Sociodemographic, behavioral, and neighborhood-environment predictors of diabetes prevalence across Asian American ethnicities: Analyses of CHIS (2013-2015).

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Abstract

Sociodemographic, behavioral, and neighborhood-environment predictors of diabetes prevalence across Asian American ethnicities: Analyses of CHIS (2013-2015).

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Background: Asian Americans are the fastest growing minority group in the U.S. and are disproportionately affected by the burden of diabetes. However, little is known about the individual vs. environmental-level predictors of diabetes and the heterogeneity among Asian American ethnicities.

Objective: To examine whether socio-demographic factors, individual health behaviors, or neighborhood environmental factors are most strongly associated with the prevalence of diabetes among Asian Americans of different ethnicities.

Methods: Using CHIS (2013-2015) data, Poisson log-link linear regression models were performed to assess the prevalence ratios of diabetes across Non-Hispanic Whites vs. Asian Americans, and if there was an interaction across six Asian American

ethnicities; Chinese, Japenese, Korean, Vietnamese, Filipino and Other Asian. Sociodemographics, health behaviors, or neighborhood-environmental factors were identified as potential predictors associated with the primary outcome of diabetes.

Results: The overall diabetes prevalence in the CHIs population was 7.8%. There was a disparity in diabetes prevalence by race/ethnicity, after adjusting for all the covariates. As compared to Non-Hispanic White (NHW), Vietnamese had a 44% (95% CI: 18%, 62%) lower prevalence of diabetes than Non-Hispanic Whites. In contrast, Filipinos had a 56% (95% CI: 21%, 101%) higher prevalence. Sociodemographic (age, gender, federal poverty level) and health behavior indicators (overweight/obesity status, perceived health status, smoking, alcohol and soda consumption) were the strongest and most significant predictors of diabetes across NHW and Asians in multivariate models. Interactions across six Asian-American subgroups were observed.

Conclusions: The present study provides insights into sociodemographic, behavioral and neighborhood-level factors that may predict diabetes across racial-ethnic groups. Findings from CHIS data warrant further studies across the US. Identifying specific predictors of diabetes within each subpopulation may allow more targeted interventions for each community.

Introduction

Asian-Americans constitute 5.6% of the total US population, and is the fastest growing minority population in the US. The first major wave of immigration from Asia to the United States of America (US) occurred in the late 1800s and early 1900s. Many South and East Asian immigrants, primarily from China, Japan, Korea, and the Philippines, immigrated to today's Hawaii and the West Coast of the US (1). Throughout the 1900s, the US passed several laws to exclude or limit immigrants, including Asian immigrants, from entering the country. However, the enactment of the Immigration Act of 1965 removed exclusions among specific immigrant groups, especially those of higher social and educational status (1). These individuals held roles such as scientists, engineers, and medical doctors, and would help contribute to America's work and research on technological advancements (2). This act was a strong contributor to the model minority myth that is currently portrayed on Asian Americans (2). In addition to educated professionals, refugees of violence were allowed to immigrate to the US in 1965. This changed the Asian American demographics significantly, allowing immigrants from Vietnam, Laos, and Cambodia to immigrate following the Vietnam War and the "Secret Wars" (1). The Refugee Act of 1980 further increased the number of refugees that were allowed to immigrate to the US from under 20,000 to 50,000 annually (3). As of 2016, the six largest Asian American subgroups are Asian Indian, Chinese, Korean, Vietnamese, Japanese and Filipino.

Today, Asian Americans are the fastest growing racial/ethnic groups in the United States (4). Between 1990 and 2000, Asian American populations have grown 72% (5), making them important populations to research regarding illness prevention.

Although Asian American races and ethnicities are highly heterogeneous, in health research, these distinct populations are often lumped into one group. Asian American subgroups have their own distinct cultures, lifestyle habits, health behaviors and practices (6). By lumping Asian Americans into a single group, prior research may be masking the prevalence of certain health conditions in any one Asian American subgroup. This practice can lead to barriers in identifying high-risk subgroups that may require distinct health related messages and interventions.

In 2014, diabetes mellitus (DM) was the 7th leading cause of death in the US with 1.4 million Americans being diagnosed with DM every year (7). Evidence suggests that the prevalence of diagnosed type 2 diabetes in Asians overall is 10% compared to 7.5% for non-Hispanic Whites (8). Previous studies have associated the prevalence of DM with certain health behaviors and practices, such as exercise habits, prior heart conditions, and age (9). Because these risk factors differ in this population, there is substantial heterogeneity in the prevalence of DM; 4.4% of Americans diagnosed are Chinese Americans, whereas Filipino Americans account for 11.3% of Americans diagnosed (10). The differences between the Asian American subgroups in terms of risk of DM have not been thoroughly researched or documented. For example, little is known about the role of socio-economics or behavioral and neighborhood level factors that may underlie the disparities between Asian subgroups. The few studies that have specifically evaluated neighborhood effects on these groups had limited generalizability. They were restricted to those who were employed (11), to South Asians (12), or adults recruited from a Veterans Affairs medical center in southeastern US (13). An example of neighborhood factors affecting DM was highlighted by Lagisetty et al. showing the odds

of developing DM was 32% lower in those with high social cohesion than low social cohesion in South Asian populations (12). Neighborhood factors related to both the built and social environments, for instance food environments, neighborhood safety, and social cohesion, are important to research because they are modifiable and relevant for policy and regulatory interventions. However, there are no studies to our knowledge that have simultaneously examined the individual compared with neighborhood environment factors that might be associated with DM prevalence in this heterogeneous group.

The present study will help to minimize this research gap. Using unique CHIS data, a State health survey with the highest representation of Asian-American subgroups in the US, we were able to categorize Asian Americans into smaller and more homogenous groups to provide better estimates of DM prevalence for each subpopulation. In addition, we identified the sociodemographic factors, health behaviors and neighborhood environmental predictors that are relevant for each subgroup. Given the limited research that has examined which neighborhood factors are associated with DM among Asian Americans we believe this aspect of our study is particularly innovative.

The specific aims of the study were:

1) To compare DM prevalence across different Asian American ethnicities and the non-Hispanic White population,

2) To examine socioeconomic, behavioral and neighborhood factors which are most strongly associated with DM across Asian Americans as a whole and non-Hispanic Whites

3) To examine if there is an interaction in predictors across six Asian American ethnic subgroups.

Methods

We performed a cross-sectional study, using data from 2013-2015 California Health Interview Survey data (CHIS), a unique dataset with a large sample of Asian Americans. CHIS is the nation's largest state health survey with extensive self-reported data on sociodemographic and lifestyle indicators, access to healthy foods, health behaviors, and health outcomes. The CHIS aims to represent the state's population. The Asian American population in California amounts to over 31% of all Asian Americans in the US (7) which results in a large and diverse sample of the Asian American population in this data source.

CHIS participants were representative of all 58 counties of California and were non-institutionalized civilian adults. A sample is drawn in each of the 44 geographic regions, which includes all 58 counties. CHIS uses random-digit dial telephone methods to conduct CHIS. In 2007, CHIS began sampling cell-phone-only households in addition to land-line household phones. This provided increased representativeness, as cell-phone only households tend to be younger than the average population of California. Only one adult is interviewed per household. The survey is conducted in English, Spanish, Cantonese, Mandarin, Korean, Tagalog, and Vietnamese to accommodate the most common languages spoken in California. The data are publically available and can be downloaded from the CHIS website. The 2013-2014 response rates of adult interviews for landline and cellphone interviews were 44.8% and 30.7%, respectively. The 2015

response rate for landline and cellphone interviews were 41.8% and 48.5%, respectively.

Measures

Asian ethnicity: The study focused on Asian American ethnic subgroups as the independent variable of interest. The six subgroups were Chinese (n=1,600), Filipino (n=865), Korean (n=582), Japanese (n=694), Vietnamese (n=735) and other Asian ethnicities (n=677). Asian Indian is an ethnic subgroup of interest, but due to low sample size, Asian Indians were excluded from individual analysis. Asian Indians were included in the "Other Asian" category along with Bangladeshi, Burmese, Cambodian, Hmong, Indian, Indonesian, Laotian, Malaysian, Pakistani, Sri Lankan, Taiwanese, and Thai. A small number of individuals self-reported more than one ethnicity and were excluded in the analysis of subpopulations (n = 82). As a comparison group we also included non-Hispanic whites (n=45,830).

DM: The primary outcome was the self-reported presence or absence of DM, that included pre-diabetes, determined by a doctor's report of DM ascertained from the following question: (Other than pregnancy) Has a doctor ever told you that you have diabetes or sugar diabetes? Respondents answered yes, no, pre-diabetes/borderline, don't know, or refused.

Predictors of DM: Potential predictors were selected a priori, from prior knowledge of what can cause or contribute to DM. The potential predictors were broken down into three larger categories: socio-demographics, health behaviors and environmental factors.

Socio-demographic variables include: age (18-54, 55-64, 65-85), gender (male, female), household size (1, 2, 3+), educational attainment (high school or less, some college or vocational, Bachelor's or graduate degree), working status (full time or part time, unemployed looking and not looking), housing tenure (own, rent/other), federal poverty level (0-99%, 100-199%, 200-299%, 300+%) and acculturation. Acculturation scores were calculated by combining data on English proficiency and years in the US. Lower values represent more acculturated individuals. For example, those with a score of zero were born in the US and only speak English whereas a score of 4 may equate to an individual who speaks English not at all or poorly and has been in the US for 10-14 years. English proficiency was categorized as only speaks English, speaks English very well/well, does not speak English at all or not well and years in US was categorized as: Born in US, 15+ years in US, 10-14 years, 5-9 years, <5 years. These two variables were summed resulting in a scale from 0 to 6. Prior studies that have used similar approaches (14,15).

Potential predictors of *health behaviors* were general health status (self reported excellent, very good, good, fair/poor), body mass index (BMI) (underweight and normal <25, overweight and obese 25+), alcohol use in the last week (yes, no), smoking status (never, former, current), fast food consumption in the last week (yes, no), soda consumption in the last week (yes, no), and walking at least 10 minutes for physical activity in the last week (yes, no). Lastly, our *neighborhood-environmental indicators* included fresh fruit and vegetable availability (always/usually, sometimes/never), fresh fruit and vegetable affordability (always, usually, sometimes/never), neighborhood safety (always felt safe, most of the time, never/sometimes) and social cohesion. Social

cohesion is calculated through three questions about being able to trust individuals in your neighborhood, people in your neighborhood are willing to help one another, and people in your neighborhood get along; all measures on a four point Likert scale which we collapsed to strongly agree/agree, strongly disagree/disagree. Anyone who indicated strongly agree/agree to 2 or 3 questions were considered to have strong neighborhood social cohesion.

Statistical data analyses

Data analyses were performed using Stata software version 14 (StataCorp, College Station, TX). A series of descriptive, bivariate and multivariate regressions were conducted to study our aims. All p-values were two-sided, and $p<0.05$ was considered to be statistically significant. In the bivariate and multivariate analysis we used survey weights in order to obtain correct point estimates that were representative of the California population. The final survey weights we used accounted for sample selection probabilities and potential bias. Weights were calculated by CHIS and analyses were conducted using the jackknife process with 80 replications. The data were analyzed through bivariate chi-squared tests to detect the difference of the prevalence of DM between all predictors within the total population, Non-Hispanic Whites, All Asian race/ethnicities, and between Asian race/ethnicity subpopulations. A Poisson regression model with a log link was used for the multivariate analysis to obtain prevalence ratios (PR) and 95% confidence intervals (CI). We attempted to use a binomial model, however, these models did not converge. To evaluate the minimally adjusted PR of Asians relative to non-Hispanic whites we performed Poisson regression models,

adjusting for age and gender. In our multivariate analysis, we used a staged modeling approach to evaluate predictors of DM for the total population, Non-Hispanic Whites, and all Asians. The first model contained only socio-demographic variables. Model two contained socio-demographic and health behavior predictors. And model three contained all three predictor categories of socio-demographic, health behaviors, and neighborhood environmental factors. The primary focus of the analysis was model three. For every Asian American subgroup, a separate Poisson regression model to determine the factors that are associated with DM prevalence within each subgroup was performed. Predictors from all three domains, socio-demographic, health behavior and neighborhood-environment, were included in one model.

Results

Descriptive Analysis

Sample distribution is provided in Table 1. The study population was majority female, overall (59%) and across Non-Hispanic Whites (NHW) vs. Asian American subgroups. The Asian population tended to be younger, (48.2% were in the age range of 18-54 years old compared to 34.7% for NHW). Majority of the sample was highly accultured (72.4% with an acculturation score of 0). However, the reverse trends in acculturation were observed across NHW vs. Asians. The overall sample was evenly distributed by household size, while Asian-Americans were more likely to have a bigger household size (48.2% with 3+ members vs. 30.3% among Whites). The sample was more likely to be educated overall (43.9% with bachelors/ college), and across 2 racial-ethnic subgroups. NHW were more likely to be home owners (70.1%) vs. 58.2% among

Asians. At least half of the sample belonged to highest income group, as defined by federal poverty level of 300+% (58.3%), and it remained similar across the two ethnic groups (59.2 vs. 50.7% respectively).

In terms of health behaviors, NHW were more likely to be overweight or obese (61.4%) as compared to Asians (39.9%). In contrast, Asians were more likely to perceive their general health to be fair/poor (26.1%) as compared to NHW (19.2%). Most of the sample never smoked (57.8%) but the reverse trend was observed for alcohol intake (69.6% consumed alcohol in the past 12 months). However, by ethnicity, the Asian subgroup was more likely to have never smoked (74.4% vs. 55.9%) and non-drinker in the past 12 months (46.6% vs. 28.6%). The study sample was significantly more likely to be physically active (76.5% reported to walk for at least 10 minutes in the past week), and the majority of them reported not to consume fast foods or soda. Similar trends were observed across two ethnic groups.

In terms of neighborhood-environment factors, availability of fresh fruits and vegetables did not seem to be issue in this study population. 89% reported to “always/ usually” have access to fruit and vegetables, and this trend did not differ across the two ethnic groups. However, access to affordable fruits and vegetables was reported by only half of the sample (53.5% overall), which did not vary across NHW (54.1%) vs. Asians (48.5%). Social cohesion did not appear to be a concern in the overall study population (80% reported strong social cohesion), or when analyzed by race/ethnicity. A majority of Non-Hispanic Whites reported feeling safe in the neighborhood all the time (55.7%) compared to 41.9% of Asians.

When comparing the Asian subpopulations (Table 1b), significant differences were observed by sociodemographic indicators. More than half of the Chinese, Filipinos and other Asians were relatively younger (18-54 year old) as compared to Japanese and Koreans. All Asian-American subgroups were less likely to be accultured (score of 3+), with the only exception of Japanese, and tended to have bigger household size. All Asian subgroups were more likely to be educated (bachelors/ graduates), higher income (indicated by federal poverty level of 300+%), employed and home-owners with the only exception of Vietnamese.

However, in terms of health behaviors, the majority of Asian Americans were least likely to perceive their general health status to be excellent. The obesity prevalence ranged from 31% among Vietnamese to 54% among Filipinos. The reported consumption of sodas and fast foods was very low among all Asian subgroups (70% or more reported none in each subgroup).

In terms of neighborhood-environment indicators, 80% of each subgroup sample reported to always/usually have access to fruits and vegetables in the neighborhood. However, access to affordable fruits and vegetables did appear to be a concern by some subgroups. Social cohesion was strong across all Asian subgroups, and 40-50% of them felt safe in their neighborhood most of the time.

Predictors of diabetes prevalence in the total CHIS population: Results from Bivariate analyses

Table 2a presents a series of bivariate analyses examining the prevalence of DM overall, and its distribution by sociodemographic, health behaviors and neighborhood-environment indicators. In the total sample, DM prevalence was significantly higher

among older respondents, those with lower acculturation score, smaller household size, lower education, lower incomes, and among those who were unemployed (p-value <0.05 for each). In terms of health behaviors, DM prevalence was much higher among overweight/obese individuals, those who perceived their general health status to be poor, former smokers and non-drinkers, and those physically inactive. DM prevalence was also much higher among those who did not have access to fruits and vegetables, or affordable fruits and vegetables in the neighborhood. Respondents with weak social cohesion were also more likely to report having DM (overall p-value <0.05 for each). Most of these factors persisted in bivariate analyses after stratifying by NHW vs. Asians, The only predictors that did not show significant differences in Asian population were gender, education, physical activity, fast food consumption and neighborhood safety

Predictors of diabetes prevalence within six Asian-American subgroups: Results from Bivariate analyses

After stratifying the broad Asian-American group into six subgroups (Table 2b), the only factors that remained significantly associated with DM across all six populations were age and general health status. Being obese, former smokers, and non-drinkers did show significant bivariate associations in certain subgroups but not others. We did not find significant associations with DM prevalence among Asian subgroups in this sample when looking at physical activity, fast food consumption, or any of the neighborhood-environment factors.

DM prevalence by racial-ethnic groups in CHIS populations

Prevalence of DM adjusted for sex and age across the racial-ethnic groups of interest from CHIS is presented in Figure 1. Using NHW as the reference, Filipinos had

an 87% (CI: 49%, 131%) higher prevalence of DM when adjusted for age and sex as seen in Table 3. After adjusting for all predictors, the prevalence ratio was attenuated, with Filipinos having a 56% (95 % CI: 21%, 101%) higher prevalence than Non-Hispanic Whites. Other ethnicities that showed a higher prevalence were Japanese (13%), Korean (35%), and Other Asians (4%) but these differences calculated were not statistically significant. Vietnamese and Chinese had a lower DM prevalence than Non-Hispanic Whites, but were determined to be not statistically significant. After further adjustment, Vietnamese had a significantly lower prevalence than Non-Hispanic Whites (44%, 95% CI: 18%, 62%). Other Asians showed a lower prevalence (10%) than Non-Hispanic Whites after adjustment, but this difference was not statistically significant.

Predictors of diabetes among Non-Hispanic Whites vs. Asians: Results from Multivariate analyses

Table 4 presents prevalence ratios for Non-Hispanic Whites and All Asians for all of the predictors of interest. There are three models for every population, adding a new category of predictors with each additional model to observe the effect of each predictor category. After adjustment for all predictors, among the Non-Hispanic White population, females had a lower prevalence than males (25%, 95% CI: 14%, 34%).

As expected, those in the older age groups showed a higher prevalence of DM than those in the younger age groups among Non-Hispanic White and Asian populations. The prevalence ratios comparing those aged 55-64 to those aged 18-54 for Non-Hispanic White and Asian populations were 101% (95% CI: 72%, 135%) and 201% (95% CI: 88%, 382%) respectively. Another trend that was observed among both populations was that individuals who quit smoking showed a higher prevalence of DM

compared to those who had never smoked before. There was an 18% (95% CI: 1%, 39%) higher prevalence in Non-Hispanic Whites, and a 57% (95% CI: 8%, 127%) high prevalence in Asians among those who quit smoking compared with those who had never smoked. Lastly, there was an inverse association between self-reported health and the prevalence of DM. Those who scored themselves lower for self-reported health tended to have a higher prevalence of DM compared with those who scored themselves higher.

Among both the NHW and Asian populations, we observed significant differences in the prevalence of DM when analyzing BMI as a predictor, however, these differences were not seen among the population as a whole. Among the NHW population, those who were overweight or obese had an 88% (95% CI: 31%, 169%) higher prevalence of DM than those who were normal or underweight; the corresponding prevalence was 81% (95% CI: 36%, 142%) for Asians.

In analyzing model three of the Asian population, we observed that living with one other person decreased DM prevalence by 33% (95% CI: 1%, 55%) compared to living alone. We also observed that those who received a high school education as their highest level of education had a 42% (95% CI: 20%, 58%) lower prevalence of DM compared with those who received a graduate or professional degree.

Across all three populations, both soda consumption and alcohol consumption was associated a statistically significantly lower prevalence of DM. Individuals who consumed soda consumption had a 51% (95% CI: 43%, 58%) lower prevalence in the total population, a 51% (95% CI: 42%, 59%) lower prevalence in Non-Hispanic Whites,

and a 50% (95% CI: 22%, 67%) lower prevalence in Asians of DM compared with Non-Hispanic Whites.

Predictors of DM across six Asian subgroups: Results from Multivariate analyses

Table 5 provides the prevalence ratios after adjustment for all sociodemographic, behavioral and neighborhood-environmental predictors within the 6 Asian subpopulations of interest. Among the Chinese subpopulation, having a household size of two was associated with a decrease of 56% (95% CI: 78%, 9%) prevalence compared to having a household size of one.

Among Japanese respondents, females had a lower prevalence of DM (57%, 95% CI: 15%, 78%) compared to their male counterparts. Those who felt their neighborhood was safe none or some of the time had a higher prevalence of DM (390%, 95% CI: 90%, 1163%) compared to those who felt safe most or all of the time.

Among Korean respondents, smoking was associated with a significantly higher prevalence of DM. Those who quit smoking had a 471% (95% CI: 103%, 1506%) higher prevalence of DM than those who never smoked. Furthermore, those who were current smokers had a 543% (95% CI: 120%, 1778%) higher prevalence of DM compared with those who had never smoked.

Among Vietnamese respondents, those who were unemployed had a 220% (95% CI: 30%, 685%) higher prevalence of DM than those who reported that they were employed. Those who reported that fresh fruits and vegetables were either never or sometimes available had a 217% (95% CI: 30%, 673%) higher prevalence of DM than those who reported that fresh fruits and vegetables were either mostly or always available. Lastly, those who found their neighborhood to be never or sometimes safe

had a 260% (95% CI: 51%, 757%) higher prevalence of DM than those who found their neighborhood to be safe most of the time or all the time.

Among Filipinos, females had a 45% (95% CI: 2%, 21%) lower prevalence of DM than males. Those with an acculturation score of two had a 382% (95% CI: 22%, 1812%) higher prevalence of DM than those with a score of zero, those with a score of zero represent being born in the US. Those who had a BMI 25 or higher had a 111% (95% CI: 23%, 262%) higher prevalence than those with a BMI less than 25.

Discussion

This study examined the prevalence of DM in Asian American subpopulations in the state of California, compared the prevalence of DM among Asian Americans to Non-Hispanic Whites, and determined the strongest predictors associated with DM in six different Asian ethnic subpopulations. Our results showed that when all Asian subpopulations were grouped together, the significant predictors of DM did not differ much between Asians and Non-Hispanic Whites. In contrast, when looking at each ethnic subpopulation individually, there was some heterogeneity of predictors across the six different ethnic groups.

Common predictors of DM across Non-Hispanic Whites, Asian Americans and many of the Asian subpopulations were alcohol consumption and soda consumption in the past week. Those who consumed alcohol had a lower prevalence of DM compared to those who did not. Similarly, those who consumed soda in the past week had a lower prevalence of DM than those who did not. It is unclear why we observed this unexpected result, but one possible explanation is measurement error related to social

desirability bias. That is, since consuming both alcohol and soda is considered by many to be unhealthy, individuals may underreport their consumption. In addition, there could be some unmeasured variables, for instance variables that are related to diet, that would have changed the association between alcohol and soda consumption and DM.

There were significant predictors present in the six subpopulations that were not observed the in overall Asian model. Within the Japanese and Vietnamese communities, perception of living in an unsafe neighborhood was a strong predictor of DM. In addition, both fresh fruit and vegetable unaffordability and unemployment were associated with higher prevalences of DM among the Vietnamese population. In the overall Asian model, education and household size were both associated with lower prevalence of DM, but when separated into the six subpopulations this association was no longer significant. The unobserved predictors in the overall Asian model, as well as the predictors that are no longer significant when they are broken down into the six subpopulations, reinforce the importance of focusing on smaller, more homogenous populations.

An additional example of the effects of heterogeneity is observed in the other Asian subpopulation. Due to the small sample size of certain ethnic groups, we were not able to analyze each group encompassing the “Other” category separately. The other Asian subpopulation accounted for over 10 different ethnicities and no significant differences among DM prevalence emerged when analyzing the associations with our predictors of interest. The inability to identify significant differences in DM prevalence for these predictors could have been related to the more heterogeneous mix of this subpopulation. Future studies with larger sample sizes for these Asian subpopulations

would provide a better understanding of the association of study predictors with DM prevalence among these important groups.

In comparison to previous studies, DM prevalence results in this study were similar, showing the lowest prevalence of DM among the Vietnamese study population compared with other Asian American populations (8). Wang et al. and Choi et al. found that age-standardized DM prevalence in men was highest in Filipinos and lowest in Vietnamese, which was similar to our results (5,9). Other studies, however, did not show Vietnamese to have the lowest odds of DM, but have a 25% higher odds that Non-Hispanic Whites (16). The associations we found between our predictors of interest and our outcome of interest, DM, are not generalizable to other self-reported chronic health conditions, such as disability, blood pressure or other cardiovascular related diseases (16,17). Risk factors for other chronic diseases may be associated by different magnitudes than the levels of association we found for DM by these predictors and therefore must be examined separately.

Many theories may explain the differences in DM prevalences that we found. The minority stress theory may explain the higher prevalence of DM in some populations. Specifically, the psychosocial effects of discrimination and racism faced by Asian Americans may lead to worse health outcomes, including a higher prevalence of DM (18).

The healthy immigrant effect theory, which has been well documented among Hispanic populations, may explain the lower prevalence of DM among the Vietnamese study population. This theory posits that immigrants arrive healthier than their US born counterparts, but the more acculturated they become, the worse health outcomes they

experience (26–28). Over 60% of our Vietnamese study population reported a higher acculturation score, representing being further away from being born in the US. Vietnamese populations may have adapted less to an American lifestyle than other Asian subpopulations, maintaining their own culture, behaviors and foods. Applying the healthy immigrant effect to Asian populations may be able to explain this health advantage among our Vietnamese study population.

The strengths of this study include the large sample size. With a large proportion of Asian Americans living in California, CHIS was able to provide a large sample size of Asian Americans within this study to analyze the predictors of DM. The large sample size allowed for sufficient power to detect any differences between populations and identify significant predictors for DM. The sample size provided the ability to analyze individual ethnicities as their own population, which is rarely accomplished.

Additionally, CHIS provided a variety of predictors through their survey. Specifically, we hypothesized that acculturation would have a significant affect on the prevalence of DM. Although the acculturation score we used (years in the US and English proficiency), was not used by other studies analyzing Latino populations, other studies have used variables including ethnic identity and classification (19,20), media use (21,22), ethnic values and interactions (23–25) to asses acculturation. Our use of two measures of acculturation is an improvement on the many studies that use only one measure of acculturation, usually US vs foreign born status. Neighborhood-environmental factors that incorporated social and built environments, such as fresh fruit and vegetable availability, as well as social cohesion and neighborhood safety, have not been examined by many previous studies. Herrick et al. found that a neighborhood with

higher super market density, representing higher fresh fruit and vegetable availability, was associated with a reduction of DM risk. In our results, fresh fruit and vegetable availability was not significantly associated with DM prevalence. The neighborhood factor that had a significantly higher prevalence of DM was neighborhood safety among Vietnamese and Japanese populations.

This study had several limitations. First, the study used self-reported data, which is subject to misclassification. The outcome of DM is reliant on whether the individual's physician had told them whether or not they have DM. Many people may not know they have DM (10) resulting in underreporting of DM prevalence. Second, some important characteristics that impact DM were unmeasured. For example, data on other environmental or genetic factors that can increase the risk of DM were not collected through the survey. Third, due to the cross-sectional study design and use of survey data, we cannot determine causation. Fourth, the sample sizes for some of the stratified models were limited, which created unstable estimates. Lastly, the data being analyzed is restricted to California residents. The generalizability of these study results are thus limited to the state of California. An analysis using national data must be performed to provide generalizability to the United States as a whole.

The results of this study help emphasize the heterogeneity of the health of Asian Americans in the state of California, which represents one of the largest proportions of Asian Americans in the US. Within the six ethnic populations, statistically significant risk factors for DM varied. No predictors were associated with more than three different ethnic subpopulations of the six groups analyzed. This result is important because if we were only able to evaluate an overall model for Asian Americans, we would have lost

information about each subpopulation. Certain interventions may not be appropriate for some populations, while approaches to reducing DM in other populations may not have been fully explored. For example, community organizations in California might now want to look into establishing smoking cessation programs for Koreans, improving employment opportunities among Vietnamese and improving neighborhood safety in Japanese communities in California. Furthermore, unnecessary resources and funding may be used to intervene in a population that might not need it.

This study encourages further research to determine the true differences in chronic health conditions between Asian American subpopulations. A nationwide study may be important to assess the differences in chronic health conditions of these subpopulations across the US. In addition, it may be important for other states which large Asian populations to implement these types of health surveys to capture data related to heterogeneous Asian populations. Further research analyzing state-specific predictors for the largest ethnic group populations will lead to improved and more culturally appropriate interventions. Through interventions that target significant predictors for distinct Asian subpopulations, we may be able to more effectively alleviate the burden of DM among Asian Americans.

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Table 1a: Socio-demographic, health behavior and neighborhood and environmental characteristics of Non-Hispanic White and Asian American residents in California 2013-2015*

	Total Population N = 51,065 n (%)	Non-Hispanic white N= 45,830 n (%)	All Asian N= 5,235[1] N (%)
Socio-Demographics			
Age			
18-54	18427 (36.1)	15902 (34.7)	2525 (48.2)
55-64	11366 (22.3)	10331 (22.5)	1035 (19.8)
65-85	21272 (41.6)	19597 (42.8)	1675 (32.0)
Gender			
Male	20959 (41.0)	18700 (40.8)	2259 (43.2)
Female	30106 (59.0)	27130 (59.2)	2976 (56.8)
Acculturation score[2]			
0	36982 (72.4)	35893 (78.3)	1089 (20.8)
1	6181 (12.1)	5316 (11.6)	865 (16.5)
2	3423 (6.7)	2014 (4.4)	1409 (26.9)
3+	4479 (8.8)	2607 (5.7)	1872 (35.8)
Household Size			
1	15606 (30.6)	14567 (31.8)	1039 (19.8)
2	19028 (37.2)	17354 (37.9)	1674 (32.0)
3+	16431 (32.2)	13909 (30.3)	2522 (48.2)
Education Attainment			
Bachelors/Graduate	22433 (43.9)	19612 (42.8)	2821 (53.9)
Vocational/Some college	14295 (28.0)	13370 (29.2)	925 (17.7)
High School or less	14337 (28.1)	12848 (28.0)	1489 (28.4)
Working Status			
Employed	24106 (47.2)	21478 (46.9)	2628 (50.2)
Unemployed	26959 (52.8)	24352 (53.1)	2607 (49.8)
House Tenure			
Own	35176 (68.9)	32129 (70.1)	3047 (58.2)
Rent/Other	15889 (31.1)	13701 (29.9)	2188 (41.8)
Federal Poverty Level			
300+ %	29775 (58.3)	27123 (59.2)	2652 (50.7)
200-299%	7051 (13.8)	6425 (14.0)	626 (12.0)
100-199%	8347 (16.3)	7397 (16.1)	950 (18.1)
0-99%	5892 (11.5)	4885 (10.7)	1007 (19.2)
Health Behaviors			
General Health			
Excellent	9324 (18.2)	8530 (18.6)	794 (15.2)
Very good	16635 (32.6)	15182 (33.1)	1453 (27.8)
Good	14927 (29.2)	13306 (29.0)	1621 (30.9)
Fair/Poor	10179 (20.0)	8812 (19.2)	1367 (26.1)
Body Mass Index			
Underweight/Normal	20846 (40.8)	17700 (38.6)	3146 (60.1)
Overweight/Obese	30219 (59.2)	28130 (61.4)	2089 (39.9)
Smoking Status			
Never	29526 (57.8)	25629 (55.9)	3897 (74.4)
Former	16188 (31.7)	15216 (33.2)	972 (18.6)
Current	5351 (10.5)	4985 (10.9)	366 (7.0)
Alcohol past 12 months			
No	15528 (30.4)	13086 (28.6)	2442 (46.6)
Yes	35537 (69.6)	32744 (71.4)	2793 (53.4)
Walked for at least 10min past week			
Yes	39087 (76.5)	34794 (75.9)	4293 (82.0)
No	11978 (23.5)	11036 (24.1)	942 (18.0)
Fast food consumption			
No	42172 (82.6)	37849 (82.6)	4323 (82.5)
Yes	8893 (17.4)	7981 (17.4)	392 (17.5)
Soda consumption			
No	37778 (74.0)	33823 (73.8)	3955 (75.5)
Yes	13287 (26.0)	12007 (26.2)	1280 (24.5)
Neighborhood & Environment Factors			
Found fresh fruits and vegetables			
Always/Usually	45485 (89.2)	41067 (89.6)	4418 (84.4)
Never/sometimes	4997 (9.8)	4292 (9.4)	705 (13.5)

Affordable fresh fruits and vegetables			
Always	27329 (53.5)	24793 (54.1)	2536 (48.5)
Usually	13289 (26.0)	11799 (27.0)	1490 (28.5)
Never/Sometimes	8051 (15.8)	7137 (15.6)	914 (17.5)
Social Cohesion[4]			
Strong	40828 (80.0)	36806 (80.3)	4022 (76.8)
Weak	9760 (19.1)	8580 (18.7)	1180 (22.6)
Feel neighborhood is safe			
All the time	27729 (54.3)	25538 (55.7)	2191 (41.9)
Most of the time	19083 (37.3)	16692 (36.4)	2391 (45.7)
Some/None of the time	3776 (7.4)	3156 (6.9)	620 (11.8)

*Data are not weighted; % indicate a column percentage
1) All Asians includes those with multiple Asian ethnicity
2) Score based on years in US and English proficiency added together. Years in US: 0 = Born in US, 1=15+ years in US, 2=10-14 years, 3=5-9 years, 4= <5 years. English proficiency: 0 = Only speaks English, 1=very well/well, 2= not well/not at all
4) Based on three question scale

Table 1b: Sociodemographic, health behavior and neighborhood and environmental characteristics of Asian American subpopulations in California 2013-2015

	Chinese N= 1,600 (30.6%)* n (%)	Japanese N= 694 (13.3%)* n (%)	Korean N= 582 (11.1%)* n (%)	Vietnamese N= 735 (14.0%)* n (%)	Filipino N= 865 (16.5%)* n (%)	Other Asian[1] N=677 (12.9%)* n (%)
Sociodemographics						
Age						
18-54	795 (49.7)	227 (32.7)	232 (39.8)	292 (39.8)	467 (54.0)	459 (67.9)
55-64	341 (21.3)	152 (21.9)	86 (14.8)	185 (25.2)	154 (17.8)	99 (14.6)
65-74	464 (29.0)	315 (45.4)	264 (45.4)	258 (35.1)	244 (28.2)	118 (17.4)
Gender						
Male	680 (42.5)	274 (39.5)	257 (44.2)	325 (44.2)	339 (39.2)	349 (51.6)
Female	920 (57.5)	420 (60.5)	325 (55.8)	410 (55.8)	526 (60.8)	328 (48.4)
Acculturation score[2]						
0	283 (17.7)	435 (62.7)	34 (5.8)	21 (2.9)	221 (25.5)	78 (11.5)
1	265 (16.6)	146 (21.0)	76 (13.1)	62 (8.4)	148 (17.1)	147 (21.7)
2	439 (27.4)	71 (10.2)	129 (22.2)	177 (24.1)	321 (37.1)	244 (36.0)
3+	613 (38.3)	42 (6.0)	343 (59.0)	475 (64.7)	175 (20.3)	208 (30.7)
Household Size						
1	327 (20.4)	202 (29.1)	147 (25.3)	166 (15.8)	145 (16.8)	93 (13.7)
2	505 (31.6)	276 (39.8)	228 (39.2)	208 (28.3)	253 (29.2)	183 (27.0)
3+	768 (48.0)	216 (31.1)	207 (35.6)	411 (56.0)	467 (54.0)	401 (59.2)
Education Attainment						
Bachelors/Graduate	967 (60.4)	397 (57.2)	313 (53.8)	189 (25.7)	501 (57.9)	413 (61.0)
Vocational/Some college	205 (12.8)	180 (25.9)	79 (13.6)	135 (18.4)	205 (23.7)	106 (15.7)
High School or less	428 (26.8)	117 (16.9)	190 (32.6)	411 (55.9)	159 (18.4)	158 (23.3)
Working Status						
Employed	844 (52.8)	308 (44.4)	254 (43.6)	278 (37.8)	485 (56.1)	409 (60.4)
Unemployed	756 (47.2)	386 (55.6)	328 (56.4)	457 (62.2)	380 (43.9)	268 (39.6)
House Tenure						
Own	1010 (63.1)	563 (81.1)	274 (47.1)	263 (35.8)	477 (55.1)	406 (60.0)
Rent/Other	590 (36.9)	131 (18.9)	308 (52.9)	472 (64.2)	388 (44.9)	271 (40.0)
Federal Poverty Level						
300+ %	855 (53.4)	492 (70.9)	222 (38.1)	179 (24.4)	465 (53.8)	392 (57.9)
200-299%	179 (11.2)	78 (11.2)	84 (14.4)	72 (9.8)	129 (14.9)	73 (10.8)
100-199%	283 (17.7)	70 (10.1)	145 (24.9)	184 (25.0)	156 (18.0)	104 (15.4)
0-99%	283 (17.7)	54 (7.8)	131 (22.5)	300 (40.8)	115 (13.3)	108 (16.0)
Health Behaviors						
General Health						
Excellent	235 (14.7)	131 (18.9)	72 (12.4)	65 (8.8)	135 (15.6)	137 (20.2)
Very good	507 (31.7)	259 (37.7)	109 (18.7)	86 (11.7)	268 (31.0)	210 (31.0)
Good	469 (29.3)	208 (30.0)	208 (35.7)	173 (23.5)	296 (34.2)	238 (35.2)
Fair/Poor	389 (24.3)	96 (13.8)	193 (33.2)	411 (55.9)	166 (19.2)	92 (13.6)
Body Mass Index						
Underweight/Normal	1053 (65.8)	397 (57.2)	390 (67.0)	505 (68.7)	395 (45.7)	357 (52.7)
Overweight/Obese	547 (34.2)	297 (42.8)	192 (33.0)	230 (31.3)	470 (54.3)	320 (47.3)
Smoking Status						
Never	1347 (84.2)	441 (63.5)	362 (62.2)	553 (75.2)	595 (68.8)	540 (79.8)

Former	179 (11.2)	204 (29.4)	161 (27.7)	124 (16.9)	196 (22.7)	92 (13.6)
Current	74 (4.6)	49 (7.1)	59 (10.1)	58 (7.9)	74 (8.6)	45 (6.6)
Alcohol past 12 months						
No	740 (46.2)	280 (40.3)	291 (50.0)	442 (60.1)	380 (43.9)	283 (41.8)
Yes	860 (53.8)	414 (59.7)	291 (50.0)	293 (39.9)	485 (56.1)	394 (58.2)
Walked for at least 10min past week						
Yes	1331 (83.2)	538 (77.5)	478 (82.1)	606 (82.4)	709 (82.0)	570 (84.2)
No	269 (16.8)	156 (22.5)	104 (17.9)	129 (17.6)	156 (18.0)	107 (15.8)
Fast food consumption						
No	1343 (83.9)	500 (86.5)	505 (86.8)	648 (88.2)	670 (77.5)	474 (70.0)
Yes	257 (16.1)	94 (13.6)	77 (13.2)	87 (11.8)	195 (22.6)	203 (30.0)
Soda consumption						
No	1246 (77.9)	541 (78.0)	430 (73.9)	605 (82.3)	589 (68.1)	485 (71.6)
Yes	190 (22.2)	95 (22.0)	78 (26.1)	130 (17.7)	276 (31.9)	192 (28.4)
Neighborhood & Environment Factors						
Found fresh fruits and vegetables						
Always/Usually	340 (86.1)	632 (81.1)	462 (79.4)	596 (81.1)	713 (82.5)	564 (83.3)
Never/sometimes	178 (11.1)	56 (8.1)	103 (17.7)	106 (14.4)	145 (16.8)	109 (16.1)
Affordable fresh fruits and vegetables						
Always	834 (52.1)	436 (62.8)	181 (31.1)	265 (36.1)	433 (50.1)	343 (50.7)
Usually	445 (27.8)	166 (23.9)	212 (36.4)	269 (36.6)	196 (22.7)	181 (26.7)
Never/Sometimes	239 (14.9)	70 (10.1)	154 (26.5)	139 (18.9)	178 (20.6)	120 (17.7)
Social Cohesion[4]						
Strong	1278 (79.9)	584 (84.1)	398 (68.4)	554 (75.4)	636 (73.5)	512 (75.6)
Weak	313 (19.6)	105 (15.1)	182 (31.3)	180 (24.5)	217 (25.1)	161 (23.8)
Feel neighborhood is safe						
All the time	616 (38.5)	342 (49.3)	209 (35.9)	348 (47.3)	339 (39.2)	312 (46.1)
Most of the time	817 (51.1)	305 (43.9)	296 (50.9)	242 (32.9)	399 (46.1)	294 (43.4)
Some/None of the time	158 (9.9)	42 (6.1)	75 (12.9)	144 (19.6)	155 (13.3)	67 (9.9)

Data are not weighted; % indicate a column percentage

*Percentage reflects percent of total Asian population

1) Other Asians include Bangladeshi, Burmese, Cambodian, Hmong, Indian, Indonesian, Laotian, Malaysian, Pakistani, Sri Lankan, Taiwanese, Thai, and other Asian American.

2) Score based on years in US and English proficiency added together. Years in US: 0 = Born in US, 1=15+ years in US, 2=10-14 years, 3=5-9 years, 4= <5 years. English proficiency: 0 = Only speaks English, 1=very well/well, 2= not well/not at all

3) Based on three question scale

Table 2a: Bivariate analysis of the prevalence of diabetes by sociodemographic characteristics, health behaviors and neighborhood and environmental factors among the total population, Non-Hispanic Whites, and Asian race/ethnicity.[1]

	Total Population Diabetes	Non-Hispanic Whites Diabetes	All Asians Diabetes
	Yes (%)	Yes (%)	Yes (%)
Socio-Demographics			
Age			
18-54	**5.14**	**5.24**	**4.6**
55-64	**14.92**	**13.72**	**21.29**
65-85	**22.67**	**21.16**	**32.36**
p-value	**< 0.01**	**< 0.01**	**< 0.01**
Gender			
Male	**11.04**	**10.72**	12.1
Female	**9.34**	**9.25**	9.48
p-value	**< 0.01**	**0.01**	0.16
Acculturation score[2]			
0	**9.1**	**9.35**	**5.5**
1	**8.95**	**9.27**	**7.61**
2	**14.86**	**12.39**	**17.16**
3+	**12.06**	**12.87**	**10.3**
p-value	**< 0.01**	**0.04**	**< 0.01**
Household Size			
1	**13.13**	**12.51**	**16.74**
2	**11.9**	**11.71**	**12.67**
3+	**8.54**	**8.29**	**9.11**
p-value	**< 0.01**	**< 0.01**	**0.01**
Education Attainment			
Bachelors/Graduate	**8.11**	**7.1**	10.82
Vocational/Some college	**10.15**	**10.16**	9.87
High School or less	**12.71**	**12.96**	10.97
p-value	**< 0.01**	**< 0.01**	0.88
Working Status			
Employed	**6.62**	**6.4**	**7.29**
Unemployed	**16.21**	**15.96**	**17.06**
p-value	**< 0.01**	**< 0.01**	**< 0.01**
House Tenure			
Own	10.4	10.21	10.83
Rent/Other	9.74	9.52	10.48
p-value	0.35	0.30	0.84
Federal Poverty Level			
300+ %	**7.73**	**7.5**	**8.44**
200-299%	**12.01**	**11.92**	**12.16**
100-199%	**14.05**	**14.05**	**13.84**
0-99%	**13.42**	**13.2**	**14.01**
p-value	**< 0.01**	**< 0.01**	**0.03**
Health Behaviors			
General Health			
Excellent	**1.86**	**1.77**	**2.24**
Very good	**4.83**	**4.38**	**6.57**
Good	**11.67**	**11.43**	**12.55**
Fair/Poor	**25.85**	**26.64**	**22.47**
p-value	**< 0.01**	**< 0.01**	**< 0.01**
Body Mass Index			
Underweight/Normal	**5.47**	**4.77**	**7.4**
Overweight/Obese	**13.51**	**13.18**	**14.97**
p-value	**< 0.01**	**< 0.01**	**< 0.01**
Smoking Status			
Never	**8.36**	**8.15**	**8.79**
Former	**15.43**	**14.55**	**21.71**
Current	**9.31**	**9.4**	**8.95**
p-value	**< 0.01**	**< 0.01**	**< 0.01**
Alcohol past 12 months			
No	**15.5**	**15.52**	**15.44**
Yes	**7.94**	**7.92**	**7.73**
p-value	**< 0.01**	**< 0.01**	**< 0.01**
Walked for at least 10min past week			
Yes	**9.33**	**9.06**	10.19

No	**13.63**	**13.68**	13.16
p-value	**< 0.01**	**< 0.01**	0.22
Fast food consumption			
No	10.03	9.73	11.0
Yes	10.62	10.83	9.59
p-value	0.69	0.49	0.58
Soda consumption			
No	**12.42**	**12.17**	**13.04**
Yes	**5.97**	**6.01**	**5.6**
p-value	**< 0.01**	**< 0.01**	**< 0.01**
Neighborhood & Environment Factors			
Found fresh fruits and vegetables			
Always/Usually	**9.7**	**9.62**	**9.76**
Never/sometimes	**13.23**	**12.7**	**14.87**
p-value	**0.03**	**0.08**	**0.02**
Affordable fresh fruits and vegetables			
Always	**9.45**	**9.2**	**10.32**
Usually	**9.14**	**9.29**	**8.13**
Never/Sometimes	**12.6**	**12.28**	**13.8**
p-value	**< 0.01**	**< 0.01**	**0.03**
Social Cohesion[4]			
Strong	**9.49**	**9.1**	10.85
Weak	**11.94**	**12.41**	9.84
p-value	**< 0.01**	**< 0.01**	0.59
Feel neighborhood is safe			
All the time	9.97	**9.7**	11.06
Most of the time	9.73	**9.42**	10.55
Some/None of the time	12.13	**13.06**	9.37
p-value	0.09	**0.02**	0.80

Bold values indicate significant variables

1) Prevalence is calculated using survey weights

2) Score based on years in US and English proficiency added together. Years in US: 0 = Born in US, 1=15+ years in US, 2=10-14 years, 3=5-9 years, 4= <5 years. English proficiency: 0 = Only speaks English, 1=very well/well, 2= not well/not at all

3) Based on three question scale

Table 2b: Bivariate analysis of the prevalence of diabetes by sociodemographic characteristics, health behaviors and neighborhood and environmental factors among Asian race/ethnicity subpopulations.[1]

	Chinese Diabetes	Japanese Diabetes	Korean Diabetes	Vietnamese Diabetes	Filipino Diabetes	Other Asian Diabetes
	Yes (%)	Yes (%)	Yes (%)	Yes (%)	Yes (%)	Yes (%)
Socio-Demographics						
Age						
18-54	**3.36**	**3.93**	**2.85**	**4.91**	**7.4**	**4.25**
55-64	**18.3**	**10.12**	**27.09**	**5.61**	**33.23**	**23.01**
65-85	**24.7**	**30.96**	**36.51**	**24.76**	**40.41**	**23.98**
p-value	**< 0.01**	**< 0.01**	**< 0.01**	**< 0.01**	**< 0.01**	**< 0.01**
Gender						
Male	7.61	14.88	17.49	7.4	19.65	7.98
Female	7.79	9.77	8.73	8.19	13.68	6.1
p-value	0.95	0.35	0.14	0.86	0.20	0.62
Acculturation score[2]						
0	8.42	12.05	**4.98**	**0.43**	**2.99**	**2.48**
1	5.93	13.54	**18.09**	**5.67**	**10.67**	**1.94**
2	8.3	8.04	**24.88**	**17.96**	**32.03**	**13.75**
3+	7.95	11.81	**2.41**	**2.99**	**16.27**	**7.48**
p-value	0.92	0.89	**0.01**	**< 0.01**	**< 0.01**	**0.05**
Household Size						
1	**15.8**	**17.22**	24.89	4.78	24.69	7.15
2	**11.43**	**19.13**	13.67	5.33	18.79	6.39
3+	**5.35**	**6.73**	8.69	8.76	14.57	7.29
p-value	**0.04**	**0.03**	0.15	0.43	0.28	0.96
Education Attainment						
Bachelors/Graduate	6.75	**7.68**	10.59	**3.99**	19.09	8.04
Vocational/Some college	8.39	**16.17**	7.92	**2.75**	13.56	7.13
High School or less	9.44	**19.46**	18.22	**12.94**	10.88	4.83
p-value	0.61	**0.02**	0.29	**< 0.01**	0.21	0.63
Working Status						
Employed	5.52	**6.76**	**7.8**	**4.51**	**11.68**	6.05
Unemployed	12.09	**20.98**	**19.36**	**13.5**	**25.41**	9.14
p-value	0.09	**< 0.01**	**0.03**	**< 0.01**	**< 0.01**	0.44
House Tenure						
Own	8.1	13.21	9.35	7.52	16.35	8.85
Rent/Other	7.06	7.57	16.0	8.11	16.36	4.8
p-value	0.67	0.48	0.24	0.88	0.99	0.27
Federal Poverty Level						
300+ %	6.29	10.74	8.43	4.03	12.59	6.51
200-299%	7.67	18.97	8.35	0.85	24.39	4.53
100-199%	12.3	8.93	15.44	18.42	15.78	9.15
0-99%	6.83	13.92	24.22	8.23	25.26	8.99
p-value	0.27	0.62	0.19	0.06	0.11	0.81
Health Behaviors						
General Health						
Excellent	**2.09**	**2.66**	**2.92**	**3.0**	**3.04**	**0.71**
Very good	**5.78**	**6.54**	**1.81**	**0.77**	**11.53**	**5.57**
Good	**7.99**	**18.62**	**16.65**	**4.08**	**19.83**	**7.72**
Fair/Poor	**15.32**	**31.2**	**25.93**	**15.93**	**34.59**	**22.49**
p-value	**0.02**	**< 0.01**	**0.01**	**< 0.01**	**< 0.01**	**0.03**
Body Mass Index						
Underweight/Normal	**5.34**	**7.46**	**10.87**	**8.71**	**10.06**	4.64
Overweight/Obese	**11.76**	**18.74**	**15.91**	**6.03**	**21.45**	9.28
p-value	**0.03**	**0.09**	**0.30**	**0.44**	**0.02**	0.15
Smoking Status						
Never	**7.19**	10.6	**5.81**	**6.62**	**14.57**	5.84
Former	**17.88**	14.62	**25.88**	**20.14**	**27.98**	11.7
Current	**3.54**	16.61	**18.56**	**1.51**	**8.8**	15.75
p-value	**0.02**	0.58	**< 0.01**	**0.03**	**0.01**	0.21
Alcohol past 12 months						
No	10.83	**20.13**	13.15	**15.11**	**25.44**	5.7
Yes	5.61	**7.57**	12.16	**1.29**	**10.93**	7.82
p-value	0.09	**0.05**	0.86	**< 0.01**	**< 0.01**	0.54
Walked for at least 10min past week						
Yes	6.52	11.72	11.55	7.15	16.44	6.73
No	12.73	12.53	19.05	10.58	15.92	9.14

p-value	0.15	0.87	0.31	0.62	0.91	0.65
Fast food consumption						
No	7.79	10.51	13.76	7.55	17.64	7.33
Yes	7.33	18.62	8.19	8.78	12.64	6.56
p-value	0.91	0.47	0.44	0.89	0.33	0.86
Soda consumption						
No	**10.16**	13.32	15.11	**10.09**	18.97	**9.75**
Yes	**2.15**	8.59	7.48	**1.17**	11.27	**1.7**
p-value	**< 0.01**	0.36	0.22	**< 0.01**	0.10	**< 0.01**
Neighborhood & Environmental Factors						
Found fresh fruits and vegetables						
Always/Usually	7.42	11.17	10.73	7.09	**14.2**	7.08
Never/sometimes	5.0	22.78	22.4	11.89	**27.46**	6.4
p-value	0.36	0.41	0.14	0.40	**0.01**	0.89
Affordable fresh fruits and vegetables						
Always	7.59	10.16	9.46	4.48	17.48	8.06
Usually	5.53	12.67	11.09	7.45	9.9	6.97
Never/Sometimes	9.64	15.78	19.39	12.41	20.4	3.91
p-value	0.51	0.65	0.39	0.19	0.17	0.68
Social Cohesion[3]						
Strong	7.81	10.53	12.09	8.31	16.91	7.99
Weak	7.7	14.58	13.39	6.62	13.71	4.23
p-value	0.97	0.47	0.81	0.78	0.48	0.44
Feel neighborhood is safe						
All the time	9.16	**7.0**	11.36	**5.04**	20.09	8.84
Most of the time	7.31	**13.48**	15.6	**5.02**	15.76	5.77
Some/None of the time	5.11	**32.97**	5.39	**17.11**	6.36	5.62
p-value	0.58	**0.05**	0.26	**0.01**	0.21	0.59

Bolded values indicate significant variables

1) Prevalence is calculated using survey weights

2) Score based on years in US and English proficiency added together. Years in US: 0 = Born in US, 1=15+ years in US, 2=10-14 years, 3=5-9 years, 4= <5 years. English proficiency: 0 = Only speaks English, 1=very well/well, 2= not well/not at all

4) Based on three question scale

Table 3: Prevalence, prevalence ratios and 95% confidence intervals of diabetes in Asian American populations (2013-2015)*

	Sex and Age adjusted Diabetes prevalence (%) (n[1])	Sex and Age adjusted Prevalence Ratio (95% CI)	Adjusted[2] Prevalence Ratio (95% CI)
Non-Hispanic White	7.7 (3529)	Referent	Referent
Chinese	7.5 (120)	0.97 (0.60, 1.56)	0.87 (0.49, 1.53)
Japanese	8.7 (60)	1.13 (0.58, 2.18)	1.41 (0.97, 2.05)
Korean	10.4 (61)	1.35 (0.91, 1.96)	1.20 (0.81, 1.78)
Vietnamese	6.7 (49)	0.87 (0.59, 1.27)	**0.56 (0.38, 0.82)**
Filipino	14.4 (125)	**1.87 (1.49, 2.31)**	**1.56 (1.21, 2.01)**
Other Asian	8.0 (54)	1.04 (0.65, 1.61)	0.90 (0.53, 1.53)

*Survey weights were used to produce these estimates
1) n is rounded to the nearest whole number
2) Adjusted for all age, gender, acculturation score, household size, education attainment, working status, house tenure, federal poverty level, general health status, body mass index, smoking status, alcohol usage, physical activity, fast food consumption, soda consumption, fresh fruit and vegetable availability and affordability, social cohesion and neighborhood safety

Table 4: Prevalence ratios of diabetes for socioeconomic, behavioral and neighborhood-environment predictors among total CHIS population (2013-2015) among Non-Hispanic Whites and Asian race/ethnicity

	Non-Hispanic Whites N = 45,830			Asians N = 5,235		
	Model 1[1]	Model 2[2]	Model 3[3]	Model 1[1]	Model 2[2]	Model 3[3]
Socio-demographics						
Gender						
Male	Referent	Referent	Referent	Referent	Referent	Referent
Female	**0.73 (0.65, 0.83)**	**0.76 (0.67, 0.86)**	**0.75 (0.66, 0.86)**	**0.66 (0.47, 0.92)**	0.72 (0.50, 1.05)	0.71 (0.50, 1.01)
Age						
18-54	Referent	Referent	Referent	Referent	Referent	Referent
55-64	**2.93 (2.48, 3.47)**	**2.04 (1.74, 2.39)**	**2.01 (1.72, 2.35)**	**4.30 (2.50, 7.39)**	**2.87 (1.71, 4.81)**	**3.01 (1.88, 4.82)**
65-85	**3.93 (2.83, 5.46)**	**2.76 (1.96, 3.88)**	**2.73 (1.92, 3.89)**	**6.28 (4.05, 9.73)**	**4.10 (2.59, 6.49)**	**3.96 (2.46, 6.36)**
Acculturation Score[4]						
0	Referent	Referent	Referent	Referent	Referent	Referent
1	1.13 (.089, 1.44)	1.12 (0.87, 1.45)	1.10 (0.85, 1.41)	1.23 (0.77, 1.95)	1.22 (0.78, 1.92)	1.22 (0.79, 1.89)
2	1.35 (0.99, 1.84)	1.14 (0.85, 1.53)	1.16 (0.86, 1.57)	**1.72 (1.07, 2.74)**	1.54 (0.97, 2.43)	1.55 (0.99, 2.42)
3+	**1.30 (1.00, 1.69)**	1.01 (0.77, 1.33)	1.00 (0.75, 1.34)	1.40 (0.91, 2.18)	1.20 (0.79, 1.83)	1.11 (0.72, 1.73)
Household Size						
1	Referent	Referent	Referent	Referent	Referent	Referent
2	1.10 (0.95, 1.23)	1.07 (0.92, 1.24)	1.06 (0.90, 1.25)	0.73 (0.49, 1.08)	0.75 (0.49, 1.17)	**0.67 (0.45, 0.99)**
3+	1.19 (0.98, 1.45)	1.14 (0.96, 1.36)	1.13 (0.94, 1.34)	0.97 (0.67, 1.40)	0.92 (0.64, 1.32)	0.91 (0.63, 1.33)
Education Attainment						
Bachelors of Graduate	Referent	Referent	Referent	Referent	Referent	Referent
Some college of Vocational	**1.25 (1.05, 1.49)**	1.09 (0.94, 1.26)	1.08 (0.92, 1.26)	0.87 (0.55, 1.40)	0.81 (0.49, 1.33)	0.84 (0.58, 1.22)
High School Diploma	**1.31 (1.11, 1.54)**	1.09 (0.94, 1.26)	1.09 (0.94, 1.26)	**0.70 (0.49, 0.99)**	**0.60 (0.42, 0.86)**	**0.58 (0.42, 0.80)**
Working Status						
Employed	Referent	Referent	Referent	Referent	Referent	Referent
Unemployed	**1.45 (1.27, 1.65)**	1.11 (0.97, 1.26)	1.11 (0.97, 1.28)	1.19 (0.86, 1.64)	1.12 (0.79, 1.57)	1.09 (0.77, 1.55)
Household Tenure						
Own	Referent	Referent	Referent	Referent	Referent	Referent
Rent/Other	1.04 (0.89, 1.21)	0.97 (0.82, 1.14)	0.94 (0.78, 1.13)	0.99 (0.72, 1.37)	0.98 (0.73, 1.32)	1.01 (0.75, 1.36)
Federal Poverty Level						
300% FPL or above	Referent	Referent	Referent	Referent	Referent	Referent
200-299% FPL	**1.42 (1.21, 1.66)**	**1.25 (1.05, 1.47)**	**1.23 (1.01, 1.49)**	1.25 (0.82, 1.91)	1.15 (0.73, 1.83)	1.20 (0.74, 1.95)
100-199% FPL	**1.69 (1.32, 2.15)**	1.32 (0.94, 1.86)	1.29 (0.89, 1.87)	1.23 (0.81, 1.86)	1.07 (0.75, 1.54)	0.98 (0.65, 1.50)
0-99% FPL	**1.70 (1.33, 2.17)**	1.29 (0.96, 1.72)	1.23 (0.96, 1.57)	1.22 (0.80, 1.87)	1.03 (0.67, 1.59)	1.08 (0.71, 1.67)
Health Behaviors						
General Health Status						
Excellent		Referent	Referent		Referent	Referent
Very Good		**2.28 (1.01, 5.12)**	2.22 (0.97, 5.09)		**2.37 (1.14, 4.91)**	**2.39 (1.08, 5.31)**
Good		**5.22 (2.17, 12.53)**	**5.07 (2.02, 12.76)**		**2.59 (1.78, 7.27)**	**3.69 (1.76, 7.73)**
Fair/Poor		**9.87 (3.64, 26.76)**	**9.51 (3.34, 27.09)**		**4.88 (2.22, 10.73)**	**4.86 (2.24, 10.53)**
BMI[5]						
Underweight or Normal 0-24.99		Referent	Referent		Referent	Referent
Overweight or Obese 25+		**1.87 (1.35, 2.59)**	**1.88 (1.31, 2.69)**		**1.87 (1.36, 2.57)**	**1.81 (1.36, 2.42)**
Smoking Status						
Never Smoked		Referent	Referent		Referent	Referent

Quit Smoking	**1.16 (1.02, 1.32)**	**1.18 (1.01, 1.39)**	**1.59 (1.08, 2.34)**	**1.57 (1.08, 2.27)**
Currently Smokes	1.03 (0.85, 1.26)	1.02 (0.83, 1.26)	1.25 (0.69, 2.26)	1.29 (0.68, 2.45)
Alcohol Consumption				
No	Referent	Referent	Referent	Referent
Yes	**0.79 (0.70, 0.90)**	**0.80 (0.70, 0.92)**	**0.71 (0.55, 0.92)**	**0.73 (0.55, 0.97)**
Walked for 10 Minutes				
Yes	Referent	Referent	Referent	Referent
No		0.93 (0.80, 1.08)	0.99 (0.66, 1.50)	0.95 (0.65, 1.39)
Fast Food Consumption in last week				
No	Referent	Referent	Referent	Referent
Yes	1.16 (0.84, 1.60)	1.18 (0.84, 1.66)	1.08 (0.68, 1.71)	1.02 (0.63, 1.66)
Soda Consumption in last week				
No	Referent	Referent	Referent	Referent
Yes	**0.50 (0.42, 0.59)**	**0.49 (0.41, 0.58)**	**0.56 (0.36, 0.88)**	**0.50 (0.33, 0.78)**
Neighborhood & Environmental Factors				
Fresh Fruit/Vegetable Available				
Always/Usually		Referent		Referent
Never/Sometimes		0.93 (0.53, 1.63)		1.16 (0.74, 1.85)
Fresh Fruit/Vegetable Affordable				
Always		Referent		Referent
Usually		1.03 (0.88, 1.20)		0.82 (0.58, 1.15)
Never/Sometimes		1.05 (0.90, 1.23)		1.28 (0.88, 1.86)
Neighborhood Social Cohesion[6]				
Strong		Referent		Referent
Weak		1.14 (0.93, 1.41)		0.94 (0.64, 1.39)
Neighborhood Safe				
All the time		Referent		Referent
Most of the time		0.96 (0.85, 1.08)		1.06 (0.75, 1.49)
Some/None of the time		1.07 (0.80, 1.44)		0.94 (0.60, 1.46)

bold denotes significant values

*Survey weights were used to produce these estimates

1) Model 1 contains only sociodemographic variables

2) Model 2 contains sociodemographic and health behavior variables

3) Model 3 contains sociodemographic, health behaviors, and neighborhood and environment factor variables

4) Score based on years in US and English proficiency added together. Years in US: 0 = Born in US, 1=15+ years in US, 2=10-14 years, 3=5-9 years, 4= <5 years. English proficiency: 0 = Only speaks English, 1=very well/well, 2= not well/not at all

5) BMI = Body Mass Index

6) Based on three factors of people in neighborhood gets along, willing to help each other, and are trusted

Table 5: Prevalence ratios of diabetes for socioeconomic, behavioral and neighborhood-environment predictors among total CHIS population (2013-2015) among Non-Hispanic Whites and Asian race/ethnicity among Asian race/ethnicity subgroups

	Chinese N= 1,600 PR (95%CI)	Japanese N= 694 PR (95%CI)	Korean N= 582 PR (95%CI)	Vietnamese N= 735 PR (95%CI)	Filipino N= 865 PR 95%CI)	Other Asian N= 677 PR (95%CI)
Socio-Demographics						
Gender						
Male	Referent	Referent	Referent	Referent	Referent	Referent
Female	0.78 (0.38, 1.59)	**0.43 (0.22, 0.85)**	1.36 (0.45, 4.09)	0.72 (0.26, 2.02)	**0.55 (0.21, 0.98)**	0.88 (0.27, 2.81)
Age						
18-54	Referent	Referent	Referent	Referent	Referent	Referent
55-64	**3.90 (1.44, 10.60)**	2.51 (0.77, 8.21)	**7.83 (1.46, 42.04)**	0.73 (0.22, 2.44)	**2.48 (1.20, 5.12)**	3.54 (0.38, 32.85)
65-85	**3.92 (1.37, 11.21)**	5.46 (0.89, 33.46)	**17.38 (2.88, 105)**	1.72 (0.47, 6.34)	2.56 (0.89, 7.37)	3.74 (0.08, 21.82)
Acculturation Score[1,2]						
0	Referent	Referent	Referent	Referent	Referent	Referent
1	1.15 (0.38, 3.48)	1.03 (0.41, 2.56)	--	--	2.53 (0.76, 8.39)	0.47 (0.01, 22.48)
2	1.15 (0.40, 3.31)	0.70 (0.22, 2.20)	1.17 (0.14, 10.03)	14.52 (0.05, 4011)	**4.82 (1.22, 19.12)**	1.49 (0.08, 27.19)
3+	0.67 (0.33, 1.35)	0.90 (0.23, 3.49)	0.44 (0.06, 3.43)	7.78 (0.04, 1437)	2.94 (0.72, 1.96)	1.30 (0.08, 21.82)
Household Size						
1	Referent	Referent	Referent	Referent	Referent	Referent
2	**0.44 (0.22, 0.91)**	0.82 (0.40, 1.68)	0.83 (0.24, 2.82)	1.03 (0.21, 5.11)	0.71 (0.33, 1.51)	0.75 (0.06, 9.06)
3+	0.58 (0.26, 1.30)	0.90 (0.21, 3.85)	1.11 (0.21, 5.78)	2.45 (0.49, 12.16)	0.82 (0.42, 1.61)	1.55 (0.17, 14.24)
Education Attainment						
Bachelors of Graduate	Referent	Referent	Referent	Referent	Referent	Referent
Some college of Vocational	1.36 (0.53, 3.70)	1.28 (0.47, 3.48)	0.88 (0.26, 2.98)	0.49 (0.09, 2.55)	0.87 (0.51, 1.46)	2.04 (0.64, 6.44)
High School Diploma	0.79 (0.39, 2.51)	1.46 (0.65, 3.30)	1.60 (0.47, 5.53)	0.55 (0.15, 2.02)	0.54 (0.27, 1.08)	0.60 (0.17, 2.14)
Working Status						
Employed	Referent	Referent	Referent	Referent	Referent	Referent
Unemployed	1.05 (0.32, 3.41)	1.35 (0.29, 6.22)	0.69 (0.20, 2.35)	**3.20 (1.30, 7.85)**	0.90 (0.57, 1.41)	0.91 (0.13, 6.27)
Household Tenure						
Own	Referent	Referent	Referent	Referent	Referent	Referent
Rent/Other	1.24 (0.57, 2.70)	0.98 (0.36, 2.68)	2.03 (0.58, 7.10)	0.67 (0.31, 1.43)	1.08 (0.64, 1.81)	0.68 (0.17, 2.65)
Federal Poverty Level						
300% FPL or above	Referent	Referent	Referent	Referent	Referent	Referent
200-299% FPL	1.05 (0.36, 3.07)	1.41 (0.50, 3.94)	0.31 (0.08, 1.17)	0.42 (0.06, 2.80)	1.90 (0.81, 4.46)	0.80 (0.05, 13.73)
100-199% FPL	1.29 (0.62, 2.69)	0.84 (0.23, 3.16)	0.62 (0.13, 2.98)	1.55 (0.30, 8.15)	0.74 (0.38, 1.45)	1.27 (0.14, 11.74)
0-99% FPL	0.99 (0.39, 2.51)	0.78 (0.29, 2.12)	1.21 (0.34, 4.30)	0.93 (0.19, 5.54)	1.12 (0.51, 2.42)	1.75 (0.15, 20.28)
Health Behaviors						
General Health Status						
Excellent	Referent	Referent	Referent	Referent	Referent	Referent
Very Good	2.05 (0.24, 17.50)	1.37 (0.32, 5.90)	1.07 (0.07, 16.93)	0.37 (0.002, 45.89)	4.23 (0.65, 27.76)	7.72 (0.98, 60.88)
Good	2.15 (0.28, 16.80)	3.67 (0.68, 19.96)	3.67 (0.44, 30.49)	1.59 (0.28, 9.08)	6.07 (0.95, 38.61)	8.51 (0.87, 83.74)
Fair/Poor	3.16 (0.41, 24.18)	4.53 (0.71, 28.78)	7.82 (0.85, 71.98)	3.84 (0.89, 16.55)	**7.63 (1.06, 55.14)**	**25.57 (2.24, 292)**
BMI[3]						

Underweight or Normal 0-24.99	Referent	Referent	Referent	Referent	Referent	Referent
Overweight or Obese 25+	1.68 (0.84, 3.36)	**2.82 (1.51, 5.30)**	1.63 (0.77, 3.43)	0.96 (0.34, 2.65)	**2.11 (1.23, 3.62)**	1.19 (0.40, 3.55)
Smoking Status						
Never Smoked	Referent	Referent	Referent	Referent	Referent	Referent
Quit Smoking	1.88 (0.63, 5.66)	0.56 (0.20, 1.55)	**5.71 (2.03, 16.06)**	2.19 (0.48, 10.00)	1.30 (0.62, 2.72)	1.57 (0.37, 6.56)
Currently Smokes	0.72 (0.10, 5.42)	1.57 (0.38, 6.49)	**6.43 (2.20, 18.78)**	0.75 (0.12, 4.72)	0.79 (0.33, 1.92)	3.71 (0.85, 16.16)
Alcohol Consumption						
No	Referent	Referent	Referent	Referent	Referent	Referent
Yes	0.84 (0.39, 1.80)	0.74 (0.42, 1.31)	1.19 (0.49, 2.92)	**0.18 (0.04, 0.85)**	0.79 (0.48, 1.31)	2.10 (0.62, 7.06)
Walked for 10 Minutes						
Yes	Referent	Referent	Referent	Referent	Referent	Referent
No	1.37 (0.70, 2.68)	0.83 (0.36, 1.89)	0.90 (0.32, 2.55)	1.10 (0.49, 2.47)	0.83 (0.46, 1.51)	1.16 (0.12, 10.91)
Fast Food Consumption in last week						
No	Referent	Referent	Referent	Referent	Referent	Referent
Yes	1.60 (0.62, 4.13)	1.07 (0.17, 6.53)	1.50 (0.49, 4.60)	1.43 (0.05, 36.62)	0.92 (0.44, 1.94)	0.73 (0.14, 3.96)
Soda Consumption in last week						
No	Referent	Referent	Referent	Referent	Referent	Referent
Yes	0.25 (0.06, 1.10)	0.52 (0.19, 1.14)	0.79 (0.29, 2.18)	0.24 (0.04, 1.35)	0.57 (0.29, 1.12)	0.17 (0.02, 1.39)
Neighborhood & Environmental Factors						
Fresh Fruit/Vegetable Available						
Always/Usually	Referent	Referent	Referent	Referent	Referent	Referent
Never/Sometimes	0.63 (0.19, 2.12)	2.11 (0.71, 6.30)	2.23 (0.68, 7.28)	0.54 (0.24, 1.32)	1.59 (0.72, 3.54)	1.32 (0.19, 9.03)
Fresh Fruit/Vegetable Affordable						
Always	Referent	Referent	Referent	Referent	Referent	Referent
Usually	0.74 (0.39, 1.40)	1.44 (0.73, 2.80)	0.59 (0.12, 2.79)	1.40 (0.58, 3.36)	0.71 (0.39, 1.29)	0.95 (0.10, 9.37)
Never/Sometimes	1.25 (0.60, 2.60)	0.81 (0.30, 2.22)	0.73 (0.17, 3.09)	**3.17 (1.30, 7.73)**	1.26 (0.57, 2.76)	0.71 (0.06, 7.95)
Neighborhood Social Cohesion[4]						
Strong	Referent	Referent	Referent	Referent	Referent	Referent
Weak	1.39 (0.69, 2.80)	0.73 (0.31, 1.72)	2.05 (0.87, 4.80)	0.76 (0.24, 2.41)	1.03 (0.44, 2.42)	0.62 (0.04, 9.66)
Neighborhood Safe						
All the time	Referent	Referent	Referent	Referent	Referent	Referent
Most of the time	0.66 (0.33, 1.33)	1.73 (0.70, 4.33)	1.21 (0.44, 3.33)	2.30 (0.65, 8.19)	0.94 (0.55, 1.61)	0.86 (0.15, 4.83)
Some/None of the time	0.50 (0.15, 1.67)	**4.90 (1.90, 12.63)**	0.49 (0.12, 1.90)	**3.60 (1.51, 8.57)**	0.39 (0.12, 1.26)	0.96 (0.10, 9.31)

Bolded values represent statistically significant values

*Survey weights were used to produce these estimates1) For Korea and Vietnamese the models used 0 or 1 (ref), 2, 3+

2) Score based on years in US and English proficiency added together. Years in US: 0 = Born in US, 1=15+ years in US, 2=10-14 years, 3=5-9 years, 4= <5 years. English proficiency: 0 = Only speaks English, 1=very well/well, 2= not well/not at all

3) BMI = Body Mass Index

4) Based on three factors of people in neighborhood gets along, willing to help each other, and are trusted

Figure 1: Plot of Asian American ethnicities and Non-Hispanic Whites diabetes prevalence after adjustment of sex and age.