UNIVERSITY OF HAWAII AT MANOA

Association of Health Literacy with Cardiovascular Disease in Chinese Americans

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ABSTRACT

As a leading cause of death in Americans, cardiovascular disease (CVD) is further aggravated by health disparities among ethnic minority sub-populations. In Hawaii and California, the Chinese American population is considered a minority population. Within these groups, CVD can be worsened by having low English proficiency and low health literacy. Low health literacy has been associated with CVD in other populations thus Chinese Americans may lack adequate health literacy required for protection against developing CVD or effective management of CVD after diagnosis. Having diminished understanding of disease prevention and health maintenance, such as through low health literacy (LHL), can exacerbate risk factors for developing CVD.

This project was a collaborative effort between the Office of Public Health Studies at The University of Hawai'i at Mānoa and the Hawai'i State Department of Health. The aim was to gain a better understanding of the relationship between health literacy and its effects on CVD in the Chinese American sub-populations of California and Hawaii. Data was taken from three health surveys across these states, respectively. The results were analyzed using descriptive statistics and multivariate logistic models. The data collected across the surveys were compared for evidence of association between health literacy and CVD in the sample populations. While descriptive results showed a relationship with CVD and low health literacy in Chinese respondents, these relationships did not hold in multivariable models. However, other associations were found, including the relationship among health literacy and age, which sets the foundation for future research.

SIGNIFICANCE

Health Literacy

Health literacy is a multi-faceted skill that contributes to individual and population-based health (Guzys et al., 2015). As defined by the Office of Disease Prevention and Health Promotion (2015), health literacy is "the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions." The healthcare system succeeds in improving health when the larger population is able to access necessary services. Although doctors can prescribe medications, give advice, and inform patients of their available treatment and health management options; health literacy can provide individuals with the confidence to manage health conditions independently.

In-person health literacy tests are used to measure functional health literacy in individual patients for research and clinical purposes (Guzys et al., 2015). Functional health literacy measures the ease of access patients have to sources needed to manage and understand their health conditions (Levin-Zamir and Peterburg, 2001). Despite the benefits from learning individual risks for low health literacy, there are positive implications from utilizing population-based surveys, as the results could give a more detailed snapshot of conditions present in the population at large.

Common methods of measuring health literacy include using the Rapid Estimate of Adult Literacy in Medicine (REALM) and the Test of Functional Health Literacy in Adults (TOFHLA). Self-reported questions, including the question, "How confident are you filling out forms by yourself?" were compared with the REALM and the TOFHLA. Chew et al. (2007) and Wallace et al. (2006) found this question to be predictive of low

health literacy in their study group of veterans. The researchers advocated the importance of assessing the effectiveness of survey questions periodically, since having a limited number of predictive questions can reduce the participant burden of having to spend time responding to the survey (Chew et al., 2007; Wallace et al., 2006). Results from their study can influence the development of future health surveys to gather data effectively on health literacy in populations.

Disparities in Ethnic Minorities

Studies have shown that ethnic minorities, including some Asian Americans and Pacific Islander subgroups, have lower self-reported health than whites (Sentell, Baker, Onaka and Braun, 2011). Some Asian Americans and Pacific Islander subgroups also have low health literacy (Sentell, Baker, Onaka and Braun, 2011). From an economic standpoint, low health literacy (LHL) is positively correlated with higher health care costs (Wolf, Gazmararian, and Baker, 2005). According to Chao, Anderson, and Hernandez (2009), health literacy variations between ethnic groups can account for 25–30 percent of differences in health outcomes. Health disparities can undoubtedly manifest with the presence of such large differences.

When minorities have insufficient understanding of their health conditions, improving their health can become a difficult problem to solve. Crengle et al. (2014) found that, in their study of indigenous populations in New Zealand, Australia and Canada, inadequate knowledge of cardiovascular disease (CVD) medications was a potential barrier to using the medications as prescribed. The researchers took a novel approach to studying small communities in Canada by proposing "single arm, pre-post

design with case studies of the surrounding environments for factors that may influence the effect of the trial" (Crengle et al., 2014).

Cardiovascular Disease

According to the Centers for Disease Control and Prevention, cardiovascular disease is the leading cause of death in Americans (Heart Disease Facts, 2015). CVD occurs when plaque builds up in the coronary arteries. Plaques are typically composed of fat and cholesterol and form when the inner lining of the arteries become impaired (Heart Disease Facts, n.d.). When plaques grow to a certain degree, the passageway of blood is blocked and the arteries rupture. Rupturing of a blood vessel results in a heart attack because the heart does not receive its necessary blood supply. Malfunctioning of the cardiovascular system thus leads to a plethora of negative health outcomes, past the burden of cardiovascular disease.

Cardiovascular disease is impacted by a variety of factors, including genetics, nutrition, and lifestyle choices, which simultaneously makes it a preventable, treatable disease. CVD is also a disease that typically requires a certain amount of health knowledge to maintain effectively. After becoming diagnosed with a chronic disease such as CVD, researchers suggest that a combination of group and individual interventions work best to sustain healthy progress and prevent risky behaviors (Taggart et al., 2012). Interventions such as education and daily lifestyle changes in nutrition and exercise can make drastic differences in health. Especially in diverse, local indigenous communities, the close circle of friends and family were found to be the most important source of health information (Crengle et al., 2014).

INTRODUCTION

Low Health Literacy Results in Poorer Health

Health literacy encompasses a set of skills that individuals learn that can help them to make informed decisions for their health. Known risk factors of low health literacy include education, language, culture, healthcare access, and age (US Department of Health and Human Services, n.d.). When individuals have inadequate health literacy, they are less likely to be able to improve or maintain their health. Wolf, Gazmararian, and Baker (2005) found that low health literacy contributed to poorer physical and mental health, affected the ability to perform tasks associated with daily living, and lowered the general quality of life. Taggart et al. (2012) also noted that the rates of hospitalization were higher in those with lower health literacy than in their counterparts who had higher health literacy. Improving health literacy is practical, important goal that can greatly diminish negative health outcomes.

Managing Cardiovascular Disease Effectively

Cardiovascular disease (CVD) is a debilitating disease that is prevalent around the world. The severity of this condition is influenced greatly by the knowledge of how to manage it. When the coronary arteries become obstructed such that blood flow to the heart is inhibited, a heart attack will occur. Having CVD and being unable to manage the disease well is a leading cause of a shortened lifespan in the US and globally (Crengle et al., 2014). One reason can be attributed to the aging process— the body naturally deteriorates over time. However, multiple lifestyle aspects can exacerbate or speed-up the effects of CVD, including genetics, diet, and exercise. The most effective method of treatment for CVD, therefore, should address these multiple lifestyle components.

Culturally Sensitive Integrative Approach

In order to achieve a proficient level of health literacy, individuals must be presented with health information in a way they can understand. The American Medical Association (AMA) supports increasing the knowledge about health literacy in medical professionals as well as the general public (AMA, 1999). There are a few interventions that have been employed to combat the problem of low health literacy in minority populations. Culture and language differences were determined to play a role in health literacy (Shaw et al., 2009). Therefore, providing information in other languages other than English, and in a culturally sensitive way will improve the health care understanding of minority groups.

Crengle et al. (2014) found that some minority groups had gaps in knowledge regarding CVD treatment options. Researchers studied healthy literacy in indigenous populations of Australia, Canada, and New Zealand (Crengle et al., 2014). In collaboration with health professionals, the team devised medication treatment plans for these minority groups and measured whether or not CVD and health knowledge increased (Crengle et al., 2014). Creating individualized treatment plans is effective in improving health because distinct issues can be addressed in an effective way.

Chinese Americans in Hawaii and California

Hawaii and California are have higher populations of Chinese Americans compared to other states. Health literacy in the Chinese is under-studied.

Chinese Americans with low English proficiency were found to also have the highest prevalence of low health literacy (Sentell, Baker, Onaka and Braun, 2011). Low English proficiency could be due to inability to learn English well if the majority of

Chinese Americans are immigrants. Although English proficiency is often taught through the education system, doctors and other health advocates can teach health literacy to some extent. There can be positive implications if the Chinese American individual knows he or she has specific conditions and is proactive about seeking information to maintain his or her health.

A Snapshot of Health in Asian Americans

According to Ghosh (2010), Asian Americans and Pacific Islanders are typically broadly classified and therefore often misrepresented in the health discussion here in the United States. In fact, prominent governmental groups such as the US Census Bureau and the Centers Disease Control and Prevention (CDC) collect aggregate data on these minority groups (Ghosh 2010). Individuals belonging to these categories are from a wide variety of locations and are nationally classified as minorities. Data must be collected with more attention on the specific groups within minorities to increase the overall health of the entire population, In Hawaii, Sentell et al. (2011) studied the groups: Filipino, Japanese, Native Hawaiian, and White for self-reported health based on health literacy. The researchers found that lower health literacy is positively correlated with poor health status [say in which AAPI population as that's what was novel about study], and thus more focused research must be done in order to improve the health of these micro-populations (Sentell et al., 2011).

In this study, focus will be on Chinese Americans in Hawaii and California. This ethnic group is the largest growing Asian American sub-population in the US (Asian American Populations, 2013), yet understudied. However, research has found that Chinese Americans have higher rates of hypertension compared to other Asian

Americans and Whites (Palaniappan et al., 2010). Additionally, 75% of Chinese American immigrants have limited English proficiency (Li and Froelicher, 2007), which may impact how well this group can manage symptoms of CVD.

In this study, health data on the Chinese American ethnic minority was examined for self-reported health status, health literacy and cardiovascular outcomes. These data were taken from existing population-based surveys implemented in Hawaii and California, the Hawaii Health Survey (HHS), the Behavioral Risk Factor Surveillance System (HBRFSS) and the California Health Interview Survey (CHIS). STATA, the statistical software program, was used to run coding to determine the association between low health literacy and cardiovascular disease among Chinese American respondents. The objective of the study was to conduct a descriptive and statistical assessment of data regarding health literacy and CVD in Chinese Americans. The hypothesis was that LHL will have a significant association with CVD in Chinese Americans.

METHODS

Sampling

Data from three telephone health surveys: the Hawai‘i Health Survey (HHS), the Hawaii Behavioral Risk Factor Surveillance System (HBRFSS), and the California Health Interview Survey (CHIS), were used to consider the Chinese American populations in Hawaii and California. These surveys included data on adult respondents (18+ years of age).

The three health surveys were slightly distinct in their purposes and languages of distribution. The HHS assesses the health status and demography of the Hawaii population (Hawaii State Department of Health, 2015). The HBRFSS is administered by the Centers for Disease Control and Prevention and encompasses various health information from residents in Hawaii. The HBRFSS also evaluates a variety of health behaviors that may result in risk factors for health issues (Hawaii State Department of Health, 2015). Lastly, the CHIS collects an assortment of health data from the wide range of California residents (UCLA Center for Health Policy Research, 2012). Questions on the CHIS are also translated into the languages of Spanish, Chinese (Mandarin and Cantonese), Korean, Vietnamese, and Tagalog (UCLA Center for Health Policy Research, n.d.).

Study Variables

Several variables were studied: health literacy, ethnicity/race, and health outcome (including CVD). The existence of relationships between these variables was determined through statistical analysis of the data.

Control Variables

Control variables were taken into account in order to accurately compare information on individuals with different characteristics. In this study, the variables: education, age, gender, income level, marital status, and insurance status were controlled.

Statistical Analysis

After data collection, statistical analysis was performed. In multivariate logistic models, CVD and other CVD-related outcomes were the dependent variables. The models assessed if low health literacy predicted CVD and CVD-related outcomes when other factors were controlled among Chinese respondents in each survey. The software program STATA, was used to perform this analysis.

Determining the significance of the relationships occurred in several ways. The first method was analyzing the p-value for significance using the rule: $p<0.05$ is significant. Additionally, odds ratio (OR) and confidence interval (CI) values were read. The OR indicates the effect size of the relationship, while the CI of the OR conveys the significance. An $OR>1$ would present higher odds of having the outcome, while $OR<1$ is lower odds of having the outcome and $OR=1$ means that there is no association between the variables. If the CI for an OR crosses 1 (i.e. 0.9-1.2), then it is not significant. However, if the CI does not cross 1 (i.e. 0.5-0.9) then the value is significant.

Deliverables/Outcomes

Prior to collecting and analyzing data, an Institutional Review Board (IRB) application was filed to ensure the study did not breach human privacy information. This study received exempt status, since it used existing secondary data from the HHS, HBRFSS, and CHIS and respondents could not be personally identified.

Collaborative Partners

The project was conducted under the mentorship of Dr. Tetine Sentell from the University of Hawai‘i at Mānoa’s Office of Public Health Studies. Dr. Sentell focuses her research on the topics of health literacy and policies in the US healthcare system. Additionally, the goal of the Office of Public Health Studies is to promote prevention of disease by raising awareness and coordinating research in a wide array of public health topics.

Collaboration was also made with Dr. Kathleen Baker from the Department of Health. Dr. Baker oversaw the HHS in terms of releasing variables to the research team. Lastly, Dr. Yan Yan Wu from the Office of Public Health Studies at UH Manoa also helped the team create a table analyzing the HBRFSS data.

The primary outcome of this study was to determine the association between of health literacy and prevalence of CVD in the Chinese American sub-populations of Hawaii and California. From there, potential adjustments in the health care system can be made to ensure participants are aware of how to access health care, prevent further degradation from CVD, and methods for living optimally with the disease.

RESULTS

Table 1. Comparison of the outcomes and control variables found on each survey.

	Survey			
	CHIS (2007)	**HHS (2008)**	**HHS (2010)**	**HBRFSS (2012)**
Outcomes				
CVD	X	X	X	X
Heart failure	X	-	-	-
Medication for high blood pressure	X	-	-	-
High blood pressure	X	-	-	-
High blood cholesterol	-	X	X	-
Stroke	-	-	X	X
Hypertension	-	X	X	-
Angina/Coronary heart attack	-	-	-	X
Myocardial infarction	-	-	-	X
Control variables				
LHL	X	X	X	X
CVD	X	X	X	X
LEP	X	-	-	-
Female	X	X	X	X
Born in US	X	-	-	-
Age	X	X	X	X
Education level	X	X	X	X
Poverty	X	X	X	X
Insurance	X	X	X	X
Rural	X	-	-	X
Married	X	X	X	X

As Table 1 shows, each survey included some similar and different questions. All surveys included the outcome variable of CVD, but the CHIS also inquired about whether respondents' had Heart Failure, Medication for high blood pressure, and High blood pressure. The 2008 HHS also asked about High blood cholesterol and Hypertension, while the 2010 version also included Stroke. Lastly, the HBRFSS included Stroke,

Angina/Coronary heart attack and Myocardial infarction in the survey. For the control variables, all surveys asked about LHL, CVD, Female, Age, Education level, Poverty, Insurance, and Married. However, the CHIS also asked about LEP, Born in US, and Rural. The HBRFSS also asked participants about Rural vs. non Rural location of residence.

Table 2. Total number of unweighted respondents in overall sample and Chinese sample from all surveys.

	CHIS (2007)	**HHS (2008 & 2010)**	**HBRFSS (2012)**
Unweighted N for overall sample	1,378	11,641	7,582
Unweighted N for Chinese sample	71	295	405

To achieve larger numbers for the Chinese sample, two years (2008 & 2010) of the HHS were used. As shown in Table 2, the unweighted N for the Chinese sample was 71 from the CHIS, 295 from the HHS, and 405 for the HBRFSS.

Table 3. CHIS (2007) Descriptive sample for Chinese respondents (unweighted n=1,378).

	Not LHL	LHL		Total N (%)
n (%) weighted	69.5%	30.5%		100%
	n (%)	n (%)	p-value (to 0.00X)	
LHL	-	-	-	30.5
CVD	3.53	7.02	0.0114	4.59
Age group			<0.001	
<25	21.57	10.1	-	18.07
25-64	64.92	63.95	-	64.63
65+	13.51	25.95	-	17.3

Female	55.41	51.89	0.4050	54.34
LEP	15.39	58.84	<0.001	28.64
Born in US	27.67	5.72	<0.001	20.97
Education level	-	-	<0.001	
<HS	6.61	2.26	-	11.48
HS/some	32.43	38.55	-	34.3
College	31.91	19.33	-	28.08
Grad deg	29.05	19.51	-	26.14
Poverty	9.43	21.41	0.0003	13.09
Insurance	87.9	81.94	0.0891	86.08
Rural	2.99	2.41	0.7373	2.81
Married	55.47	71.03	0.0016	60.22
Only people with CVD (unweighted n=71)				
Heart Failure	2.53	19.76	0.0086	10.56
HBP	18.22	23.03	0.0811	19.37
Medication for HBP	71.27	82.67	0.1740	74.45

In Table 3, the variables with p-values of <0.001 were Age group, LEP, Born in US, and Education level. A higher percentage of participants did not have LHL (69.5%) compared to those with LHL (30.5%). Additionally, 4.59% of the respondents had CVD. Among the 71 respondents with CVD, the majority responded to taking Medication for HBP (74.45%), compared to having HBP (19.37%) or Heart Failure (10.56%).

Table 4. Multivariable logistic model predicting CVD by LHL among Chinese respondents in CHIS (2007).

	CVD
	Odds Ratio (95% CI)
LHL	1.17 (0.55-2.47)
LEP	0.78 (0.32-1.89)
College (vs. no college)	1.03 (0.49-2.17)
Born USA	0.61 (0.19-1.91)
Age (continuous)	1.08 (1.05-1.12)
Female	1.65 (0.81-3.37)
Poverty	0.91 (0.34-2.46)
Rural	1 (omitted)
Married	0.89 (0.39-2.01)
Insured	0.57 (0.23-1.41)

Table 4 shows the multivariate logistic model predicting CVD by LHL among Chinese respondents for the CHIS. Among the Chinese respondents, there was no association found between CVD and Rural, therefore this value was omitted. However, CVD was found to have a direct relationship with the factors of LHL, College, Age group, and Female. Similarly insignificant, inverse relationships were found between the factors of LEP, Born USA, Poverty, Married, and Insured but these results were not significant due to the wide range of the confidence intervals. The only significant relationship could be found between Age group and CVD, since the OR=1.08 and the CI does not cross 1.

Table 5. HHS (2008 & 2010) descriptive sample for Chinese respondents (unweighted n=11,641).

	Not LHL	LHL		Total N (%)
% (weighted)	80.03	19.97		100%
	%...weighted)	(%)	p-value (to 0.00X)	
LHL	-	-	-	19.97
CVD	4.58	4.40	0.9547	4.54

Age group	-	-	<0.001	
<25	5.17	22.83	-	8.59
25-64	79.78	52.32	-	74.46
65+	15.05	24.86	-	16.95
Female	47.79	59.38	0.1164	50.04
Education level	-	-	0.3217	
<College	38.67	45.71	-	40.03
College+	61.33	54.29	-	59.97
Poverty	5.21	3.77	0.6214	4.93
Insurance	96.74	98.78	0.3053	97.13
Married	52.57	52.70	0.9869	52.60
Only people with CVD (unweighted n= 295)				
Stroke	3.0	0.8	0.1202	2.56
Hyphbp	24.73	25.57	0.8767	24.89
Highbc	28.05	28.0	0.9934	28.04

From the respondent data shown in Table 5, 80.03% did not have LHL while 19.97 did have LHL. The only variable that had a significant p-value for LHL was Age group (<0.001). Among the respondents with CVD, 2.56% had Stroke, 24.89% had hyphbp (hypertension and high blood pressure), and 28.04% had highbc (high blood cholesterol). However, these variables did not reach statistical significance.

Table 6. Multivariable logistic model predicting CVD among Chinese respondents in HHS (2008 & 2010).

	CVD
	Odds Ratio (95% CI)
LHL	0.78 (0.17-3.47)
Female	0.49 (0.14-1.72)
Married	3.53 (0.80-15.57)
Education	1.43 (0.33-6.11)
Insurance	1 (omitted)
Poverty	1 (omitted)
Age	4.73 (1.08-20.75)

As Table 6 shows, CVD had a direct relationship with Married, Education, and Age although these relationships were could not be considered significant due to the wide

confidence intervals that cross 1. There were inverse relationships found between CVD and the factors of LHL and Female. Insurance and Poverty were found to have no significant association with CVD and were therefore omitted.

Table 7. HBRFSS (2012) descriptive sample for Chinese respondents.

		Low HL		Not LHL			Total	
Variables	**levels**	N	wt %	Not LHL	wt %	wt p.val	n	wt %
CVDCRHD4	Yes	5	26.98	10	73.02	0.7743	15	2.83
	No	74	22.39	284	77.61		387	97.17
CVDINFR4	Yes	4	29.87	11	70.13	0.6106	15	4.05
	No	73	21.94	285	78.06		387	95.95
CVDSTRK3	Yes	7	38.67	10	61.33	0.2062	17	4.56
	No	71	21.40	285	78.60		385	95.44

From the HBRFSS, there were three distinct heart conditions within CVD that were analyzed for significance: CVDCRHD4 (Ever Diagnosed with Angina or Coronary Heart Disease), CVDINFR4 (Myocardial Infarction) and CVDSTRK3 (Stroke), as can be seen in Table 7. In the CVDCRHD4 analysis, 26.98% of respondents responded with LHL and 73.02% did not have LHL. Similarly, 29.87% had LHL and 70.13% did not have LHL for the CVDINFR4 variable. Lastly, a slightly larger amount of respondents with CVDSTRK3 had LHL with 38.67% response and a smaller amount did not have LHL at 61.33% respondents.

Table 8. Multivariable logistic model predicting "Ever Diagnosed with Angina or Coronary Heart Disease" among Chinese respondents in HBRFSS (2012) (unweighted n=387).

	CVDCRHD4		
Variables	**OR**	**95% CI**	**p-value**
Low HL	1.38	[0.15,12.61]	0.77766
College	4.01	[0.89,18.07]	0.07196
AGE (continuous)	1.06	[1.04,1.08]	<0.00001
Female	0.45	[0.05,3.73]	0.45872
Poverty	0.44	[0.05,4.13]	0.47355
Rural	0.73	[0.1,5.47]	0.76097

Married	0.15	[0.02,1.15]	0.06886
Not Insured	2948024	[848388,10243950]	0

Table 9. Multivariable logistic model predicting "Myocardial Infarction" among Chinese respondents in HBRFSS (2012) (unweighted n=387).

	CVDINFR4		
Variables	**OR**	**95% CI**	**p-value**
Low HL	1.58	[0.25,9.82]	0.62289
College	2.10	[0.36,12.33]	0.41323
AGE (continuous)	1.03	[0.99,1.08]	0.11179
Female	0.34	[0.04,2.82]	0.31992
Poverty	1.34	[0.09,19.91]	0.83125
Rural	1.03	[0.12,8.93]	0.98034
Married	0.19	[0.04,0.97]	0.04659
Not Insured	7610495	[1825813,31722640]	0

Table 10. Multivariable logistic model predicting "Stroke" among Chinese respondents in HBRFSS (2012) (unweighted n=387).

	CVDSTRK3		
Variables	**OR**	**95% CI**	**p-value**
Low HL	2.10	[0.4,11.13]	0.38503
College	0.51	[0.1,2.54]	0.41350
AGE (continuous)	1.07	[0.99,1.15]	0.07224
Female	0.53	[0.06,4.45]	0.56276
Poverty	0.56	[0.02,19.62]	0.74719
Rural	2.52	[0.69,9.16]	0.16258
Married	0.40	[0.09,1.73]	0.21901
Not Insured	3294671	[989752,10967246]	0

In the Table 8, the variable of Age (continuous) showed significance with a p-value of <0.01. In the Table 9, the variable of Married had a p-value of <0.05 that was close to significance. Lastly, Tables 8-10 all showed significance for the variable of Not Insured with p-values of <0.01.

Table 11. Comparison table of n% (unweighted) respondents with LHL and odds ratio (95% CI) of respondents with CVD by LHL across the three health surveys.

	CHIS (2007)	**HHS (2008 & 2010)**	**HBRFSS (2012)**
n % (unweighted) with LHL	30.5	19.97	26.98

Variables	Odds Ratio (95% CI)		
LHL	1.17 (0.55-2.47)	0.78 (0.17-3.47)	1.38 (0.15-12.61)
Education	1.03 (0.49-2.17)	1.43 (0.33-6.11)	4.01 (0.89-18.07)
Age (continuous)	1.08 (1.05-1.12)	4.73 (1.08-20.75)	1.06 (1.04-1.08)
Married	0.89 (0.39-2.01)	3.53 (0.80-15.57)	0.15 (0.02-1.15)

Table 11 shows the summary of the findings from this study. Among the three surveys, the CHIS had the highest percentage of respondents with LHL at 30.5%. Next highest were HBRFSS respondents at 26.98%. Lastly, the combined HHS surveys had 19.97% of respondents with LHL.

The second part of Table 11 shows a select few variables of respondents with CVD by LHL in the multivariate logistic models previously mentioned above. Across the surveys, the only variable that consistently showed significance was that of Age (continuous). For Age, the odds ratio was larger than 1 in all three surveys, which shows that with increasing age, the odds of having CVD increase. Additionally, the 95% CI for all three surveys for Age did not cross 1, therefore the values are statistically significant. The variables of LHL, Education, and Married are shown for comparative purposes.

DISCUSSION

From analysis of the three surveys, CHIS, HHS, and HBRFSS, the only significant association found was between CVD and Age. The association between Age and CVD is not surprising, as prevalence of chronic diseases increases with older age. Unexpectedly, LHL was not found to have association with CVD. This result could have arisen from a number of factors, the first and foremost being the sample size. The main challenge of this study was due to the small Chinese samples in each health survey. Although the CHIS, HHS, and HBRFSS gather quite a bit of information about the general population, this study shows that their reach towards minority populations needs to increase for more in-depth understanding to be achieved. Fortunately, questions in these surveys are updated frequently to gather the best possible snapshot of health in communities.

Historically, Chinese immigrating to Hawaii may have assimilated differently compared to those immigrating to the mainland United States (McDermott and Andrade 2011). The differences in integration may be due to the cultural and social composition of the respective states. These differences in assimilation might impact the Chinese Americans' predictors of CVD and the relationship with LHL.

Since the Chinese Americans living in Hawaii and California have smaller communities, it is possible that they assimilated quicker than other ethnic groups. During assimilation, learning the dominant English language is key to integration with the majority population. Communication becomes more fluid between Chinese Americans and the rest of society, which can allow health practices and management methods to increase. This factor pertains to the findings of this study because there was no significant

association found between the level of health literacy in this ethnic group and CVD, which could be due to an already health literate majority of Chinese Americans included in the surveys.

There was an experiential aspect of this study in which the primary researcher learned to generate code to study variables of interest and manage data effectively, especially since the data contained in the CHIS, HHS, and HBRFSS were in large volumes. As a capstone project in the degree of Public Health, independent and collaborative efforts were practiced.

Public Health Limitations & Implications

This study was limited by a principle factor. From the onset, the population sizes of Chinese Americans surveyed in the CHIS, HHS, and HBRFSS were rather small in number. The population size in turn gave the results poor statistical power. However, since health surveys are already in place, there are great public health implications the data can give. A possible factor behind the low response rate could be due to a language barrier between English, which the HHS and BRFSS were administered in, and Chinese.

From the findings of this study, there are many proposals for public health that can be advanced. Health research needs to make the distinction between various groups within the broad category of "Asian American," because differences do exist between the constituent groups. There should be development in the methods of collecting data from minority groups such as the Chinese Americans. These data collection methods must be able to account for individuals who may not speak English, or may not understand the survey questions asked. Thus, perhaps administering the surveys in a greater variety of languages (such as the method with which the CHIS is presently being issued) would be

beneficial. If more data can be collected on minority groups, the understanding of specific conditions that may plague them can be addressed with greater attention and this can manifest in the refinement in treatment options available to them.

Future studies involving health literacy and CVD in Chinese Americans need to reach a greater number in the sample populations. Research has proven the link between health literacy and CVD, but not much is known about this association in Chinese Americans. To gain a better understanding of the effect of chronic conditions in various populations, it is of utmost importance to fund projects such as this one that look specifically into ethnic groups. This is especially important in the diverse communities such as Hawaii and California, since traditional health services that are geared towards English speakers may not reach those with poorer health literacy. Hopefully, results from this investigation can be used to model other health-related studies in the future.

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