampled center.

Because the populations of children within the 1- to 4- and 5- to 12-year age categories who sought care at each community health center in 2001 were known, the selection probability for each sampled child could be determined as $\Pi_{sa} = 1/C_s \times n_{sa}/N_{sa}$, where C_s is the number of centers in geographic-by-size substratum s, n_{sa} is the number of children drawn in the ath age group from the sampled center, and N_{sa} is the number of children in the ath age group at the center. Case weights equal to the inverse of the probability of selection $w_{sa} = 1/\Pi_{sa}$ were then computed. Finally, poststrata consisting of $R = 6$ age × geographic cells were formed, and poststratification adjustments $f_{ra} = \Sigma_{s\epsilon r} N_{sa}/\Sigma_{s\epsilon r} w_{sa}$ were computed so that the sum of the weighted sample matched known age-geographic totals. The final weights used in the analysis were then given by $fw_{sa} = f_{ra}w_{sa}$; these final weights were appended to each child's data record, where the child is a member of the ath age group in the sth center.

Data Collection

All data were collected by using chart abstraction at the community health center by the centers' staff using a standardized procedure. A standardized extraction form was provided to the centers for each data record together with detailed instructions for data abstraction. Because of the wide geographic distribution of the centers, quality checks could not be performed at each center, but careful quality control was performed after data entry, and no significant patterns of mistakes were discovered. When several visits were available for a randomly selected child, the last visit in 2001 during which height was measured was selected. Clinically measured weight and height were extracted form the charts, as well as age, gender, and race/ethnicity. The extraction forms, without patient identifiers, were sent to The Children's Hospital of Philadelphia for data entry and transferred to the University of Pennsylvania for analyses. The institutional review boards of both institutions exempted the study from approval, because no identifiers were available to the investigators.

Data Analysis

Data for a total of 3579 children were obtained from the 30 participating centers; of these, 377 were dropped from the sample because they were missing age, gender, or weight information, yielding a second-stage response rate of 89%. By design, as explained above, an additional 720 respondents were dropped from the analysis as ineligible based on age (<2 or >11 years of age). Finally, data from 8 subjects were removed from the analysis because they seemed to be extreme outliers with respect to height or weight for their age, biologically implausible, and probably a result of transcription errors: a height or weight z score >10 in absolute value or ad hoc agreement with the principal investigator that values were unrealistic. This process yielded a total of 2474 cases available for analysis. For each child, body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. A Box-Cox transformation[19] to normality was then calculated as in the Cole LMS method,[20] yielding a BMI z score and percentile, compared with the reference population.[21] Height- and weight-for-age z scores were calculated in a similar way. Children were classified as overweight if their BMI for age was ≥95th percentile of the Centers for Disease Control and Prevention (CDC) growth charts.[21] The prevalence of underweight was not assessed, because the limited chart abstraction performed would not have allowed for differentiation of a nutritional origin from an underlying medical condition.

Of the 2474 cases used in the analysis, 606 cases were missing height data. Because the main reason for the missing data was children having had height data collected at a recent visit preceding the last visit of 2001, the conditions for a "missing at random" missingness mechanism[22] were satisfied, that is, conditional on the observed data elements of center, age, and weight, whether or not height was recorded was unrelated to the child's actual height. Because of concerns about both efficiency and bias (missingness was distributed unequally across the centers, with rates ranging from 2% to 72%), a multiple imputation procedure[23,24] was implemented by using PROC MI in SAS 8.2 (SAS Institute Inc, Cary, NC). Within each center and age (2–5 and 6–11 years) category, the height z score was multiply imputed under a bivariate normal assumption using observed height and weight z scores.[20,21] For

TABLE 1. Characteristics of the 30 Participating Community Health Centers in 2001

Location	State	Study Stratum	Pediatric Users, n	Asian Americans, %	Hispanic, %	Non-Hispanic Black, %	Non-Hispanic White, %	Migrant and Seasonal, %	Below Poverty Level, %	Uninsured Pediatric Users, %
Buffalo	NY	Urban	3847	0	4	6	60	0	8	15
Syracuse	NY	Suburban	17 198	1	9	44	36	0	65	19
Brockport	NY	Urban	6061	1	11	5	61	11	28	12
Brooklyn	NY	Urban	33 070	6	48	9	19	0	83	14
New York	NY	Urban	10 402	2	48	21	20	0	74	22
Naranjito	PR	Nonurban	39 578	0	100	0	0	13	68	5
Loíza	PR	Nonurban	10 904	0	100	0	0	1	88	16
San Juan	PR	Urban	5609	0	100	0	0	0	100	15
Pulaski	NY	Suburban	4056	0	0	2	98	7	1	22
Camden	NJ	Urban	9875	1	44	40	8	0	60	11
New York	NY	Chinatown	7473	99	0	0	0	0	78	9
Peekskill	NY	Suburban	10 643	1	29	19	44	10	53	52
Warrensburg	NY	Suburban	13 343	0	0	0	76	0	4	19
Barceloneta	PR	Nonurban	4623	0	100	0	0	0	99	0
Bronx	NY	Urban	11 838	1	66	29	1	0	70	15
Lares	PR	Nonurban	11 354	0	100	0	0	0	96	1
Bronx	NY	Urban	23 560	0	51	43	1	0	80	14
Bronx	NY	Urban	22 382	2	47	34	8	0	68	10
Susquehanna	PA	Rural	2842	0	0	0	100	0	37	18
Wilkes-Barre	PA	Suburban	7096	0	1	5	94	0	54	28
New Canton	VA	Rural	7821	0	0	46	50	0	34	27
Nassawadox	VA	Rural	7405	0	11	42	46	11	43	31
Fairmont	WV	Rural	4524	0	0	6	94	0	23	43
Gary	WV	Rural	1841	0	0	27	73	0	62	47
Franklin	WV	Rural	1615	0	1	3	93	0	14	24
Hancock	MD	Suburban	2125	0	0	0	96	0	20	17
Denton	MD	Rural	5676	0	8	27	65	5	29	21
Baltimore	MD	Urban	7497	1	3	40	43	0	6	42
Erie	PA	Suburban	7766	1	9	40	45	0	11	13
Washington	DC	Urban	10 944	1	31	63	1	0	80	28
Median			7632	0	11	8	43	0	57	18

PR indicates Puerto Rico.

TABLE 2. Prevalence of Overweight, as Defined by CDC Reference Definitions, in a Representative Sample of 2474 Children Living in a Medically Underserved Area and Seeking Care at Community Health Centers Supported by HRSA Regions II and III According to Gender, Age, and Racial/Ethnic Group

Gender	Age, y	All, % (95% CI)	Asian American, % (95% CI)	Hispanic, % (95% CI)	Non-Hispanic Black, % (95% CI)	Non-Hispanic White, % (95% CI)
Both genders	2–5	21.8 (19.1–24.8)	12.1 (5.6–24.0)	25.0 (20.4–30.2)	21.8 (15.8–29.3)	22.8 (17.5–29.0)
	6–11	23.8 (19.6–27.7)	23.0 (12.4–39.0)	24.3 (19.9–29.3)	28.2 (21.6–36.0)	22.8 (17.9–28.7)
	All	23.0 (20.9–25.1)	18.2 (11.2–28.3)	24.6 (21.3–28.2)	25.6 (20.8–30.9)	22.8 (19.0–27.0)
Male	2–5	22.9 (19.1–27.2)	13.8 (5.6–30.4)	28.0 (21.4–35.6)	22.4 (14.2–33.5)	22.1 (16.1–31.7)
	6–11	23.3 (19.6–27.7)	33.6 (16.2–56.9)	24.8 (18.8–31.9)	24.4 (16.2–31.7)	22.1 (15.4–30.7)
	All	22.7 (20.0–25.7)	23.7 (13.3–38.6)	26.0 (21.5–31.2)	23.5 (17.5–30.9)	22.5 (17.4–28.5)
Female	2–5	20.4 (16.7–24.7)	9.2 (2.1–32.2)	21.4 (15.7–28.6)	21.1 (13.1–32.0)	22.5 (15.1–32.1)
	6–11	24.3 (20.4–28.7)	12.9 (3.8–35.8)	23.8 (17.7–31.1)	32.3 (22.4–44.2)	23.6 (16.7–32.2)
	All	23.2 (20.3–26.4)	11.5 (4.5–26.5)	22.9 (18.4–28.1)	27.7 (20.8–36.1)	23.1 (17.9–29.4)

each imputation, height was obtained by backtransforming the imputed z score; imputed BMI and BMI z scores were then computed, and an imputed obesity indicator was obtained. A total of 20 imputed data sets were used in the analysis.

For each imputed data set, a case-weighted logistic-regression analysis estimating the logit of the probability of overweight as a function of age, gender, race/ethnicity, and/or geographic area was conducted. To account for the unequal probability of selection and clustering by center, robust Taylor-series linearization estimates of the logistic-regression parameter variances were calculated by using SAS-callable SUDAAN Software for the Statistical Analysis of Correlated Data (Version 7.5; Research Triangle Institute, Research Triangle Park, NC). The results of the analysis for each imputed data set were then combined as described by Schafer.[24] To compare community health center prevalence estimates with nationally representative estimates according to age, gender, and ethnicity from NHANES,[1] z statistics were constructed and P values assessed under the null hypothesis of no difference between the community health center estimates and the NHANES estimates. Because 18 comparisons were made between community health center and NHANES prevalence estimates, it is possible that some comparisons may yield statistically significant differences by chance. A Bonferroni correction to account for multiple comparisons is given by a nominal significance level of $1 - \alpha/q$, where α is the overall test level desired and q is the number of comparisons. Hence, a Bonferroni correction would denote any comparison with a P value of $<.0028$ as significant at $\alpha = .05$.

RESULTS

Charts from 2474 children in 30 community health centers were abstracted and used for analysis. In this sample, 47.6% of the children were female, 4.2% were Asian American, 33.7% were Hispanic (any race), 15.6% were non-Hispanic black, and 35.3% were non-Hispanic white; 33.5% lived in the continental urban area stratum (except Chinatown, NY), 21.0% lived in suburban areas, 25.1% lived in rural areas, 3.6% lived in Chinatown, NY, 3.7% lived in urban Puerto Rico, and 13.2% lived in nonurban Puerto Rico. In the 2- to 5-year-old age group, 58 children were Asian American, 439 were Hispanic, 200 were non-Hispanic black, and 465 were non-Hispanic white. In the 6- to 11-year-old age group, 51 children were Asian American, 437 were Hispanic, 200 were non-Hispanic black, and 422 were non-Hispanic white. The prevalence of overweight was high in the overall sample (23.0%) and in each category, with no significant differences between genders ($P = .8$), race/ethnicity ($P = .5$) (Table 2), or geographic strata ($P = .8$) (Table 3). It should be noted, however, that

TABLE 3. Prevalence of Overweight, as Defined by CDC Reference Definitions, in a Representative Sample of 2474 Children Living in a Medically Underserved Area and Seeking Care at Community Health Centers Supported by HRSA Regions II and III According to Gender, Geographic Strata, and Racial/Ethnic Group

Gender	Geographic Strata	All, % (95% CI)	Asian American, % (95% CI)	Hispanic, % (95% CI)	Non-Hispanic Black, % (95% CI)	Non-Hispanic White, % (95% CI)
Both genders	Continental urban*	23.7 (20.6–27.2)	†	25.1 (20.2–30.2)	27.8 (21.4–35.1)	23.4 (15.5–33.9)
	Continental suburban	24.0 (20.0–28.5)	†	42.9 (27.0–60.4)	17.8 (10.5–28.5)	23.7 (18.7–29.7)
	Continental rural	22.9 (19.3–26.9)	†	†	35.0 (25.6–45.8)	19.1 (15.2–23.8)
	Chinatown, NY	NA	17.1 (10.3–26.7)	†	†	†
	Urban, Puerto Rico	NA	†	20.4 (13.0–30.4)	†	†
	Nonurban, Puerto Rico	NA	†	21.4 (16.8–26.9)	†	†
Male	Continental urban*	24.3 (19.8–29.4)	†	28.4 (21.5–36.4)	26.5 (18.1–37.1)	22.7 (12.5–37.7)
	Continental suburban	24.2 (18.8–29.4)	†	†	17.3 (9.1–30.5)	22.9 (16.2–31.4)
	Continental rural	21.3 (16.7–26.8)	†	†	25.3 (14.3–40.7)	20.2 (14.9–26.8)
	Chinatown, NY	NA	23.4 (13.2–38.2)	†	†	†
	Urban, Puerto Rico	NA	†	22.8 (11.6–40.1)	†	†
	Nonurban, Puerto Rico	NA	†	19.2 (13.5–26.4)	†	†
Female	Continental urban*	23.1 (18.8–28.0)	†	21.1 (15.3–28.4)	28.9 (20.1–39.7)	24.2 (13.1–40.4)
	Continental suburban	23.6 (17.9–30.6)	†	†	18.4 (7.1–40.1)	24.6 (17.5–33.6)
	Continental rural	24.6 (19.3–30.7)	†	†	45.5 (31.2–60.7)	17.9 (12.6–24.8)
	Chinatown, NY	NA	9.6 (3.2–23.8)	†	†	†
	Urban, Puerto Rico	NA	†	18.5 (10.0–31.7)	†	†
	Nonurban, Puerto Rico	NA	†	24.4 (17.1–33.5)	†	†

NA indicates not applicable.
* Except Chinatown, NY.
† Insufficient sample.

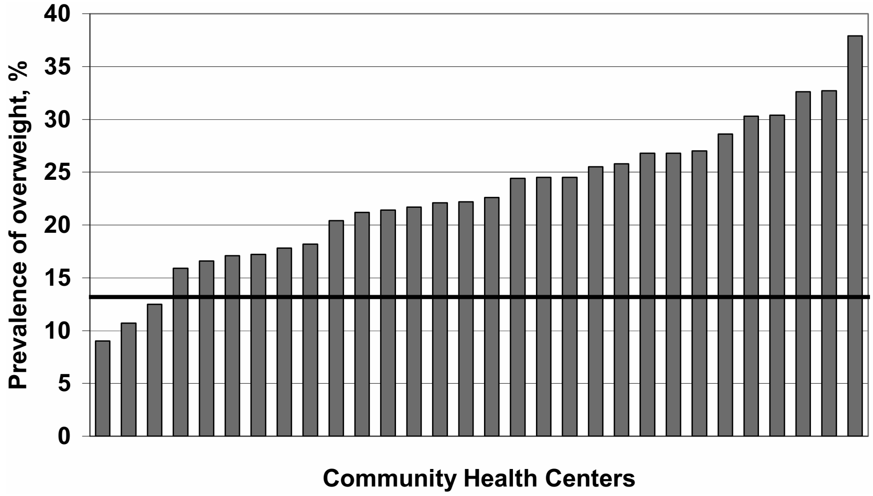

Fig 1. Prevalence of overweight (percent), according to center, in children ages 2 to 11 years seeking care at 30 community health centers supported by the HRSA regions II and III. The horizontal line represents the expected prevalence in the general population of US children with the same age distribution.

the confidence intervals (CIs) are wide and do not exclude type II errors. The only significant subgroup difference was observed between rural non-Hispanic black girls ($n = 53$ [45.5%]) and rural non-Hispanic white girls ($n = 191$ [17.9%]; $P < .001$). The prevalence of overweight ranged widely between centers from 9.0% (95% CI: 3.8–20.0) to 37.9% (27.7–49.4) (Fig 1). Compared with a nationally representative sample of children (NHANES) measured between 1999 and 2002,[1] the prevalence of overweight was significantly higher in this sample of children using community health centers (Table 4). Because Hispanic children from this sample were different (mostly Puerto Rican) in many ways from Mexican American children from NHANES, these groups were not compared. The point estimate of the prevalence of overweight was above the expected prevalence in a general population of children of this age distribution (13.1%) in 27 of the 30 centers (Fig 1).

DISCUSSION

The prevalence of overweight was elevated in this population of children using community health centers and did not seem to vary by racial/ethnic group or geographic characteristics. These results suggest that living in medically underserved areas and using community health centers may be a strong indicator of the risk for pediatric obesity, perhaps even stronger than other characteristics such as race/ethnicity or geographic area. This is important information to know when deciding how to direct limited resources for obesity prevention and treatment to children who are at high risk.

When compared with a nationally representative sample of children measured during the same period,[1] the children in our sample were more frequently overweight regardless of gender or race/ethnicity. This difference was particularly large in younger children, suggesting an earlier onset of obesity in this sample compared with the rest of the country. The higher prevalence of overweight in our sample than in the nationally representative sample could be explained by regional differences. However, smaller surveys in the community health care setting also described high prevalence of childhood overweight in Los Angeles, CA,[25] Washington, DC,[26] and Michigan.[27] Our sample was based on consultations at primary care clinics rather than being population based, which also could partially explain the high prevalence of overweight in our sample, because obese children are more likely to have chronic conditions, such as asthma, that require more frequent heath care visits.[28] It is likely, however, that the high prevalence of overweight in this study is also related to characteristics of medically underserved areas, particularly access to care. Anticipatory guidance by primary care providers to prevent obesity by promoting healthy eating and physical activity is a potentially powerful approach to prevent obesity,[29,30] but it may not be as widely available in medically

TABLE 4. Comparison in the Prevalence of Overweight, as Defined by CDC Reference Definitions, Between a Representative Sample of 2474 Children Living in a Medically Underserved Area and Seeking Care at Community Health Centers Supported by HRSA Regions II and III and a Nationally Representative Sample (NHANES 1999–2002) According to Gender, Age, and Racial/Ethnic Group

Gender	Age, y	All			Non-Hispanic Black			Non-Hispanic White		
		HRSA	NHANES	P	HRSA	NHANES	P	HRSA	NHANES	P
Both genders	2–5	21.8	10.3	<.001*	21.8	8.8	.001*	22.8	8.6	<.001*
	6–11	23.8	15.8	<.001*	28.2	19.8	.04	22.8	13.5	.003
Male	2–5	22.9	9.9	<.001*	22.4	8.0	.007	23.0	8.2	.001*
	6–11	23.3	16.9	.007	24.4	17.0	.15	22.1	14.0	.06
Female	2–5	20.4	10.7	.0002*	21.1	9.6	.028	22.5	9.1	.006
	6–11	24.3	14.7	.0003*	32.3	22.8	.13	23.6	13.1	.02

* Statistically significant differences for a global test level of $\alpha = .05$ under the Bonferroni correction.

underserved areas as in more privileged areas despite the fact that users of community health centers usually receive better preventive care than other uninsured patients.[17] Additionally, areas that are medically underserved may also be characterized by poor access to healthy foods or lack of opportunities for physical activities, defining a particularly "obesogenic" environment.[12,13] The wide variability in the prevalence of overweight between centers seems to be unrelated to racial/ethic or geographic differences between centers but may be a result of unmeasured variations in the environment. Although HRSA-funded community health centers serve communities that are medically underserved but not necessary of low income, the populations of many of these communities also are of low income. It is therefore useful to compare our findings to other studies of low-income populations. Sherry et al[9] described, in young children participating in federally funded programs that submit data to the Pediatric Nutrition Surveillance System, an elevated prevalence of overweight that increased from 1989 to 2000. However, in the same population, Mei et al[31] did not find significant differences in the weight-for-height z scores between these children and the general population of children.

Contrary to our expectation and nationally representative samples, no significant differences were detected between racial/ethnic groups in our sample, which was restricted to users of community health centers. In the most recent nationally representative NHANES sample of 1999–2002,[1] no ethnic difference was detected in children aged 2 to 5 years, but among children aged 6 to 11 years, Mexican American boys ($n = 384$) had a higher prevalence of overweight than non-Hispanic white ($n = 295$) and non-Hispanic black ($n = 363$) boys. Among girls in the 6- to 11-year-old age group, Mexican American ($n = 361$) and non-Hispanic black ($n = 351$) girls were more likely to be overweight than non-Hispanic white girls ($n = 281$). In our sample, no differences between ethnic groups were observed, not because of a lower prevalence of overweight among non-Hispanic black and Hispanic children compared with the nationally representative sample but rather because of an elevated prevalence among non-Hispanic white children. It is possible that the prevalence of overweight among Hispanic and non-Hispanic black children living in the same areas who are not users of community health centers is even higher than the community health center users in our sample. These centers have been shown to be successful in decreasing racial/ethnic health disparities, especially in preventive care.[14,15]

In this study, we identified a population of children at high risk for obesity based on characteristics related to the health care system rather than personal characteristics. This finding could be particularly useful for directing services, training, and research resources to health care structures serving high-risk populations. HRSA-supported community health centers, which serve 4.7 million children,[11] may be especially appropriate points of access and settings to deliver pediatric obesity prevention and treatment, because in addition to serving a high-risk population, their financial security depends less on private insurers, and their primary mission is community service. The continuity of care provided by community health centers over time[14] may also allow long-term interventions that would not be possible in the context of managed care and frequent insurance changes. Among uninsured Americans, community health center users are more likely than nonusers to have a usual source of care and more likely to make regular medical visits.[17] Therefore, pediatric obesity interventions in this setting may be distinctly useful, with a potentially strong public health impact.

This study had several limitations. The cross-sectional observational design does not allow causal inference. Furthermore, the health care–based sampling may not have yielded a representative sample of children living in medically underserved areas but rather only a sample of children seeking care at community health centers in these areas. This limitation may have artificially inflated the prevalence of obesity because of chronic conditions associated with obesity that increase the chance of consultations. On the other hand, families who consult for yearly routine visits, particularly those with children in the older age group, may be healthier and less likely to be overweight than the general population. The significance of our results identifying a population at risk based on health care system characteristics is unaffected by this limitation. The lack of detected differences between racial/ethnic groups may be the result of a type II error, ie, an insufficient sample size to detect an existing difference, especially in the smaller group of Asian American children. Weight and height data were extracted from clinical charts, and measurements were not standardized between centers. This may have led to misclassification of overweight status. Weight and height, even when measured clinically, are relatively reproducible[32]; therefore, we do not believe that this has led to a significant bias. However, to our knowledge, clinical measurements have not been validated to classify children as overweight, and this constitutes a limitation of the present study. Missing data are a concern in this study, but the method we used to impute height data relies on a missing-at-random assumption, which assumes that height is independent of missingness conditional on weight, age, gender, and center; this generally will reduce bias when compared with a complete case analysis,[22] which in this setting assumes missing completely at random (ie, that missingness is unassociated with height, weight, age, and gender within a center). Because of the large variation in prevalence between centers, conclusions cannot be drawn for all community health centers, and additional research is needed to understand the reasons for this variability. However, 27 of the 30 centers had a prevalence of overweight higher than what would be expected in the general population. Therefore, our conclusions probably apply to most community health centers. No information is available on the prevalence of overweight in the 9 nonparticipating centers. Therefore, we cannot assess if this nonparticipation has resulted in a biased estimate of the prevalence or if our results can be generalized to nonparticipating centers. Finally, because of the regional sampling strategy, our findings may not be generalized to other US regions.

This study also had unique strengths. The complex sampling strategy provides a representative sample of children seeking care in HRSA-sponsored community health centers of regions II and III in 2001. Additionally, this study provides important data on understudied minorities, such as non-Mexican American Hispanic children, and allows comparisons between geographic areas. The Youth Risk Behavior Surveillance System[33] also provides data on overweight prevalence by state and metropolitan areas, but these data are self-reported and limited to adolescents.

CONCLUSIONS

This study describes a high prevalence of overweight in children 2 to 11 years old using community health centers in medically underserved areas regardless of race/ethnicity and geographic characteristics. Identifying a high-risk population, based on use of community health centers, may provide useful information for targeting obesity prevention and treatment to those who are most vulnerable and to better understand the socioeconomic risk factors for pediatric obesity.

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