

# RACIAL DISPARITIES IN BEHAVIOR RISK FACTORS AND DIABETES PREVENTIVE HEALTH CARE AMONG ASIAN/PACIFIC ISLANDERS WITH TYPE 2 DIABETES

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**Objective:** To estimate behavior risk factors and diabetes preventive health care among Asian/Pacific Islanders (API) diagnosed with type 2 diabetes.

**Design:** Population-based telephone survey.

**Participants:** APIs and non-Hispanic Whites (NHW) surveyed in the 2009 Behavioral Risk Factor Surveillance System (BRFSS) data.

**Main Outcome Measures:** Diabetes preventive health care (taking insulin, taking educational classes, receiving flu shot and pneumococcal vaccine, blood sugar check, cholesterol check, HbA1C check, and eye and foot examination), behavior risk factors (fruit and vegetable consumption, physical exercise, smoking and binge drinking).

**Results:** By constructing the logistic regression model, odds ratios (OR) were calculated to compare the risk factors and preventive care between NHW and API groups. Compared with NHW, the APIs were significantly less likely to check their blood sugar at least once a day (OR = .59, 95% CI = .393–.886), got flu shots (OR = .597, 95% CI = .394–.903) and have had pneumococcal vaccines (OR = .455, 95% CI = .296–.7). The results also showed that APIs eat more fruits, are more likely to be physically active, and are less likely to participate in binge drinking and smoking. There are no differences between these two groups for diabetes education, having seen professionals for diabetes within past year, having cholesterol or HbA1C checked in past year, and having an eye or foot exam in past year.

**Conclusions:** Our results can inform the best intervention strategies to deliver diabetes preventive health care services for the APIs with type 2 diabetes and to help NHWs reduce risk factors for diabetes. (*Ethn Dis.* 2015;25[2]:220–225)

**Key Words:** Diabetes Preventive Health Care, Risk Factors, Type 2 Diabetes, Racial Disparity

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## INTRODUCTION

In 2006, diabetes mellitus was estimated to be the sixth leading cause of death in the United States.<sup>1</sup> It is the leading cause of non-traumatic lower limb amputation, blindness and kidney failure.<sup>2</sup> Several risk factors can increase the risk of diabetes and its complications, such as obesity, physical inactivity, poor eating habits, tobacco smoking and binge drinking. The findings from the Centers for Disease Control and Prevention, based on 2001–2003 BRFSS data, indicate a slightly lower percentage of recommended moderate-intensity physical activity and vigorous physical activity in Asians/Pacific Islanders (APIs) compared with non-Hispanic Whites (NHW).<sup>3</sup> Very few studies have examined physical activity levels, as well as other risk factors for type 2 diabetes among APIs. Effective diabetes management, including self-care, keeping diabetes care appointments and getting vaccinated against influenza and pneumonia, is important for reducing diabetes-related morbidity and mortality. Much evidence indicates that diabetes can be better controlled by lifestyle modification.<sup>4,5</sup> Differences in diabetes self-management among racial and ethnic groups have been linked to socioeconomic status, disease awareness and knowledge, and access to health care – all of which may influence disparities in diabetes outcomes among these groups.<sup>6–12</sup> In the United States, Asian American populations have grown rapidly, from 11.9 million (4.2%) in 2000 to 17.3 million (5.6%) in 2010.<sup>13,14</sup> According to the US Census Bureau, the number of Asian Americans will increase to more than 40.6 million (9.2%) by 2050. While the prevalence of diabetes is less among Asian groups compared with African Americans,

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American Indians and Hispanics, a greater increase in risk for type 2 diabetes has been observed in Asian Americans compared with NHWs.<sup>15</sup> From the National Diabetes Statistics Report data released in June 2014, the diabetes prevalence among Asian Americans is 1.4% higher than in NHWs.<sup>16</sup> Because there is little information about the diabetes management and behavior risk factors for this population, our study examined data collected through a nationwide telephone survey to determine the use of diabetes preventive health care and the prevalence behavior risk factors for diabetes among APIs compared with NHWs.

## METHODS

### Study Population and Data

The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based system that is used to gather information through telephone surveys conducted by the health departments of all 50 states, the District of Columbia, Guam, Puerto Rico, and the US Virgin Islands, with help from Centers for Disease Control and Prevention

(CDC). The BRFSS objective is to collect uniform, state-specific data on preventive health practices and risk behaviors that are linked to chronic diseases, injuries, and preventable infectious diseases that affect the adult population.<sup>17</sup> BRFSS data were consistently used to provide valid and reliable estimates compared with other national household survey.<sup>18,19</sup> Of the total 432,607 survey participants aged  $\geq 18$  years in the 2009 BRFSS survey, 52,386 (12.1%) were diagnosed with diabetes. The analyses in our study were based on a subgroup of NHWs and APIs with type 2 diabetes; we used only respondent records that were complete and did not have any missing values for the variables studied.

### Definitions

Diabetes status was determined using responses to the question, "Have you ever been told by a doctor that you have diabetes?" BRFSS participants were considered to have diabetes if they reported having been told by a doctor that they had the disease. Study participants were considered to have type 2 diabetes if, at diagnosis, they were aged  $\geq 30$  years or were aged  $< 30$  years and did not use insulin.<sup>20,21</sup>

Race and ethnicity status were based on self-report. Ethnicity was coded as Hispanic or non-Hispanic. Non-Hispanic participants were assigned one of the following racial categories: White, African American/Black, Asian, Native Hawaiian/Pacific Islander, American Indian/Native Alaskan (Native American), other, or mixed race. In our study, we included NHW and Asian, and included Native Hawaiian/Pacific Islander in the Asian group. Most of the census data and some of the national survey data use API as a unit to measure Native Hawaiian/Pacific Islander and Asian.<sup>22</sup> For the purpose of this article, we use the term API to indicate Asian/Pacific Islander/Native Hawaiian.

Diabetes preventive health care variables included: checked blood sugar at

least once/day; had A1C test within past year; had blood cholesterol check within past year; had eye, foot exam in past year; had flu shot in past year; had Pneumococcal shot (ever); took educational class to manage diabetes; and insulin use. All these variables were defined into dichotomous variables.

Behavior risk factors included: smoking; binge drinking; fruit and vegetable consumption; physical activity; and body mass index (BMI). Respondents were considered to be smokers if they reported smoking at least 100 cigarettes in their lifetime and were currently smokers or they reported being a former smoker. Those who never smoked were considered to be nonsmokers. Participants were considered to be physically inactive if they had not participated in any leisure time physical activity or exercise during the previous 30 days.<sup>23</sup> Binge drinking was defined as the consumption of  $\geq 5$  drinks on at least one occasion in the past month. Fruit and vegetable consumption of  $< 5$  times per day was considered inadequate consumption.<sup>24</sup> Obesity was measured using BMI value. Different cut-off values were used for NHWs and APIs. BMI  $\geq 30.0$  was considered obese for NHWs, while BMI  $\geq 27.5$  is considered obese for APIs, as recommended by World Health Organization.<sup>25,26</sup>

### Statistics

Descriptive analysis for socioeconomic characteristics (age, duration of disease, sex, marital status, education level, income level, health care access and inability to see doctor because of cost) were determined for APIs and NHWs. The mean, with standard deviation, was reported for continuous variables and percentages, with 95% CI, were reported for categorical variables. Individual diabetes preventive health care and behavior risk factors were compared for the two defined race groups using analysis of variance or Rao-Scott chi-square test. Logistic

regression analyses for complex sample surveys were performed to calculate adjusted odds ratios (OR) and 95% CI. For each indicator of diabetes preventive care and behavior risk factors, a logistic model was formulated in which the logarithm of the odds that a participant answered "yes" to an indicator of preventive care and behavior risk factor (eg, Have you had a flu shot in the past year?) was analyzed as the dependent variable in a logistic regression model that included race as independent variable. To obtain the adjusted odds ratio of answering "yes" if the participant was API relative to a participant who was NHW, covariates including age, sex, diabetes duration, education, income, employment status, marriage status and can't see doctor because of medical cost were used. The SAS complex survey procedures were used to consider several survey study design factors, such as strata, primary sample units, and sampling weights. Statistical significance was determined to be  $P \leq .05$ . No multiple comparison correction was applied. All the analyses were conducted using SAS (version 9.2).

### RESULTS

Selected characteristics and risk factors of the 22,747 study participants, with type 2 diabetes (378 APIs and 22,369 NHWs) are shown in Table 1. The APIs (mean age=52.5) were younger than NHWs (mean age = 62.2) ( $P < .0001$ ) and duration of diabetes was one and a half years less ( $P = .0464$ ) than NHWs. Almost 81% of APIs graduated from college compared with nearly 53% NHWs. More than 65% of APIs were employed compared with only 40% of NHWs and nearly 60% of APIs had income levels  $\geq \$50,000$  compared to 36% of the NHWs. No difference in having health insurance was observed. More than 85% of NHWs and 90% APIs saw a health care professional for diabetes in past year and there were no

**Table 1. Selected characteristics and other risk factors in Asian Pacific Islanders (API) and non-Hispanic White (NHW) adults with type 2 diabetes, Behavior Risk Factor Surveillance System, 2009<sup>a</sup>**

	NHW, n= 22,369	API, n=378	P
Age, mean years	62.2 (61.8–62.6)	52.5 (50–55)	<.0001 <sup>b</sup>
Duration of disease, mean years	9.8 (9.6–10)	8.3 (7–9.6)	.0464
Male, %	52.2 (51–53.3)	62 (52.5–71.5)	.0502
Education, %			<.0001 <sup>b</sup>
≤High school	11.6 (11–12.3)	5.3 (1.4–9.1)	
High school graduate	35.9 (34.8–36.9)	13.8 (8–19.7)	
Some college or college graduate	52.5 (51.4–53.6)	80.9 (74.1–87.7)	
Marital status, %			<.0001 <sup>b</sup>
Married	64.1 (63.1–65.1)	84.6 (78.7–90.5)	
Never married	8.1 (7.4–8.8)	6.2 (1.5–10.9)	
Previously married	27.8 (26.9–28.7)	9.2 (5.1–13.4)	
Employed, %	40.4 (39.3–41.5)	65.4 (56.1–74.8)	<.0001 <sup>b</sup>
Household income, %			<.0001 <sup>b</sup>
<20000	20.4 (19.5–21.3)	12.7 (6.6–18.8)	
20000–50000	43.8 (42.6–45)	27.9 (18.7–37.2)	
≥50000	35.8 (34.6–37)	59.4 (49.1–69.7)	
Health plan, % yes	92.8 (92.1–93.5)	91.7 (86.7–96.6)	.6372
Have seen health care professional for diabetes in past year, %	87 (86.2–87.8)	90 (84.5–95.4)	.3468
Body mass index, %			<.0001 <sup>b</sup>
Normal	13.6 (12.9–14.3)	41.9 (31.8–52.1)	
Overweight	32.2 (31.2–33.3)	35.6 (26.3–45.0)	
Obese	54.1 (53–55.3)	22.4 (14.3–30.5)	
Can't see doctor because of medical cost, %	12.0 (11.2–12.9)	20.1 (11.2–29.0)	.0298 <sup>b</sup>

<sup>a</sup> Data are mean (CI) or % (CI).

<sup>b</sup>  $P < .05$ .

significant differences ( $P = .3468$ ). More than 20% APIs, compared with 12% NHWs, could not see a doctor because of cost ( $P = .0298$ ).

The frequency of diabetes preventive care among study participants are shown in Table 2. In both groups, attending a diabetes education class

was similar (>50%). Compared with NHWs, fewer APIs checked their blood glucose levels at least once a day (59.6% vs 40.2%, respectively,  $OR = .59$ ,  $95\%CI = .393-.886$ ). Similar discrepancies between these two groups were observed for cholesterol and HbA1C check as well as feet and eye exams.

More than 20% NHWs were taking insulin while only 15% of APIs did ( $OR = .607$ ,  $95\%CI = .37-.994$ ).

After controlling for socioeconomic variables, the results indicated the APIs were still less likely to check blood sugar at least once day ( $OR = .611$ ,  $95\%CI = .39-.959$ ). Before controlling the

**Table 2. Frequency of diabetes preventive care in different type of races/ethnicities with type 2 diabetes**

	% NHW (95% CI)	% API (95% CI)	Unadjusted Odds Ratio (95% CI) <sup>a</sup>	Adjusted Odds Ratio <sup>a</sup> (95%CI) <sup>b</sup>
Insulin, yes	22.6 (21.7–23.5)	15 (8.8–21.3)	.607 (.370–.994) <sup>c</sup>	.731 (.441–1.210)
Diabetes education	54.7 (53.6–55.8)	52.5 (42.5–62.6)	.917 (.611–1.375)	.862 (.563–1.320)
Had flu shot in past year	64.7 (63.6–65.8)	52.2 (41.9–62.5)	.597 (.394–.903) <sup>c</sup>	.774 (.488–1.227)
Ever had pneumococcal vaccine	59.6 (58.4–60.7)	40.2 (29.9–50.4)	.455 (.296–.700) <sup>c</sup>	.564 (.326–.978) <sup>c</sup>
Check blood sugar at least once a day	61.2 (60–62.3)	48.2 (38.1–58.2)	.590 (.393–.886) <sup>c</sup>	.611 (.390–.959) <sup>c</sup>
Had cholesterol checked within past year	94.2 (93.7–94.8)	95 (91.5–98.5)	1.161 (.552–2.445)	1.160 (.514–2.619)
Had HbA1C test within past year.	91.7 (91–92.4)	91.7 (86.1–97.3)	.995 (.477–2.076)	1.321 (.647–2.695)
Had feet checked for sore or irritation in past year	73 (72–74)	66.2 (55.5–76.9)	.725 (.448–1.172)	.567 (.339–.951) <sup>c</sup>
Had eye exam in past 12 months	70.2 (69.2–71.3)	71.6 (63.1–80.1)	1.067 (.700–1.628)	1.126 (.695–1.824)

NHW, non-Hispanic White; API=Asian/Pacific Islander.

<sup>a</sup> Reference group was non-Hispanic Whites.

<sup>b</sup> Adjusted for age, sex, diabetes duration, education, income, employment status, marriage status and can't see doctor because of medical cost.

<sup>c</sup>  $P < .05$ .

**Table 3. Frequency of behavior risk factors in different type of races/ethnicities with type 2 diabetes**

	% NHW (95% CI)	% API (95% CI)	Unadjusted Odds Ratio <sup>a</sup> (95% CI)	Adjusted Odds Ratio <sup>a</sup> (95% CI) <sup>b</sup>
Fruit vegetable $\geq 5$ times/day	22.8 (21.8–23.7)	33.6 (23.3–43.8)	1.713 (1.078–2.722) <sup>c</sup>	1.991 (1.207–3.284) <sup>c</sup>
Physically active, yes	78.9 (78–79.8)	87 (80.8–93.2)	2.759 (1.517–5.018) <sup>c</sup>	1.841 (.953–3.559)
Obese, yes	54.1 (53–55.3)	33.7 (24.7–42.8)	.431 (.288–.647) <sup>c</sup>	.277 (.175–.439) <sup>c</sup>
Smoking, yes	15.3 (14.5–16.2)	8 (2–14.1)	.478 (.314–.727) <sup>c</sup>	.536 (.350–.821) <sup>c</sup>
Binge drinking, yes	5.4 (4.9–6)	.8 (1–1.4)	.134 (.054–.329) <sup>c</sup>	.086 (.032–.231) <sup>c</sup>

NHW, non-Hispanic White; API=Asian/Pacific Islander.

<sup>a</sup> Reference group was non-Hispanic Whites.

<sup>b</sup> Adjusted for age, sex, diabetes duration, education, income, employment status, marriage status and can't see doctor because of medical cost.

<sup>c</sup>  $P < .05$ .

covariates, the APIs were significantly less likely to have had a flu shot in past year (OR=.597, 95% CI=.394–.903) and were also significantly less likely to have had pneumococcal vaccine (OR=.455, 95% CI=.296–.7). After controlling for the covariates, the APIs had comparable frequencies as NHWs for the flu vaccine (OR=.774, 95% CI=.488–1.227), but were still significantly less likely to have had pneumococcal vaccine (OR=.564, 95% CI=.326–.978). After controlling for socioeconomic variables between the two groups, no significant difference was observed for having had: cholesterol checked, HbA1C test, feet checked and eye exam within past year.

The frequency of behavior risk factors among participants is shown in Table 3. The results indicated that APIs were almost half as likely to be obese using standard criterion mentioned previously (Table 1). Using the cut-off value BMI  $\geq 27.5$ , more than 54% of the NHWs and <35% APIs were obese, which was also considered a statistically significant difference (OR=.431, 95% CI=.288–.647). APIs were more likely to participate in exercise (OR=2.759, 95% CI=1.517–5.018) and less likely to binge drink alcohol (OR=.134, 95% CI=.054–.329) than NHWs. Compared to NHWs, more APIs consumed 5 or more servings of fruits and vegetables daily (OR=1.713, 95% CI=1.078–2.722) and were nearly 50% less likely to smoke (OR=.478, 95% CI=.314–.727). After adjusting for socioeconomic variables, APIs were still significantly less

likely to drink (OR=0.086, 95% CI=0.032–0.231) and have higher percentage of fruit vegetable consuming less than 5 times a day (OR=1.991, 95% CI=1.207–3.284). APIs were also less likely to smoke (OR=0.536, 95% CI=0.35–0.821).

## DISCUSSION

Using national survey data to examine racial disparities of diabetes preventive health care between APIs and NHWs, we found that, compared to NHWs with type 2 diabetes, APIs with type 2 diabetes were less likely to check their blood sugar at least once a day and were less likely to have received pneumococcal vaccination. These differences remained significant even after adjusting for other characteristics. Little research has focused on racial disparities among Asian populations in regard to health care use in the management of diabetes. Yet, our findings are in accord with one study, using the California Health Interview Survey (CHIS), which reported that Asians were significantly less likely than Whites to check their blood sugar on regular basis.<sup>27</sup> Cultural misunderstanding, lack of information, poor awareness of services, health care access, and communication problems may impose significant barriers for APIs in using diabetes preventive health care strategies.

The same and other similar studies showed that Asian patients with diabetes were less likely to have received HbA1c

tests or foot and eye examination in past year compared to Whites.<sup>27,28</sup> Our results differ from these findings in that we found no differences between the two groups for most of the outcomes in diabetes management, including: had seen a health care professional for diabetes in past year; had cholesterol checked; had HbA1C test; and had foot and eye examination in past year. This difference in findings could be attributed to the slightly different study population of the CHIS (ie, data focus on adults aged  $\geq 60$ ) where the older participants may see health care professionals more frequently and check cholesterol, HbA1C and perform eye and foot examination more often. The other possible reason could be that the BRFSS excludes non-English speakers who may be less likely to engage in diabetes management.<sup>29</sup> In our study, both the NHWs and APIs had low rates of attending educational classes to learn how to manage their diabetes. This is similar with the previous study<sup>28</sup> and other studies, which showed that individuals who received diabetes education were significantly more likely than those who had not received the education to be physically active, to have eye exam, to have received flu shot and pneumococcal vaccine, to have checked their blood daily, to have feet checked and HbA1C check.<sup>30,31</sup> Thus, diabetes education has been found to be an important factor that can assist in better self-care that could prevent or delay potential diabetes complications among persons with type 2 diabetes.

*In our study, both the NHWs and APIs had low rates of attending educational classes to learn how to manage their diabetes.*

We also examined disparities in behavior risk factors between APIs and NHWs. In the general population, it has been consistently reported that APIs have fewer risk factors compared to NHWs. The 2001–2003 BRFSS data showed lower rates of physical activity, moderate-intensity physical activity and vigorous physical activity among APIs compared with NHWs.<sup>3</sup> Yet, another report showed no significant difference of rates of regular physical activity between APIs and NHWs who are considered pre-diabetic.<sup>32</sup> Our results showed that the APIs were more likely to participate in exercise, which is contrary with previous findings.<sup>27,28</sup> Again, this may be linked to different characteristics of the studied population. The higher rate of physical activity in our study may imply that APIs with type 2 diabetes may be eager to actively control their diabetes. The other possible reason is that the self-reported physical activity may rely on other covariates such as socioeconomic status and may explain why no significant difference exists after adjusting for socioeconomic status. Our results also showed a lower rate of smoking and less likelihood of alcohol binge drinking in APIs. After controlling for other variables, APIs were still significantly less likely to participate in binge drinking and smoking. These findings were consistent with the previous conclusion that APIs with diabetes or pre-diabetes were less likely to be smokers or binge drinkers and had fewer risk factors for complications.<sup>32</sup>

Changing dietary habits is an important step in preventing or controlling diabetes. However, our study of those

diagnosed with diabetes found that only 22.8% NHWs and 33.6% APIs consumed adequate amounts of fruits and vegetables each day. Fruits and vegetables consumed daily have been well-documented in decreasing the risk for diabetes and other chronic diseases.<sup>33</sup> Other studies have found that, for White and Asian women, eating healthfully is also associated with an increased rate of physical activity.<sup>32</sup>

### Limitations

There are several limitations to this study. First, the type 2 diabetes status and all the independent variables are based on self-reported results and were not verified by medical record review. Those individuals with severe physical disease, such as heart attack, stroke, or mental health problems might not have been able to complete the survey. Second, the BRFSS questionnaire is delivered only in English or Spanish, which may have eliminated potential APIs from participating in the study. Third, we combined the Native Hawaiian/Pacific Islander into the Asian population and BRFSS did not subclassify the Asian American population or report on the duration of US residence. This missing information may add some bias to the analysis because different subgroups of APIs may make different lifestyle choices and the duration of residence in the United States may also lead to the lifestyle changes. Lastly, the 2009 BRFSS data excluded individuals without land-line telephones and may be subject to bias.

### CONCLUSION

The behavior risk factors and some diabetes preventive care strategies are significantly different between APIs and NHWs. These factors should be addressed when public health workers design prevention programs to better manage diabetes. Behavior modification

and diabetes management should take into account the characteristics and cultural norms of the targeted population.

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#### AUTHOR CONTRIBUTIONS

*Design and concept of study:* Guo, Cui  
*Acquisition of data:* Yan  
*Data analysis and interpretation:* Guo, Yan  
*Manuscript draft:* Guo, Cui, Yan  
*Statistical expertise:* Yan  
*Supervision:* Yan