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Risk Factors for Cardiometabolic Disease among Pacific Islanders in California: Results from the California Health Interview Survey

THESIS

Submitted in partial satisfaction of requirements for the degree of

MASTER OF SCIENCE

Epidemiology

by

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DEDICATION

To

My parents, Mohammed and Faresha Faruk, for teaching me to dream, allowing me to pursue my dreams and being there for me when I faltered.

My sister, Fauziya Faruk, for putting up with me while I stole all the attention, and “set the bar too high”. For reminding me that I have someone that looks up to me.

My best friend, Ruddy Calderon, for unfailingly supporting me, and taking care of me when I would forget to take care of myself.

To the rest of my family, for always showering me with love and support.

Thank you for believing in me.

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LIST OF ABBREVIATIONS

CHIS California Health Interview Survey

BMI Body Mass Index

OR Odds Ratio

PI Pacific Islanders

API Asian Pacific Islanders

CVD Cardiovascular Disease

FPL Federal Poverty Level

SAS Statistical Analysis System

WHO World Health Organization

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ABSTRACT OF THE THESIS

Risk Factors for Cardiometabolic Disease among Pacific Islanders in California: Results from the California Health Interview Survey

By

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Master of Science in Epidemiology

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Professor Hoda Anton-Culver, Chair

Pacific Islanders are often analyzed as a subset of the Asian population. There is a lack of research on the Pacific Islander population in California. Although the Pacific Islander population in the United States is rather small, it is still important to study. The objective of this study determined the risk factors for these cardiometabolic disease conditions in Pacific Islanders. The prevalence of diabetes, high blood pressure, and overweight/obesity were examined in Pacific Islanders, and risk factors associated with these conditions were examined in Pacific Islanders. We found that Pacific Islanders had a weighted prevalence of diabetes that was intermediate in comparison to other race groups. Hypertension was lower than the overall sample prevalence and most race groups. Overweight and obesity prevalence was second highest in the Pacific Islander population. It was also found that the risk factors associated with each disease outcome differed between Pacific Islanders and Whites. Smoking status, high blood pressure, and high BMI were associated with odds of diabetes. Insurance status, diabetes, and high BMI were associated with odds of high blood pressure. Diabetes, high blood pressure, and sex were associated with odds of high BMI in Pacific Islanders.

Chapter 1: Introduction & Background

The Asian Pacific Islanders (API) population has historically been known to have lower rates of diabetes and cardiometabolic diseases compared to the overall California population, however, new research has shown this may be changing. [3] Previous studies have found that overall health among API varies across socioeconomic status.[2] Compared to Whites, the API population is more likely to be diagnosed with stroke.[7] The API population compared to Whites, may have higher rates of patients diagnosed at younger ages with cardiometabolic disease. [8] They also may have a higher prevalence of diagnosed cases of diabetes, hypertension and obesity. [7] As diabetes and other cardiometabolic risk factors increase in prevalence in the United States, they are steadily increasing in the API population as well. [4] Many studies have found that pooling Asian and Pacific Islanders together decreases the risk of the overall group.[5] As each subgroup within the API grouping has different prevalence of diseases.[3] This study focuses on identifying the differences in cardiometabolic diseases and factors associated with disease prevalence in the Pacific Islander population. We were interested in the Pacific Islander population in California due to the lifestyle differences in California. From 2000 to 2010 Pacific Islanders account for about .4% of the California population.[9] Studies on Pacific Islander men in California illustrate men with higher body mass index (BMI) have less risk of diabetes and, other risk factors are not associated with BMI.[6] Overweight and obesity is an ongoing issue among the API population, and men are more likely to fall into the stereotype of large/obese.[10] These findings are controversial as other studies have found that higher BMI among Pacific Islanders was related to diabetes, hypertension and MI.[5]

This project will use data from the California Health Interview Survey (CHIS) pooled over ten years (2001-2009). CHIS is the largest state-level survey currently available.[14] CHIS does not use a simple random sampling technique used in most studies. Therefore the variance cannot be calculated by default in statistical software.[14] Data collection for CHIS is done in two steps, the first step random phone numbers are selected per county.[14] The second step chooses one adult member from the household, this member is then contacted for interview.[14] Due to this data collection method, CHIS data needs to account for the weighted variables.[14] The outcomes of interest are specifically diabetes, and other cardiometabolic risk factors associated with diabetes; obesity and hypertension. The covariates to investigate are, lifestyle factors that are similarly documented throughout the years, and socioeconomic factors, and diabetes, hypertension, BMI interchangeably when they are each not the outcome

Background

Per the Department of Health for minorities, diabetes is among the top five leading causes of death for the Pacific Islander population.[5] About 30 percent of Fijians are obese, with 80 percent of American Samoan women being obese.[5] This seems to be associated with the increase in importation of food from other countries, but also the poor health care availability.[4] Hypertension in Native Hawaiian/Pacific Islanders, according to the State of Hawaii, indicate that Pacific Islanders are 1.6 times more likely to have hypertension than Whites.[9]

According to the WHO, about 40% of the population in the pacific island region has been diagnosed with cardiovascular disease, diabetes and hypertension and three-quarters of all deaths in the pacific islands can be accounted for by these diseases.[2]

The two major types of diabetes affecting the population are type 1 and type 2 diabetes mellitus.[6] Type 1 diabetes, where the immune system attacks and destroy the pancreatic cells that create insulin, resulting in the body not having the ability to produce insulin and patients become dependent on synthetic insulin.[6] Type 2 diabetes occurs when the body cannot properly use or create insulin, it is the most common type of diabetes and can occur at any age.[11] Metabolic syndrome is a term coined towards a collection of cardiovascular disease risk factors including elevated glucose, dyslipidemia, hypertension, and abdominal obesity.[8]

Hypertension or high blood pressure is defined by increased pressure on the blood vessels which increases the strain on the heart and risk of heart attack or stroke.[14] Hypertension accounts for 47% of all ischemic heart disease events.[2] The risk for coronary heart disease increases incrementally as blood pressure rises about 115/75 mmHg.[2] The risk for coronary heart disease in Pacific Islanders is 1.1 times higher than Whites in Hawaii.[9] According to the American heart association, high blood pressure has been revised to 140/60 mmHg.[1] Studies done on hypertension, have shown that the Pacific Islander population had a lower medication adherence and a lower hypertension education.[13] A survey done on the Tongan and Samoan population in California, found that overall both Samoans and Tongans have a lower risk of hypertension than other Californians.[12] Another study done in California on Pacific Islanders found that they have lower rates of hypertension compared to other race groups, they also found that those with hypertension are less aware of healthy behaviors.[13]

Being overweight or obese is a very prominent issue among the Pacific Islander population. Pacific Islander men are more likely to fall into the stereotype of large/obese.[5] A study focusing on Tongan and Samoan men in the United States found that being overweight or obesity started from a younger age in Pacific Islander men compared to white adult males in the United States.[10] They found that overall obesity reduced the risk of having more than one health disparity in these men. They also found that these overweight/obese men had a lower risk of diabetes.[10] BMI may not be well representative of obesity in the Pacific Islander population as the population is particularly seen as being “obese” a better indicator of obesity may be body fat percentage.[10] A BMI from 18.5 to 25 kg/m^2 falls within the normal range, and 25 to 30 lies in overweight, BMI 30-40 is considered obese and a BMI of over 40 is considered morbidly obese. The highest risk of cardiovascular disease lies in the overweight or obese groups, so it is important to analyze the risk of CVD by obesity status among the Pacific Islander populations.[3] Many risk factors such as lifestyle and environment are related to increased BMI such as diet and smoking. [3] Previous studies have had inconsistent results regarding risk factors, thus researching the risk factors of cardiometabolic diseases within Pacific Islander populations is important to properly understand the underlying risk of CVD.

Research Question and Public Health Relevance

Research Question

To determine if there is an increased prevalence of diabetes, high blood pressure and overweight/ obesity among Pacific Islanders in California compared to Whites and identify risk factors associated with these conditions.

Public Health Relevance:

The Pacific Islander population has been constantly underrepresented in biomedical research while the burden of cardiometabolic diseases in the population seems to be rising. This study will bridge the gap in knowledge related to the association between obesity, diabetes, and hypertension among the Pacific Islander population in California. The results may be informative for future interventions targeting lifestyle factors specific to the Pacific Islanders.

Chapter 2: Aims

Specific Aim 1

Use the California Health Interview Survey Data to estimate prevalent rates of cardiometabolic disease within the Pacific Islander population (2001-2009).

The first aim of this study is to determine if there is an increase in the prevalence of obesity, hypertension, and diabetes among the Pacific Islander population compared to other ethnic groups.

Hypothesis: Pacific Islanders will have an increased prevalence of these cardiometabolic disease conditions compared to other ethnicities.

Specific Aim 2

To analyze the difference among risk factors associated with these cardiometabolic disease conditions, between Pacific Islanders and Whites.

Hypothesis: Pacific Islanders who smoke, have other cardiometabolic syndrome outcomes, or have a lower educational attainment, will have a higher prevalence of these cardiometabolic disease conditions compared to Whites. However, work status, marital status, and medical insurance status may not significantly associated with cardiometabolic outcomes.

Chapter 3: Methods

Population of Study

CHIS data was from 2001 to 2009, with a total sample of 239,996 adults. The CHIS study sample includes men and women age 18-90. The average age of the population was about 47 years, and 49 percent of the population was male, with 51 percent female. For the population break down by race group please refer to Figure 1. The population surveyed was from California, and every year the sample population differs, decreasing the risk of duplicates across years. Due to the dual stage sampling, each geographic region within California is well represented.

Design

Data Source and Definitions

This project would be considered a cross-sectional study, nine years of CHIS data from the years 2001-2009 will be pooled. From 2001-2009 CHIS data was conducted every two years, starting in 2010 the surveys were conducted yearly. Although pooling was still possible between the biennial and yearly surveys, we were advised against it, to avoid any weighting complications. CHIS is the largest state-based health survey in the United States and is conducted over the telephone via random digit dialing. The survey is conducted yearly and thousands of California households are selected as part of the sample, to represent the diverse state population. Counties and regions are well represented as a multistage sample design is implemented, every county is broken into 44 geographic strata and 14 sub-groups for landline calls. The mobile phone calls only take up twenty percent of the sample and the rest are all landline calls. Adults, children, and teens are all included in the CHIS surveys, but for

purposes of this research project, we are only interested in the adult population. The sample was chosen for CHIS in a dual stage random digit dialing method, in order to increase the external validity of the data, proper weights need to be applied. Weighing the data allows statisticians to calculate the estimates of the health characteristics for the entire California population including counties and cities. The weighting procedure used with CHIS decreases the variance, and any selection bias, but also adjusts for over-sampling in certain populations and under-sampling in others. Due to the relatively small sample size of Pacific Islanders, we decided to pool 9 years of data to increase the power of analysis done among the Pacific Islander groups. Only certain variables were included in the analysis due to inconsistencies in data collection throughout the surveys. Variables that were not collected every year were not included in the analysis.[9]

Variable Definitions

Outcome Variables

Diabetes is questioned in different ways but the questions that interest the study are, “Has the doctor ever told you, that you have diabetes or sugar diabetes?”, “Are you now taking insulin”, and “Do you now take diabetic pills to lower your blood sugar?”. It is important to include all three to account for participants that believe that managing diabetes would mean they do no longer have the disease. Hypertension is similarly questioned and continues to be consistent throughout the survey years just as diabetes including; "Has a doctor ever told you that you have high blood pressure?", "Are you now taking any medications to control your high blood pressure?". Participants refusing to respond and responding as don't know, pre-diabetes, or pre-hypertensive were excluded from the study. BMI was calculated using self-reported height and weight, and

overweight to obese factor was determined using the BMI cutoff points. BMI over 25 kg/m^2 were considered overweight and BMI over 30 kg/m^2 was determined to be obese.[9]

Covariates

To properly capture the different languages spoken in California the surveys were conducted in different languages including English, Spanish, Chinese (Cantonese and Mandarin), Japanese, Korean, and Vietnamese.[9] These languages were derived from the 2000 census as most commonly spoken languages in the State of California, this was a great way to be all inclusive and decrease language barrier issues while conducting the surveys.[9] Topics investigated included information about health status, health conditions, mental health, health behaviors, women's health, dental health, food insecurity and hunger, access to and use of health care, health insurance, public program eligibility, neighborhood, interpersonal violence, child care, school attendance, employment, income, and the interviewee demographic characteristics. All questions were self-reported and there was no medical record verification, however, not all variables are included in the analysis as not all were of interest to this study. [9]

General health status is a participant opinion question as they are asked if generally, they would categorize their health as excellent, very good, good or poor. We also included questions about heart disease, so that it can be adjusted for in the analysis; " Has the doctor ever told you, that you have any kind of heart disease?" and "Has a doctor ever told you that you have heart failure or congestive heart failure?".

Smoking is always an important health behavior to consider due to its positive association with multiple diseases, questions we asked included “Have you smoked 100

or more cigarettes in your entire lifetime?” as this is the cutoff number used to represent a “smoker”. We also included more specific smoking questions “Do you now smoke cigarettes every day, some days, or not at all?” and “On the average, how many cigarettes do you now smoke a day?” . Alcohol consumption is included in the analysis also and the only consistent question throughout the surveys was “ Have you had alcohol in the past 30 days?”.[9]

Educational attainment was based on the response to the question “What is the highest grade of education you have completed and received credit for?”. Work status last week, was the most consistent way of analyzing work pattern, as it was the only consistent variable on work status throughout the survey years it is actually worded as “What were you doing last week?” and the options including working at a job, looking for work, or not working to follow up on this we include a question about reason why not working and the options include vacation, sick time, or unemployed and more.[9]

Nutrition was not questioned similarly throughout the years, 2003 had a detailed questionnaire about food intake but it was not replicated, so in order to account for nutrition we used the questions about balanced meals. This question encompassed diet, and socioeconomic status: "(I/We) couldn't afford to eat balanced meals." Was that often true, sometimes true, or never true for you and your household in the last 12 months?”[9]

Income was denoted by the households total annual income, we categorized the continuous variable by less than 30,000USD, 31,000USD- 50,000USD, 51,000USD-70, 000USD, 71, 000USD - 90,000USD and 91,000USD or more. In our analysis 51,000USD- 70,000USD total annual income was used as the reference. Insurance

status was also questioned based on currently insured and any insurance in the past year. Marital status was questioned including all statuses but not the number of marriages a person may have had. Race was determined by “which you most identify with”, and age was determined by the date of birth, gender was “male or female”.[9]

Statistical Methods

CHIS public use data was analyzed in using SAS 9.2 statistical software (SAS Institute, Inc., Cary, NC), and all analyses include the CHIS designed replicate weights to account for complex study sampling. Statistical significance was fixed at a p-value of less than 0.05. Strata and cluster variables were only available in the confidential datasets, and were not necessary to use with replicate weight analysis. The covariates can be categorized as lifestyle or health-based. Lifestyle factors include employment, education, marital status, smoking, drinking, age and sex. Health-based factors include medical insurance, diabetes, hypertension, and obesity.

Aim 1 Methods

The first aim of the study was to determine the prevalence of diseases by race group. The prevalence of each disease outcome, by race, was determined by dividing cases of disease by the population of each race group after applying the appropriate replicate weights to the sample. The survey frequency procedure in SAS was utilized to determine appropriate weighted disease prevalence.

Aim 2 Methods

The second aim of the study focuses on the association between all the covariates independently with disease outcomes, and the differences between Pacific Islanders and Whites. All covariates may be associated with cardiometabolic diseases,

so first we analyzed them independently, and then adjusted for other variables. This aim focused on analyzing the different factors and studying whether these factors were associated with diabetes, hypertension, and overweight/obesity or not.

Variable Selection

Forward and backward selection algorithms were utilized to determine which covariates to include in the model with a inclusion p-value of 0.20. Individual logistic regression models for each outcome of interest (diabetes, high blood pressure, and overweight/obesity) were run for Pacific Islanders. Variable selection for the White group, for each outcome of interest, was determined using forward and backward selection as well. Adjusted odds ratios were obtained after running the logistic regression for each model. The groups were then compared to one another to determine the differentiation between factors associated with cardiometabolic disease prevalence.

Bivariate Analyses

Logistic regression analysis was implemented for; work status, sex, education, medical insurance status, marital status, heart disease, smoking status, diabetes, hypertension, and obesity for all Pacific Islanders and Whites. A bivariate logistic regression was utilized to examine the independent association of each variable and outcome. Every variable was analyzed for an association with diabetes, high blood pressure and overweight/obesity outcomes among both Pacific Islanders and Whites. Unadjusted odds ratios were extrapolated from these bivariate logistic regression analyses.

Multivariate Analysis

Adjusted models will include; sex, education, medical insurance status, marital status, smoking status. These covariates are important to include, and adjust for, to increase the external validity of the study. There are multiple covariates to consider so it would be best to run a multivariate logistic regression with all the variables in the model. Multivariate logistic regression analyses were implemented to determine the odds of disease in the overall sample, and then separately in Pacific Islanders compared to Whites. In the overall logistic regression model with race, we used Whites as the reference group. Diabetes, hypertension, and overweight/obesity were used as outcomes for each logistic regression model. When predicting one of these conditions the other diseases were included as independent variables in the regression model, for example when predicting diabetes, high blood pressure and overweight/obesity were included as independent variables.

Weighting

The weighting and variance accounted for the data collection method. A code is provided by CHIS to use in SAS for proper variance calculations considering the weighted variables [9]. Using the weights allowed for standardization across the population and increases the external validity. Overall the Pacific Islander population was compared to each ethnicity present in the CHIS population to examine differences by outcome.

Chapter 4: Results

Descriptive Statistics

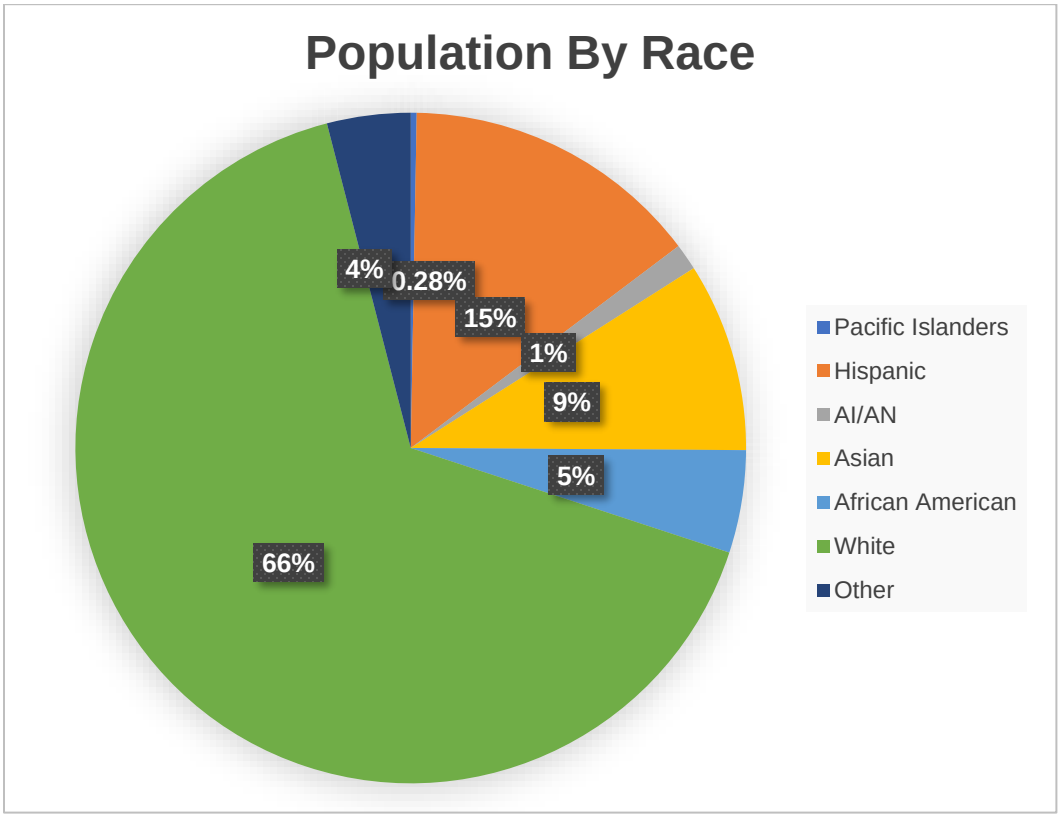

Figure 1 Study population by Race/Ethnicity

Figure 1 shows a breakdown of the sample population by race in the CHIS dataset. Pacific Islanders are the smallest population group taking up only .28 percent, followed by Alaskan Indian/American Natives that only account for 1 percent. Hispanics and Asians were better represented than African Americans in this sample population. The largest and best represented race group in the sample population was Whites.

Table 1.1 Participant Descriptive Characteristics by Race

	Race																
Demographic Characteristics	**Pacific Islander** n=681 (N=108286)		**Hispanic** n=34639 (N=6367973)		**AI/AN** n=3057 (N=259639)		**Asian** n=21869 (N=3258518)		**African American** n=11871 (N=1567620)		**White** n=158217 (N=13285732)		**Other** n=9662 (N=1354399)		**Total** n=239996 (N=26202165)		**P-Val**
Age (Mean)	44.7		40.7		50		47.2		49.7		54.8		47.1		51.4		<.0001
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Gender																	<.0001
Male	304	44.6	14398	41.6	1261	41.3	9450	43.2	4349	36.6	64567	40.8	3931	40.7	98260	40.9	
Female	377	55.4	20241	58.4	1796	58.8	12419	56.8	7522	63.4	93650	59.2	5731	59.3	141736	59.1	
BMI																	<.0001
Underweight	81	11.9	2952	8.5	287	9.4	3825	17.5	926	7.8	18247	12.5	713	7.4	27031	11.4	
Normal Weight	229	33.6	11529	33.3	966	31.6	12094	55.3	3792	31.9	65369	41.3	3390	35.8	97369	41.1	
Overweight/ Obese	360	52.8	19329	55.8	1774	58	5573	25.5	7057	59.5	73112	46.2	5484	56.8	112689	47.5	
Diabetes																	<.0001
Yes	84	10.4	3264	9.4	434	14.2	1613	7.4	1525	12.9	11804	4.9	999	10.3	19710	8.2	
No	597	89.6	31375	90.6	2623	85.8	20256	92.5	10346	87.1	146413	95.1	8663	89.7	220286	91.8	
General Health																	<.0001
Excellent	107	15.7	4608	13.3	461	15.1	3780	17.3	1816	15.3	36107	22.8	1711	17.7	48590	20.3	
Very good	221	32.5	7283	21.0	790	25.8	6126	28.0	3479	29.3	56771	35.9	2623	27.2	77293	32.2	
Good	222	32.6	12384	35.8	916	30.0	6814	31.2	3674	31.0	41305	26.1	3001	31.1	68316	28.5	
Fair	90	13.2	8523	24.6	542	17.7	3737	17.1	2077	17.5	17081	10.7	1738	18.1	33788	14.1	
Poor	41	6.0	1832	5.3	348	11.4	1405	6.4	822	6.9	6926	4.3	588	6.1	11962	4.9	
Hypertension																	<.0001
Yes	196	28.8	7192	20.8	1150	37.6	5412	24.8	5061	42.6	52127	21.7	2810	29.1	73948	30.8	
No	485	71.2	27447	79.2	1907	62.4	16457	75.2	6810	57.4	106090	78.3	6852	70.9	166048	69.2	
Heart Disease																	<.0001
Yes	53	7.8	1552	4.5	424	13.9	1245	5.7	1048	8.8	17286	7.2	726	7.5	22334	9.3	
No	628	92.2	33087	95.5	2633	86.1	20624	94.3	10823	91.2	140931	92.8	8936	92.5	217662	90.7	
Total	681	0.3	34639	14.4	3057	1.3	21869	9.1	11871	4.9	158217	65.9	9662	4.0	239996	100.0	

Table 2.2 Participant Descriptive Characteristics by Race

	Race																
Demographic Characteristics	Pacific Islander n=681 (N=108286)		Hispanic n=34639 (N=6367973)		AI/AN n=3057 (N=259639)		Asian n=21869 (N=3258518)		African American n=11871 (N=1567620)		White n=158217 (N=13285732)		Other n=9662 (N=1354399)		Total n=239996 (N=26202165)		P-Val
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Alcohol last 30 days																	<.0001
Yes	375	55.1	18126	52.3	1641	53.7	10926	50.0	6416	54.1	110711	70.0	5965	61.7	154160	64.2	
No	324	44.9	16513	47.7	1416	46.3	10143	50.0	5455	45.9	47506	30.0	3697	38.3	85836	35.8	
Smoker																	<.0001
Currently Smoking	147	21.6	4195	12.1	887	29.1	2370	10.8	2247	18.9	23197	14.7	1544	16.0	34587	14.4	
Quit Smoking	140	20.6	6139	17.7	921	30.1	3534	16.2	2914	24.6	54467	34.4	2346	24.3	70461	29.4	
Never Smoked	393	57.7	24276	70.1	1244	40.7	15947	72.9	6693	56.4	80335	50.8	5767	59.7	134655	56.2	
Education																	<.0001
Highschool	380	60.5	14866	68.3	1717	67.7	6727	30.8	6063	56.2	69643	46.4	4559	58.1	103955	48.3	
Some College	130	20.7	2877	13.7	457	18.0	4503	20.6	2378	22.3	35801	23.8	1510	19.3	47656	22.3	
BA/BS Degree	100	15.9	2871	13.3	302	11.9	7212	33.0	2039	18.9	37277	24.6	1435	18.3	51236	24.1	
Graduate School	17	2.7	264	1.2	55	2.2	1225	5.6	307	2.8	7734	5.1	235	3.0	9837	4.6	
No Formal Education	1	0.2	751	3.5	7	0.3	158	0.7	7	0.1	68	0.1	104	1.3	1096	0.01	
Work Status																	<.0001
Working	414	60.8	21162	61.1	1539	50.3	12892	59.9	6604	55.6	86901	54.9	5442	56.3	134954	56.2	
Unemployed	267	39.2	13477	38.9	1518	49.7	8977	41.1	5267	44.4	71316	45.1	4220	43.7	105042	43.8	
Couldn't afford food																	<.0001
Inapplicable	465	68.3	13639	39.4	1712	56.0	14421	65.9	7380	62.2	125000	79.1	5503	57.1	168120	70.1	
Often True	18	2.6	1641	4.7	209	6.8	617	2.8	390	3.3	2299	1.5	387	4.1	5561	2.3	
Sometimes True	56	8.2	6816	19.7	348	11.4	1570	7.2	1177	9.9	5610	3.6	1230	12.7	16807	7.2	
Never True	140	20.6	12347	35.6	779	25.5	5189	23.7	2897	24.4	25064	15.8	2523	26.1	48939	20.4	
Currently Insured																	<.0001
Yes	603	88.6	24970	72.1	2597	85.0	18883	86.4	10728	90.4	147043	92.9	7962	82.4	212786	88.7	
No	78	11.5	9669	27.9	460	15.1	2986	13.7	1143	9.6	11174	7.1	1700	17.6	27210	11.3	
Marital Status																	<.0001
Married	343	50.4	18213	52.6	1304	42.7	14050	64.3	3807	32.1	81892	51.8	4687	48.5	124296	51.8	
Widowed/Divorced	202	29.7	9202	26.6	1258	41.2	3547	16.2	4787	40.3	54763	34.6	3113	32.2	76872	32.1	
Never Married	134	19.7	7192	20.8	493	16.1	4251	19.4	3267	27.5	21475	13.6	1848	19.1	38660	16.1	

Table 1.1 indicates that there are significant differences in participant demographic characteristics across race categories. There are 239,996 participants in the dataset, Pacific Islanders had the smallest population in the study (N=108286). Average age was lower in Pacific Islanders than Whites but was higher than Hispanics. As shown in Table 1.1 race categories were similar in proportion of males to females. Across almost all race categories there were more overweight or obese participants than normal weight, the only exception was for Asians. Due to the relatively small number of underweight

participants across race, we excluded the underweight population from our analyses. Diabetes percentage varies by group but was highest in the Alaskan Indian and American Native group, followed by African American and Pacific Islanders. Hypertension varies significantly by race group, the lowest percent was among Hispanics followed by Pacific Islanders. Table 1.2 indicates that across all race groups slightly more than half of the population has consumed at least one drink of alcohol in the last 30 days, with more than 70% of White participants that drank alcohol in the last 30 days. Overall in each race group there were more “never smokers” than current smokers or past smokers. Educational attainment varied by groups but followed a decreasing pattern with a majority of participants with only a high-school education, in Asians however there were more participants with a Bachelor’s degree.

Prevalence of disease among Pacific Islanders

Table 2 Weighted Prevalence and Frequency of Cardiometabolic Disease by Race

	Race								
Disease	Pacific Islander	Hispanic	AI/AN	Asian	African American	White	Other	Total	P- Value
	% (Weighted Freq)	% (Weighted Freq)	% (Weighted Freq)	% (Weighted Freq)	% (Weighted Freq)	% (Weighted Freq)	% (Weighted Freq)	% (Weighted Freq)	
Diabetes	8.8 (8895.4)	8.6 (514160)	15.1 (38343.5)	7.0 (193883)	11.3 (164122)	6.4 (766950)	9.9 (126770)	7.6 (1813123)	<.0001
High Blood Pressure	16 .0 (16145.4)	10.3 (613230)	23.8 (57189.9)	17.9 (491881)	27.3 (395571)	20.2 (2402277)	15 .0 (192549)	17.6 (4168843)	<.0001
Overweight & Obesity	65.8 (65980)	64.0 (3739840)	67 .0 (78763.8)	32.8 (892036)	62.3 (918968)	52.9 (6267716)	62.0 (791740)	54.7 (12840000)	<.0001

Table 2 shows the weighted prevalence of each cardiometabolic disease by race group. The Rao Scott chi square test indicated that the weighted prevalence of disease was significantly different across race groups. After applying appropriate weights the prevalence of disease in all race groups decreased.

Diabetes Prevalence

As shown in Table 2 within each race group, diabetes was the least prevalent in Whites. Diabetes weighted prevalence was lowest in the White group, and highest in the AI/AN group, differing significantly across race ($p<.0001$). Pacific Islanders weighted diabetes prevalence was higher than Hispanics and Whites but less than AI/AN. Overall the weighted prevalence of diabetes in the sample was less than 10 percent. Although the percentages seem relatively similar, the race groups are statistically significant in difference of diabetes prevalence.

High Blood Pressure Prevalence

The Rao-Scott Chi square test indicates that the weighted prevalence of hypertension differs by race group. Weighted prevalence of high blood pressure in Pacific Islanders was higher than Hispanics and Others but lower than the overall sample weighted prevalence. The African American weighted high blood pressure prevalence is more than 1.5 times larger than the high blood pressure prevalence in Pacific Islanders. High Blood pressure weighted prevalence was only 10 percent in the Hispanic group, the lowest across all race groups, and highest among African Americans at about 27 percent.

Overweight/obese Prevalence

The overweight and obese weighted prevalence was shown to be statistically significantly different across race, by the Rao-Scott Chi square test. Overweight and Obesity were clumped into one category, the lowest prevalence of overweight and obesity was about 33 percent in the Asian group. All other race groups have more than a 50 percent weighted prevalence of being overweight or obese. The highest prevalence was in the AI/AN group followed by the Pacific Islanders.

Table 3 Overall Sample Odds of Cardiometabolic Disease Condition

	Cardiometabolic Condition		
	Diabetes	**High Blood Pressure**	**Overweight/Obesity**
Covariates	OR (95% CI)	OR (95% CI)	OR (95% CI)
Race			
Whites	Ref	Ref	Ref
Pacific Islanders	1.25 (1.17-1.32)**	0.65 (0.45-0.94)*	1.76 (1.32-2.35)***
Hispanics	1.22 (1.12-1.32)***	0.38 (0.35-0.40)**	1.69 (1.62-1.76)***
AI/AN	1.98 (1.58-2.48)*	0.82 (0.70-0.98)*	1.72 (1.50-1.98)***
Asians	1.17 (1.04-1.33)***	0.99 (0.92-1.07)	0.42 (0.39-0.45)***
African Americans	1.33 (1.18-1.48)***	1.35 (1.2501.45)**	1.49 (1.38-1.60)***
Others	1.43 (1.17-1.75)**	0.59 (0.52-0.66)***	1.51 (1.38-1.64)***
BMI			
Normal	Ref	Ref	----
Overweight/Obese	2.11(1.98-2.36)***	2.00(1.92-2.08)***	----
High Blood Pressure			
No	Ref	Ref	Ref
Yes	6.62 (6.21-7.06)***	----	2.08 (2.00-2.16)***
Diabetes			
No	----	Ref	Ref
Yes	----	5.71(5.31-6.13)**	2.12 (1.98-2.26)***
Sex	----		
Male	Ref	Ref	Ref
Female	----	----	0.57 (0.55-0.59)***
Smoking Status			
Never Smoker	Ref	Ref	Ref
Current Smoker	1.15(1.06-1.27)**	0.86 (0.81-0.93)**	----
Past Smoker	1.53 (1.43-1.63)***	1.70 (1.63-1.78)**	----
Heart Disease			
No	Ref	Ref	Ref
Yes	----	0.19 (0.18-0.21)*	----

*p<0.05,**p<0.01, ***p<0.001

Table 3 shows the adjusted odds ratios for each cardiometabolic disease condition by race group. Whites were used as our reference group and the odds ratios were adjusted for variables that stayed in the model after forward and backward variable selection with a cutoff p-value of <.20. All race groups were statistically significant. All other covariates had similar results as Table 4, Table 5 and Table 6.

The diabetes model was adjusted for race, high blood pressure, high BMI, and smoking status. In the diabetes model AI/AN had the highest odds related to diabetes,

and Asians had the lowest odd associated diabetes with Whites as the reference. All covariates included in the overall model for diabetes significantly ($p>.05$) increased the odds associated with diabetes. Current smokers had a slightly smaller odds ratio associated with diabetes status compared to past smokers when using never smoking as a reference.

The model for high blood pressure was adjusted for race, diabetes, high BMI, heart disease and smoking status. African Americans had a higher odds associated with high blood pressure compared to other race groups and Hispanics had the lowest odds associated with high blood pressure with Whites as a reference. Heart disease was inversely associated with high blood pressure.

The overweight/obesity model was adjusted for race, diabetes, high blood pressure, and sex. Pacific Islanders, using Whites as a reference, had the highest odds associated with being overweight or obese in comparison to other race groups. Overall Asians have the lowest odds associated with being overweight or obese. Females had a lower odds associated with being overweight or obese than males.

Risk Factor Analyses

Table 4 Results of Diabetes Risk Factors by Race

Logistic Regression Indicators of Diabetes				
	Pacific Islanders (N=600)		**Whites** (N=139968)	
Covariates	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
High Blood Pressure				
No	1	Ref	1	Ref
Yes	7.94 (3.35-18.58)***	5.33(2.11-13.41)**	7.13 (6.71-7.59)***	4.52 (4.23-4.84)***
BMI				
Normal Weight	1	Ref	1	Ref
Overweight/Obese	3.74 (1.57-8.90)**	4.20 (1.91-9.08)*	2.81(2.63-2.90)***	2.42 (2.52-2.61)***
Education				
Highschool	1	Ref	1	Ref
Some College	0.68 (0.25-0.82)***	----	0.75(0.69-0.81)***	----
Bachelors	1.96 (0.56-6.81)	----	0.58 (0.54-0.63)***	----
Graduate Degree	0.43(0.23-1.87)	----	0.63 (0.55-0.73)***	----
Insurance				
Insured	1	Ref	1	Ref
Uninsured	0.55(0.11-0.29)	----	1.82(0.36-9.41)	----
Heart Disease				
No	1	Ref	1	Ref
Yes	5.14 (0.63-16.30)	----	4.46 (4.15-4.79)***	2.40(2.21-2.59)***
Sex				
Male	1	Ref	1	Ref
Female	1.98 (0.87-4.50)	----	0.86 (0.813-0.92)**	----
Smoking Status				
Never Smoked	1	Ref	1	Ref
Current Smoker	2.40 (0.73-7.94)	0.69(0.46-0.89)*	1.08 (0.98-1.17)	----
Quit Smoking	2.65 (1.0-7.01)	2.84 (2.08-9.64)*	1.92(1.79-2.08)**	----

*p<0.05,**p<0.01, ***p<0.001
Adjusted values are adjusted for all variables listed in the model.

Table 4 shows the unadjusted and adjusted logistic regression analysis that was run between each variable of interest and diabetes. For Pacific Islanders and Whites high blood pressure was significantly associated with an increased odds of diabetes. High BMI was also associated with a higher odds of diabetes in both race groups, however, the adjusted odds of overweight/obese Pacific Islanders was about 2 times higher than Whites. ‘Some college’ was associated with a decrease in odds of diabetes

in Pacific Islanders, prior to adjusting for other variables. For Whites the unadjusted odds associated with diabetes decreased as educational attainment increased, however education was not significant after adjusting for other variables. White females had a lower unadjusted odds of diabetes, and current White smokers had an increased odds associated with diabetes compared to never smokers. Smoking was not significantly associated with the unadjusted odds of diabetes in Pacific Islanders. Smoking status in Pacific Islanders, after adjustment for covariates, was associated with diabetes odds, as current smokers had a lower odds of diabetes, and past smokers had a significantly higher odds related to diabetes, compared to never smokers.

Table 5 Results of High Blood Pressure Risk Factors by Race

Logistic Regression of Indicators of High Blood Pressure				
	Pacific Islanders (N=600)		**Whites** (N=139968)	
Covariates	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Diabetes				
No	1	Ref	1	Ref
Yes	7.94 (3.35-18.82)**	5.32 (2.17-13.12)***	7.13(6.71-7.59)***	4.55 (4.25-4.86)***
BMI				
Normal Weight	1	Ref	1	Ref
Overweight/Obese	3.40 (1.37-8.69)***	4.20 (1.94-9.08)***	2.10(2.02-2.18)*	2.01 (1.93-2.10)***
Education				
Highschool	1	Ref	1	Ref
Some College	1.01 (0.39-2.63)	----	1.28 (1.20-1.32)**	0.80(0.76-0.85)***
Bachelors	0.83 (0.30-2.27)	----	1.57(1.49-1.65)***	0.68 (0.62-0.72)***
Graduate Degree	0.96 (0.11-8.02)	----	1.30(1.20-1.40)***	0.79(0.72-0.87)***
Insurance				
Insured	1	Ref	1	Ref
Uninsured	0.22 (0.04-1.07)	0.02 (0.03-0.29)**	0.24 (0.21-0.27)***	0.25 (0.22-0.29)***
Heart Disease				
No	1	----	1	Ref
Yes	11.4 (4.13-31.40)*	----	5.95 (5.64-6.28)***	4.89 (4.59-5.19)***
Sex				
Male	1	----	1	Ref
Female	1.19 (0.62-2.30)	----	1.14 (1.10-1.18)***	----
Smoking Status				
Never Smoked	1	----	1	Ref
Current Smoker	2.58 (1.01-6.69)*	----	2.47 (2.32-2.64)***	----
Quit Smoking	1.75 (0.74-4.13)	----	1.12 (1.05-1.19)***	----

*p<0.05,**p<0.01, ***p<0.001
Adjusted values are adjusted for all variables listed in the model.

Table 5 shows the unadjusted and adjusted odds ratios by race group for covariates associated with high blood pressure. It was shown that there are more covariates significantly associated with odds of high blood pressure for Whites, than Pacific Islanders. For both race groups, diabetes and high BMI are associated with increased odds for high blood pressure. In Whites higher education was associated with decreased odds of high blood pressure, but educational attainment was not significantly associated with odds of high blood pressure for Pacific Islanders. After

adjusting for other variables, the odds for high blood pressure in overweight or obese Pacific Islanders was almost 2 times higher than Whites. Heart disease among Whites was associated with higher odds of high blood pressure, but was not associated with adjusted odds of high blood pressure in Pacific Islanders. Not having medical insurance decreased the unadjusted and adjusted odds associated with high blood pressure in both race groups. Smoking status in Pacific Islanders was not associated with odds of high blood pressure, but was statistically significantly associated with the unadjusted odds of high blood pressure for Whites. Smoking status, heart disease, and insurance did not meet the <.020 p-value cutoff for variable selection and were not included in the adjusted model.

Table 6 Results of Overweight and Obesity Risk Factors by Race

Logistic Regression Indicators of Overweight or Obesity				
	Pacific Islanders (N=600)		**Whites** (N=139968)	
Covariates	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
High Blood Pressure				
No	1	Ref	1	Ref
Yes	3.43 (1.37-8.61)**	2.94 (1.08-7.97)**	2.10(2.02-2.18)	4.52 (4.23-4.84)***
Diabetes				
No	1	Ref	1	Ref
Yes	3.74 (1.57-8.90)**	2.99 (1.13-7.90)**	3.04(2.83-3.26)***	2.31(2.16-2.51)***
Education				
Highschool	1	Ref	1	Ref
Some College	1.26 (0.63-2.51)	----	0.83 (0.79-0.87)***	0.84(0.80-0.88)***
Bachelors	0.71 (0.33-1.54)	----	0.74 (0.71-0.78)***	0.76 (0.72-0.79)***
Graduate Degree	0.51 (0.12-2.08)	----	0.69(0.64-0.75)***	0.62(0.57-0.68)***
Insurance				
Insured	1	Ref	1	Ref
Uninsured	1.02(0.46-4.29)	----	0.98 (0.89-1.07)	----
Heart Disease				
No	1	Ref	1	Ref
Yes	1.45 (0.49-4.27)	----	1.36(1.28-1.43)***	2.40(2.21-2.59)***
Sex				
Male	1	Ref	1	Ref
Female	0.61 (0.34-1.09)	2.13(2.02-3.23)**	0.53 (0.51-0.55)***	0.52 (0.49-0.54)***
Smoking Status				
Never Smoked	1	Ref	1	Ref
Current Smoker	1.08 (0.45-2.59)	----	0.79 (0.75-0.83)***	----
Quit Smoking	0.95(0.44-2.10)	----	0.71(0.68-0.73)***	----

*p<0.05,**p<0.01, ***p<0.001
Adjusted values are adjusted for all variables listed in the model.

Table 6 indicates the unadjusted and adjusted logistic regression results of variables associated with being overweight or obese. These results are similar to variables associated with diabetes and high blood pressure for Pacific Islanders and Whites. High blood pressure and diabetes are both associated with increased odds of being overweight or obese in Pacific Islanders and Whites. Smoking in Whites was shown to be associated with a decreased unadjusted odds of being overweight or

obese, but was not the same after adjusting for covariates. After adjusting for covariates, Whites with high blood pressure however have almost 1.2 times higher odds of being overweight or obese than Pacific Islanders. Pacific Islanders with diabetes have a slightly higher adjusted odds of being overweight or obese, than Whites. Pacific Islander females had a 2.5 times higher adjusted odds of being overweight and obese than males. Unlike Pacific Islanders, White females actually had a lower odds of being overweight or obese compared to males. Heart disease increased the odds of being overweight or obese in Whites. Educational attainment, Insurance status, and heart disease were excluded from the adjusted model for Pacific Islanders, these variables did not meet the p-value cutoff of <.20 for forward and backward selection. Insurance status and smoking status were not included in the adjusted model for Whites, as they did not meet the requirements for forward variable selection.

Chapter 5: Discussion

Previous Studies

Prior research had found that Pacific Islanders that are overweight or obese would be less likely to have other cardiometabolic diseases, which our findings did not support.[10] Previous studies have also indicated that there would be a large proportion of Pacific Islanders with diabetes compared to Whites.[4] BMI, education and age were indicated in previous studies to be associated with increased rates of hypertension in Pacific Islanders.[4] Other research studies also indicate BMI may be a risk factor related to diabetes in Pacific Islanders.[6] Smoking has also been studied as being associated with a lower odds of high BMI but an increased odds of diabetes.

Summary of Major Findings

Aim 1 *Disease Prevalence*:

- To determine if there is an increase in the prevalence of obesity, hypertension, and diabetes among the Pacific Islander population compared to other ethnic groups.

Our first hypothesis was that Pacific Islanders would have a higher prevalence of diabetes, high blood pressure, and obesity than other race groups. This hypothesis was not supported by the data, as the weighted prevalence of diabetes was significantly different by race group. Although Pacific Islander's weighted diabetes prevalence was higher than the overall sample prevalence, it was almost 2 times lower than the AI/AN group.

For hypertension the race group differentiation was statistically significant. Pacific Islanders did not have the highest or lowest weighted prevalence of high blood pressure. High blood pressure was lower in the Pacific Islander group than the overall sample population prevalence.

Overweight and Obesity weighted prevalence was also statistically significantly different by race group. Pacific Islanders did not have the highest age adjusted prevalence of being overweight or obese, however the prevalence was the second highest, after AI/AN. The weighted prevalence for Pacific Islanders was very different from the Asian group that had the lowest prevalence. This supports the fact that Pacific Islanders and Asians are different, and if they were to be clumped together the prevalence would not be justified representation of either population.

Aim 2 *Risk Factors*:

- To analyze the difference among covariates, or risk factors, associated with cardiometabolic disease.

Overall Sample

In the overall analysis we find that Asians had lower odds associated with all cardiometabolic disease conditions. High blood pressure was highly associated with an increased in odds of diabetes in the entire sample, compared to the multivariate logistic regression run for Pacific Islanders and Whites. This finding was consistent with previous research, indicating that cardiometabolic conditions would be interrelated.

Interestingly heart disease decreased odds of high blood pressure in the overall sample, this can be attributed to heart disease medication usage which lowers blood pressure. Current smokers had lower odds of high blood pressure in the overall sample compared to never smokers, which may be due to the lower rate of current smokers in the overall sample. Odds of being overweight or obese was higher in Pacific Islanders than other race groups and lowest in Asians. This validates our decision to separate Asians from Pacific Islanders as previous studies have supported. There were lower odds associated with being overweight or obese among females in the overall analysis, which was not found when we analyzed cardiometabolic disease conditions within Pacific Islanders only.

Pacific Islanders & Whites

Diabetes

We also hypothesized that Pacific Islanders that smoke, have other cardiometabolic syndrome outcomes, and a lower educational attainment will have a higher odds of diabetes than Whites. However, marital status, and medical insurance status may not significantly differ.

In the bivariate analysis we found that independently more variables are associated with the odds of diabetes in Whites than Pacific Islanders. Among Pacific Islanders high blood pressure was associated with an increase in odds of diabetes independently and after adjusting for other variables. However, the confidence interval for high blood pressure was wide, perhaps due to the small sample of Pacific Islanders with high blood pressure. After adjusting for the other variables in the model high blood

pressure was still significantly associated with diabetes in both race groups, the odds ratios decreased after adjustment, as other factors are accounted for in the model.

Educational attainment in the bivariate analysis was not associated with diabetes among Pacific Islanders and was not included in the model after variable selection. Among Whites, educational attainment was associated with the odds of diabetes in the independent bivariate analysis but, after variable selection, it was not included in the model.

Among Whites and Pacific Islanders as BMI increased, odds associated with diabetes also increased, but BMI was associated with a higher odds of diabetes in Pacific Islanders than in Whites. This may be attributed to the fact that there is a higher percentage of overweight and obese people among the Pacific Islanders compared to the Whites.

Smoking status was not significantly associated with diabetes in the independent analysis, however when forward and backward selection algorithms were applied smoking status was significant enough to be included in the adjusted model. In the adjusted model for diabetes in Pacific Islanders smoking status was associated with a statistically significant odds of diabetes. Current smokers had a lower odds of diabetes, as smoking disrupts the metabolism but former smokers had a higher odds associated with diabetes than never and current smokers. This may be supported by studies that state eating habits of past smokers can be more detrimental to health, as smoking may previously decreased appetite.[15] Smoking was associated independently with the odds of diabetes in Whites but was not significant in the adjusted model.

High Blood Pressure

It was also hypothesized that Pacific Islanders that smoke, have diabetes, are overweight/obese and have lower educational attainment will have higher odds of high blood pressure. The hypothesis was not completely supported by the data. Diabetes increased the odds of high blood pressure in both Whites and Pacific Islanders. In Pacific Islanders the confidence interval for diabetes was slightly wider than the confidence intervals associated with high blood pressure in Whites, which could be attributed to the small sample size. Increased BMI level was associated with a higher odds of high blood pressure in Whites and Pacific Islanders before and after adjustment for other variables in the model. As previously expected BMI and diabetes were associated with increased odds of high blood pressure in Pacific Islanders and Whites, and comparatively the odds associated with Pacific Islanders was higher than the odds in Whites.

Educational attainment was not independently associated with odds of high blood pressure in Pacific Islanders and not included in the model. Smoking was independently associated with the odds of high blood pressure, however it was not significant in the model and our hypothesis was not supported. Uninsured Whites and Pacific Islanders had a lower unadjusted and adjusted odds associated with high blood pressure, which could be due to them being unaware of their disease status. There were more risk factors associated with Whites odds of high blood pressure than Pacific Islanders odds, which supports the overall hypothesis of the populations differing in risk factors.

Overweight/Obesity

When the same hypothesis was applied to overweight and obese groups once again, it was not supported by the data. Hypertension was associated with an increased odds of higher BMI in Whites. Diabetes increased the odds associated with higher BMI in both race groups, which is consistent with most research. Smoking was only associated with the odds of being overweight or obese in the unadjusted models. Being a female decreased the odds of higher BMI in Whites compared to men. In the independent analysis sex was not associated with the odds of being overweight or obese but in the multivariate analysis females had higher odds of being overweight or obese than Pacific Islander men. This could be explained if there were to be an interaction between sex, and either high blood pressure or diabetes on overweight and obesity in Pacific Islanders.

Educational attainment was significantly associated with lower odds of being overweight and obese in Whites but not in Pacific Islanders, we could attribute this to sample size difference or simply the fact that educational attainment is not a risk factor associated with being overweight or obese in Pacific Islanders. The hypothesis was not supported by the data but Pacific Islanders did differ from Whites in many risk factors associated with each outcome of interest.

Other Findings

Whites with heart disease had significantly higher odds of having high blood pressure and of being overweight or obese compared to those without heart disease. Although this finding is not unexpected, heart disease was not associated with

increased odds in Pacific Islanders. This could simply be attributable to the fact that not many Pacific Islanders had been diagnosed with the broad ‘heart disease’. The odds for diabetes was associated with educational attainment in Pacific Islanders but was not a statistically significant association in Whites. Within Pacific Islanders there are risk factors that were not independently associated with the odds of cardiometabolic disease but were significant in the model. This could be due to missing data or interactions present that we did not analyze, as they were not in the scope of this project.

Limitations

With a cross-sectional study we are limited to data from a specific point in time, so the conclusions we come to do not answer questions regarding temporality. We also could not properly compare race groups due to the major sample size differences.

A major limitation of our study was that we had a very small sample of Pacific Islanders. The Pacific Islanders that we do have in the sample are not separated by subgroup, this prevents us from address issues of sociocultural differences among Pacific Islander subgroups. Clumping all Pacific Islanders together gives rise to the same issue, that Pacific Islander subgroups may have major differences and should be analyzed separately.

We are also very limited with survey data, as many participants chose not to answer questions. Self-reported health outcome data cannot be verified due to lack of medical records. Survey data is also subject to recall bias, thus reliability of the data may also be limited. Unfortunately, we could not analyze data on physical activity as many variables on physical activity were missing or not consistent throughout the years.

The only consistent questions about diet are in regards to balanced meals. The questions about balanced meals, however, did not have a sufficient number of responses. With applying the weights race groups were comparable, but this study did show that Pacific Islanders had different risk factors compared to Whites.

Conclusion

This study investigated a population that has been seldom studied previously. This study gave information on the prevalence difference of cardiometabolic diseases in Pacific Islanders compared to other ethnicities. We did find BMI level in Pacific Islanders was associated with all of the cardiometabolic disease outcomes. This is important as a large amount of Pacific Islanders in our sample were overweight or obese affirming previous studies that found that BMI health based guidelines may need to be further examined for Pacific Islanders.[10] The study needed a larger sample of Pacific Islanders. This sample may not be reliable as the Pacific Islander population was very small, less than 1% of the CHIS dataset included Pacific Islanders. We also found that Pacific Islanders did not have the highest weighted prevalence of diabetes, high blood pressure, and overweight/obesity. However Pacific Islanders did have a very high prevalence of overweight and obesity.

Diet and physical activity need to be addressed more as well. This dataset did not have sufficient information on either diet or physical activity. Both diet and physical activity are significant lifestyle factor determinants while studying diabetes, high blood pressure or overweight/obesity. Pacific Islanders have a heavy starch-based diet with lots of seafood.[7] Studying the effect of the original Islander diet on diabetes, high blood

pressure, and overweight/obese compared to the implementation of healthy dietary changes may help us understand the specific dietary risk factors associated with disease outcomes in the population[7].

This study shows that more research needs to be done on Pacific Islanders in California. There are many studies that focus on Pacific Islanders in other countries, but we do not have enough studies focusing on this race group in California. It may also be necessary to study how assimilation may affect disease outcomes among Pacific Islanders. This study outlines that more research is necessary on the Pacific Islander population and diabetes, high blood pressure and high BMI among this population. More studies need to focus on Pacific Islanders so that we can create proper interventions to decrease cardiometabolic disease risks.

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