GLUCOSE INTOLERANCE BY RACE AND ETHNICITY IN THE U.S. VIRGIN ISLANDS

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This study describes the prevalence on glucose intolerance by race and ethnicity in the United States Virgin Islands. A population-based sample of 1026 individuals 20 years of age or older was recruited on the island of St. Croix, U.S. Virgin Islands, where 80% of the population classify their race as African American and 20% indicate their ethnicity as Hispanic. American Diabetes Association (ADA) criteria was used to classify glucose tolerance for the entire sample. Persons 40 years of age or older (405) were also administered a 2-h oral glucose tolerance test. Among the major race/ethnic groups, the prevalence of diabetes in patients 20 years of age or older (age-adjusted to the 1995 world population) was 14.1% for non-Hispanic blacks (n = 712), 12.1% for Hispanic blacks (n = 145), 13.5% for Hispanic whites (n = 70) and 1.2% for non-Hispanic whites (n = 37). In each group, the prevalence of diabetes increased with age and appeared higher for men. Among individuals 40 years of age or older a slightly higher prevalence of newly diagnosed diabetes was found when using World Health Organization (WHO) criteria compared to ADA criteria (WHO 10.3%, ADA 7.7% for black non-Hispanic persons and WHO 10.4%, ADA 6.0% for all other groups combined). The prevalence of diabetes for African Americans residing in the U.S. Virgin Islands is similar to rates for the African-American population on the United States mainland and is double that of estimates for blacks on neighboring islands. (*J Natl Med Assoc.* 2002;94:135–142.)

Key words: glucose intolerance ♦ ethnicity ♦ Blacks ♦ Caribbean

Studies comparing the frequency of diabetes in populations of the African diaspora have usually shown a gradient in which diabetes rates among black populations living in the Caribbean are intermediate between lower rates for persons in west African countries and higher rates for those living in developed countries such as the United States and the United Kingdom.[1–3] Among black populations, African Americans in the United States Virgin Islands are unique in that they reside in the Caribbean although their lifestyle patterns resemble those on the U.S. mainland. Moreover, more than 50% of adults over 20 years of age in the U.S. Virgin Islands are immigrants from other Caribbean islands.[4] However, little is known about

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how rates of diabetes among African Americans in the U.S. Virgin Islands compare to rates for African Americans living in the continental United States or in neighboring islands of the eastern Caribbean.

Little attention has been paid to differences in the frequency of diabetes and associated risk factors that may exist between various cultural and ethnic subgroups that comprise the African-American population. In addition, we know very little about the frequency of diabetes in the population of individuals who classify themselves as Hispanic blacks. One population in which diabetes rates can be examined in African Americans according to ethnicity is the U.S. Virgin Islands. According to the 1990 census, 80% of the U.S. Virgin Island residents indicate that their race was black and 20% of all residents said that their ethnicity was Hispanic.[4]

In 1994, the Virgin Islands Diabetes Study (VIDS), a population-based cross-sectional study was initiated to determine the prevalence of diabetes in the U.S. Virgin Islands population. Data for the study were collected on the island of St. Croix, the largest island of the U.S. Virgin Islands. The following report presents a descriptive summary of prevalence data collected from February 2, 1995 through February 28, 1998.

RESEARCH DESIGN AND METHODS

The U.S. Virgin Islands comprise three main islands, St. Croix, St. Thomas, and St. John, and approximately 100 smaller islands and cays. These islands are located in the Caribbean Sea approximately 70 miles east of Puerto Rico at the beginning of the Lesser Antilles chain of islands. Participants for the VIDS were recruited on the island of St. Croix, the largest of the U.S. Virgin Islands. The procedures for recruitment and data collection in the VIDS involved a home interview and a clinic examination. First, a simple random sample of households was generated from a list of all households on the island of St. Croix. The household listing was made available by the Virgin Islands Water and Power Authority and covers approximately 98% of homes in the U.S. Virgin Islands. A media campaign, including announcements on television, radio, and in the local newspapers was conducted to inform the public about the study. A letter about the study was mailed to the homes of potential participants if a mailing address was available. A study representative subsequently visited each selected household and randomly selected one nonpregnant occupant 20 years of age or older to participate in the study. Individuals selected for participation were vigorously pursued if they were not at home or moved to another location. A summary of recruitment is presented in Table 1.

An initial interview was conducted at the home of study subjects to collect demographic data and information about previously diagnosed diabetes. A total of 1277 subjects 20 years of age or older (94.2% of eligible subjects) completed the home interview. At the conclusion of the interview each participant was scheduled for a visit to the study clinic for a physical examination and a fasting blood specimen. All participants in the study signed a consent form approved by the Biomedical Institutional Review Board of the University of Pittsburgh.

To determine race and ethnicity in the study, participants were asked to classify their own race and ethnicity based on the questions used in the 1990 census of the U.S. Virgin Islands population. Therefore, of the 1276 interviewed, 1026 individuals completed the clinical examination. Of those who completed the clinical examination, 717 were non-Hispanic blacks, 37 were non-Hispanic whites, 145 were black Hispanics, 70 were white Hispanics, and information was not available on the race or ethnicity of 57 individuals. Hispanic individuals in the U.S. Virgin Islands are those whose ancestry is primarily from Puerto Rico or the Dominican Republic. The participation rates were high from and similar among the ethnic groups ranging from 80.5% for Hispanic blacks to 76.9% for non-Hispanic whites.

Table 1. Characteristics and Prevalence of Diagnosed and Undiagnosed Diabetes by Race and Ethnic Classification Among Participants 20 Years of Age or Older of the Virgin Islands Diabetes Study

Variable	Hispanic black	Hispanic white	Non-Hispanic black	Non-Hispanic white	All races*
n	145	70	712	37	1021
Age (years)	48.2 ± 15.5	48.5 ± 16.7	47.3 ± 15.4	50.7 ± 13.6	47.7 ± 15.3
Female (%)	65.5	60.0	70.0	67.6	68.5
Body mass index	28.9 ± 6.2	27.7 ± 5.3	28.9 ± 6.2	26.1 ± 5.4	28.6 ± 6.1
Overweight (%)	56.5	50.0	53.8	27.0	53.0
Diagnosed diabetes (%)	11.7	11.4	12.5	2.7	12.0
Undiagnosed diabetes (%)	3.5	4.3	5.2	0.0	4.6
Total diabetes (unadjusted; %)	15.2	15.7	17.7	2.7	16.6
Total diabetes (adjusted; %)†	12.1	13.5	14.1	1.2	13.1

Data are *n* (number of subjects), means ± SD, or %.
*Values include those of racial and ethnic groups not listed separately.
†Values are age- and sex-standardized using the 1995 world population estimates.

At the clinic, a blood sample was drawn after an overnight fast of 10 to 12 h. All study subjects 40 years of age or older who visited the study clinic and did not have physician-diagnosed diabetes (n = 574) were also invited to participate in an oral glucose tolerance test. This strategy was based on the National Health and Nutrition Examination Survey (NHANES) III[5] protocol. Those who agreed were administered a 75-g oral glucose challenge (Trutol) and a blood sample was drawn 2 h (± 10 min) later. Seventy percent (70%) of eligible subjects completed the oral glucose tolerance test. Each participant was also measured for weight and height. Weight was measured on a balance beam scale without shoes and height was taken with a wall mounted ruler. Body mass index, a measure of adiposity, was calculated as weight in kilograms divided by height in meters squared (kg/m^2) with body mass index cutpoints of 27.8 and 27.3 used to classify overweight in men and women, respectively.[6]

Serum glucose from fasting and 2-h blood specimens was measured at the St. Croix Hospital Laboratory with a Kodak Ektachem 700 Analyzer (Eastman Kodak Company, Rochester, NY) using a glucose oxidase colorimetric method.

Diabetes and impaired fasting glucose were classified according to the following criteria recommended by the ADA[7]: undiagnosed diabetes–fasting plasma glucose ≥7.0 mmol/L (≥126 mg/dL); impaired fasting glucose (IFG)– 6.1–6.9 mmol/L (110–125 mg/dL). For those individuals who completed the oral glucose tolerance test, the WHO criteria[8] were used to classify individuals with impaired glucose tolerance (IGT) as follows: undiagnosed diabetes—fasting plasma glucose ≥ 7.8 mmol/L (≥140 mg/dL), or 2-h plasma glucose (2-h PG) ≥ 11.1 mmol/L (≥200 mg/dL); IGT—fasting plasma glucose < 7.8 mmol/L (<140 mg/dL), and 2-h PG, 7.8 to 11.0 mmol/L (140–199 mgdL).

Estimates of the prevalence of diabetes (diagnosed and undiagnosed), IFG and IGT were computed for each of the major race and ethnic classifications in the U.S. Virgin Islands (black Hispanic, non-Hispanic black, white Hispanic, and non-Hispanic white). The prevalence estimates were age-standardized by the direct method[9] with the 1995 United Nations world population estimates used as the standard.[10] All analyses were preformed with Statistical Analysis System software.[11]

RESULTS

Data on the prevalence of diabetes for the major race and ethnic groups in the U.S. Virgin

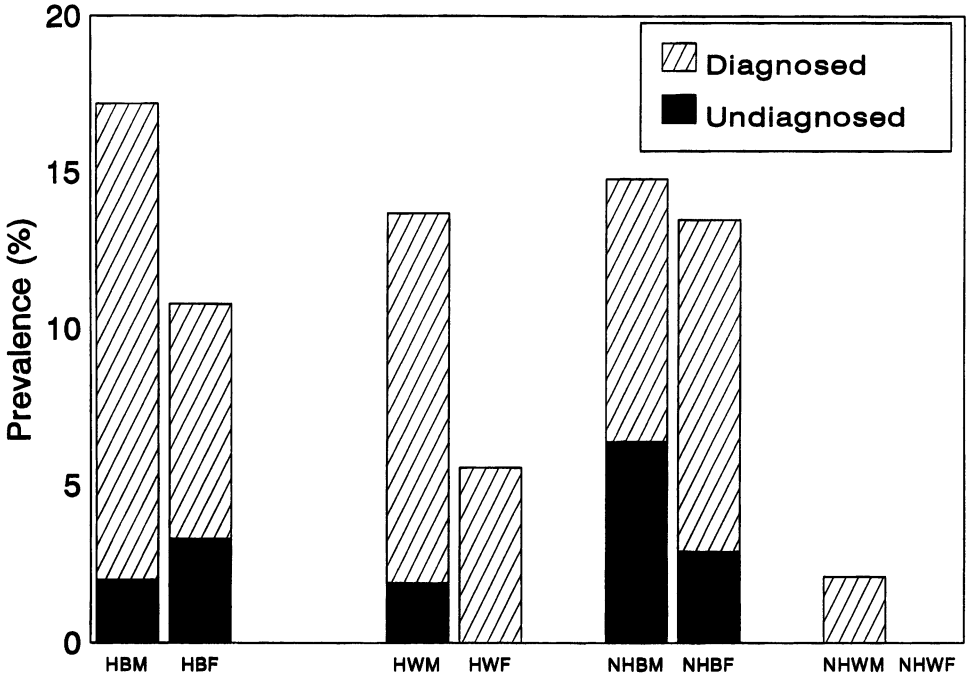

Figure 1. Prevalence of diagnosed and undiagnosed diabets by enthic group and gender. HBM, Hispanic black male; HBF, Hispanic black female; NHBM, non-Hispanic black male; NHBF, Non-Hispanic black female; NHWM, non-Hispanic white male; NHWF, non-Hispanic white female. There were no cases of undiagnosed diabetes for HWF or NHWM and no cases of diabetes for NHWF.

Islands are presented in Table 1. Among all subjects 20 years of age or older, the crude prevalence of diabetes was 16.9%, with 12.0% having diagnosed diabetes and 4.9% having undiagnosed diabetes. The crude rates for black Hispanics (15.2%) and white Hispanics (15.7%) were similar and slightly lower than the rate for non-Hispanic blacks (17.7%). The prevalence of total diabetes appeared lowest for non-Hispanic whites (2.7%). After standardization by age and sex, the corresponding prevalence rates were lower but demonstrated a similar pattern by ethnic group. With the exception of non-Hispanic whites, the frequency of overweight was high (>50%) among U.S. Virgin Islands residents. For each ethnic group, the prevalence of diabetes appeared greater for males than females (Fig. 1) and increased with age (Table 2).

A comparison of the prevalence of diabetes according to ADA and WHO diagnostic criteria was made for those individuals 40 year of age or older who completed the oral glucose tolerance test. For non-Hispanic blacks and all other groups combined fewer individuals were diagnosed with diabetes when ADA criteria were used compared with WHO criteria (7.7% vs. 10.3%, respectively, for non-Hispanic blacks and 6.0% vs. 10.4%, respectively, for all other groups combined). Of all subjects diagnosed by ADA criteria (n = 29), 34% had nondiabetic 2-h PG values. Among those diagnosed by WHO criteria (n = 42), 54% did not have fasting values ≥7.0 mmol/l. Of the newly diagnosed subjects, 37% satisfied both criteria.

The frequency of IFG and IGT in the cohort is shown in Fig. 2. Among individuals with Hispanic ethnicity, the prevalence of IFG was 5.7% for black participants and 0.48% for white participants. The rates for non-Hispanic blacks and whites were 4.0% and 3.3%, respectively. The age- and sex-standardized prevalence for

Table 2. Number of Subjects and Percent with Diabetes by Age and Ethnic Group in the Virgin Islands Diabetes Study

	Age in years					
	20–44		45–64		65 and older	
	n	Diabetes (%)	*n*	Diabetes (%)	*n*	Diabetes (%)
Hispanic black	66	6.1	54	18.5	25	32.0
Hispanic white	32	3.1	27	18.5	11	45.5
Non-Hispanic black	303	4.6	300	26.3	109	30.3
Non-Hispanic white	12	0.0	18	0.0	7	14.3
All ethnic groups*	437	4.3	425	24.0	159	30.8

*Values include those of race and ethnic groups not listed separately.

IGT (13.7%) was highest among Hispanic blacks. Non-Hispanic whites had a slightly higher rate than non-Hispanic blacks (11.6% vs. 9.0%, respectively) and Hispanic whites had the lowest rate (5.9%).

The age- and sex-specific patterns of obesity, diabetes, IFG, and IGT are shown in Fig. 3 for non-Hispanic blacks only because of the small sample size in the other ethnic categories. The frequency of overweight rose for both men and women from age 20 to 40 but thereafter decreased for men although remaining consistent for women until declining at about age 60. For both sexes, there was a dramatic rise in glucose intolerance at about age 40, which appeared to coincide with the increase in obesity rates over

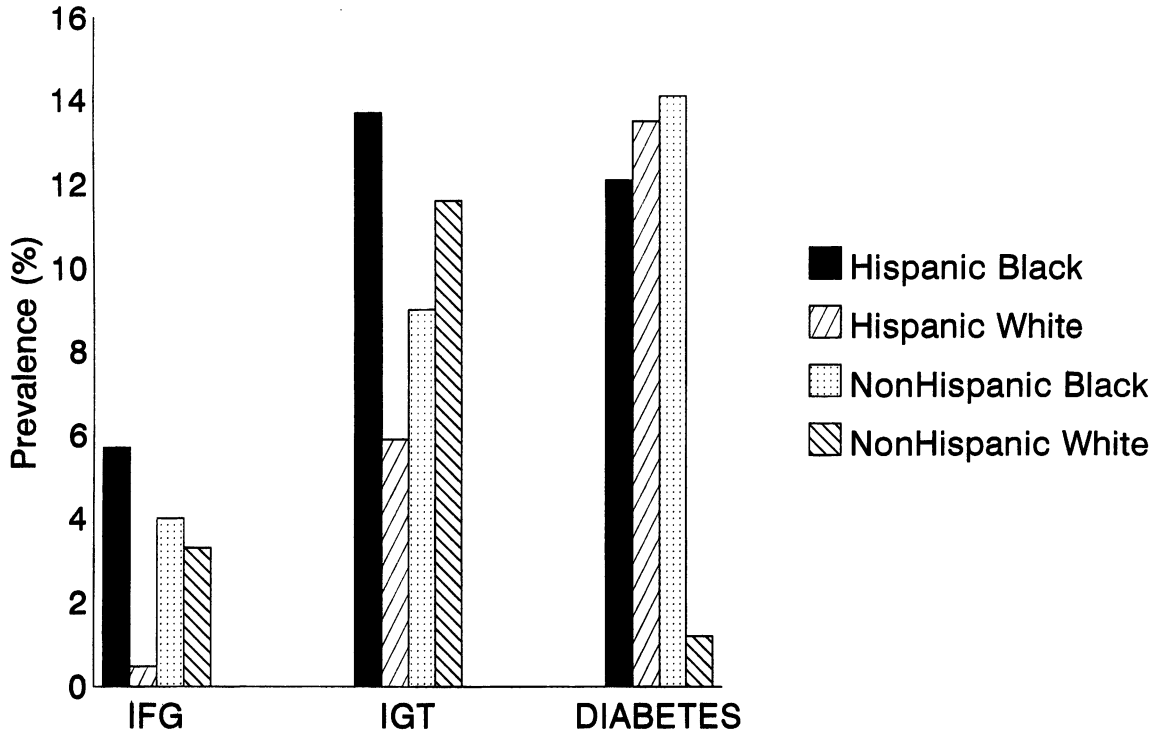

Figure 2. Age-standardized prevalence of impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) by ethnicity. Rates of IFG based on ADA criteria for persons age 20 and older; rates of IGT based on WHO criteria for persons age 40 and older.

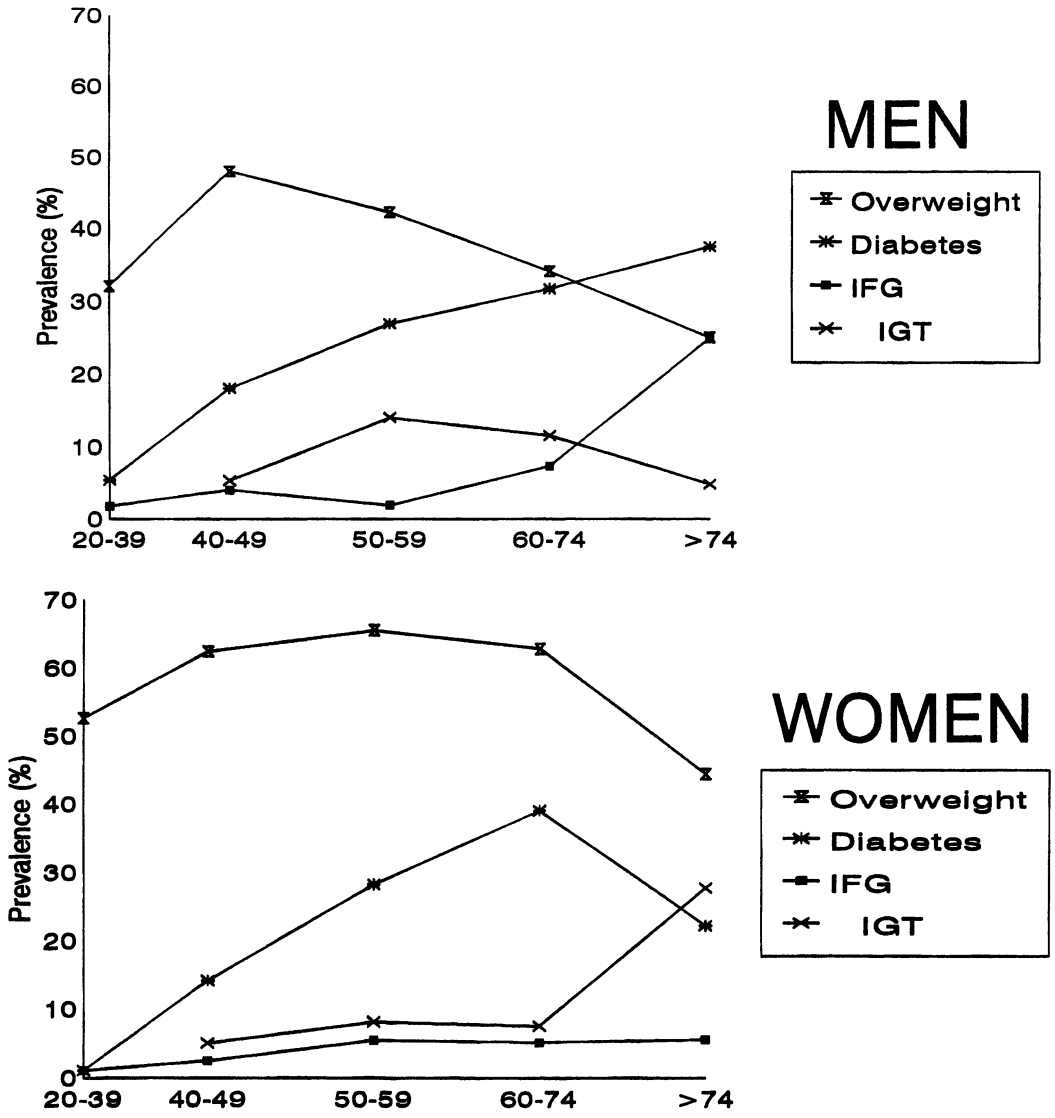

Figure 3. Prevalence of overweight, diabetes, impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) b age for non-Hispanic black men and women in the U.S. Virgin Islands.

the same age range. However, although for men the prevalence of diabetes increased consistently after age 40 throughout all age groups, it declined for women after age 60. The prevalence of IFG increased with age for men up to 75 years of age or older but plateaued for women after age 50. For men, the prevalence of IGT increased from age 40 to 74 and declined slightly at age 75 or older, whereas the rate for women increased throughout all age groups.

DISCUSSION

In this study, the prevalence of diabetes was examined in the U.S. Virgin Islands, a Caribbean territory of the United States in which 80% of the population is of black African origin. One of the interesting aspects of the current study is the classification of individuals of Hispanic ethnicity into racial categories. As a result, for the first time, population-based estimates for categories of glucose intolerance are presented for individuals who characterize

themselves as Hispanic blacks. On the U.S. mainland, these individuals who are primarily of Puerto Rican and Dominican Republic origin would be grouped together with other 'Hispanics' in most studies. The division of individuals of Hispanic origin into racial groups is consistent with the way census and intercensal population data have been collected in the U.S. Virgin Islands since 1980.

In the current study, the age-standardized prevalence of diabetes among non-Hispanic black Virgin Islanders 20 years of age or older is more than twice that of recent estimates of diabetes prevalence (<5%) made by WHO for other islands of the eastern Caribbean,[12] although it is similar to reported rates for African Americans on the U.S. mainland.[13] This finding is noteworthy because it was anticipated that diabetes rates among non-Hispanic blacks in the U.S. Virgin Islands would be lower than for mainland blacks. In 1989, a population-based study of diagnosed diabetes in the U.S. Virgin Islands[14] reported a prevalence of 5%, which was intermediate between rates seen on the African continent and rates reported for African Americans in the NHANES II.[13] Because the variation in diabetes rates across black populations parallels their relative degree of fatness,[2,3] the similarity of diabetes rates between African Americans in the U.S. Virgin Islands and the continental United States is consistent with the observation that the frequency of overweight for blacks in the current study is comparable to that of their counterparts on the U.S. mainland.[15]

Harris et al.[5] have shown that the prevalence of diabetes for all races 40 years of age or older in the United States increased by 2.9% to 3.4% in the 1988 to 1994 NHANES III compared with the 1976 to 1980 NHANES II, when either WHO or ADA criteria or were used to determine diabetes. A similar increase in diabetes prevalence may have occurred in the U.S. Virgin Islands over the past 10 years, resulting in the current rates of diabetes among non-Hispanic African Americans in the U.S. Virgin Islands that resembles that of their counterparts living in the continental United States. If this is true, then, the possibility exists that the prevalence of diabetes for other eastern Caribbean countries may increase during the next 10 to 15 years at a far greater rate and to a much higher level than that recently suggested by King et al.[12]

Among black participants 20 years of age or older in the U.S. Virgin Islands, the frequency of newly diagnosed diabetes was higher for men than for women. This pattern was consistent with reports showing that African-Caribbean and African-American men have a higher prevalence of newly diagnosed diabetes than their female counterparts when diagnosis is based on 1997 ADA criteria.[5,16] In the NHANES III study,[5] it was noted that rates of glucose intolerance in men were higher when ADA criteria were used because the mean fasting plasma glucose value in men without previously diagnosed diabetes was greater than that for women.

There has been much interest in the relative impact of the new ADA diagnostic criteria on the prevalence of diabetes mellitus in different populations. The results have been variable, with some populations showing an increase in prevalence whereas others have shown a decreased rate.[17,18] The data for persons 40 years of age or older in the U.S. Virgin Islands are similar to results for the continental United States,[19] showing a decrease in diabetes prevalence when using ADA compared with WHO criteria.

In summary, the current study provides the first estimates of the prevalence of various categories of glucose intolerance among African Americans of Hispanic background. Despite living in the Caribbean, non-Hispanic African Americans in the U.S. Virgin Islands do not appear to be protected from the high rates of diabetes that characterize their counterparts on the United States mainland.

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