PREVALENCE OF THE METABOLIC SYNDROME IN SAN JUAN, PUERTO RICO

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Objective: The metabolic syndrome is associated with a high risk of diabetes and cardiovascular disease, and Hispanics in the United States have higher rates than do other ethnic groups. We assessed the prevalence of the metabolic syndrome and its individual components in Puerto Rican adults.

Methods: We conducted a cross-sectional study that used a probability cluster design to select a sample of households of the San Juan metropolitan area from 2005 through 2007. A total of 859 persons aged 21–79 years completed a face-to-face interview, blood pressure and waist circumference measurements, and blood sampling. Our primary outcome measure was metabolic syndrome as defined by the updated NCEP-ATP criteria.

Results: Prevalence of the metabolic syndrome was 43.3%; 45.3% for men and 42.2% for women ($P>.05$). Prevalence significantly rose with age, from 12.8% among participants aged 21–29 years to 58.2% for participants aged 70–79 years ($P<.001$). Corresponding increases in the prevalence of the metabolic syndrome in both men and women were also observed; the prevalence peaked in men aged 50–59 years (62.6%) and in women aged 70–79 years (65.2%). Elevated glucose (49.8%) and abdominal obesity (49.0%) were the most common components of the metabolic syndrome, followed by elevated blood pressure (46.1%), reduced high-density lipoprotein cholesterol (46.0%), and elevated triglycerides (31.3%). Substantial variations were found between men and women in the prevalence of individual components.

Conclusions: Puerto Ricans have a high prevalence of the metabolic syndrome. This health disparity has implications for diabetes and cardiovascular prevention programs. (*Ethn Dis*. 2008;18:434–441)

Key Words: Metabolic Syndrome, Puerto Ricans, Hispanics, Updated NCEP-ATP III

INTRODUCTION

The metabolic syndrome is emerging as a major public health issue because it is a risk factor for cardiovascular disease and type 2 diabetes.[1] The prevalence of the metabolic syndrome varies by ethnicity, but differences in the clinical criteria used may account for some of this variation.[2–5] Using the revised National Cholesterol Education Program-Adult Treatment Panel (NCEP-ATP) III criteria, the National Health and Nutrition Examination Survey (NHANES) 1999–2002 found that the age-standardized prevalence of the metabolic syndrome in the population aged ≥20 years in the United States was 34.6%.[3] The standardized prevalence increased with age and varied from 24.5% among African American men to 44.0% among Mexican American women. Those data are consistent with previous studies that have shown that, compared with Whites, Mexican Americans are more prone to develop hyperinsulinemia, insulin resistance, and an unfavorable distribution of body fat, all central components of the metabolic syndrome.[6,7] The age-standardized prevalence in women increased from 27.0% in NHANES III to 32.9% in NHANES 1999–2002; however, a nonsignificant increase was observed among men (31.4% in NHANES III to 31.8% in NHANES 1999–2002).[8]

Hispanics, the current largest ethnic minority population in the United States, have many health disparities, and these are evidenced in several health indicators identified in the 2010 National Health Objectives. Hispanics have more age-adjusted years of potential life lost before age 75 per 100,000 population than do non-Hispanic Whites for stroke, chronic liver disease and cirrhosis, diabetes, HIV/AIDS, and homicide.[9] Hispanics are also disproportionately affected by overweight and obesity, and at each body mass index level, Hispanics have a higher prevalence of diabetes than non-Hispanic Whites.[9]

NHANES has documented the prevalence of the metabolic syndrome among US Whites, African Americans, and Mexican Americans. The latter group is oversampled in NHANES, but Puerto Ricans residing in the United States are not, and, as a jurisdiction, is excluded from NHANES. Health behaviors and outcomes vary considerably across Hispanic subpopu-

Because the health care costs of the metabolic syndrome are considerable, we estimated the prevalence of the metabolic syndrome and its individual components in the noninstitutionalized Puerto Rican population residing in the San Juan metropolitan area.

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lations, including islander Puerto Ricans and those residing in the United States.[9–11] Because the health care costs of the metabolic syndrome are considerable, we estimated the prevalence of the metabolic syndrome and its individual components in the noninstitutionalized Puerto Rican population residing in the San Juan metropolitan area.

METHODS

Study Sample

The study population consisted of non-institutionalized Puerto Ricans aged 21 to 79 years residing in the San Juan metropolitan area, a geographical area that includes seven municipalities (n=955,431). The sampling frame was based on the maps of the San Juan metropolitan area census tracts, and the sampling procedure was a cluster design for household surveys.[12] A three-stage sample design was used. The first stage consisted of the random selection of groups of blocks using a systematic design, in which the groups of blocks were sorted by their median housing value and weighted by the number of potential area segments of 12 consecutive households in each block. The second stage consisted of the random selection of a single block from each block group. Each selected block was visited to enumerate the actual number of households within area segments. The random selection of one area segment per block was the third stage of sample selection. All individuals aged 21–79 years from each selected household were eligible to participate in the study and asked to undergo a personal interview, physical exam, and biochemical measurements.

Data Collection

Persons who consented to participate in the study were instructed to fast for at least eight hours before their morning appointment in a mobile examination center located near their homes. Persons who refused to be interviewed or to undergo the physical evaluation and biochemical measurements were considered nonrespondents. A questionnaire was administered by specially trained interviewers and covered the following areas: sociodemographic characteristics, lifestyle characteristics, medical history, current medication use, and family history of various chronic diseases. Participants were considered current smokers if they reported having smoked ≥100 cigarettes during their lifetime and were still smoking. Participants who reported having at least one drink of any type of alcohol during the past 30 days were considered current drinkers. Respondents were classified as meeting national guidelines on physical activity if they reported participation in moderate-intensity activities for ≥30 minutes on five days per week or vigorous-intensity activity for ≥20 minutes on three days per week.[13]

The metabolic syndrome was defined based on the American Heart Association/National Heart, Lung, and Blood Institute (AHA/NHLBI) revised definition of the NCEP-ATP III report.[1] According to this definition, participants who meet three or more of the following five criteria have the metabolic syndrome: 1) abdominal obesity determined by elevated waist circumference (≥102 cm in men and ≥88 cm in women); 2) elevated triglyceride level (≥1.7 mmol/L) or on drug treatment for hypertriglyceridemia; 3) reduced high-density lipoprotein (HDL) cholesterol level (<1.0 mmol/L in men and <1.3 mmol/L in women) or on drug treatment for low HDL cholesterol; 4) elevated blood pressure (≥130 mm Hg systolic blood pressure or ≥85 mm Hg diastolic blood pressure) or antihypertensive drug treatment in a patient with a history of hypertension; and 5) elevated fasting glucose level (≥5.6 mmol/L) or on drug treatment for elevated glucose. Since fibrates and nicotinic acid are the most commonly used drugs for elevated triglyceride and low HDL cholesterol levels, participants who reported using one of these medications were counted as having elevated triglycerides and low HDL cholesterol.[1]

Anthropometric measurements were taken in duplicate according to the NHANES III Anthropometric Video Procedures, and the average of the two measures was used.[14] Waist circumference was determined with a measuring tape at the high point of the iliac crest at minimal respiration. A Cardinal Detecto digital scale (Cardinal/Detecto, Webb City, Mo) was used to measure current body weight in kilograms, and a portable Seca stadiometer (Seca Corporation, Hanover, Md) was used to determine height in meters. Body mass index (BMI) categories were defined as underweight (<18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), and obese (≥30.0 kg/m^2).

Three blood pressure measurements were taken 10 minutes apart with an appropriate cuff size and a standard aneroid sphygmomanometer. Before the measurement, participants were asked to sit quietly in a chair for at least five minutes, with feet on the floor and arm supported at chest level. Blood pressure status was based on the average of the three measurements. Fasting blood samples were collected, centrifuged, refrigerated at the mobile examination center, and transferred in iceboxes to a local reference laboratory on the day taken for analyses. Concentrations of total cholesterol, triglycerides, HDL cholesterol, and fasting plasma glucose were determined by using commercial enzymatic colorimetric kits (Bayer Diagnostics, Tarrytown, NY). LDL cholesterol levels were calculated by using the Friedewald formula. Participants received a copy of their test results and referrals to their primary care providers. The study was approved by the institutional review board of the University of Puerto Rico Medical Sciences Campus.

Statistical Analysis

A logistic regression model with generalized estimating equations was used to estimate the overall and age- and sex-specific prevalence of the metabolic syndrome.[15] This approach was used to control for the intra-class correlation ($\hat{\rho}_I = 0.034$) among participants of the same block. A sandwich estimate of variance was used to determine the standard errors of the logistic regression parameters.[15] Differences between subgroups were assessed with the Wald test statistic. The direct method of standardization was used to estimate the age-standardized prevalence of the metabolic syndrome according to the 2000 US population.[16] All analyses incorporated the sampling weights to obtain unbiased estimates from the complex sampling design by using Stata for Windows release 10.0 (StataCorp LP, College Station, Texas).

RESULTS

We identified 1200 eligible adults; of these, 867 (72.3%) participated in the face-to-face interview, physical exam, and biochemical measurements. Eight participants were excluded because they had missing data needed to define the metabolic syndrome, and the final analytic sample included 859 participants (99.1%), for a total participation rate of 71.5%.

The study participants had a mean age of 49.4±16.1 years, and most of them (65.7%) were women (Table 1). Nearly 72% of the participants had completed ≥12 years of education, and 67.2% reported an annual family income <$20,000. More than one third (33.8%) were covered by the government-administered health insurance, whereas 9.5% reported no healthcare coverage.

Analysis of cardiovascular risk factors revealed that 19.9% were current smokers, 45.6% reported the consumption of at least one alcoholic drink

Table 1. Characteristics of 859 Puerto Ricans aged 21–79 years from the San Juan metropolitan area, Puerto Rico, 2005–2007

Characteristic	*n* (%)
Age (years)	
21–29	127 (14.8)
30–39	141 (16.4)
40–49	152 (17.7)
50–59	165 (19.2)
60–69	166 (19.3)
70–79	108 (12.6)
Sex	
Female	564 (65.7)
Male	295 (34.3)
Education (years) (*n*=858)	
<12	243 (28.3)
12–15	368 (42.9)
≥16	247 (28.8)
Annual family income (*n*=753)	
<$10,000	331 (44.0)
$10,000–$19,999	175 (23.2)
$20,000–$29,999	99 (13.1)
≥$30,000	148 (19.6)
Type of health insurance (*n*=855)	
Private	347 (40.6)
Medicare/Advantage	138 (16.1)
Government administered	289 (33.8)
None	81 (9.5)
Current smoking	
Yes	171 (19.9)
No	688 (80.1)
Current drinking (*n*=856)	
Yes	390 (45.6)
No	466 (54.4)
Moderate or vigorous physical activity	
Yes	332 (38.7)
No	527 (61.3)
BMI (kg/m^2) (*n*=858)	
<18.5	17 (2.0)
18.5–24.9	176 (20.5)
25.0–29.9	315 (36.7)
≥30.0	350 (40.8)
Blood pressure (mm Hg) (*n*=857)	
<120/80	390 (45.5)
120–39/80–89	299 (34.9)
140–159/90–99	132 (15.4)
≥160/100	36 (4.2)
Blood glucose (mmol/L) (*n*=858)	
<5.6	441 (51.4)
5.6–6.9	271 (31.6)
≥7.0	146 (17.0)
Total blood cholesterol (mmol/L)	
<5.2	541 (63.0)
5.2–6.1	209 (24.3)
≥6.2	109 (12.7)
Triglyceride (mmol/L) (*n*=857)	
<1.7	592 (69.1)
1.7–2.2	120 (14.0)
2.3–5.6	131 (15.3)
≥5.7	14 (1.6)
HDL cholesterol (mmol/L)	
<1.0	177 (20.6)
1.0–1.5	532 (61.9)
≥1.6	150 (17.5)

Table 1. Continued.

Characteristic	*n* (%)
Estimated LDL cholesterol (mmol/L) (*n*=832)	
<2.6	302 (36.3)
2.6–3.3	298 (35.8)
3.4–4.0	148 (17.8)
4.1–4.8	68 (8.2)
≥4.9	16 (1.9)

BMI, body mass index; HDL, high-density lipoprotein; LDL, low-density lipoprotein.

within the past 30 days, and 38.7% reported participation in moderate-intensity activity for a minimum of 30 minutes on five days per week or vigorous-intensity activity for a minimum of 20 minutes on three days per week (Table 1). Moreover, 36.7% were overweight, 40.8% were obese, 19.6% had blood pressure levels equal to or greater than 140/90 mm Hg, 31.6% had fasting blood glucose between 5.6 mmol/L and 6.9 mmol/L, and 17.0% had fasting blood glucose equal to or greater than 7.0 mmol/L. Blood lipid determination revealed that 37.0% had blood cholesterol levels equal to or greater than 5.2 mmol/L, 30.9% had triglycerides equal to or greater than 1.7 mmol/L, 20.6% had HDL cholesterol below 1 mmol/L, and 27.9% had LDL values equal to or greater than 3.4 mmol/L.

The overall prevalence of the metabolic syndrome was 43.3%, and the age-standardized prevalence was 38.1% (Table 2). The prevalence significantly ($P<.001$) increased with age, from 12.8% among participants aged 21–29 years to 58.2% for participants aged 70–79 years. Corresponding increases in the prevalence of the metabolic syndrome in both men and women were also observed; the prevalence peaked in men aged 50–59 years (62.6%) and in women aged 70–79 years (65.2%).

Table 3 shows the overall and sex-specific prevalence of the five individual components of the metabolic syndrome. Elevated fasting glucose level (49.8%) and abdominal obesity (49.0%) were the most prevalent components of the metabolic syndrome, followed by high blood pressure (46.1%), reduced HDL cholesterol level (46.0%), and elevated triglyceride level (31.3%). The ranking of the components with age-standardization varied somewhat with reduced HDL cholesterol (48.1%) being the most prevalent, followed by abdominal obesity (46.1%). Elevated fasting glucose (44.2%) and high blood pressure (37.1%) ranked third and fourth, respectively, and elevated triglycerides (28.7%) were fifth. Compared with women, men had a significantly ($P<.001$) higher prevalence of elevated triglyceride level, elevated blood pressure, and elevated fasting glucose level. Women had a significantly ($P<.001$) higher prevalence than men of abdominal obesity and reduced HDL cholesterol level.

Only 14.9% of participants had no abnormalities in any of the components of the metabolic syndrome, 22.1% had one abnormality, 20.1% had two abnormalities, 19.8% had three abnormalities, 16.5% had four abnormalities, and 6.6% had five abnormalities. Among all possible sets of qualifying criteria for the metabolic syndrome, the five-component combination of abdominal obesity, elevated triglyceride level, reduced HDL cholesterol level, elevated blood pressure, and elevated fasting glucose level yielded the highest prevalence (overall: 6.6%, 95% CI 5.2%–8.3%; age-standardized: 5.6%, 95% CI 4.1%–7.1%). The three-criteria combination of abdominal obesity, elevated blood pressure, and elevated fasting glucose level yielded the second highest prevalence (overall: 5.9%, 95% CI 4.6%–7.6%; age-standardized: 4.5%, 95% CI 3.2%–5.7%), whereas the four-criteria combination of abdominal obesity, reduced HDL cholesterol level,

Table 2. Prevalence of the metabolic syndrome among Puerto Rican adults, San Juan metropolitan area, Puerto Rico, 2005–2007 (*N*=859)

	Total		Men		Women	
Category	Prevalence (%)	95% CI	Prevalence (%)	95% CI	Prevalence (%)	95% CI
Overall	43.3	39.3–47.3	45.3	38.8–51.9	42.2	37.9–46.6
Age-standardized	38.1	35.0–41.3	42.1	36.5–47.7	36.4	32.7–40.2
Age-specific						
21–29 years	12.8	8.0–19.9	13.5	6.2–26.9	12.4	6.8–21.5
30–39 years	25.9	19.2–33.8	34.1	21.6–49.3	21.8	14.6–31.1
40–49 years	43.8	36.0–51.9	54.0	39.6–67.8	39.1	30.2–48.8
50–59 years	57.3	49.6–64.8	62.6	49.3–74.3	54.7	45.2–63.8
60–69 years	55.8	48.0–63.3	53.1	40.2–65.6	56.9	47.3–65.9
70–79 years	58.2	48.7–67.3	47.7	33.1–62.8	65.2	53.0–75.7

CI, confidence interval.

Table 3. Prevalence of individual components of the metabolic syndrome among Puerto Rican adults, San Juan metropolitan area, Puerto Rico, 2005–2007 (*N*=859)

Component	Total		Men		Women	
	Prevalence (%)	95% CI	Prevalence (%)	95% CI	Prevalence (%)	95% CI
Abdominal obesity						
Overall	49.0	45.0–52.9	37.9	32.2–44.0	54.8	50.1–59.4
Age-standardized	46.1	42.7–49.6	36.7	31.0–42.5	51.1	46.9–55.3
Elevated triglyceride level or on drug treatment						
Overall	31.3	28.1–34.6	39.7	34.2–45.4	26.8	23.3–30.7
Age-standardized	28.7	25.7–31.8	39.8	34.0–45.6	23.5	20.2–26.9
Reduced HDL-C level or on drug treatment						
Overall	46.0	42.1–49.9	34.7	29.1–40.7	51.9	47.3–56.6
Age-standardized	48.1	44.6–51.5	37.7	31.7–43.6	53.4	49.2–57.7
Elevated blood pressure or on drug treatment						
Overall	46.1	41.9–50.5	56.1	49.8–62.2	40.8	36.1–45.7
Age-standardized	37.1	34.3–39.9	47.3	41.9–52.7	32.1	28.9–35.3
Elevated fasting glucose level or on drug treatment						
Overall	49.8	45.7–53.9	60.7	54.6–66.5	44.0	39.4–48.7
Age-standardized	44.2	41.0–47.4	55.3	49.8–60.9	38.7	34.9–42.4

CI, confidence interval; HDL-C, high-density lipoprotein cholesterol.

elevated blood pressure, and elevated fasting glucose level yielded the third highest prevalence (overall: 4.9%, 95% CI 3.6%–6.8%; age-standardized: 4.0%, 95% CI 2.8%–5.3%).

DISCUSSION

This is the first epidemiologic study to assess the prevalence of the metabolic syndrome and its individual components in the general population of Puerto Rico and provides evidence of the high prevalence of the condition in the island. We estimate that approximately 413,702 Puerto Rican adults aged 21–79 years living in the San Juan metropolitan area have the metabolic syndrome. The age-standardized prevalence of the metabolic syndrome was substantial (38.1%, 95% CI 35.0%–41.3%), a slightly higher estimate than that reported for US adults aged ≥20 years (34.6%). Several investigators have proposed that obesity is the predominant driving force behind the metabolic syndrome.[1,8,17] A noteworthy finding was that 77.5% of our study sample was overweight (36.7%) or obese (40.8%), a higher prevalence than the self-reported estimate provided in the 2006 Behavioral Risk Factor Surveillance System (BRFSS) (39.4% overweight and 24.7% obese).[11] This excess prevalence of overweight and obesity might be a factor responsible for the high prevalence of the metabolic syndrome observed in this study.

Women in this study had a higher age-adjusted prevalence of the metabolic syndrome (36.4%) than US White women (31.5%), similar to US African American women (36.4%) but lower than Mexican American women (44.0%).[3] In contrast, men in this study had a higher age-adjusted prevalence of the metabolic syndrome (42.1%) than US White men (35.4%), African American men (24.5%), and Mexican American men (40.3%).[3] Since aging is associated with increased risk for insulin resistance, other hormonal alterations, and increase in visceral adipose tissue,[18,19] the prevalence of the metabolic syndrome in this study was expected to increase steeply with age. This pattern was more evident among women, who experienced a fivefold increase in prevalence from age 21–29 (12.4%) to age 70–79 (65.2%). This observation is consistent with those of previous studies that have reported that the prevalence of the metabolic syndrome is age-dependent.[2–5,8] This finding also suggests that to reduce the increasing trend of the metabolic syndrome with age, interventions should be targeted at the school-age population.

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Substantial variations were found between men and women on the prevalence of the individual components of the metabolic syndrome. Men had a higher prevalence of elevated triglyceride level, elevated blood pressure, and elevated fasting glucose level, whereas women had a greater prevalence of abdominal obesity and reduced HDL cholesterol level. These findings are consistent with the variations in the sex-specific prevalence of the individual

components of the metabolic syndrome among US adults aged ≥20.[2] However, the age-standardized prevalence of high fasting glucose level is 37.7% for US adult men and 23.8% for US adult women, values considerably lower than those observed in this Puerto Rican population (55.3% for men and 38.7% for women). These findings support previous observations that Puerto Ricans are more affected by diabetes than are other ethnic groups in the United States.[9,17,20–23] Research suggests that the interactions among poor nutritional status, physical inactivity, and genetic predisposition might contribute to type 2 diabetes among Hispanics.[21,22]

Population-based studies assessing the prevalence of the metabolic syndrome in Latin America and the Caribbean are scarce. The prevalence of the metabolic syndrome, using the original NCEP definition, in seven Latin American cities was as follows: 13.7% in Quito, Ecuador; 16.7% in Buenos Aires, Argentina; 17.9% in Lima, Perú; 20.4% in Bogotá, Colombia; 21.0% in Santiago, Chile; 25.8% in Barquisimeto, Venezuela; and 27.2% in Mexico City, Mexico.[24] The prevalence observed in Mexico City is comparable to that found in a Mexican nationwide survey that used the updated NCEP definition (30%).[25] Moreover, the prevalence of the metabolic syndrome, based on the original NCEP definition, among Caribbean-born residents of St. Croix, US Virgin Islands (USVI), was 20.5%.[26] Compared with Hispanic Whites, non-Hispanic Blacks born in the USVI, and non-Hispanic Blacks born elsewhere in the Caribbean, the prevalence of the metabolic syndrome was higher among those who classified themselves as Hispanic Blacks (27.8%). A noteworthy observation is that most Hispanics in the USVI have origins on the island of Puerto Rico.[26]

The analysis of all possible sets of qualifying criteria for the metabolic syndrome revealed striking differences. Nearly 15% of the participants had none of the criteria for the metabolic syndrome, whereas 6.6% met all five criteria. As expected from the high prevalence of abdominal obesity, elevated fasting glucose level, and elevated blood pressure, the three most common combinations of the metabolic syndrome components included these criteria. From the clinical practice standpoint, the presence of abdominal obesity and elevated blood pressure may represent a first-step approach for identifying individuals at high risk for the metabolic syndrome.

According to the 2005 AHA/NHLBI scientific statement on the diagnosis and management of the metabolic syndrome, mitigation of underlying risk factors among individuals with the metabolic syndrome constitute first-line intervention.[1] Therefore, healthy lifestyles that include weight reduction and maintenance through reduced caloric intake and increased physical activity should be promoted. In addition, non-atherogenic and non-diabetogenic diets characterized by reduced intake of saturated fat, trans fat, cholesterol, sodium, and simple sugars are recommended. BRFSS data suggest that the prevalence of no leisure-time physical activity and poor nutrition in Puerto Rico is considerable.[9,11,21] Consistent with the 2005 BRFSS data in Puerto Rico, the percentage of adults in this study who reported achieving recommended guidelines of physical activity was 38.7%, a lower figure than the median percentage reported for the United States (48.7%).[11] Moreover, BRFSS data show that the percentage of adults who eat fruits and vegetables five or more times per day in Puerto Rico is lower than the median reported nationwide (14.3% and 23.2%, respectively). In order to achieve the Healthy People 2010 objectives, health promotion programs targeting these behaviors and practices must be developed and implemented, particularly in school-age children, before components of the metabolic syndrome can develop.

Strengths of our study are the inclusion of a Hispanic sample of homogeneous origin, an adequate response rate, and extensive data from both the face-to-face interview and laboratory measurements on cardiovascular risk factors in both men and women aged 21–79. Moreover, this study demonstrated the feasibility of conducting a household survey that combined face-to-face interviews, physical examinations, and biochemical measurements in a mobile examination unit in a defined geographic area of Puerto Rico, a method similar to that used in the NHANES program.[2,3,8] This approach might increase the accuracy of the prevalence estimation of certain behavioral risks and chronic conditions, thus improving our understanding of the healthcare needs of this Hispanic population. There are, however, limitations to this study that merit comment. Although the distribution of age, education level, and family income of our sample was comparable to that of the adult population of the San Juan metropolitan area, according to the Census 2000, women were overrepresented. However, the prevalence of the metabolic syndrome was not affected when the corresponding proportions of men and women in the San Juan metropolitan area from the 2000 Census were considered. Another methodologic concern is the validity of self-reporting of some measures, such as lifestyles and chronic illnesses. However, the prevalences seen in this study were similar to estimates yielded by other surveys conducted in the island.[11]

Notwithstanding these limitations, the present study contributes to the understanding of the metabolic syndrome and its components in a Hispanic population and provides baseline data for comparison purposes with other subgroups in the United States. Enhanced awareness and understanding of the epidemiologic patterns of the metabolic syndrome and its components in our population should lead to

better approaches to risk factor control and will most likely result in a reduction of cardiovascular disease and diabetes complications. Multi-component, school-based interventions that promote physical activity and good nutrition might contribute to reducing obesity-related morbidity and mortality.[27,28] Moreover, interventions in the worksite that combine nutrition and physical activity have been effective in helping employees lose weight and keep it off in the short term. In view of the increase in the prevalence of cardiovascular disease and related risk factors in the US Latino/Hispanic community,[29] more studies that include a broader representation of Hispanic subgroups are needed since differences likely exist in the factors that contribute to metabolic syndrome and its complications.

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