Comparing Obesity-Related Health Disparities among Native Hawaiians/Pacific Islanders, Asians, and Whites in California: Reinforcing the Need for Data Disaggregation and Operationalization

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Abstract

Since the 2000 Census, Asians and Pacific Islanders have been categorized as separate races. Government initiatives have called for greater study of Asian, Native Hawaiian, and other Pacific Islander (NHPI) health outcomes. NHPI often have worse health outcomes than Asians and Whites. Despite this, the lack of operationalization of racial definitions may affect the magnitude of health disparities. This analysis examined how utilizing different sociological race definitions could influence NHPI health outcomes when compared to Asians and Whites. Utilizing data from the 2009 California Health Interview Survey, NHPI had significantly higher age adjusted obesity prevalence than Whites under the UCLA Center for Health Policy Research (CHPR) (OR = 1.72, P = .03) and Self-Report (OR = 1.57, P = .01) definitions, but not the Census definition (OR = 1.42, P = .11). NHPI had significantly higher age adjusted obesity prevalence than Asians under all definitions (Census OR = 4.05, P < .01; CHPR OR = 4.81, P < .01; Self-Report OR = 4.46, P < .01). NHPI had significantly higher age adjusted diabetes/pre-diabetes prevalence than Whites across all definitions (Census OR = 3.27, P < .01, CHPR OR = 3.03, P < .01, Self-Report OR = 1.99, P = .01) but only the Census (OR = 2.12, P = .01) and CHPR (OR = 1.86, P = .04) when NHPI were compared to Asians. Overall, race definition changed the identification of health disparities. Future studies should operationalize racial definitions, as health disparities are masked post-hoc when utilizing different race definitions.

Keywords

data disaggregation, Native Hawaiians and Pacific Islanders, Asians and Asian Americans, health disparities, chronic disease, race, ethnicity

Introduction

The crisis surrounding the increasing incidence of obesity in the United States has called for greater efforts to understand the factors attributable to this morbidity and exploration of its disproportionate presence among different ethnic and racial populations.[1] The 2010 National Health Interview Survey (NHIS) found that 34% of Americans were overweight, while another 28% of Americans were obese. The NHIS also found that obesity prevalence among non-Hispanic black adults and Hispanic adults were 37% and 32%, respectively. Obesity prevalence among White adults was 26%, while only 11% of surveyed Asians were classified as obese. Native Hawaiians and Pacific Islanders (NHPI), the smallest reported group, reported 42% of participants as obese.[2] They were classified by sex, age, race and Hispanic origin, education, current employment status, family income, poverty status, health insurance coverage, marital status, and place and region of residence. Obesity has been attributed to poor nutrition and lifestyle and is associated with development of heart disease, diabetes, and cancer. Numerous studies have emphasized disparities of obesity and obesity-related comorbidities such as type II diabetes,[3–7] hypertension,[8,9] and heart disease[6,8] among different ethnic and racial groups.

There is a growing need to understand NHPI health disparities. Over 1.2 million NHPI currently reside in the United States, and this population has increased by 40% since 2000, second to the growth of Asians (45.6%).[10,11] With the exception of research conducted in Hawai'i, NHPI have traditionally been grouped with Asians as "Asian and Pacific Islander" according to US Census definitions. This grouping has masked the health disparities and morbidities experienced by NHPI.[12] Disaggregation of NHPI from Asians since the 2000 Census has revealed the ethnic and health heterogeneity.[13]

The 2012 Pacific Islander Health Study, a health survey of a stratified random sample of Samoan and Tongan households in faith-based organizations in Los Angeles and San Mateo counties, found that more than 95% of NHPI were above normal BMI ranges and 90% of participants were classified as overweight or obese.[14] Nationally, about 57% of NHPI were physically inactive compared to 44.1% of Non-Hispanic Whites. NHPI were 30% more likely to be diagnosed with cancer than Non-Hispanic Whites. NHPI experience greater obesity and obesity-related health disparities compared to other races.[2] The change in Census race definition moved the agenda forward for Asian and NHPI health disparities research.[13,15] Studies since the definition change have revealed that NHPI experience disparities in obesity,[16,17] cardiovascular disease,[6] type II diabetes,[3,7] physical activity,[18] and dietary behaviors.[19]

Despite the inclusion of "Native Hawaiian and Pacific Islander" as a race category by the Census, federal initiatives have called for continued disaggregation of data among Asian Americans and NHPI to better understand the hidden health, economic, and educational disparities within this community.[20] Newly defined racial and ethnic categories address the multifaceted nature of race. Specifically, the University of California Los Angeles Center for Health Policy Research (UCLA CHPR) utilized multiple race definitions (US Census, UCLA CHPR, and Self-Identification) through their biannual health survey.[21] Though each definition is based off self-identification, the Census classifies multiracial individuals as "More than one race,"[22] severely undercounting smaller racial populations by grouping them into a heterogeneous category; this in turn poses methodological difficulties in health disparities research.[23,24] The UCLA CHPR definition asks multiracial persons to choose the race they most identify with, broadening race as a self-determined

attribute.[22] This definition is especially useful for the NHPI population; 56% of NHPI reported more than one race in the 2010 Census.[25] Few analyses examine the multiracial nature of the NHPI population.

Hardy notes that sociological race definitions are often "complex and poorly defined…[which] obscures attempts to identify and address health disparities"(p. 46).[24] It is important to operationalize race, especially for multiracial individuals. Geneticists emphasize a biological/phenotypic definition of race and advocate including genetics in health disparities research.[26,27] While genetic race definitions may elucidate the molecular and physiological factors behind disease, opponents claim that such definitions promote further stigmatization of people of color, eugenics, and may be irrelevant in describing health disparities.[28–31]

Despite the disagreements between the usefulness of socially constructed and genetic definitions of race, it is clear that the definition of race needs to be operationalized. Data disaggregation attempts to understand the multifaceted nature of racial identities, but more research is needed in understanding the relationship between race identification and health outcomes. This study (1) examines differences in obesity-related health outcomes and behavioral correlates among Whites, Asians, and Pacific Islanders utilizing the US Census, UCLA CHPR, and Self-Report definitions of race, (2) examines pairwise health disparities of NHPI compared to Whites and Asians, and (3) seeks to identify concordance in significant pairwise differences between different race definitions.

Methods
Study Design
Data were taken from the UCLA CHPR's 2009 California Health Interview Survey (CHIS). The CHIS is a biannual random digit dialing survey conducted by UCLA CHPR. The CHIS collects data on health status, health conditions, health-related behaviors, health insurance coverage, healthcare access, and health related issues. Surveys were conducted in English, Spanish, Chinese, Korean, Tagalog, and Vietnamese through a computer-assisted telephone interview system. Though the CHIS interviewed both children and adults, adult interviews were examined in this analysis. CHIS data are publicly available and provide statewide and countywide estimates for health in California. The 2009 CHIS received 47,614 total adult responses with response rates of 49.0% and 56.2% for landline and cellphone interviews respectively.[32,33]

Race Definitions
The 2009 CHIS provided two race definitions: the US Census 2000 and UCLA Center for Health Policy Research (CHPR). The Census 2000 race definition was comprised of a combination of six self-reported race questions (Pacific Islander, American Indian/Alaska Native, Asian, African American, White, or Other). Participants selected any race or races they self-identify with. Selection of multiple races will classify multi-racial individuals as "More than one race" under the US Census 2000 race

definition.[34] The UCLA CHPR definition utilized the same six self-reported race questions. However, race was determined by asking additional questions as to the race the participants most identified with thereby accounting for the heterogeneity of multi-racial individuals. Participants who do not specifically identify as one race were classified as "More than one race" under the UCLA CHPR definition.[34] The Self-Report race definition was investigator-derived by combining and recoding the CHIS 2009 self-reported race variables. Participants who self-identified as NHPI, regardless of other reported races, were recoded from the sample first. After identifying any self-reported NHPI, self-reported Whites (who were not also NHPI) were recoded, followed by self-reported Asians (who were not also NHPI or White). Recoding was done to maximize the number of self-reported NHPI for analysis.

Responses for each race definition were subcategorized into NHPI, White, or Asian. Sample sizes for groups varied by each definition of race for NHPI, Whites, and Asians. Those who did not identify as NHPI, White, or Asian (eg, identified as Native American/Alaska Native, Hispanic, African American, or Other) by each race definition were excluded from analysis.

Outcome Variables
Participants were examined for the following disease-related variables: classification as overweight or obese based on body mass index (BMI), self-reported diabetes diagnosis (including borderline and pre-diabetes), self-reported high blood pressure or hypertension diagnosis, and self-reported heart disease diagnosis. Participants' physical activity levels and consumption of fruits, vegetables, fast food, and soda were also examined. Adherence to physical activity guidelines was measured dichotomously by identifying if participants did at least 30 minutes of moderate physical activity (MPA) per day for at least five days a week. Adherence to vigorous activity (VPA) guidelines were measured dichotomously by identifying if participants did at least 20 minutes of VPA for at least three days a week.[34] Fruits, vegetables, and soda consumption were asked on a monthly recall basis (eg, "During the past month, how often did you drink regular soda or pop that contains sugar? Do not include diet soda). Fast food consumption was asked on a weekly recall.[35] Dietary behaviors (fruits, vegetables, fast food, and soda) were continuous variables.

Statistical Analysis
Data were analyzed through Statistical Analysis Software (SAS) Version 9.4 (SAS Institute Inc, Cary, NC) to identify significant disparities between each race group. Three conditions were examined: (1) comparison of differences among all three racial groups, (2) comparison of NHPI to Whites only, and (3) comparison of NHPI to Asians only. Participants classified as overweight or obese were clustered within each ethnic group to account for a more comprehensive prevalence calculation. These measures intended to account for potential onset of disease. Participants having pre-diabetes or diabetes and hypertension or high blood pressure were also grouped in order to provide

a more comprehensive prevalence between each ethnic group. Chi-square tests examined significant differences in overweight/obese classification, pre-diabetes/diabetes, hypertension/high blood pressure, heart disease prevalence, and physical activity adherence by racial definition. Significant associations were analyzed post-hoc using logistic regressions, controlling for age. The results of separate analyses are included to examine age adjusted odds ratios between different sexes. Each post-hoc analysis sought to identify if there were differences between NHPI to Whites and NHPI to Asians. Differences in dietary behaviors between races per definition were initially analyzed using one-way ANOVA. Significant associations in dietary behaviors were analyzed post-hoc using the Bonferroni t-test while controlling for age. Additional analyses are included to examine dietary behaviors by sex between NHPI to Whites and NHPI to Asians.

Results
Sample sizes of NHPI, Whites, and Asians differed with each race definition. The Census 2000 sample included 39,204 participants, with 0.23% identified as NHPI (n = 90), 87.25% identified as White (n = 34,205), and 12.52% identified as Asian (n = 4,909). The UCLA CHPR sample included 36,718 participants, with 0.20% identified as NHPI (n = 75), 86.52% identified as White (n = 31,769), and 13.27% identified as Asian (n = 4,874). The Self-Report sample included 40,251 participants, 0.38% identifying as NHPI (including multi-racial NHPI) (n = 153), 87.34% identifying as White-only (n = 35,157), and 12.28% identifying as Asian-only (n = 4,941) (Table 1).

Overweight and Obesity Prevalence
NHPI had significantly higher overweight/obesity (BMI ≥ 25.0)[36] age adjusted prevalence than Whites under the UCLA CHPR (OR = 1.72, $P = .03$) (Table 2) and Self-Report (OR = 1.57, $P = .01$) (Table 3). Only NHPI women were significantly more overweight/obese when compared to White women under each race definition: UCLA CHPR (OR = 2.16, $P = .01$), Self-Report (OR = 2.13, $P < .01$), Census (OR = 2.01, $P = .01$).

Overweight/obesity prevalence was significantly higher among NHPI than Asians under all race definitions after age adjustment: UCLA CHPR (OR = 4.81, $P < .01$), Self-Report (OR = 4.46, $P < .01$), Census (OR = 4.05, $P < .01$). After stratifying by sex, both NHPI men and women had significantly higher overweight/obesity prevalence compared to Asian men and women (Tables 2-4).

Pre-Diabetes and Diabetes Prevalence
Age adjusted analyses revealed that NHPI had significantly higher odds of diabetes/pre-diabetes than Whites for each race definition: UCLA CHPR (OR = 3.03, $P < .01$), Self-Report (OR = 1.99, $P < .01$), Census (OR = 3.27, $P < .01$) (Tables 2-4). After stratifying by sex, only NHPI women had significantly

higher odds of diabetes/pre-diabetes than Whites for each definition: UCLA CHPR (OR = 4.17, $P < .01$), Self-Report (OR = 2.87, $P < .01$), Census (OR = 4.17, $P < .01$).

NHPI had significantly higher age adjusted diabetes/pre-diabetes prevalence than Asians under the UCLA CHPR Definition (OR = 1.86, $P = .04$) (Table 2) and Census Definition (OR = 2.12, $P = .01$) (Table 4). After stratification by sex, NHPI women continued to have signifanctly higher diabetes/pre-diabetes prevalence than Asian women under the UCLA CHPR Definition (OR = 2.58 $P = .01$) and Census Definition (OR = 2.75, $P < .01$). Self-Reported NHPI women also had significantly higher diabetes/pre-diabetes prevalence than Asian women (OR = 1.92, $P = .03$) (Table 3).

Hypertension, High Blood Pressure, and Heart Disease Prevalence
Age and sex adjustment attenuated initial differences in hypertension/high blood pressure prevalence between NHPI, Whites, and Asians. Heart disease prevalence experienced similar results; NHPI had significantly lower heart disease prevalence (5.9%) than Whites (11.5%) ($P = .03$) (Table 1). However, age and sex adjustment attenuated these effects.

Physical Activity
NHPI had significantly higher age adjusted MPA than Whites across Self-Report definition (OR = 1.78, $P < .01$) (Table 3). After stratifying by sex, Male NHPI had significantly higher MPA than White males across Self-Report (OR = 2.36, $P < .01$) and Census (OR = 2.64, $P = .01$) definitions (Table 3 and 4).

NHPI had significantly greater MPA than Asians under Self-Report (OR = 2.02, $P < .01$) and Census definitions (OR = 1.81, $P = .04$) and after controlling for age (Table 3 and 4). NHPI males had significantly greater MPA than Asian males under Self-report (OR = 2.48, $P < .01$) and Census definitions (OR = 2.75, $P = .01$). NHPI also had significantly higher age adjusted VPA than Asians across all definitions. When stratified by sex, NHPI men had significantly higher VPA than Asian men across all race definitions (Tables 2-4). VPA was significantly higher among NHPI women than Asian women under the Census definition VPA (OR = 2.31, $P = .02$) Census definition (Table 4).

Dietary Intake
NHPI fruit consumption was not significantly different from Whites or Asians across each race definition (Table 5). However, NHPI consumed significantly less vegetables than Whites when using the Census ($P = .01$) and Self-Report definitions ($P < .01$). NHPI and Asians did not differ in vegetable consumption. NHPI also consumed more fast food than Whites and Asians across each race definition ($P < .05$). Soda consumption was significantly higher among NHPI than Asians under all race definitions ($P < .05$); no differences were seen between NHPI and Whites.

Table 1. General Demographics, Chronic Disease Prevalence, and Consumption Behavior by Race Definition

	Census 2000				UCLA CHPR				Self-Report			
	NHPI (n=90)	White (n=34,205)	Asian (n=4,909)	P-Value[b]	NHPI (n=75)	White (n=31,769)	Asian (n=4,874)	P-Value[b]	NHPI (n=153)	White (n=35,157)	Asian (n=4,941)	P-Value[b]
Sex (%)												
Female	55 (66.1)	20,391 (59.6)	2,766 (56.3)	<.01	50 (66.7)	18,811 (59.2)	2,739 (56.2)	<.01	90 (58.8)	20,960 (59.6)	2,789 (56.4)	<.01
Male	35 (38.9)	13,814 (40.3)	2,143 (43.7)	.77 .36	25 (33.3)	12,958 (40.8)	2,135 (43.8)	.19 .07	63 (41.2)	14,197 (40.4)	2,152 (43.5)	.84 .56
Age[a]	45.8 (17.2)	58.3 (16.7)	50.5 (16.7)	<.01 <.01 .02	49.8 (16.0)	59.2 (16.3)	50.6 (16.7)	<.01 <.01 1.0	44.6 (17.0)	58.2 (16.7)	50.4 (16.7)	<.01 <.01 <.01
Chronic Disease (%)												
Overweight or Obese	58 (64.4)	19,368 (56.6)	1,526 (31.3)	<.0 .14 <.01	51 (68.0)	17,721 (55.8)	1,497 (30.7)	<.01 .04 <.01	102 (66.7)	19,951 (56.8)	1,542 (31.2)	<.01 .01 <.01
Diabetic or Pre-diabetic	17 (18.9)	3,649 (10.7)	585 (11.9)	<.01 .01 .05	14 (18.7)	3,308 (10.4)	574 (11.8)	<.01 .02 .07	19 (12.4)	3,777 (10.7)	588 (11.9)	.04 .50 .85
High Blood Pressure or Borderline Hypertension	30 (33.3)	13,594 (39.7)	1,546 (31.5)	<.01 .22 .71	26 (34.7)	12,860 (40.5)	1,534 (31.5)	<.01 .31 .55	47 (30.7)	13,952 (39.7)	1,553 (31.4)	<.01 .02 .85
Heart Disease	6 (6.7)	3,917 (11.5)	302 (6.2)	<.01 .16 .84	6 (8.0)	3,794 (11.9)	300 (6.2)	<.01 .29 .51	9 (5.9)	4,035 (11.5)	304 (6.2)	<.01 .03 .89
Physical Activity (%)												
MPA	14 (15.6)	3,577 (10.5)	457 (9.3)	.01 .11 .05	11 (14.7)	3,382 (10.7)	458 (9.4)	.02 .01 .12	26 (17.0)	3,691 (10.5)	459 (9.3)	<.01 .01 <.01
VPA	23 (25.6)	4,778 (14.0)	565 (11.5)	<.01 <.01 <.01	16 (21.3)	4,452 (14.0)	550 (11.3)	<.01 .07 .01	32 (20.9)	4,914 (14.0)	572 (11.6)	<.01 .01 <.01
Food Consumption[a]												
Fruits	7.5 (6.8)	8.3 (7.0)	7.9 (6.4)	<.01 .31 .56	7.1 (6.8)	8.3 (6.9)	8.0 (6.4)	<.01 .16 .28	7.9 (6.9)	8.3 (7.0)	7.9 (6.4)	<.01 .56 .98
Vegetables	6.4 (5.4)	8.1 (6.0)	7.5 (5.3)	.01 .06	7.1 (5.6)	8.3 (6.0)	7.5 (5.3)	<.01 .09 .56	6.6 (5.6)	8.1 (6.0)	7.5 (5.3)	<.01 <.01 .06
Fast Food	1.7 (1.9)	1.0 (1.7)	.98 (1.5)	<.01 <.01	1.5 (2.0)	1.0 (1.6)	.96 (1.5)	<.01 .02 .01	1.6 (1.8)	1.0 (1.7)	.97 (1.5)	<.01 <.01 <.01
Soda	1.8 (4.1)	1.1 (3.4)	.9 (2.6)	.10 .03	1.6 (4.2)	1.1 (3.4)	.83 (2.6)	<.01 .19 .08	2.1 (5.0)	1.1 (3.5)	.87 (2.7)	<.01 .02 <.01

Note: NHPI = Native Hawaiian and Pacific Islander; UCLA CHPR = University of California, Los Angeles Center for Health Policy Research. MPA = Moderate Physical Activity, indicates percentage of participants who did at least 30 minutes of moderate physical activity for at least 5 days per week. VPA = Vigorous Physical Activity, indicates percentage of participants who did at least 20 minutes of vigorous physical activity, at least 3 times per week. All values are based on self-report data from the 2009 California Health Interview Survey (CHIS). Census 2000, UCLACHPR, and Self-Report Race Definitions were determined using participants' responses to questions involving race.
[a]Indicates mean and standard deviation; [b]P-values indicate overall P-value, P-value between NHPI and Whites, P-value between NHPI and Asian

Table 2. Age Adjusted Odds Ratio for NHPI compared to Whites and Asians for UCLA CHPR Definition of Race

	Adjusted Odds Ratio (95% Confidence Interval)								
	Total (N = 36,718)			Male (n = 15,118)			Female (n = 21,600)		
	NHPI to White	NHPI to Asian	P -Value[a]	NHPI to White	NHPI to Asian	P -Value[a]	NHPI to White	NHPI to Asian	P -Value[a]
Chronic Disease (%)									
Overweight or Obese	1.72 (1.06, 2.80)	4.81 (2.94, 7.81)	.03 < .01	1.32 (.55, 3.16)	3.88 (1.61, 9.34)	.54 < .01	2.16 (1.20, 3.89)	6.33 (3.50, 11.36)	.01 < .01
Diabetic or Pre-diabetic	3.03 (1.66, 5.52)	1.86 (1.01, 3.41)	< .01 .04	1.70 (.50, 5.81)	1.06 (.31, 3.54)	.40 .93	4.17 (2.08, 8.33)	2.58 (1.28, 5.21)	< .01 .01
High Blood Pressure or Borderline Hypertension	1.28 (.77, 2.15)	1.25 (.75, 2.14)	.34 .39	1.59 (.69, 3.68)	1.57 (.68, 3.65)	.28 .29	1.17 (.60, 2.25)	1.13 (.58, 2.19)	.65 .72
Heart Disease	1.15 (.48, 2.76)	1.49 (.61, 3.60)	.76 .38	1.26 (.28, 5.59)	1.85 (.41, 8.26)	.76 .42	1.24 (.42, 3.64)	1.48 (.50, 4.39)	.69 .48
Physical Activity (%)									
MPA	1.46 (.77, 2.77)	1.66 (.87, 3.17)	.25 .12	2.39 (.95, 5.99)	2.49 (.99, 6.32)	.06 .05	1.04 (.41, 2.61)	1.28 (.50, 3.27)	.94 .60
VPA	1.34 (.76, 2.34)	2.14 (1.21, 3.76)	.31 .01	1.72 (.74, 4.05)	2.52 (1.07, 5.95)	.20 .03	1.19 (.55, 2.56)	2.18 (1.00, 4.74)	.66 .05

Note: NHPI = Native Hawaiian and Pacific Islander; UCLA CHPR = University of California, Los Angeles Center for Health Policy Research. MPA = Moderate Physical Activity, indicates percentage of participants who did at least 30 minutes of moderate physical activity for at least 5 days per week. VPA = Vigorous Physical Activity, indicates percentage of participants who did at least 20 minutes of vigorous physical activity, at least 3 times per week. All values are based on self-report data from the 2009 California Health Interview Survey (CHIS). UCLA CHPR Race Definitions were determined using participants' responses to questions involving race.
[a]Indicates P-value comparing NHPI to White and NHPI to Asian

Table 3. Age Adjusted Odds Ratio for NHPI compared to Whites and Asians for Self-Report Definition of Race

	Adjusted Odds Ratio (95% Confidence Interval)								
	Total (N = 40,251)			Male (n = 16,412)			Female (n = 23,839)		
	NHPI to White	NHPI to Asian	P -Value[a]	NHPI to White	NHPI to Asian	P -Value[a]	NHPI to White	NHPI to Asian	P -Value[a]
Chronic Disease (%)									
Overweight or Obese	1.57 (1.12, 2.20)	4.46 (3.17, 6.29)	.01 < .01	1.01 (.60, 1.71)	2.99 (1.76, 5.08)	.97 < .01	2.13 (1.37, 3.31)	6.41 (4.46, 10.00)	< .01 < .01
Diabetic or Pre-diabetic	1.99 (1.21, 3.27)	1.31 (.79, 2.16)	.01 .29	1.07 (.42, 2.74)	.71 (.28, 1.83)	.88 .48	2.87 (1.59, 5.18)	1.92 (1.05, 3.48)	< .01 .03
High Blood Pressure or Borderline Hypertension	1.33 (.92, 1.94)	1.32 (.90, 1.93)	.13 .15	1.16 (.65, 2.05)	1.17 (.65, 2.09)	.62 .59	1.49 (.91, 2.44)	1.46 (.88, 2.40)	.11 .14
Heart Disease	1.04 (.51, 2.10)	1.34 (.65, 2.74)	.92 .42	1.03 (.35, 3.01)	1.51 (.51, 4.44)	.95 .46	1.08 (.42, 2.76)	1.30 (.50, 3.37)	.88 .60
Physical Activity (%)									
MPA	1.78 (1.17, 2.72)	2.02 (1.31, 2.13)	< .01 < .01	2.36 (1.32, 4.24)	2.48 (1.37, 4.48)	< .01 < .01	1.36 (.72, 2.55)	1.67 (.87, 3.19)	.35 .12
VPA	1.19 (.80, 1.77)	1.78 (1.19, 2.67)	.39 .01	1.44 (.83, 2.49)	2.02 (1.16, 3.55)	.19 .01	.98 (.54, 1.78)	1.63 (.89, 3.00)	.95 .11

Note: NHPI = Native Hawaiian and Pacific Islander. MPA = Moderate Physical Activity, indicates percentage of participants who did at least 30 minutes of moderate physical activity for at least 5 days per week. VPA = Vigorous Physical Activity, indicates percentage of participants who did at least 20 minutes of vigorous physical activity, at least 3 times per week. All values are based on self-report data from the 2009 California Health Interview Survey (CHIS). Self-Report Race Definitions were determined using participants' responses to questions involving race.
[a]Indicates P-value comparing NHPI to White and NHPI to Asian

Table 4. Age Adjusted Odds Ratio for NHPI compared to Whites and Asians for Census Definition of Race								
Adjusted Odds Ratio (95% Confidence Interval)								
	Total (N = 39,204)			Male (n = 15,992)			Female (n = 23,212)		
	NHPI to White	NHPI to Asian	P-Value[a]	NHPI to White	NHPI to Asian	P-Value[a]	NHPI to White	NHPI to Asian	P-Value[a]
Chronic Disease (%)									
Overweight or Obese	1.42 (.92, 2.19)	4.05 (2.62, 6.25)	.11 < .01	.85 (.43, 1.69)	2.54 (1.27, 5.05)	.64 .01	2.01 (1.15, 3.51)	6.02 (3.44, 10.64)	.01 < .01
Diabetic or Pre-diabetic	3.27 (1.89, 5.65)	2.12 (1.22, 3.69)	< .01 .01	2.31 (.87, 6.17)	1.51 (.56, 4.05)	.09 .41	4.17 (2.15, 8.06)	2.75 (1.40, 5.38)	< .01 < .01
High Blood Pressure or Borderline Hypertension	1.45 (.90, 2.34)	1.42 (.88, 2.30)	.13 .15	1.31 (.61, 2.80)	1.31 (.61, 2.82)	.48 .49	1.56 (.84, 2.89)	1.52 (.81, 2.82)	.16 .19
Heart Disease	1.15 (.48, 2.73)	1.46 (.61, 3.51)	.76 .39	1.05 (.23, 4.61)	1.52 (.34, 6.71)	.95 .58	1.32 (.45, 3.83)	1.56 (.53, 4.59)	.42 .61
Physical Activity (%)									
MPA	1.62 (.91, 2.87)	1.81 (1.01, 3.24)	.10 .04	2.64 (1.23, 5.65)	2.75 (1.28, 5.95)	.01 .01	.97 (.39, 2.43)	1.18 (.47, 3.00)	.95 .72
VPA	1.59 (.98, 2.58)	2.40 (1.47, 3.92)	.06 < .01	1.95 (.97, 3.92)	2.75 (1.36, 5.59)	.06 .01	1.37 (.68, 2.75)	2.31 (1.14, 4.67)	.38 .02

Note. Note: NHPI = Native Hawaiian and Pacific Islander. All values are based on self-report data from the 2009 California Health Interview Survey (CHIS). MPA = Moderate Physical Activity, indicates percentage of participants who did at least 30 minutes of moderate physical activity for at least 5 days per week. VPA = Vigorous Physical Activity, indicates percentage of participants who did at least 20 minutes of vigorous physical activity, at least 3 times per week. Census 2000 Race Definitions were determined using participants' responses to questions involving race.
[a]Indicates P-value comparing NHPI to White and NHPI to Asian

Table 5. Age Adjusted Consumption Behaviors by Racial Definition								
Adjusted Mean Proportion (95% Confidence Interval)								
	Census 2000			UCLA CHPR			Self-Report		
	NHPI (n=90)	White (n=34,205)	Asian (n=4,909)	NHPI (n=75)	White (n=31,769)	Asian (n=4,874)	NHPI (n=153)	White (n=35,157)	Asian (n=4,941)
Fruits per month	7.90 (6.47, 9.33)	8.26 (8.18, 8.33)	8.16 (7.96, 8.35)	7.43 (5.87, 8.99)	8.25 (8.17, 8.32)	8.21 (8.01, 8.41)	8.34 (7.24, 9.44)	8.24 (8.17, 8.31)	8.14 (7.95, 8.34)
Vegetables per month	6.53 (5.31, 7.75)	8.09 (8.03, 8.15)	7.53 (7.36, 7.70)	7.13 (5.80, 8.45)	8.28 (8.21, 8.35)	7.50 (7.33, 7.66)	6.75 (5.81, 7.69)	8.09 (8.02, 8.15)	7.53 (7.36, 7.69)
Fast food per week	1.45 (1.11, 1.78)	1.04 (1.02, 1.06)	0.83 (0.79, 0.88)	1.39 (1.02, 1.75)	1.02 (1.00, 1.04)	0.82 (0.77, 0.86)	1.38 (1.13, 1.63)	1.05 (1.03, 1.07)	0.83 (0.79, 0.88)
Soda per month	1.45 (0.77, 2.13)	1.16 (1.12, 1.19)	0.62 (0.53, 0.71)	1.43 (0.69, 2.17)	1.09 (1.06, 1.13)	0.59 (0.50, 0.69)	1.65 (1.12, 2.18)	1.17 (1.14, 1.21)	0.63 (0.54, 0.73)

Note. UCLA CHPR = University of California, Los Angeles Center of Health Policy Research. NHPI = Native Hawaiian and Pacific Islander. All values are based on self-report data from the 2009 California Health Interview Survey (CHIS). Census 2000, UCLA CHPR, and Self-Report Race Definitions were determined using participants' responses to questions involving race.

Figure 1. Summary of Chronic Disease and Health Behavior Concordance of Pacific Islanders by Racial Definition			
Indicator	**Census 2000**	**UCLA CHPR**	**Self-Report**
Overweight/Obesity	NHPI = White NHPI > Asian	NHPI > White NHPI > Asian	NHPI > White NHPI > Asian
Diabetic/Pre-diabetic	NHPI > White NHPI > Asian	NHPI > White NHPI > Asian	NHPI > White NHPI = Asian
Hypertension	NHPI = White NHPI = Asian	NHPI = White NHPI = Asian	NHPI = White NHPI = Asian
Heart Disease	NHPI = White NHPI = Asian	NHPI = White NHPI = Asian	NHPI = White NHPI = Asian
MPA	NHPI = White NHPI > Asian	NHPI = White NHPI > Asian	NHPI > White NHPI > Asian
VPA	NHPI = White NHPI > Asian	NHPI = White NHPI > Asian	NHPI = White NHPI > Asian
Fruits per month	NHPI = White NHPI = Asian	NHPI = White NHPI = Asian	NHPI = White NHPI = Asian
Vegetables per month	NHPI < White NHPI = Asian	NHPI = White NHPI = Asian	NHPI < White NHPI = Asian
Fast food per week	NHPI > White NHPI > Asian	NHPI > White NHPI > Asian	NHPI > White NHPI > Asian
Soda per month	NHPI = White NHPI > Asian	NHPI = White NHPI > Asian	NHPI = White NHPI > Asian

Note. UCLA CHPR – UCLA Center for Health Policy Research. NHPI – Native Hawaiian and Pacific Islander. MPA = Moderate Physical Activity, indicates percentage of participants who did at least 30 minutes of moderate physical activity for at least 5 days per week. VPA = Vigorous Physical Activity, indicates percentage of participants who did at least 20 minutes of vigorous physical activity, at least 3 times per week. Concordance is based on identification of obtaining the same statistically significant/insignificant result with a cutoff significance value of P =.05 for Native Hawaiians and Pacific Islanders compared to Whites and Asians after adjusting for age.

Discussion

This analysis examined how different definitions of race could influence health disparity outcomes for NHPI when compared to Asians and Whites. Results indicate that race definition did change the types of health disparities that were presented in each analysis (Figure 1). The high overweight/obesity prevalence among NHPI were consistent with nationally representative data and previous studies.[23,4,17] NHPI were more likely to be overweight or obese than Whites and Asians. Diabetes prevalence was also comparable to previous studies.[3,7] NHPI had a higher prevalence of diabetes than Whites and Asians. Heart disease and hypertension prevalence was also similar to previous studies.[6] NHPI appeared to engage in greater MPA and VPA than Whites and Asians. This was unexpected, given the high rates of obesity among NHPI. However, measuring obesity through BMI has limitations. BMI may be the standard proxy measure of adiposity, but it does not distinguish between muscle mass and adipose tissue.[37] Future studies of adiposity among NHPI should consider using different adiposity measures to best determine the severity of obesity in this population. NHPI appeared to consume significantly fewer vegetables and significantly more fast food and soda when compared to Whites and Asians.

Strengths of this study include the operationalization of race definitions to account for the multiracial composition of the NHPI population. The lack of concordance in identifying health disparities between different race definitions reveals the importance of standardizing race definitions (Figure 1). The UCLA CHPR race definition provides a subjective view of race by asking participants to identify the race they best identify with.

While the Census race definition has been traditionally used, the aggregation of multiracial people diminishes its usefulness in health disparities research. However, the three race definitions in this study are ultimately subjective. The increasing research of health disparities genetics will elucidate the molecular and physiological basis behind health disparities and allow for a somewhat more objective definition. However, the controversy surrounding the social implications of genetic definitions is still hotly debated.[28–31]

Study limitations include the small sample size of NHPI relative to Whites and Asians. The small NHPI sample size may contribute to the large disparity seen between NHPI relative to each racial group. Often an "invisible minority" by researchers, underrepresentation of NHPI in research is a major concern for a population that experiences significant health disparities when compared to Whites and Asians.[13,15] Public health has acknowledged the lack of data regarding NHPI and current national initiatives are underway to understand the diverse NHPI population.[38] The availability of nationally representative data through the National Center of Health Statistics will only continue to uncover the story surrounding NHPI health in the United States.

The lack of analyses considering socioeconomic status and access to healthcare serves as another limitation to this study. The data and analyses acknowledge that there are disparities in chronic disease between NHPI to Whites and Asians. However, these disparities may be due to the socioeconomic and healthcare environment available.

The results of this study ultimately highlight the need for continued data disaggregation of NHPI and the importance of operationalizing racial definitions in health disparities research. Data disaggregation has led to more research surrounding the NHPI community, but it is important to acknowledge the multiethnic nature of the NHPI community. Smaller NHPI ethnic groups, such as the Chuukese and Ni-Vanauatu, have experienced significant growth since the 2000 Census.[10] Though these NHPI ethnic groups are smaller compared to Native Hawaiians, Samoans, Chamorros, Tongans, and Fijians, their rapid growth will contribute to the growing NHPI health narrative. Future studies should focus on both the multiracial and multiethnic composition of the NHPI population and continue to address these chronic health disparities within the NHPI community. Community-based participatory research provides an avenue to examine the correlates of these chronic health disparities among NHPI and should be employed as a mainstay for future interventions.[39] Moving forward, it is important that more research focus on how race is defined in health disparities research. As one of the fastest growing racial groups in the United States, it is important to continue to address health disparities within the NHPI community and increase their voice in the US health narrative.

Conflicts of Interest
None of the authors identify any conflicts of interest.

Acknowledgements

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