Ethnicity & Health

ISSN: 1355-7858 (Print) 1465-3419 (Online) Journal homepage: http://www.tandfonline.com/loi/ceth20

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To cite this article: N. Kau'i Baumhofer, Sela V. Panapasa, E. Francis Cook, Christina A. Roberto & David R. Williams (2017): Sociodemographic factors influencing island foods consumption in the Pacific Islander Health Study, Ethnicity & Health, DOI: 10.1080/13557858.2017.1418300

To link to this article: https://doi.org/10.1080/13557858.2017.1418300

Published online: 28 Dec 2017.

ETHNICITY & HEALTH, 2017
https://doi.org/10.1080/13557858.2017.1418300

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Sociodemographic factors influencing island foods consumption in the Pacific Islander Health Study

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ABSTRACT

Objectives: Pacific Islander Americans are a small, but quickly growing population that experiences alarming disparities in obesity and obesity-related chronic illnesses influenced by dietary patterns. This population also has a unique culinary heritage including traditional foods and more contemporary imports such as tinned meats and refined carbohydrates. This analysis is a novel attempt to understand the sociodemographic factors influencing island foods consumption.

Design: A sample of 240 Samoan and Tongan adults in California from the Pacific Islander Health Study was used. Following univariate and bivariate analyses, a series of four multivariable regression models were created to predict past week frequency of island foods consumption after sequential adjustment for demographic, socioeconomic, and cultural covariates.

Results: Participants reported consuming island foods an average of 2.93 times in the previous week, with the largest proportion of participants (20.42%) reporting eating island foods 6 or more times. Age and Samoan ethnicity were initially significant, positive predictors of island foods consumption, but their effect was attenuated after addition of cultural covariates. With the third model that adjusted for birthplace, financial insecurity and Tongan birthplace were positive predictors. Both lost significance in the fourth and final model upon addition of cultural affinity, which was positively associated with island foods.

Conclusion: Understanding how sociodemographic factors are associated with island foods consumption is a first step in understanding the broad way in which an ethnically specific dietary pattern may be associated with obesity-related chronic illness risk among Pacific Islander Americans.

ARTICLE HISTORY
Received 15 December 2016
Accepted 6 December 2017

KEYWORDS
Native Hawaiian/Pacific Islander; obesity; dietary patterns

Introduction

According to data from the 2011 National Health Interview Survey, Native Hawaiians and Pacific Islanders (NHPI) are 1.4 times more likely to be overweight and 1.3 times more

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likely to be obese compared to non-Hispanic Whites (Schiller, Lucas, and Peregoy 2012). Although NHPI make up 0.4% of the national population, approximately 1.2 million individuals identified themselves as NHPI alone or in combination on the 2010 census and NHPI are the second fastest growing racial group in the country (Hixson, Hepler, and Kim 2012). This is a small, but growing population that exhibits significant diet-related cardiovascular and metabolic health disparities (Mau et al. 2009).

Historically, data from Pacific Islander Americans has been aggregated with Asian Americans until the Office of Management and Budget required separate data collection of these two very distinct racial groups in 1997 (OMB 1996). This study will use data collected for the Pacific Islander Health Study (PIHS), which is a pilot questionnaire, adapted from the National Health information Survey and the National Survey of American Life that provides health data for Pacific Islander Americans (S. V. Panapasa, Jackson, Caldwell, Herringa, et al., 2012b). Island food consumption among Pacific Islander migrants to the continental United States is an important way for individuals to maintain a culinary connection to their cultural homelands (Lassetter 2011). Such foods are part of a bi-directional flow of information and goods between the Pacific and the United States and the contemporary dietary pattern eaten by Pacific Islanders has significantly shifted throughout contact with the West to include Western foods such as canned meats and refined carbohydrates in addition to more traditional foods such as fish, shellfish, chicken, taro, breadfruit, sweet potato, and fruits (Errington and Gewertz 2008). This new 'contemporary' island food pattern that includes both traditional lean-proteins and produce and Western foods may be an unhealthy stepping stone between a healthful traditional diet and a fully-Western diet that puts Pacific Islander Americans at even higher risk for obesity and cardiometabolic disease – especially among younger, U.S.-born Pacific Islanders. Therefore, examining an overall contemporary dietary pattern that includes both 'traditional' and 'contemporary' foods such as processed, canned meats and refined sugar gives a more accurate picture of risk than limiting the analysis to just 'traditional' or 'contemporary' foods. This analysis is a novel effort to describe variation in an overall contemporary island food consumption pattern including both traditional and contemporary foods among Pacific Islander Americans living in Southern California by key sociodemographic variables including age, ethnicity, gender, socioeconomic status, and migration history.

Demographic factors such as age, gender, and marital status will be important components of this analysis. Previous literature has shown differences in dietary patterns between Pacific Islander elders and youth. Bell et al. (1999) found that individuals under the age of 40 ate significantly more calories from dairy, takeaway foods, soft drinks, and snacks compared to those over the age of 40 who ate more calories from meat/pulses/eggs, fruit and vegetables, starchy staples, and traditional food. In the same study, men of all ages ate slightly more traditional food compared to women (Bell et al. 1999). In a multi-ethnic cohort in Los Angeles, male gender was associated with a dietary pattern high in fat and meat while Native Hawaiian ethnicity and physical activity were associated with dietary patterns high in vegetable consumption (Park et al. 2005). However, another study found no significant differences in dietary patterns by gender (Finau, Prior, and Maddill 1986). These disparate findings indicate that gender is also an important factor to explore. No previous literature includes a focus on dietary patterns by marital status among Pacific Islanders, but studies have found differences in diet healthfulness based on marital status in other ethnic and cultural groups. For example,

results from the Whitehall II study of London civil servants indicated that higher proportions of participants reporting an 'unhealthy' or 'very unhealthy' diet were unmarried compared to the proportion of unmarried participants reporting a 'healthy,' 'very healthy,' or 'sweet' diet (Martikainen, Brunner, and Marmot 2003). Basic demographic variables such as these can often help explain dietary patterns as they are highly correlated with explanatory variables such as gender, marital status, or employment status.

Socioeconomic status is also a driving factor behind food choices. Perceived food cost and availability influences food choice in low SES, minority communities as does the differential reinforcement value of food in within the socioeconomic gradient (Buchthal 2014; Epstein et al. 2007; Lin et al. 2013; Mhurchu et al. 2013; Young, Batch, and Svetkey 2008). In the previously mentioned Hawaii-Los Angeles Multiethnic Cohort Study, a positive, dose-response relationship was observed between educational attainment – a proxy for SES – and dietary patterns rich in vegetables, fruit, and milk while the opposite pattern was seen for a dietary pattern high in fat and meat (Park et al. 2005). A study determining the perceived availability and perceived nutrition of both imported and traditional food in Tonga among individuals of high and low socioeconomic status found that participants with lower socioeconomic status perceived a higher availability of imported food compared to participants with higher socioeconomic status who perceived a higher availability of indigenous complex carbohydrates and uncommon traditional food (Evans et al. 2002). Rush et al. (2007) found that food insecurity – being uncertain about one's household's access to regular and adequate food – was high (43.6%) among Pacific Islander families living in Auckland. Participant families who reported food insecurity also reported purchasing less unhealthy luxury items such as alcohol, soft drinks, ice cream, and fruit juice and more nutrient dense foods such as bread, meat/chicken. However, purchase of healthy staples such as milk, fruit and vegetables also decreased (Rush et al. 2007).

A final layer of factors that may drive island food consumption are cultural variables such as birthplace and cultural affinity. There is a large body of research documenting both the traditional dietary patterns of Pacific Islanders living in rural environments as well as the dietary shifts experienced by Pacific Islanders as a result of increased dependence on imported food products upon emigration to urban centers within Oceania such as Auckland, Honiara, or Port Moresby (Gewertz and Errington 2010; Hughes and Lawrence 2005; Hughes and Marks 2009). Limited previous literature has examined the dietary patterns of Native Hawaiians, but only one study (Moy, Sallis, and David 2010) included non-Hawaiian Pacific Islanders and focused on fruit and vegetable consumption rather than traditional or imported island food consumption (Harmon et al. 2015; Kim et al. 2008; Lassetter 2011; Maskarinec et al. 2006; McEligot et al. 2012; Sharma et al. 2013; Takata et al. 2007). Moy, Sallis, and David (2010) evaluated several health indicators including fruit and vegetable consumption from a convenience sample of Pacific Islanders recruited from cultural events and religious organizations in Southern California and found that participants ate a mean number of 0.8 ± 1.3 daily servings of fruit and vegetables with women eating slightly more than men. Within this sample, 99% indicated consuming fewer than the recommended 5 daily servings of fruit and vegetables. The same study reported that only 76.9% of a chronologically comparable U.S. population consumed less than the recommended amount. Although this study had limitations, including small sample size ($n = 100$) and a low response rate (29.2%), it was a novel contribution to the body of literature describing NHPI dietary patterns in the United States. There is no

known literature, however, that describes dietary patterns among Pacific Islander Americans with a specific emphasis on island food consumption.

Previous research has examined the dietary shifts seen in populations of other migrants (Satia-Abouta 2003; Satia-Abouta et al. 2002). For example, first generation Mexican-Americans tend to have a healthier diet, with more fruits and vegetables, compared to their second and third generation counterparts (Espinosa de Los Monteros et al. 2008; Sharkey, Johnson, and Dean 2011). The same pattern is seen among Asian migrants (Gadgil et al. 2014). Tillotson et al. (1973) showed a strong gradient of dietary acculturation among men of Japanese ancestry living in Japan, Hawai'i, and California. Proportion of Japanese food consumed decreased with geographic (and presumably, cultural) distance from Japan while proportion of Western foods consumed increased. Striking differences in prevalence of diabetes mellitus between Pima Indians living in Mexico versus their counterparts living on the U.S.-side of the border suggest dietary acculturation and adoption of a Western lifestyle contribute to negative obesity-related health outcomes (Ravussin et al. 1994; Schulz et al. 2006). These findings support the idea that populations living in home countries consume a more traditional diet and adopt a Westernized diet upon migration to the United States, based partially on changing social norms as well as changing access to traditional foods in their new home country.

In light of the patterns seen in other American minority groups and the scarcity of literature exploring the dietary patterns of Pacific Islander Americans, this paper will use a secondary analysis of the Pacific Islander Health Study (PIHS) data to explore the sociodemographic distribution of island food consumption among a population of Samoan and Tongans living in California. Specifically, this analysis will calculate the distribution of times individuals reported eating island foods during the past week and explore the bivariate relationships between island food consumption and key sociodemographic variables. Finally, the relationships between island food consumption and sociodemographic characteristics will be examined in a series of multivariable regression models. Within the context of the previous research presented in this introduction, it is expected that characteristics such as increased age, male gender, currently married, foreign birth, and high cultural affinity will be positively associated with island food consumption. The effect of socioeconomic status, could produce an inverted-U shaped relationship with island food consumption: lower socioeconomic status, as measured by lower educational attainment, under- or unemployment, and food insecurity could constrain food choice while higher socioeconomic status could indicate higher levels of assimilation to American culture and diet, weakening the association with island foods. Performing this analysis will accomplish two goals: 1) provide valuable dietary information about Pacific Islander Americans as a part of America's multi-ethnic environment and 2) understanding of the sociodemographic characteristics influencing dietary choices that could inform future interventions for this unique population.

Methods

Pacific Islander Health Study sample

The PIHS is a pilot questionnaire, which is adapted from the National Health Interview Survey, California Health Interview Survey, the National Survey of American Life, and Chicago Community Adult Health Study and provides health data for Pacific Islander

Americans (S. V. Panapasa, Jackson, Caldwell, Herringa, et al., 2012b). Historically, data from Pacific Islander Americans has been aggregated with Asian Americans until the Office of Management and Budget required separate data collection of these two very distinct racial groups in 1997 (OMB 1996). The collection of disaggregated NHPI health data will significantly increase the ability of health researchers to report and monitor health disparities within this community (S. V. Panapasa, Jackson, Caldwell, Heeringa, et al., 2012b; S. V. Panapasa, Jackson, Caldwell, Herringa, et al., 2012a).

The PIHS collected data during the 2-year project, beginning in June 2009, from adults and adolescents in 300 Samoan and Tongan households in California (S. V. Panapasa, Jackson, Caldwell, Heeringa, et al., 2012a). Research partners and community religious organizations used a community-based participatory research framework to design and implement the PIHS. Drawing from a population made up of members of 20 Samoan and Tongan community-based religious organizations located respectively in Los Angeles County and San Mateo County, a stratified random sample frame was used to recruit participants from 300 households. Religious organizations were used in this pilot study in order to access a tight social network that is central to the lives of Pacific Islander Americans and maximize community participation. Data collection occurred as an in-person interview and questions covered health status and conditions, health behaviurs, healthcare access and utilization, personal demographics, mental health, financial status, life events, and religion. The response rate was 80% and 240 households completed the survey, yielding a final sample size of 240 adults and 240 adolescents. The data was weighted, post-collection, so that the results are generalizable to the population of Pacific Islanders in California. Further description of the PIHS data collection methods and participants have been published elsewhere (S. V. Panapasa, Jackson, Caldwell, Heeringa, et al., 2012a). This sample utilizes the 240 adult participants only.

Variables

Island food consumption was operationalized as the self-reported number of times a participant has eaten 'island foods' during the previous 7 days. Participants were prompted with a list that includes cassava, taro, yams, corned beef, SPAM, turkey tail or seafood, meat or pastry cooked in coconut milk, but are also allowed to define 'island foods' in their own way. The count of incidents was restricted from 0 to ≥6.

Ethnicity was Samoan or Tongan. *Age* was calculated using the participant's birth year and date. *Gender* was reported by household member. *Marital status* was defined by three categories: 'married' includes participants who are currently living with their partners, with or without legal marriage, 'formerly married' includes participants who are separated from their spouse, divorced, or widowed, 'never married' includes participants who have never been married and are not currently living with a partner.

Education was defined by three categories including 'less than a high school diploma,' 'a high school diploma,' and 'more than a high school diploma.' *Employment status* was also defined by three categories which includes 'full-time work,' 'part-time work,' and 'not currently working/other.' *Financial insecurity* was operationalized as a categorical variable using a composite financial security score from the Chicago Community Adult Health Survey (S. V. Panapasa, Jackson, Caldwell, Herringa, et al., 2012a). Participants were asked if they have needed to liquidate assets, postpone medical care, borrow money,

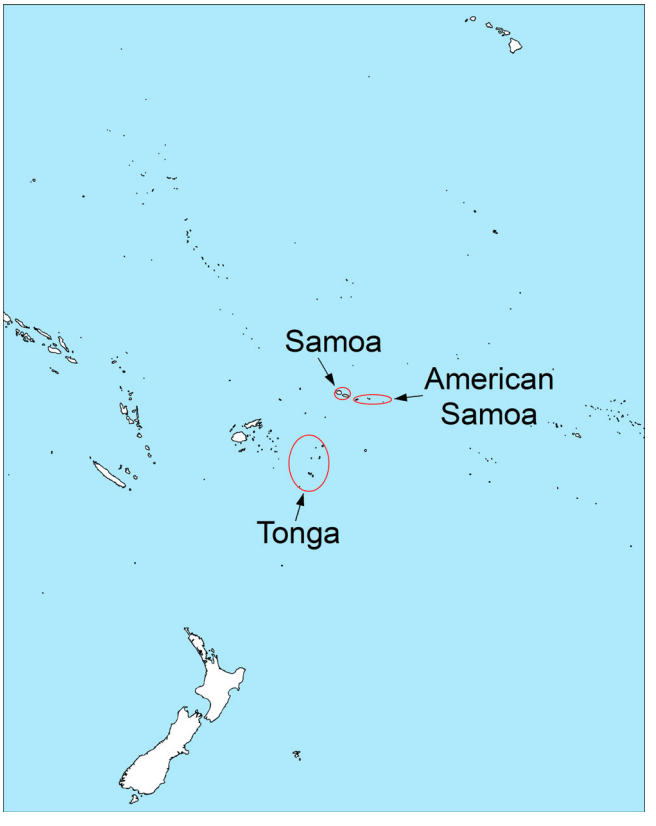

Figure 1. Map of the southwestern Pacific Islands.

apply for government assistance, obtain a loan, or alter living arrangements due to financial difficulties during the past year in a series of 7 questions. For each affirmative answer 1-point is added to the financial security score. Lower scores indicate less financial insecurity while higher scores indicates more financial insecurity.

Birthplace was self-reported by participants as United States, American Samoa, Samoa, and Tonga (Figure 1), but length of residence in the United States was not collected. *Pacific cultural affinity* was a continuous variable using a composite cultural identity score with a range of 11–44 that was specifically developed for use in the PIHS ($\alpha = 0.85$). However, in the regression analysis cultural affinity was centered about the mean in order to produce more interpretable results. Participants were asked how often they participate in a series of 11 different Tongan or Samoan cultural activities including: speaking Samoan or Tongan language, listening to Samoan or Tongan music, cooking Samoan or Tongan food, spending time with Samoan or Tongan friends, time spent with Samoan or Tongan friends growing up, identifying oneself as a Samoan/Tongan American, identifying oneself as only Samoan or Tongan, identifying oneself as only American, listening to Samoan or Tongan radio, watching Samoan or Tongan TV shows, and reading Samoan or Tongan news or other materials. Each activity is given a numeric score based on the following frequencies: very often – 1, fairly often – 2, not too often – 3, and never – 4. However, for this analysis, all questions except 'How often do you identify yourself as only American?' were reverse coded.

Analysis plan

All statistical analyses were completed using STATA 12.0. Univariate analyses were performed to examine the distribution of each variable and to check model assumptions. Means and proportions for each variable were calculated for the entire sample as a whole as well as for Samoans and Tongans, independently. Given the historic and political differences between Samoans and Tongans, tests of difference were performed to identify sociodemographic differences between these two disparate groups at the alpha = 0.10 level as this analysis uses a small pilot sample and the analysis was designed to detect broad, hypothesis-generating trends from an initial dataset rather than explanatory models. Bivariate analyses were performed to assess the correlation and distribution for each variable. The final portion of the analysis used the SVYSET command, which applied population weights and corrected for clustering within community religious organization. Four Poisson models were created to assess the effects of sociodemographic variables on island food consumption. The first model includes a block of 'demographic' covariates that includes age, gender, ethnicity, and marital status:

$$g\{E(y)\} = \beta_0 + \beta_1 age + \beta_2 gender + \beta_3 ethnicity + \beta_4 marital\ status + \varepsilon \quad (1)$$

where $g = \ln\{E(y)\} = ln\{E(island\ foods\ consumption)\}$ and $y \sim Poisson$.

The second model adds a block of 'socioeconomic' covariates that includes educational attainment, employment status, and a financial insecurity score:

$$\begin{aligned} g\{E(y)\} = {} & \beta_0 + \beta_1 age + \beta_2 gender + \beta_3 ethnicity + \beta_4 marital\ status \\ & + \beta_5 education + \beta_6 employment\ status \\ & + \beta_7 financial\ insecurity + \varepsilon \end{aligned} \quad (2)$$

where $g = \ln\{E(y)\} = ln\{E(island\ foods\ consumption)\}$ and $y \sim Poisson$.

The third model adds birthplace:

$$\begin{aligned} g\{E(y)\} = {} & \beta_0 + \beta_1 age + \beta_2 gender + \beta_3 ethnicity \\ & + \beta_4 marital\ status + \beta_5 education + \beta_6 employment\ status \\ & + \beta_7 financial\ insecurity + \beta_8 birthplace + \varepsilon \end{aligned} \quad (3)$$

where $g = \ln\{E(y)\} = ln\{E(island\ foods\ consumption)\}$ and $y \sim Poisson$.

The fourth and final model adds the cultural affinity score:

$$\begin{aligned} g\{E(y)\} = {} & \beta_0 + \beta_1 age + \beta_2 gender + \beta_3 ethnicity + \beta_4 marital\ status \\ & + \beta_5 education + \beta_6 employment\ status \\ & + \beta_7 financial\ insecurity + \beta_8 birthplace \\ & + \beta_9 cultural\ affinity + \varepsilon \end{aligned} \quad (4)$$

where $g = \ln\{E(y)\} = ln\{E(island\ foods\ consumption)\}$ and $y \sim Poisson$.

The QIC-*u* (Quasi-likelihood under the Independence Criterion model) goodness of fit statistic was obtained for each model to assess model fit while also adjusting for model size.

This statistic is used as an alternative to the R^2 statistic that normally accompanies regression models as likelihood-based model fit statistics are not applicable to complex survey data with multiple levels of clustering and strata such as the PIHS (Cui and Qian 2007).

Results

Descriptive statistics

The distribution of all variables in the total samples as well as between Samoans and Tongans was examined (Table 1). Two-sided t-tests, chi-squared, and Fischer's exact tests indicated significant differences between the two groups in employment status, birth country, cultural affinity, and island food consumption. In the full sample, 36.66% ± 2.91% work full-time, 8.91% ± 2.71% work part-time, and 54.43% ± 4.17% are not working or are engaged in another type of work. Of those categorized as 'not working or engaged in another type of work,' 23 (19%) reported being retired, 6 (5%) reported being permanently disabled, and 94 (76%) reported 'Other.' While there were no differences in the proportion of Samoans and Tongans engaged in full-time work, there were significantly more Tongans reporting part-time work and significantly more Samoans reporting not working or performing 'Other' work. Significantly more Tongans were born in Tonga and more Samoans were born in Samoa compared to other option. However, there were no differences in the proportion of either Samoans or Tongans who reported being born in the United States. In the total sample 35.48% ± 3.11% were born in the United States, 19.89% ± 6.50% were born in Samoa, 26.68% ± 4.75% were born in American Samoa, and 17.95% ± 3.85% were born in Tonga. The total sample has an average cultural affinity score of 33.09% ± 0.28% (out of 44), among Samoans alone the average score was 33.68 ± 0.25 and among Tongans alone the average score was 31.57 ± 0.38 with the difference between the groups reaching statistical significance ($p < 0.001$). The number of times participants consumed island foods in the previous week ranges from the 16.67% of the sample who reported no incidents to the 20.42% who reported eating island foods 6 or more times. Among the total sample, island foods were consumed an average of 2.93 ± 0.17 times in the previous week. Tongans had significantly higher consumption of island foods being eaten an average of 3.54 ± 0.28 times over the course of the previous week and only 2.69 ± 0.17 times for Samoans ($p = 0.02$). Figure 1 shows a roughly bimodal pattern in island food consumption, with most participants reporting very few or several incidents of consumption throughout the previous week (Table 2).

Bivariate analyses (Table 3) showed that older age, birthplace outside of the U.S., and higher cultural affinity – characteristics related to a more 'traditional' lifestyle – was associated with more island food consumption. Island food consumption is negatively correlated with Samoan ethnicity and educational attainment; characteristics that could be proxies for with exposure to American culture were associated with lower island food consumption. Among other combinations, variables were only slightly correlated with one another except birth country, which was moderately correlated with ethnicity ($r(238) = -0.50$, $p < 0.01$) and age ($r(238) = 0.54$, $p < 0.01$) and marital status, which was correlated with age ($r(238) = -0.49$, $p < 0.01$).

Table 1. Means and proportions of demographic variables and island food consumption.

		Total ($n = 240$)	Samoan ($n = 137$)	Tongan ($n = 103$)	
Variable		Mean (S.E.)	Mean (S.E)	Mean (S. E.)	p**
Age		39.74 (1.51)	39.52 (2.01)	40.31 (1.24)	0.73
Male gender (%)		49.63 (3.25)	50.39 (4.21)	47.67 (4.90)	0.69
Marital (%)	Living with partner	60.01 (4.46)	60.00 (5.55)	60.40 (5.55)	0.57
	Formerly married	9.40 (2.63)	10.10 (3.33)	7.58 (3.31)	
	Never married	30.50 (5.25)	29.91 (7.15)	32.02 (4.31)	
Education (%)	Less than HS	13.60 (3.32)	12.28 (3.96)	17.01 (6.13)	0.71
	High School	45.45 (5.80)	45.51 (7.46)	45.31 (5.85)	
	More than HS	40.94 (6.26)	42.41 (8.62)	37.68 (3.94)	
Employ. (%)	Full-time	36.66 (2.91)	35.26 (3.30)	40.27 (6.18)	**0.04**
	Part-time	8.91 (2.71)	5.21 (3.01)	18.42 (5.57)	
	Not working/Other	54.43 (4.17)	59.52 (5.33)	41.31 (4.89)	
Financial Insecurity		1.20 (1.28)	1.30 (0.15)	0.95 (0.17)	0.17
Birth country (%)	United States	35.48 (3.11)	36.21 (4.21)	33.60 (3.98)	**<0.001**
	Samoa	19.89 (6.50)	27.23 (7.75)	0.97 (0.84)	
	American Samoa	26.68 (4.75)	35.97 (6.90)	2.74 (2.12)	
	Tonga	17.95 (3.85)	0.58 (0.59)	62.69 (3.27)	
Cultural affinity score		33.09 (0.28)	33.68 (0.25)	31.57 (0.38)	**<0.001**
Island Food		2.93 (0.17)	2.69 (0.17)	3.54 (0.28)	**0.02**

*May not equal 100% due to rounding.
**Difference between Samoan and Tongans.

Multivariable analysis

Table 4 shows the coefficients for island food consumption in the past week after adjustment for four blocks of sociodemographic covariates. Within the first model, increased age was associated with a slight and moderately significant increase in weekly incidents of

Table 2. Frequency of island food consumption in past week.

	Frequency	Percent
0	40	16.67
1	40	16.67
2	40	16.67
3	27	11.25
4	21	8.75
5	23	9.58
≥6	49	20.42
Total	240	100.00

Table 3. Bivariate correlations between island food consumption and demographic covariates.

r (*p*)	Island food	Ethnicity	Age	Gender	Marital status	Education	Employment	Financial insecurity	Foreign birth	Cultural affinity
Island food	1.00									
Ethnicity	**−0.21**	1.00								
(Samoan)	**(<0.01)**									
Age	**0.19**	**−0.16**	1.00							
	(<0.01)	**(0.01)**								
Gender	0.04	0.07	−0.08	1.00						
(Male)	(0.49)	(0.29)	(0.25)							
Marital status	−0.06	0.04	**−0.49**	0.11	1.00					
	(0.34)	(0.57)	**(<0.01)**	(0.10)						
Education	**−0.15**	0.04	**−0.16**	**−0.13**	0.06	1.00				
	(0.02)	(0.52)	**(0.01)**	**(0.05)**	(0.33)					
Employ-ment	0.03	0.06	0.05	0.06	**0.24**	**−0.29**	1.00			
	(0.64)	(0.43)	(0.44)	(0.33)	**(<0.01)**	**(<0.01)**				
Financial insecurity	0.07	0.10	0.01	−0.06	**−0.14**	**−0.13**	**0.18**	1.00		
	(0.30)	(0.14)	(0.86)	(0.35)	**(0.04)**	**(0.05)**	**(0.01)**			
Foreign birth	**0.26**	**−0.50**	**0.54**	−0.05	**−0.39**	−0.07	0.03	−0.05	1.00	
	(<0.01)	**(<0.01)**	**(<0.01)**	(0.43)	**(<0.01)**	(0.26)	(0.65)	(0.41)		
Cultural affinity	**0.28**	**0.20**	**0.16**	−0.06	**−0.13**	−0.10	0.01	**0.13**	0.05	1.00
	(<0.01)	**(<0.01)**	**(0.02)**	(0.46)	**(0.05)**	(0.12)	(0.84)	**(0.05)**	(0.45)	

island food consumption ($IRR = 1.01 \pm 0.004$, $p = 0.09$) while Samoan ethnicity and being formerly married were both associated with fewer incidents of island food consumption ($IRR = 0.77 \pm 0.07$, $p = 0.01$ and $IRR = 0.71 \pm 0.10$, $p = 0.02$, respectively). When socioeconomic variables are added in the second model, these same three variables retain their significance. Age is still associated with a slight, but significant increase ($IRR = 1.01 \pm 0.004$, $p = 0.06$) and Samoan ethnicity and being formerly married are associated with larger decreases in island food consumption ($IRR = 0.76 \pm 0.007$, $p = 0.01$ and $IRR = 0.68 \pm 0.08$, $p = 0.01$, respectively). However, both age and ethnicity lose their significant associations with the final two models.

With the addition of birth country in the third model, the formerly married category retained significance and was associated with ($IRR = 0.72 \pm 0.09$, $p = 0.02$) times fewer incidents of island food consumption compared to those who are currently married. An increased financial insecurity score and Tongan birthplace were both marginally, but significantly associated with more incidents of island food consumption ($IRR = 1.08 \pm 0.04$, $p = 0.08$ and $IRR = 1.36 \pm 0.23$, $p = 0.09$, respectively). In the fourth and final model cultural affinity was added. Again, being formerly married was associated with a large decrease in island food consumption ($IRR = 0.74 \pm 0.10$, $p = 0.04$), but financial insecurity and Tongan birthplace lost significance. Cultural affinity was slightly, but significantly associated with

Table 4. Incident rate ratios from Poisson regression for island food consumption in past 7 days after adjustment for four sets of covariates.

	Demographic[a] B (S.E.)	SES[b] B (S.E.)	Birth Country[c] B (S.E.)	Cultural Affinity[d] B (S.E.)
Age	**1.01+(0.004)**	**1.01+(0.004)**	1.01 (0.01)	1.00 (0.01)
Ethnicity (Samoan)	**0.77*(0.07)**	**0.76*(0.07)**	0.90 (0.15)	0.81 (0.14)
Gender (Male)	1.16 (0.19)	1.14 (0.18)	1.14 (0.18)	1.15 (0.16)
Marital Status Married (Ref.)	–	–	–	–
Formerly married	**0.71*(0.10)**	**0.68*(0.08)**	**0.72*(0.10)**	**0.74*(0.10)**
Never married	1.11 (0.63)	1.22 (0.25)	1.28 (0.27)	1.22 (0.21)
Education <HS (Ref.)	–	–	–	–
HS	–	0.94 (0.12)	0.95 (0.12)	0.90 (0.12)
>HS	–	0.86 (0.12)	0.86 (0.15)	0.88 (0.13)
Emp. Status FT (Ref.)	–	–	–	–
PT	–	0.90 (0.14)	0.92 (0.13)	0.93 (0.13)
Not working/ Other	–	0.95 (0.14)	0.94 (0.14)	0.99 (0.13)
Fin. Insecurity	–	1.07 (0.04)	**1.08+(0.04)**	1.06 (0.04)
Birthplace US (Ref.)	–	–	–	–
Samoa	–	–	1.02 (0.20)	0.90 (0.17)
Am. Samoa	–	–	1.09 (0.21)	0.97 (0.17)
Tonga	–	–	**1.36+(0.23)**	1.25 (0.22)
Cultural Affinity	–	–	–	**1.06*(0.02)**
Constant	2.42 (0.50)	2.38 (0.39)	2.02 (0.43)	0.40 (0.18)
QIC-u	1038	990	978	875

**$p < 0.001$, *$p < 0.05$, +$p < 0.10$; all models adjusted for clustering by religious institution.
[a]Demographic covariates (age, gender, ethnicity, marital status).
[b]Socioeconomic covariates (education, employment status, financial insecurity).
[c]Birth country (United States, American Samoa, Samoa, Tonga).
[d]Cultural affinity score.

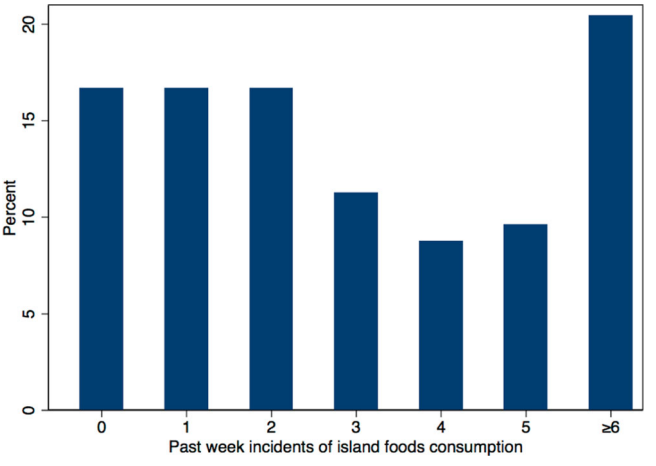

Figure 2. Frequency of island food consumption in past week.

an increase in island food consumption. Centered about a mean score of 32.75, a one-point increase in cultural affinity is associated with a 6% increase in weekly incidents of island food consumption ($IRR = 1.06 \pm 0.02$, $p = 0.002$).

Discussion

Although just over 16% of participants reported not eating any island foods during the previous week, over 20% reported eating island foods at least 6 times (Figure 1). Many participants either report very high or very low levels of island food consumption, with relatively few participants reporting mid-range values. This may speak to multiple driving factors such as availability and affordability of island foods, normative eating behaviors within subgroup communities, individual eating habits, and expression of culture and identity – some of which are addressed in the multivariable analysis.

In the first multivariable model, age, ethnicity, and formerly married were significantly associated with increased island food consumption. Given that older individuals in this sample were more likely to be born outside of the United States and may be more used to eating island foods, this is not a surprising finding (Bell et al. 1999). A study of the dietary preferences of Samoan teenagers in Auckland showed that the children preferred Westernized 'junk' foods such as fast foods, fizzy drinks, sweets, and fried foods although traditional foods were eaten when purchased by older, female relatives (Fuamatu 1997). Pacific Islander Americans are a young population and these types of foods have been linked to negative health outcomes such as obesity and diabetes (Duffey et al. 2012; Grimes et al. 2013; Liese et al. 2009; McNaughton, Mishra, and Brunner 2008; Panapasa 2009; van Dam et al. 2002). If this eating pattern exhibited among the youth of Auckland is widespread among Pacific Islander youth, the population could face even worse health consequences in coming decades.

Upon addition of socioeconomic variables in the second multivariable model, age and ethnicity retain significance while "formerly married" gains statistical significance. This finding is surprising since age is significantly correlated with marital status – those

formerly married are, on average, 63.18 years of age while those living with partners are 48.12 years, and those never married are 25.32 years old – and older individuals in this population report higher island food consumption. However, this result is shown in a model that already controls for the effect of age. This means that for individuals of the same age, those who are formerly married are less likely to eat island foods compared to those who are living with a partner or never married. Although it is beyond the scope of this study, perhaps these individuals are turning to Western convenience foods. One further layer of conclusion in this finding is that of the 28 individuals who reported being formerly married, only six are men and 22 are women. Recall that Bell et al. (1999) reported men eating slightly more traditional foods than women. It is possible that an aspect of gender roles within Pacific Islander communities are influencing the types foods men and women eat.

One notable socioeconomic variable that did not reach statistical significance, except for at a very marginal level in the third model and then was attenuated during the final model, was financial insecurity. In other settings, the consumption of some types of island foods such as mutton flaps or corned beef has been linked to lower cost in comparison to leaner meats (Evans et al. 2002; Gewertz and Errington 2010). However, this analysis suggests that island food consumption is not driven by financial difficulties in this population. This lends even more weight to the suggestion that island food consumption is primarily driven by personal habit or cultural factors.

In the final two multivariable models, the cultural variables birth country and cultural affinity were both statistically significant predictors of island food consumption, but the effect of birth country was attenuated once cultural affinity was added in the final model. The significant difference in island food consumption between Samoans and Tongans may be explained by differences in birth country, since a higher proportion of Samoans were born either in the United States or American Samoa compared to Tongans. This is supported by the loss of significance for the effect of ethnicity upon the addition of birth country. Evidence for variation in Pacific Islanders' dietary patterns based on island nativity and subsequent migration to a more Western or urbanized environment is plentiful and suggests that individuals living in more Westernized or urbanized environments eat fewer traditional foods and more Western foods (Pawson and Janes 1981; Stanhope and Prior 1980; Stanhope, Sampson, and Prior 1981). The finding that Tongan birthplace was significantly associated with increased island food consumption is not surprising. Tonga is, by far, the most rural, least Americanized, and geographically distant of the three foreign birthplaces. Culturally, Tonga stands proud as the only Pacific Island nation never to surrender its sovereignty to a foreign power and does not have the political ties to the United States that American Samoa has.

Finally, cultural affinity is one of two strong, significant predictors of island food consumption in the final model. Given that all other predictors are identical between two PIHS participants, the one with a higher reported cultural affinity score is expected to also report a higher level of island food consumption. However, this result does not explain what aspect of cultural affinity is responsible for this association. Social norms, habit, identity, or political assertion could all be potential driving factors of culturally-related food choice. For example, a study of Native Hawaiian migrants to Las Vegas, Nevada revealed that consumption of Hawaiian foods was associated with well-being, mitigating homesickness, and comfort (Lassetter 2011). The migrants also indicated

that they believed some Hawaiian foods to be 'unhealthy' and that portion control was difficult, suggesting an emotional connection between food consumption and culture; eating increased portions of foods that reminded them of home lessened feelings of isolation and homesickness (Lassetter 2011). This conclusion is beyond the scope of this analysis, but future work may be better able to inform the relationship between cultural affinity and island food consumption.

There are multiple strengths and limitations of this analysis that should be addressed. There are no other known studies that have examined patterns of island food consumption among Pacific Islander Americans. This study also used robust statistical techniques to account for potential confounders and community-level clustering to create a dataset whose responses are generalizable to the entire population of Samoans and Tongans living in California. However, there are also limitations. First, the PIHS is a pilot test of a larger, forthcoming project. Therefore, ethnic diversity within the sample is limited and participants were chosen specifically from Samoan and Tongan faith-based organizations (S. V. Panapasa, Jackson, Caldwell, Heeringa, et al., 2012b). The inclusion of two ethnic groups and recruitment from religious organizations may limit the generalizability of this sample. Second, these data are cross-sectional in nature, which makes causal inference impossible and self-report data could introduce social desirability or recall bias. Third, the high alpha value chosen for tests of significance in order to show trending within a relatively small data set greatly increased the possibility of type I error. Lastly, the global nature and self-definition of the island foods variable made nuanced interpretation difficult. The island foods variable used in this analysis did not differentiate between the type or nutritional quality of island foods consumed as there are many types of island foods that vary greatly in availability and nutritional content both within the Pacific region and the Pacific diaspora. Canned coconut milk and canned pork products are lower in nutritional quality than their fresh counterparts, but are widely available in the continental United States and have been accepted as convenient substitutes. It is unknown whether fresh, high-quality fish may be more or less available to the participants of this study given the high cost of fresh fish in many Pacific Islands (and subsequent consumption of canned fish as a cheaper alternative). Furthermore, 'traditional' diets also vary widely throughout the Pacific Islands. Although this study population only included Samoan and Tongan individuals, the study was designed as a pilot test for a larger, national study in which all Pacific Islanders will be included. Therefore, a global islands food variable allows for more flexibility and self-definition across ethnic groups. Future research should explore how foods consumed by participants vary by nutritional quality.

This analysis is simply the first step in answering important questions regarding the dietary choices of one of the fastest growing ethnic groups in California that also experiences elevated rates of diet-related health outcomes such as obesity, cardiovascular disease, and diabetes. Although the results of this study are not generalizable to a national population, they contribute to the larger body of knowledge regarding culture, migration, and dietary patterns in Pacific Islander Americans. Understanding the food choices of this population could help policy makers and community members to address diet-related health disparities in this and other minority populations. Furthermore, this analysis generates other questions for future research such as which specific aspects of cultural affinity influence island food consumption or how the relationships between various characteristics and island food consumption are moderated by cultural affinity.

Acknowledgments

This paper was written with support from the Harvard University Native American Program 1665 Caleb Cheeshateaumuck Pre-Doctoral Fellowship and the Queen's Health System Health Equity Fellowship.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the Harvard University Native American Program through the 1665 Caleb Cheeshateaumuck Pre-Doctoral Fellowship and the Queen"s Health System Health Equity Fellowship.

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References

Bell, A. C., B. A. Swinburn, H. Amosa, R. Scragg, and S. J. Sharpe. 1999. "Measuring the Dietary Intake of Samoans Living in New Zealand: Comparison of a Food Frequency Questionnaire and a 7 Day Diet Record." *Asia Pacific Journal of Clinical Nutrition* 8 (2): 149–154.

Buchthal, V. 2014. "Insights in Public Health: Is the Gap Growing? Patterns in Poverty-Related Disparities in Nutrition and Physical Activity in Hawai'i." *Hawai'i Journal of Medicine & Public Health* 73 (10): 332–334.

Cui, J., and G. Qian. 2007. "Selection of Working Correlation Structure and Best Model in GEE Analyses of Longitudinal Data." *Communications in Statistics - Simulation and Computation* 36 (5): 987–996.

Duffey, K. J., L. M. Steffen, L. Van Horn, D. R. Jacobs, and B. M. Popkin. 2012. "Dietary Patterns Matter: Diet Beverages and Cardiometabolic Risks in the Longitudinal Coronary Artery Risk Development in Young Adults (CARDIA) Study." *American Journal of Clinical Nutrition* 95 (4): 909–915.

Epstein, L. H., J. J. Leddy, J. L. Temple, and M. S. Faith. 2007. "Food Reinforcement and Eating: A Multilevel Analysis." *Psychological Bulletin* 133 (5): 884–906. doi:10.1037/0033-2909.133.5.884.

Errington, F., and D. Gewertz. 2008. "Pacific Island Gastrologies: Following the Flaps." *Journal of the Royal Anthropological Institute* 14 (3): 590–608. doi:10.1111/j.1467-9655.2008.00519.x.

Espinosa de Los Monteros, K., L. C. Gallo, J. P. Elder, and G. A. Talavera. 2008. "Individual and Area-Based Indicators of Acculturation and the Metabolic Syndrome Among Low-Income Mexican American Women Living in a Border Region." *American Journal of Public Health* 98 (11): 1979–1986. doi:10.2105/ajph.2008.141903.

Evans, M., R. C. Sinclair, C. Fusimalohi, and V. Liava'a. 2002. "Diet, Health and the Nutrition Transition: Some Impacts of Economic and Socio-Economic Factors on Food Consumption Patterns in the Kingdom of Tonga." *Pacific Health Dialog* 9 (2): 309–315.

Finau, S., I. Prior, and J. Maddill. 1986. "Food Consumption Patterns Among Urban and Rural Tongans." *Journal of Food and Nutrition* 43 (2): 78–84.

Fuamatu, N. 1997. "The Food Choices of Samoan Teenagers in Auckland: Big mac Combo or Pisupo and Taro?" *Pacific Health Dialog* 4 (2): 6–10.

Gadgil, M. D., C. A. Anderson, N. R. Kandula, and A. M. Kanaya. 2014. "Dietary Patterns in Asian Indians in the United States: An Analysis of the Metabolic Syndrome and Atherosclerosis in

South Asians Living in America study." *Journal of the Academy of Nutrition and Dietetics* 114 (2): 238–243. doi:10.1016/j.jand.2013.09.021.

Gewertz, D., and F. Errington. 2010. *Cheap Meat: Flap Food Nations in the Pacific Islands*. Berkeley, California: University of California Press.

Grimes, C. A., L. J. Riddell, K. J. Campbell, and C. A. Nowson. 2013. "Dietary Salt Intake, Sugar-Sweetened Beverage Consumption, and Obesity Risk." *Pediatrics* 131 (1): 14–21.

Harmon, B. E., C. J. Boushey, Y. B. Shvetsov, R. Ettienne, J. Reedy, L. R. Wilkens, Le Marchand L., Henderson B. E., L. N. Kolonel. 2015. "Associations of Key Diet-Quality Indexes with Mortality in the Multiethnic Cohort: The Dietary Patterns Methods Project." *American Journal of Clinical Nutrition* 101 (3): 587–597. doi:10.3945/ajcn.114.090688.

Hixson, L., B. B. Hepler, and M. O. Kim. 2012. "The Native Hawaiian and Other Pacific Islander Population: 2010." *2010 Census Briefs*. http://www.census.gov/prod/cen2010/briefs/c2010br-12.pdf.

Hughes, R. G., and M. A. Lawrence. 2005. "Globalisation, Food and Health in Pacific Island Countries." *Asia Pacific Journal of Clinical Nutrition* 14 (4): 298–306.

Hughes, R. G., and G. C. Marks. 2009. "Against the Tide of Change: Diet and Health in the Pacific Islands." *Journal of the American Dietetic Association* 109 (10): 1700–1703. doi:10.1016/j.jada.2009.07.015.

Kim, H. S., S. Y. Park, A. Grandinetti, P. S. Holck, and C. Waslien. 2008. "Major Dietary Patterns, Ethnicity, and Prevalence of Type 2 Diabetes in Rural Hawaii." *Nutrition* 24 (11–12): 1065–1072. doi:10.1016/j.nut.2008.05.008.

Lassetter, J. H. 2011. "The Integral Role of Food in Native Hawaiian Migrants' Perceptions of Health and Well-Being." *Journal of Transcultural Nursing* 22 (1): 63–70. doi:10.1177/1043659610387153.

Liese, A. D., K. E. Weis, M. Schulz, and J. A. Tooze. 2009. "Food Intake Patterns Associated With Incident Type 2 Diabetes: The Insulin Resistance Atherosclerosis Study." *Diabetes Care* 32 (2): 263–268.

Lin, H., K. A. Carr, K. D. Fletcher, and L. H. Epstein. 2013. "Food Reinforcement Partially Mediates the Effect of Socioeconomic Status on Body Mass Index." *Obesity* 21 (7): 1307–1312. doi:10.1002/oby.20158.

Martikainen, P., E. Brunner, and M. Marmot. 2003. "Socioeconomic Differences in Dietary Patterns Among Middle-Aged Men and Women." *Social Science & Medicine* 56 (7): 1397–1410.

Maskarinec, G., Y. Takata, I. Pagano, L. Carlin, M. T. Goodman, L. Le Marchand, A. M. Y. Nomura, L. R. Wilkens, and L. N. Kolonel. 2006. "Trends and Dietary Determinants of Overweight and Obesity in a Multiethnic Population." *Obesity* 14 (4): 717–726. doi:10.1038/oby.2006.82.

Mau, M. K., K. Sinclair, E. P. Saito, K. N. Baumhofer, and J. K. Kaholokula. 2009. "Cardiometabolic Health Disparities in Native Hawaiians and Other Pacific Islanders." *Epidemiologic Reviews* 31: 113–129. doi:10.1093/ajerev/mxp004.

McEligot, A. J., J. McMullin, K. Pang, M. Bone, S. Winston, R. Ngewa, and S. P. Tanjasiri. 2012. "Dietary Intakes, Obesity and Health Behaviors in Native Hawaiians Residing in Southern California." *Hawai'i Journal of Medicine & Public Health* 71 (5): 124–128.

McNaughton, S. A., G. D. Mishra, and E. J. Brunner. 2008. "Dietary Patterns, Insulin Resistance, and Incidence of Type 2 Diabetes in the Whitehall II Study." *Diabetes Care* 31 (7): 1343–1348.

Mhurchu, C. N., H. Eyles, C. Schilling, Q. Yang, W. Kaye-Blake, M. Genc, T. Blakely, and H. Zhang. 2013. "Food Prices and Consumer Demand: Differences Across Income Levels and Ethnic Groups." *PLoS ONE* 8 (10): e75934–e75934. doi:10.1371/journal.pone.0075934.

Moy, K. L., J. F. Sallis, and K. J. David. 2010. "Health Indicators of Native Hawaiian and Pacific Islanders in the United States." *Journal of Community Health* 35 (1): 81–92. doi:10.1007/s10900009-9194-0.

Panapasa, S. 2009. "Social, Demographic, and Cultural Characteristics of US Pacific Islanders." In *Asian American Communities and Health*, edited by C. Trinh-Shevrin, N. S. Islam, and M. J. Rey, 50–72. San Francisco: Jossey-Bass.

Panapasa, S. V., J. Jackson, C. Caldwell, S. Heeringa, J. McNally, D. Williams, Debra Coral, et al. 2012a. "Community-Based Participatory Research Approach to Evidence-Based Research:

Lessons from the Pacific Islander American Health Study." *Progress in Community Health Partnerships: Research, Education, and Action* 6 (1): 53–58. doi:10.1353/cpr.2012.0013.

Panapasa, S. V., J. S. Jackson, C. Caldwell, S. Herringa, J. McNally, and D. R. Williams. 2012b. *Pacific Islander Health Study Report: Preliminary Findings*. Retrieved from Ann Arbor, MI: http://projects.isr.umich.edu/nhpi/Pacific_Islander_Health_Study_Report_2012_Preliminary_Findings.pdf.

Park, S. Y., S. P. Murphy, L. R. Wilkens, J. F. Yamamoto, S. Sharma, J. H. Hankin, B. E. Henderson, and L. N. Kolonel. 2005. "Dietary Patterns Using the Food Guide Pyramid Groups are Associated with Sociodemographic and Lifestyle Factors: The Multiethnic Cohort Study." *Journal of Nutrition* 135 (4): 843–849.

Pawson, I. G., and C. Janes. 1981. "Massive Obesity in a Migrant Samoan Population." *American Journal of Public Health* 71 (5): 508–513.

Ravussin, E., M. E. Valencia, J. Esparza, P. H. Bennett, and L. O. Schulz. 1994. "Effects of a Traditional Lifestyle on Obesity in Pima Indians." *Diabetes Care* 17 (9): 1067–1074.

Revisions of the standards for the classification of federal data on race and ethnicity, 632 C.F.R. 1996.

Rush, E., N. Puniani, N. Snowling, and J. Paterson. 2007. "Food Security, Selection, and Healthy Eating in a Pacific Community in Auckland New Zealand." *Asia Pacific Journal of Clinical Nutrition* 16 (3): 448–454.

Satia-Abouta, J. 2003. "Dietary Acculturation: Definition, Process, Assessment, and Implications." *International Journal of Human Ecology* 4 (1): 71–86.

Satia-Abouta, J., R. E. Patterson, M. L. Neuhouser, and J. Elder. 2002. "Dietary Acculturation: Applications to Nutrition Research and Dietetics." *Journal of the American Dietetic Association* 102 (8): 1105–1118.

Schiller, J. S., J. W. Lucas, and J. A. Peregoy. 2012. "Summary Health Statistics for U.S. Adults: National Health Interview Survey, 2011." *Vital and Health Statistics* 10 (256): 1–218.

Schulz, L. O., P. H. Bennett, E. Ravussin, J. R. Kidd, K. K. Kidd, J. Esparza, and M. E. Valencia. 2006. "Effects of Traditional and Western Environments on Prevalence of Type 2 Diabetes in Pima Indians in Mexico and the U.S." *Diabetes Care* 29 (8): 1866–1871. doi:10.2337/dc06-0138.

Sharkey, J. R., C. M. Johnson, and W. R. Dean. 2011. "Nativity is Associated with Sugar-Sweetened Beverage and Fast-Food Meal Consumption Among Mexican-Origin Women in Texas Border Colonias." *Nutrition Journal* 10: 235. doi:10.1186/1475-2891-10-101.

Sharma, S., L. R. Wilkens, L. Shen, and L. N. Kolonel. 2013. "Dietary Sources of Five Nutrients in Ethnic Groups Represented in the Multiethnic Cohort." *British Journal of Nutrition* 109 (8): 1479–1489. doi:10.1017/s0007114512003388.

Stanhope, J. M., and I. A. M. Prior. 1980. "The Tokelau Island Migrant Study: Prevalence and Incidence of Diabetes Mellitus." *New Zealand Medical Journal* 92 (673): 417–421.

Stanhope, J. M., V. M. Sampson, and I. A. Prior. 1981. "The Tokelau Island Migrant Study: Serum Lipid Concentration in Two Environments." *Journal of Chronic Diseases* 34 (2–3): 45–55.

Takata, Y., G. Maskarinec, S. Y. Park, S. P. Murphy, L. R. Wilkens, and L. N. Kolonel. 2007. "Mammographic Density and Dietary Patterns: The Multiethnic Cohort." *European Journal of Cancer Prevention* 16 (5): 409–414. doi:10.1097/01.cej.0000243852.05104.02.

Tillotson, J. L., H. Kato, M. Z. Nichaman, D. C. Miller, M. L. Gay, K. G. Johnson, and G. G. Rhoads. 1973. "Epidemiology of Coronary Heart Disease and Stroke in Japanese Men Living in Japan, Hawaii, and California; Methodology for Comparison of Diet." *American Journal of Clinical Nutrition* 26 (2): 177–184.

van Dam, R. M., E. B. Rimm, W. C. Willett, M. J. Stampfer, and F. B. Hu. 2002. "Dietary Patterns and Risk for Type 2 Diabetes Mellitus in U.S. Men." *Annals of Internal Medicine* 136 (3): 201–209.

Young, C. M., B. C. Batch, and L. P. Svetkey. 2008. "Effect of Socioeconomic Status on Food Availability and Cost of the Dietary Approaches to Stop Hypertension (DASH) Dietary Pattern." *The Journal of Clinical Hypertension* 10 (8): 603–611.