Type 2 Diabetes Prevalence in Asian Americans

Results of a national health survey

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OBJECTIVE — Asians are thought to be at high risk for diabetes, yet there is little population-based information about diabetes in Asian Americans. The purpose of this study was to directly compare the prevalence of type 2 diabetes in Asian Americans with other racial and ethnic groups in the U.S. using data from the 2001 Behavioral Risk Factor Surveillance System (BRFSS).

RESEARCH DESIGN AND METHODS — The BRFSS is a population-based telephone survey of the health status and health behaviors of Americans in all 50 states, Guam, Puerto Rico, and the U.S. Virgin Islands. Subjects included 3,071 Asians, 12,561 blacks, 12,153 Hispanics, 2,299 Native Americans, 626 Pacific Islanders, and 129,116 non-Hispanic whites aged ≥30 years. Subjects who reported a physician-diagnosis of diabetes were considered to have type 2 diabetes unless they were diagnosed before age 30.

RESULTS — Compared with whites, odds ratios (95% CIs) for diabetes, adjusted for age and sex, were 1.0 (0.7–1.4) for Asians, 2.3 (2.1–2.6) for blacks, 2.0 (1.8–2.3) for Hispanics, 2.2 (1.6–2.9) for Native Americans, and 3.1 (1.4–6.8) for Pacific Islanders. Results adjusted for BMI, age, and sex were 1.6 (1.2–2.3) for Asians, 1.9 (1.7–2.2) for blacks, 1.9 (1.6–2.1) for Hispanics, 1.8 (1.3–2.5) for Native Americans, and 3.0 (1.4–6.7) for Pacific Islanders.

CONCLUSIONS — Similar proportions of Asian and non-Hispanic white Americans report having diabetes, but after accounting for the lower BMI of Asians, the adjusted prevalence of diabetes is 60% higher in Asian Americans.

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Asian Americans are a rapidly growing population of over 10 million people, comprising ~4% of the total U.S. population in 2000 (1). Asian Americans are a diverse population, comprised of individuals of Chinese (24%), Filipino (18%), Asian Indian (16%), Vietnamese (11%), Korean (11%), Japanese (8%), and other Asian (13%) ancestry (1). Yet, relatively little is known about the health of Asian Americans compared with other racial and ethnic American populations. Previous national health surveys that may have provided this information coded race as non-Hispanic white, African American, Hispanic, and other, and thus were not informative in providing information specifically on Asian Americans.

Asian Americans are thought be at increased risk for type 2 diabetes compared with non-Hispanic white Americans (2,3). Cross-study comparisons suggest that Japanese Americans are about twice as likely to develop diabetes as whites, even though they are less obese. For example, in the Honolulu Heart Study the prevalence of physician-diagnosed plus newly diagnosed diabetes was 40% in Japanese American men over age 70 years (4), as compared with 19.2% in non-Hispanic white men aged 75 or greater from the third National Health and Nutrition Examination Survey (NHANES III) (5). Similarly, the 5- to 6-year incidence of diabetes was 10.8% in Japanese Americans (6) compared with a 7.5-year diabetes incidence of 5.6% in non-Hispanic whites (7). However, cross-study comparisons are limited by differences in study subject recruitment, methodology, and the inability to fully adjust for covariates such as age and obesity.

The Behavioral Risk Factor Surveillance System (BRFSS) is an annual national U.S. telephone health survey. Before 2001, the BRFSS classified Asians together with Pacific Islanders. The majority of Pacific Islander Americans are of Native Hawaiian, Guamanian/Chamarro, or Samoan ancestry (1). Pacific Islanders also have a high prevalence of diabetes, but they have much higher rates of obesity than Asians (2). For the first time in 2001, the BRFSS released data that categorized Asian and Pacific Islander Americans separately (8). The purpose of this study was to use 2001 BRFSS data to describe the prevalence of diabetes in Asian Americans compared with other Americans.

RESEARCH DESIGN AND METHODS

— The BRFSS is an annual, national population-based standardized telephone interview of health status and health habits conducted in all 50 U.S. states, the District of Columbia, Guam, Puerto Rico, and the U.S. Virgin Islands (8). Survey sampling techniques are designed to be representative of the U.S. population and include both listed and unlisted phone numbers. The median response rate for the 2001 BRFSS has been reported by others to be 51.1% (9).

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Abbreviations: BRFSS, Behavioral Risk Factor Surveillance System.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

Table 1—*Characteristics of 163,584 subjects ≥30 years of age by race and ethnicity*

Characteristic	Asian	Black	Hispanic	Native American	Pacific Islander	White	Other	Multiracial
n	3,071	12,561	12,153	2,299	626	129,116	1,290	2,468
% of all subjects	2.4	9.0	11.1	1.0	0.3	74.0	0.8	1.3
Age (years)	46.1 ± 0.5	49.3 ± 0.0	46.6 ± 0.3	50.2 ± 0.7	46.8 ± 1.3	52.7 ± 0.1	51.7 ± 0.6	50.8 ± 0.5
Sex (% male)	54.3	44.5	50.2	50.3	57.7	48.5	55.7	51.3
BMI (kg/m^2)	24.0 ± 0.2	28.7 ± 0.1	27.9 ± 0.1	28.5 ± 0.3	27.8 ± 0.5	26.8 ± 0.2	27.6 ± 0.2	27.9 ± 0.2
Normal weight (%)	62.4	25.8	29.5	30.6	26.2	39.0	39.8	35.9
Overweight (%)	32.8	39.5	42.2	35.1	40.8	39.2	39.0	36.5
Obese (%)	4.8	34.8	28.3	34.3	33.0	21.8	21.2	27.6
Type 2 diabetes (%)	5.0	12.0	9.4	11.8	13.8	6.9	8.9	10.6
Health insurance (%)	91.4	83.9	74.9	78.7	93.4	92.2	83.7	86.9

Data are means ± SE unless otherwise stated. Normal weight defined as BMI <25 kg/m^2; overweight defined as BMI 25–29 kg/m^2; and obese defined as BMI ≥30 kg/m^2. *P* values for comparisons across ethnic groups are ≤0.001 for all row variables.

Study subjects

Study subjects must reside at the residence that corresponded to the sampled telephone number and be able to answer the survey questions in English or Spanish unless an available interviewer speaks the subject's language. Proxy responses are not used. A total of 176,807 men and women aged ≥30 years participated in the BRFSS survey in 2001. The analyses presented in this study were based on a subgroup of 163,584 subjects aged ≥30 years who were not missing data for any of the following variables: height, weight, race/ethnicity, health insurance status, and diabetes.

Definitions

Ethnicity was coded as Hispanic or non-Hispanic. Subjects who identified themselves as non-Hispanic were assigned one of the following racial categories based on self-report: Asian, African American/black, American Indian/Native Alaskan (Native American), Native Hawaiian/Pacific Islander, white, other, or mixed race. BMI (kg/m^2) was calculated from self-reported body weight and height. Self-reported health insurance status was coded as any (including Medicare, Medicaid, and other government plans) or none. Subjects were asked "Have you ever been told by a doctor that you have diabetes?" Possible responses included *1*) Yes; *2*) Yes, female told only during pregnancy; *3*) No; *4*) Don't know/not sure; and *5*) Refused. Subjects who reported a diagnosis of diabetes were asked "How old were you when you were told you have diabetes?" Type 1 diabetes was defined as a self-reported physician diagnosis of diabetes before the age of 30 years because additional information to determine diabetes type was not available. All other respondents who reported a physician diagnosis of diabetes were assumed to have type 2 diabetes. Subjects who were uncertain if they had diabetes and were not taking medication for diabetes, or who declined to answer this question, were considered to have missing data for type 2 diabetes status. Women who reported that a physician diagnosed them with diabetes only during a pregnancy were not considered to have type 2 diabetes.

Statistical analysis

All statistical analyses accounted for the strata, primary sampling units, and sampling weights applicable to the survey study design, using the appropriate statistical test computations for complex survey data in Stata 7.0 for Windows (Stata, College Station, TX). Individual variables were compared across racial/ethnic groups using the Pearson's χ^2 test or ANOVA. Multivariable logistic regression was used to calculate odds ratios for type 2 diabetes, adjusting for age, sex, BMI, and health insurance status. The significance of first-order multiplicative interaction terms was tested using a logit model and the Wald statistic.

RESULTS

— The characteristics of the 163,584 participants are shown in Table 1. Asian Americans were younger, had lower BMI, and had lower unadjusted prevalence of diabetes compared with other racial and ethnic groups ($P <$ 0.001). The distribution of diabetes prevalence across racial/ethnic groups was similar for men and women. For example, the lowest crude diabetes prevalence was observed in Asians (5.9% men, 3.9% women) and non-Hispanic whites (7.5% men, 6.5% women). The highest crude diabetes prevalence was observed in Pacific Islanders (15.8% men, 11.0% women), blacks (12.6% men, 11.5% women), and Hispanics (10.3% men, 13.4% women). Hispanics and Native Americans were the least likely groups to report having any form of health insurance, whereas <9% of Asian Americans were uninsured.

Adjusted odds of diabetes relative to non-Hispanic whites

The age- and sex-adjusted prevalence of diabetes was higher than non-Hispanic whites in every ethnic and racial minority group except for Asian Americans (Table 2). However, after results were adjusted for BMI in addition to age and sex, the odds of diabetes was 1.6 times higher in Asian Americans ($P = 0.009$) and 1.8–3.0 times higher in the other racial and ethnic groups ($P < 0.05$) compared with non-Hispanic whites. Further adjustment for health insurance status did not influence the odds ratios for diabetes compared with the results adjusted only for age, sex, and BMI. The association between ethnicity and diabetes risk did not vary significantly by sex (coefficient of a sex-ethnicity interaction term in a logit model including ethnicity, age, sex, and BMI was 0.029, 95% CI −0.005 to 0.064, $P = 0.09$).

BMI cutoffs and diabetes risk in Asian Americans

Because others have proposed lower cutoffs to define obesity in Asian Americans

Table 2—*Odds ratios (OR) of type 2 diabetes by race and ethnicity*

	White	Asian	Black	Hispanic	Native American	Pacific Islander	Other	Multiracial
Model 1	1.0	1.0 (0.7–1.4)	2.3* (2.1–2.6)	2.0* (1.8–2.3)	2.2* (1.6–2.9)	3.1* (1.4–6.8)	1.4 (1.0–1.9)	1.8* (1.5–2.9)
Model 2	1.0	1.6* (1.1–2.2)	1.9* (1.7–2.2)	1.9* (1.6–2.1)	1.8* (1.3–2.5)	3.0* (1.4–6.7)	1.5† (1.0–2.1)	1.6* (1.3–2.1)
Model 3	1.0	1.6* (1.1–2.2)	1.9* (1.7–2.1)	1.9* (1.6–2.1)	1.8* (1.3–2.5)	3.0* (1.4–6.7)	1.5† (1.0–2.1)	1.6* (1.3–2.1)

OR is the odds ratio for diabetes (95% CI). Model 1 is adjusted for age and sex. Model 2 is adjusted for age, sex, and BMI. Model 3 is adjusted for age, sex, BMI, and health insurance status. *$P < 0.01$; †$P < 0.05$.

(10), we also performed analyses using various obesity definitions for Asians. Compared with whites with BMI ≥30 kg/m^2, odds ratios for diabetes, adjusted for age and sex, were 1.7 (95% CI 0.7–4.5) for Asians with BMI ≥30 kg/m^2, 1.0 (0.5–2.2) for Asians with BMI ≥29 kg/m^2, 0.9 (0.4–1.7) for Asians with BMI ≥28 kg/m^2, and 0.6 (0.3–1.1) for Asians with BMI ≥27 kg/m^2. As indicated by the wide CIs, there was insufficient statistical power to determine the precise BMI threshold in Asian Americans that is associated with the same diabetes risk as BMI ≥30 kg/m^2 in whites.

Results in combined group of Asians and Pacific Islanders

In past BRFSS surveys, Asians were combined with Pacific Islanders, so we also analyzed results for this combined group. The prevalence of type 2 diabetes among Asians/Pacific Islanders was 5.9% compared with 5% for Asians and 13.8% for Pacific Islanders. The age- and sex-adjusted odds ratio for diabetes for Asians/Pacific Islanders was 1.2 (95% CI 0.9–1.7), which is not significantly different than the non-Hispanic white reference group. The odds of diabetes in Asians/Pacific Islanders increased to 1.8 (1.3, 2.5) after adjustment for age, sex, and BMI. Results were not changed with further adjustment for health insurance status.

Pacific Islanders compared with Asian Americans

In comparison to Asians, Pacific Islanders had a higher age- and sex-adjusted odds of type 2 diabetes (3.0, 95% CI 1.3–7.1). However, this was not statistically significant after further adjustment for BMI in addition to age and sex (1.6, 0.7–3.9).

CONCLUSIONS — This study is the first population-based, national U.S. survey that directly compares the prevalence of type 2 diabetes in Asians with that in other racial/ethnic groups. The age-, sex-, and BMI-adjusted prevalence of diabetes in Asian Americans was ~60% higher than in non-Hispanic whites and ~20–30% lower than in African American, Hispanic, or American Indians. The increased odds of diabetes became apparent only after adjustment for BMI, indicating that for any given BMI, Asian Americans are more likely to develop diabetes than non-Hispanic whites.

This study cannot definitively determine why Asian Americans are at increased risk for diabetes. One possible explanation is that the association between BMI and proportion of body fat may vary due to racial/ethnic differences in skeletal frame and body composition. Deurenberg et al. (11) reported that for a given percentage of body fat, Asians have a 3–4 kg/m^2 lower BMI than Caucasians. Other possible explanations include a greater propensity for intra-abdominal fat deposition (12,13) or impaired β-cell function (14) in Asian Americans compared with other groups.

This study also demonstrated that Pacific Islanders have a very high prevalence of type 2 diabetes compared with whites. The age-, sex-, and BMI-adjusted odds of diabetes was not significantly higher in Pacific Islanders than in Asian Americans, although the sample size was likely inadequate to detect small differences in risk between these two groups.

There are several limitations to this study. Previous studies have shown the specificity of self-reported diabetes status to be 97% when compared with physician records (15), yet undiagnosed diabetes accounts for ~35% of the total diabetes prevalence in the U.S (5). Thus, diabetes prevalence is almost certainly underestimated in this study because glucose was not measured. Use of self-reported diabetes may disproportionately underestimate diabetes prevalence in Asian Americans. The majority of Asians with diabetes do not meet criteria for diabetes using fasting glucose alone (16,17), and the oral glucose tolerance test is not routinely used in U.S. clinics. Also, clinicians may be less likely to screen for diabetes in Asian Americans because they are less likely to have a high BMI.

The BRFSS does not subclassify Asian Americans, and diabetes risk may vary by country of ancestry. For example, the DECODA study showed that India has a higher prevalence of diabetes than China or Japan (18). The BRFSS also does not include information about the duration of U.S. residence. Diabetes risk in Asians appears to increase with prolonged exposure to Western lifestyle (2,19). Thus diabetes risk may be higher in predominantly U.S.-born groups, such as Japanese Americans, than in Asian Americans groups with a higher proportion of recent immigrants. Because the BRFSS questionnaire is available only in English and Spanish, non-English speaking Asian Americans are likely underrepresented in this study. The fact that the proportion of Asian Americans who participated in the 2001 BRFSS was less than the 4% expected from U.S. Census data (1) is consistent with the assumption that non-English speaking Asian Americans were underrepresented. Underrepresentation of recent Asian immigrants may have resulted in an overestimation of the risk of diabetes in Asian Americans in this study.

In conclusion, this population-based study demonstrates that for a given BMI, Asian Americans have a higher prevalence of type 2 diabetes than non-Hispanic whites. Several limitations may have resulted in biased estimates of diabetes prevalence in Asian Americans in this study, so these results should be confirmed using fasting and 2-h glucose measurements to identify subjects with diabetes. Further study is also needed to better characterize diabetes risk among various subgroups of Asian Americans and to better understand the physiologic

basis for the increased risk of diabetes in this heterogeneous population.

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