

## Prevalence of Childhood Obesity in a Representative Sample of Elementary School Children in Puerto Rico by Socio-Demographic Characteristics, 2008

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**Objective:** Childhood obesity is a worldwide epidemic; its prevalence has quadrupled in the US among children from 6-11 y/o. In the US, Hispanic children have a higher prevalence of obesity compared to non-Hispanic whites. No representative data was available for Puerto Rican children from first to sixth grades in Puerto Rico or the US. The aim of this study was to measure the prevalence of childhood obesity among Puerto Rican children from first to sixth grade by different socio-demographic characteristics in a sub-urban municipality in Puerto Rico.

**Methods:** A two-stage stratified cluster sampling design was used (n=250). Weights and heights were measured twice to the nearest 0.1 kg and 0.1 cm, respectively. Weight status of children was determined based on the CDC criteria. Chi-square and Fisher tests were used to compare proportions. Simple logistic regressions were used to assess associations with socio-demographic variables.

**Results:** Nearly half of the students (51.0%) were boys; mean age was 9.5 +1.9 years. Almost 40% of the children had family monthly incomes under \$1,000. Overall childhood obesity prevalence (BMI > 95th percentile) was 26.8%. Prevalence of having some type of overweight (BMI for age > 85%) was statistically similar by gender and school grade. Low family-income children had 76% higher odds of having some type of overweight compared with those with higher income.

**Conclusion:** This study documents a high prevalence of Puerto Rican childhood obesity among first to sixth grade regardless of grade level and gender, which is higher than the prevalence among Hispanics in the US. A higher probability of overweight was seen among the poorer children. This is the first study conducted among first to sixth graders. Thus, it calls for attention towards Puerto Rican children in the island and the US. [*PR Health Sci J* 2010;4:357-363]

*Key words:* Prevalence of Childhood Obesity, Puerto Rico, Low Income Families

Childhood overweight is a worldwide epidemic (1). Over the past 30 years, the prevalence of obesity in the United States (US) has nearly tripled for children 2 to 5 years of age and youth 12 to 19 years, whereas it has quadrupled for children 6-11 years old (2-3). Although this epidemic surpasses socio-economic boundaries, a higher prevalence is seen among lower socio-economic populations and ethnic minorities. Hispanic children in the US have a higher prevalence of obesity when compared to Non-Hispanic Whites (4). The most recent National Health and Nutrition Examination Survey (NHANES) data (2007–2008) showed that all Hispanic children 6-11y/o, of both sexes (including Mexican Americans) have a higher prevalence of obesity (25.1%) compared to Mexican-Americans exclusively (24.7%), non-Hispanic Blacks (19.4%), or non-Hispanic White children (19.0%). However, these national estimates fail to distinguish the heterogeneity among Hispanics

in the US, particularly Puerto Ricans who represent the second largest Hispanic subgroup in the states.

Among Hispanics, Puerto Ricans continue to be one of the most disadvantaged and vulnerable subgroups. More than half (58.5%) of Puerto Rican children living in the island, and almost one-third (29.4%) of Puerto Rican children in the US, live in poverty compared to only 8.7% of White children (6).

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Adult Puerto Ricans have a higher prevalence of overweight and obesity (64.5%) compared to non-Hispanic Whites (61.7%) and the burden of the metabolic syndrome is substantial (7-8). However, there is very limited information on the prevalence of childhood obesity in Puerto Rico, particularly among elementary school children (6-11 years old) living in the island, the group of age with the highest increase in childhood obesity prevalence in the states. A study conducted by the Puerto Rico Department of Health showed a high prevalence of overweight (26%) and obesity (16%) however the study only included children from second grades. Another study, conducted by Otero and García in a small convenience sample (n=154) of children ages 2-12 receiving primary care in a local Hospital in San Juan, Puerto Rico, also found a high prevalence (56%) of obesity (9); however, no stratification by age groups or sex were reported. Children weight status, and consequently their association to health conditions, is determined not only by their age group, but also by their sex characteristics.

The increased prevalence in childhood overweight worldwide represents an “unprecedented burden” on children’s health. Obesity is associated with significant health problems in the pediatric age group and is an important early risk factor for much of adult morbidity and mortality (10). The disproportionate burden of overweight and its related co-morbidities in Hispanics, especially type 2 diabetes, is evident early in life (11). For example, the risk of developing diabetes is higher among Hispanics, with a lifetime risk approximately 50% higher for children born in the year 2000. Some very obese youths suffer from immediate health problems, such as respiratory disorders, orthopedic conditions, and hyper insulinemia (12-18). Overweight in young people is also related to elevated blood cholesterol levels, high blood pressure, asthma, sleep apnea, and social discrimination which can lead to low self-esteem and depression.

A myriad of studies document the persistence of childhood overweight into adulthood thus representing a risk factor for severe obesity over the life course (19-23). Obesity decreases longevity, quality of life, and economic productivity (24). Obese adults are at higher risk for serious diet-related non-communicable diseases, including diabetes mellitus, cardiovascular disease, strokes, and cancer, among other chronic conditions that reduce the overall quality of life and contribute to premature death. These non-communicable diseases are by far the leading causes of death in the world (25).

In view of these tendencies, it is important to identify, early in life, children who are overweight or obese in order to reduce morbidity and mortality risks associated to it. Therefore in 2008, a nutritional study was conducted in Cayey, a suburban municipality of Puerto Rico with the goal of measuring dietary, socioeconomic, and environmental factors associated with the prevalence of childhood overweight among elementary school children from public and private schools. As previously stated, children from these age groups have had the greatest increase

in childhood overweight over the last decades compared to other age-groups in the US. Our study represents the first one examining the prevalence of childhood obesity among a representative sample of children from elementary schools (first to sixth grades) living in the island.

This article focuses on describing the prevalence of childhood overweight in a representative sample of Puerto Rican children participating in this study. In addition, it describes the association between parental socio-economic status and children weight status, since there is a need to examine how obesity and its consequences are patterned socially.

## Methods

This study was conducted in two stages. The first stage of the study consisted of a series of focus group sessions conducted with both parents and students, separately, that were selected from the same geographic areas as the survey sample. This qualitative phase allowed investigators to become familiar with the target audience’s characteristics and lifestyles associated to childhood overweight or obesity. Six focus group sessions were conducted with groups of 7-10 children from each grade with similar characteristics to the students to be included in the study. Four focus group discussions were conducted with parents from schools not included in the sample. The information obtained from the focus groups allowed the development of parental and child questionnaires used for the second phase of the study. The questionnaires were pilot-tested on 20 students selected from all grades in a school not included in the sample.

The second stage of the study was a cross-sectional survey. The parents’ validated and self-administered questionnaire, along with a consent form for participation, were sent to parents through homeroom teachers. This questionnaire included questions on socio-demographic characteristics, dietary practices, weight, and height, as well as physical activities of both students and parents. Family socio-economic status (SES) was measured by means of two variables: family monthly income and health insurance coverage. This last criterion was used as a proxy of socio-economic status since eligibility for participation in the public health insurance, called “La Reforma de Salud” (Health Reform), is based on poverty level. Based on the Puerto Rican Health Reform Law, health insurance coverage is provided free of charge to individuals of family groups with family income (including wages, properties, or other economic assets) below 200% of poverty threshold (26). Parents returned the questions to the teachers in a sealed envelope provided by the researchers.

A trained interviewer administered the children’s questionnaire at the school using food models and measuring tools for estimating quantity of food consumed. This questionnaire included questions regarding dietary practices, physical activities, and leisure activities of children, as well as their perception of their weight status. Weights and heights were measured to the nearest 0.1 kg and 0.1 cm, respectively, by

survey personnel using a portable and standardized scale/stadiometer (Detecto). Shoes were removed for the height and weight measurements. Waist circumference was measured using a flexible tape measure. All measurements were taken twice by the same research staff member. A nutritionist and a nutrition graduate student administered a 24 hour food recall for the dietary assessment.

### Sample Design

A representative sample of students from first to sixth grades, as well as their parents, from public and private elementary schools in the municipality of Cayey, Puerto Rico, was selected using a two-stage stratified cluster sampling design. Cayey is a suburban municipality located in the mountain region of Puerto Rico with a population of 47,370 inhabitants (2000 Census), and a tremendous economic and demographic growth over the last decades. Approximately 47.4% of the population is below poverty level similar to the rest of the island (45.0%).

The sampling frame, a list of all elementary schools, included the number of enrolled students stratified by grade. The study population consisted of approximately 5,441 children. The first stage of sample selection was the selection of the schools within each strata (private or public schools) using probability proportional to size of the student population. Each school selected was further stratified by grade. After selection of schools, a field supervisor visited all the schools and prepared a list of all available sections before the selection of the groups for the sample. The second stage of sample selection was the selection of the specific groups within the schools using a modified Kish table (27). All students and their parents within the selected groups (clusters) were included in the final sample. Using the STATCALC module of Epi-Info, version 6.04d, software, a sample size of 398 students and their respective parents of caregivers was determined using an expected prevalence of 24%, a desired precision of  $\pm 4\%$ , and a 5% significance level (28). This study was approved by the Human Research Subjects Protection Office at the Medical Sciences Campus of the University of Puerto Rico (protocol A1470107). Children provided written assent and parents gave written consent prior to participation in the study.

### Data analyses

Weight status of children was determined based on the 2000 sex-specific body mass index (BMI) for age growth charts from the Centers for Disease Control and Prevention (CDC) (29). Obesity was defined as at or above the 95th percentile of the sex-specific BMI-for-age growth chart. Overweight was defined as at or above the 85th percentile, but less than the 95th percentile of the sex-specific BMI for age, as defined by the growth chart. Normal weight was defined as a BMI for age between the 5th and the 85th percentiles, and underweight as a BMI for age below the 5th percentile.

The data was analyzed using SPSS (Statistical Package for the Social Sciences) for Windows (version 15.0) and SAS (SAS

Institute Inc.) for Windows (version 9.1). Bivariate analyses were performed in order to compare the proportion of children with some type of overweight and children not overweight. These proportions were compared across socio-economic status and demographic characteristics. Chi-square and Fisher tests were used to compare proportions. Simple logistic regression models were used to assess the strength of the association between demographic and socioeconomic characteristics and overweight. This sample is representative of all students between first and sixth grade in Cayey. Results were weighted using the inverse of the probability of sample selection. All analyses were performed on weighted data.

## Results

A total of 250 student participants and their parents were included in the final sample. This represented a response rate of 63.0% among children and 44.0% among parents. Socio-demographic characteristics of students are summarized in Table 1. Nearly half of the students (51.0%) were boys, and the mean age was 9.5 +1.9 years. Students from public schools accounted for 78.1% of the sample; 52.7% were located in a rural area. Among those students who had health coverage, 52.2% had government-provided health insurance ("La Reforma de Salud"). Only 2.6% of parents reported not having any health insurance coverage. Among parents of students, a higher proportion (37.3%) reported monthly incomes of less than \$1,000. Only one fifth (18.6%) of parents reported monthly family incomes of \$3,000 or higher.

Overall, the prevalence of obesity among students was 26.8% with 11.3% overweight. The weight status of children participating in this study is summarized in Table 2. A slightly higher proportion of girls (29.8%) were classified as obese compared to boys (24.0%), and a higher proportion of boys (12.4%) were classified as overweight compared to girls (9.9%). However, these differences were not statistically significant ( $p=0.081$ ).

Table 3 summarizes the prevalence of some type of overweight (BMI  $\geq 85$  percentile) within groups of children for selected socio-demographic characteristics. The sub-groups with the highest prevalence of some type of overweight were: girls in lower grades (40%), except males in fifth or sixth grade (56.1%), girls in private school (52.0%), and girls with a <\$1,000 monthly family income (50.0%).

Students in fifth or sixth grade had a higher prevalence of some type of overweight (46.8%) than students in third or fourth grade (38.5%) or in first or second grade (28.4%). This difference was marginally significant ( $p=0.07$ ). However, prevalence of overweight was similar by school type, private (40.0%) or public (37.4%). Females in all grades, except those in fifth or sixth grade, had a higher prevalence of overweight than boys. Over half (56.1%) of male fifth or sixth graders had some type of overweight compared to only 36.8% of females in the

same grades. There was also a higher prevalence of overweight among girls from private schools (52.0%) compared to the prevalence seen among girls from public schools (37.4%).

**Table 1.** Description of Socio-Demographic Characteristics among Elementary School Students, Cayey, Puerto Rico, 2008

Socio-demographic characteristics	Unweighted frequency	Unweighted percentage	Weighted frequency	Weighted percentage
Gender				
Female	121	48.4	1,883	49.0
Male	129	51.6	1,960	51.0
School grade				
First or Second	59	23.6	1,026	26.7
Third or Fourth	101	40.4	1,469	38.2
Fifth or Sixth	90	36.0	1,348	35.1
School type				
Public	205	82.0	3,001	78.1
Private	45	18.0	842	21.9
School geographic location				
Rural	130	52.0	2,024	52.7
Urban	120	48.0	1,819	47.3
Type of medical insurance				
Private	101	45.5	1,607	46.6
Government	115	51.8	1,755	50.9
None	6	2.7	88	2.6
Family monthly income				
<\$1,000	84	39.3	1,244	37.3
\$1,000-1,999	59	27.6	922	27.7
\$2,000-2,999	36	16.8	549	16.5
≥\$3,000	35	16.4	618	18.6
<b>Total</b>	<b>250</b>	<b>100.0</b>	<b>3,843</b>	<b>100.0</b>

A higher prevalence of some type of overweight (BMI >85th percentile) was seen among children from rural areas (41.7%) compared to children from urban areas (33.6%), for both girls and boys. Prevalence among children with government health coverage or no insurance (38.5%) was similar to the prevalence seen among children with private health coverage (35.6%). The highest prevalence of overweight was seen among children whose family's monthly income was less than \$1,000 (45.7%), with the highest prevalence among girls in that income level (50.0%).

**Table 2.** Weighted Prevalence Estimates of Weight Status by Gender among Elementary School Students, Cayey, Puerto Rico, 2008

Weight status	Gender*				Total	
	Female %	95% CI	Male %	95% CI	%	95% CI
Obese	29.8	21.6-37.9	24.0	16.4-31.6	26.8	21.3-32.4
Overweight	9.9	4.6-15.2	12.4	6.5-18.3	11.3	7.2-15.1
Normal weight	51.2	42.3-60.1	61.2	52.5-69.8	56.2	49.9-62.4
Underweight	9.1	4.0-14.2	2.5	0-5.2	5.7	2.8-8.7

\*p=0.081

Table 4 presents the estimated association of having any type of overweight (BMI >85th percentile) with selected socio-economic characteristics and the odds associated to these characteristics. In general, the odds of being obese increased with school grade. Children in higher grades (5th or 6th) had over twice the odds of being overweight (POR 2.23; C: 1.12, 4.44) than children in 1st or 2nd grade. Also, students in schools located in rural areas had 41% higher odds of being overweight compared with those in schools in urban areas, although this association was not statistically significant (p=0.200). Children with a low family income (<\$1,000 per month) had 76% higher odds of being overweight compared with those with a high income (≥\$1,000). This association was marginally significant (p=0.051). Moreover, there seems to be a dose-response relationship between income and overweight; the lower the income the higher the prevalence (data not shown).

## Discussion

This research is the first study in Puerto Rico that measures the extent of childhood overweight in a representative sample of first to sixth grade children, most of which are aged 6-11 years old, the age group with the highest increase in childhood overweight in the US. This study provides prevalence estimates of childhood overweight in a representative sample of children from this age group in the municipality of Cayey, and explores socio-demographic correlates of overweight.

Our study documents a high prevalence of obesity among Puerto Rican children from Cayey (26.8%), which is higher than the prevalence of childhood obesity prevalence reported in the US among non-Hispanic Whites (19.0%), non-Hispanic Blacks (19.4%), and even among all Hispanic children (25.1%), a group that includes Mexican Americans and Hispanic from other different backgrounds, and compared to Mexican Americans exclusively (24.7%). In addition, this study confirms results from other studies indicating a higher prevalence in poorer populations. These results posit the plausibility that children from this municipality could be at a higher risk for overweight-associated chronic conditions, compared to US children.

This high prevalence is consistent across gender, age groups, socio-economic levels, type of school (private or public), and geographic location of school (rural or urban). However, our study also shows a higher probability of being overweight among the poorer children, compared to children with higher family incomes. This result confirms other studies associating overweight with poverty thus the health disparity that prevails among lower income populations (30).

Our study calls attention to the need for the development of nationwide strategies as to the measurement and monitoring of the prevalence of childhood overweight in the entire island. There is a need to examine how obesity and its consequences are patterned socially. A health disparities perspective, which systematically examines how health is distributed across racial/

**Table 3.** Prevalence Estimates of Overweight (BMI for age >85th percentile) within Selected Groups by Socio-Demographic Characteristics of Elementary School Students, Cayey, Puerto Rico, 2008

Socio-Demographic characteristics	Gender				Total	
	Female		Male		Prevalence (%)	95% CI
	Prevalence (%)	95% CI	Prevalence (%)	95% CI		
School grade						
First or Second	41.9	24.6-59.3	14.3	2.7-25.9	28.4	17.6-39.2
Third or Fourth	41.2	27.7-54.7	35.6	21.6-49.5	38.5	28.8-48.3
Fifth or Sixth	36.8	21.5-52.2	56.1	40.9-71.3	46.8	35.8-57.8
School type						
Public	37.1	27.5-46.7	38.5	28.5-48.5	37.4	30.5-44.4
Private	52.0	32.4-71.6	30.0	13.6-46.4	40.0	27.1-52.9
School geographic location						
Rural	40.9	29.0-52.8	42.4	30.5-54.3	41.7	33.3-50.1
Urban	38.9	25.9-51.9	29.1	17.1-41.1	33.6	24.8-42.5
Type of medical insurance						
Private	38.8	25.1-52.4	31.4	18.6-44.1	35.6	26.3-45.0
Government or none	40.3	28.1-52.5	36.4	23.7-49.1	38.5	29.6-47.3
Family monthly income						
<\$1,000	50.0	34.1-65.9	41.9	27.1-56.6	45.7	34.8-56.5
\$1,000-1,999	34.4	17.9-50.8	26.9	9.9-44.0	31.0	19.1-42.9
\$2,000-2,999	30.0	9.9-50.1	33.3	6.7-60.0	29.0	13.1-45.0
≥\$3,000	37.5	13.8-61.2	33.3	14.5-52.2	35.0	20.2-49.8
<b>Total</b>	<b>40.0</b>	<b>31.2-48.8</b>	<b>36.4</b>	<b>27.8-44.9</b>	<b>100.0</b>	

ethnic and socioeconomic groups, can contribute to obesity research (31). Moreover, results from this study document the need for the design of a culturally-based prevention program targeted to both Puerto Rican children and their families, particularly from the lower socio-economic levels that tend to have a higher prevalence of childhood overweight.

One of the strengths of this study is that it is a representative sample of all students between first and sixth grade in a suburban municipality in Puerto Rico. This represented a population of approximately 5,500 students. In addition, the study included the parents of students in the study, which contributed to obtaining information not familiar to children. Parents were able to provide information regarding family's socio-economic status and lifestyles more accurately.

However, our results should be interpreted in light of several limitations, particularly pertaining to the extrapolation of the findings. Given the fact that the study was conducted

in a particular suburban municipality, our results provide preliminary data only for the Cayey population. More research is needed in order to better estimate the prevalence of childhood overweight for the entire Puerto Rican population. Another limitation pertains to the self-administered methodology used with the parents. Sending the questionnaire with the student may have limited the response rate of parents and the completion of some areas of the questionnaires, such as parental health status and income level. These factors may have limited some of the data analyses. Also, 37% of students did not participate, which may lead

to selection bias and an under-reporting of the prevalence of overweight, particularly among students in private schools. Approximately 29% of the students did not participate because their parents did not give authorization. This non participation

**Table 4.** Weighted Prevalence Estimates of Weight Status among Elementary School Students and Prevalence Odds Ratios by Socio-Demographic Characteristics, Cayey, Puerto Rico, 2008

Socio-demographic characteristics	Weight status			Prevalence Odds Ratio (POR)	95% CI
	Overweight/ At risk of overweight (%)	Normal weight/ Underweight (%)	p value		
Gender					
Female	40.0	60.0	0.561	1.17	0.69-1.96
Male	36.4	63.6		Reference	
School grade					
First or Second	28.4	71.6	0.073	Reference	
Third or Fourth	38.5	61.5		1.58	0.81-3.10
Fifth or Sixth	46.8	53.2		2.23	1.12-4.44
School type					
Public	37.4	62.6	0.730	0.90	0.49-1.66
Private	40.0	60.0		Reference	
School geographic location					
Rural	41.7	58.3	0.200	1.41	0.83-2.38
Urban	33.6	66.4		Reference	
Type of medical insurance*					
Private	35.6	64.4	0.668	Reference	
Government or none	38.5	61.5		1.13	0.65-1.96
Family monthly income					
<\$1,000	45.7	54.3	0.051	1.76	1.00-3.12
≥\$1,000	32.3	67.7		Reference	

\*Medical insurance dichotomized (private vs. public or none) for analysis

was disproportionately high among children in private schools; over half of the non participating parents had children in private schools. Underreporting of overweight among private school students, and thus among those with higher family income, might have occurred. This is a concern since family income was the only socio-demographic characteristic marginally associated with overweight. It is possible that this characteristic could have been found not to be associated with obesity, had some of the non participating private school children participated in the study.

Nonetheless, our study fulfills a gap in the literature as to the measurement of the overweight prevalence in a representative sample of Puerto Rican children from different socio-economic levels. Our study evidences the need for the inclusion of Puerto Rican children living in the island in future epidemiological as well as intervention studies, in order to better understand the factors associated to childhood overweight and to identify best practices for its prevention.

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### Resumen

**Objetivo:** La obesidad en niños es una epidemia mundial; su prevalencia se ha cuadruplicado en los niños de 6-11 años. En EU, los niños Hispánicos tienen una prevalencia más alta que los niños blancos no Hispánicos. No existen datos sobre la prevalencia de obesidad para los niños de primero a sexto grado en Puerto Rico o en los Estados Unidos. El objetivo de este estudio fue medir la prevalencia de obesidad en niños de escuelas elementales (primero a sexto grado) de una municipalidad semi-urbana en Puerto Rico por distintas características socio-demográficas. **Métodos:** Se seleccionó una muestra representativa por medio de un diseño de muestreo por conglomerados estratificada en dos etapas (n=250). El peso y estatura de los niños se midió dos veces, redondeando las cifras al 0.1 kg y 0.1 cm más cercanos, respectivamente. Se utilizó el criterio establecido por CDC para la clasificación de peso por talla y sexo. Se usaron las pruebas de Ji-cuadrada y Fisher para comparar proporciones. Se evaluaron asociaciones con características socio-demográficas por medio de Regresiones Logísticas Simples. **Resultados:** Cerca de 51% eran varones y la edad promedio fue de 9.5 +1.9 años. Casi el 40% de los niños eran de familias de ingresos <\$1,000. En general, la prevalencia de obesidad (IMC > percentila 95) fue de 26.8%. La prevalencia de tener algún sobrepeso (IMC > percentila 85) fue estadísticamente similar por sexo y grado

escolar. Los niños de familias con ingresos <\$1,000 tuvieron 76 veces mayor probabilidad de estar en sobrepeso que los niños de familias de ingresos más altos. **Conclusión:** Este estudio documenta la alta prevalencia de obesidad en niños de escuelas elementales en Puerto Rico independientemente del grado o sexo; esta prevalencia es mayor que la reportada para niños Hispánicos en Estados Unidos. Dicha prevalencia fue mucho mayor entre los niños de familias más pobres. Este es el primer estudio realizado con niños de primero a sexto grado en la isla. El mismo representa un llamado a una mayor atención a los niños puertorriqueños en la isla y los Estados Unidos.

### References

1. World Health Organization. Obesity: Preventing and Managing the Global Epidemic. Report Of A Who Consultation. Geneva: World Health Organization; 2000. WHO Technical Report Series No. 894.
2. Institute of Medicine. Progress in Preventing Childhood Obesity: How Do We Measure Up?, 1st Ed; Washington, DC: National Academy Press; 2006.
3. Ogden CL, Carroll MD, Curtin LR, McDowell MA, et al. Prevalence of overweight and obesity in the United States 1999-2004. *JAMA* 2006;295:1549-1555.
4. Ogden CL, Carroll MD, Flegal KM. High body mass index for age among US children and adolescents, 2007-2008. *JAMA* 2010;303:242-249.
5. Centers for Disease Control and Prevention. Differences in prevalence of obesity among black, white, and Hispanic adults-United States 2006-2008. *MMWR Morb Mortal Wkly Rep* 2009;58:740-744.
6. Puerto Rico Department of Health, Pan-American Health Organization, World Health Organization. Situación de salud en Puerto Rico: Indicadores Básicos 2000. San Juan, Puerto Rico; 2001.
7. Behavioral Risk Factor Surveillance System Survey Data [database online]. Atlanta, Ga: Centers for Disease Control and Prevention 2009.
8. Pérez CM, Guzmán M, Ortiz AP, Estrella M, Valle Y, et al. Prevalence of metabolic syndrome in San Juan, Puerto Rico. *Ethn Dis* 2008;18:433-441.
9. Otero-González, M., García-Fragoso, L. Prevalence of overweight and obesity among a group of children 2-12 years old, in Puerto Rico (2008), *P R Health Sci J*. 2008 Jun;27:159-161.
10. American Academy of Pediatrics. Policy statement: prevention of pediatric overweight and obesity. *Pediatrics* 2003;112:424-430.
11. Narayan KM, Boyle JP, Thompson TJ, Sorensen SW, et al. Lifetime risk for diabetes mellitus in the United States. *JAMA* 2003;290:1884-1890.
12. Troiano RP, Flegal KM. Overweight children and adolescents: description, epidemiology, and demographics. *Pediatrics* 1998;101:497-504.
13. Dietz WH. Health consequences of obesity in youth: childhood predictors of adult disease. *Pediatrics* 1998;101:518-525.
14. Freedman DS, Dietz WH, Srinivasan SR, Berenson GS. The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa Heart Study. *Pediatrics* 1999;103:1175-1182.
15. Maffei C, Pietrobello A, Grezzani A, Provera S, et al. Waist circumference and cardiovascular risk factors in prepubertal children. *Obes Res* 2001;9:179-187.
16. Must A. Does overweight in childhood have an impact on adult health? *Nutr Rev* 2003;61:139-142.
17. Hannon TS, Goutham R, Arslanian SA. Childhood obesity and type 2 diabetes mellitus. *Pediatrics* 2005;116:473-480.
18. Schwartz MS, Chadha A. Type 2 diabetes mellitus in childhood obesity and insulin resistance. *J Am Osteopath Assoc* 2008; 108:518-524.
19. Whitaker RC, Pepe MS, Wright JA, Seidel KD, et al. Early adiposity rebound and the risk of adult obesity. *Pediatrics* 1998;101:e5. Available

- from: American Academy of Pediatrics, Elk Grove Village, Ill. Accessed September 28, 2009.
20. Freedman DS, Kettel Khan L, Serdula MK, Dietz WH, et al. The relation of childhood BMI to adult adiposity: the Bogalusa Heart Study. *Pediatrics* 2005;115: 22-27.
  21. Serdula MK, Ivery D, Coates RJ, Freedman DS, et al. Do obese children become obese adults? A review of the literature. *Prev Med* 1993; 167-177.
  22. Deshmukh-Taskar P, Nicklas TA, Morales M, Yang SJ, et al. Tracking of overweight status from childhood to young adulthood: the Bogalusa Heart Study. *Eur J Clin Nutr* 2006;60:48-57.
  23. Ferraro Kf, Thorpe RJ Jr, Wilkinson JA. The life course of severe obesity: does childhood overweight matter? *J Gerontol B Psychol Sci Soc Sci* 2003; 58: S110-S119.
  24. Wyatt SB, Winters KP, Dubbert PM. Overweight and obesity: prevalence, consequences, and causes of a growing public health problem. *Am J Med Sci* 2006; 331:166-74.
  25. World Health Organization. *Interventions on Diet and Physical Activity: What Works - Summary Report*. Geneva: World Health Organization Press; 2009.
  26. Estado Libre Asociado de Puerto Rico. *Ley de la Administración de Salud de Puerto Rico*. Puerto Rico; 1993; 72. Available at: <http://www.gobierno.pr/ASES/BaseLegal>.
  27. Kish L. *Survey Sampling*. New York: John Wiley & Sons, Inc.; 1967.
  28. *Epi Info 6* [computer program]. Version 6.04d. Atlanta, Ga: Centers for Disease Control and Prevention; 2001.
  29. Barlow SE, Dietz WH. Obesity evaluation and treatment: expert committee recommendations. *Pediatrics* 1998;102:e29. Available from: American Academy of Pediatrics, Elk Grove Village, Ill. Accessed July 22, 2009.
  30. Centers for Disease Control and Prevention. Obesity prevalence among low-income, preschool-aged children - United States, 1998-2008. *MMWR Morb Mortal Wkly Rep* 2009; 58:769-773.
  31. Braveman P. A health disparities perspective on obesity research. *Prev Chronic Dis* 2009;6: A91. Available from: Centers for Disease Control and Prevention. Accessed July 12, 2009.
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