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An Exploration of the Prevalence, Risk Factors, and Health Outcomes of Obesity Among an Ethnically Diverse Sample of Asian Americans

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By

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DEDICATION

This thesis is dedicated to my grandparents. Without their endless sacrifices and unconditional support, I would not be where I am today. They both have shown me the value of hard work and education. Their constant love and commitment to my success has always been my greatest motivation.

TABLE OF CONTENTS

LIST OF TABLES

ABSTRACT

An Exploration of the Prevalence, Risk Factors, and Health Outcomes of Obesity Among an Ethnically Diverse Sample of Asian Americans

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Obesity has increased to epidemic proportions and has become a major public health concern of the 21st century (Stein, & Colditz, 2004). When examining obesity rates among different ethnic groups, Asian Americans are usually less obese than their counterparts (Nam, 2013). Consequently, this has led Asian Americans to become an understudied population within obesity research (Nam, 2013).

Despite Asian Americans being frequently reported as having low overweight and obesity rates as compared to other major racial/ethnic groups, the rates of obesity are increasing (Singh & Lin, 2013). Therefore, the present study seeks to expand the limited literature on obesity among Asian Americans. My study aims to identify the following: 1) the prevalence of obesity and obesity-related diseases (e.g., type 2 diabetes) and 2) risk factors related to obesity among Asian Americans using the social ecological model of health. Specifically, I focus on individual level factors (e.g., diet) and community level factors (e.g., access to fresh produce).

The current study used data from the 2017 California Health Interview Survey (CHIS). A total of 1,057 Asian Americans (Chinese: N=410, 38.8%; Filipinos, N=265, 25.1%; Japanese: N=141, 13.3%; Vietnamese: N=137, 13%; Korean: N=104, 9.8%) residing across California were included in the study. Descriptive analyses were conducted via crosstabs to assess the distribution of obesity and obesity-related health outcomes (e.g., type 2 Diabetes and Cardiovascular disease (CVD)) across the Asian subgroups. Furthermore, multivariate analyses (MANOVAs) were used to assess ethnic group differences among BMI categories on five outcomes: diet, SES, physical activity, food environment, and neighborhood environment across aggregated and disaggregated data. Ultimately, the findings of this study will aid in the development of obesity interventions that ensure Asian Americans receive equitable care.

INTRODUCTION

Statement of Problem

Obesity has increased to epidemic proportions and has become a major public health problem of the 21st century (Stein, & Colditz, 2004). This is concerning because obesity poses a large economic burden (Spieker & Pyzocha, 2016). The total cost of obesity is as high as $275 billion and accounts for more than 20% of all annual health care spending in the U.S. (Spieker & Pyzocha, 2016). Of the total cost, approximately $66 billion go toward indirect costs of obesity, which includes the treatment of cardiovascular disease (CVD) and type 2 diabetes (Spieker & Pyzocha, 2016). Furthermore, the medical costs associated with treatment of obesity-related diseases are estimated to increase by $48–66 billion/year in the USA (Wang, McPherson, Marsh, Gortmaker, & Brown, 2011). Beyond the economic burden, obesity has detrimental physical and psychological consequences for affected populations. As compared to normal weight adults, overweight and obese adults are more likely to be diagnosed with several health problems including diabetes and high blood pressure (Mokdad et al., 2003). Consequently, individuals who are overweight and obese have a decrease in life expectancy (Fontaine, Redden, Wang, Westfall, & Allison, 2003; Olshansky, et al., 2005*;* Peeters, et al., 2003). Overall, the continuing economic and health consequences of obesity underline the need to address this growing epidemic.

Prevalence and Incidence of Obesity in the United States

Since 1980, the prevalence of obesity has doubled in countries worldwide and continues to rise (GBD 2015 Obesity Collaborators, 2017). Obesity has increased from 3.2% in 1975 to 10.8% in 2014 for men, and from 6.4% to 14.9% for women worldwide (NCD Risk Factor Collaboration, 2016). By 2025, obesity prevalence will reach 18% in men and exceed 21% in women (NCD Risk Factor Collaboration, 2016). Among US adults, the rates of obesity have

risen over the past decade (Hales, Frayar, Caroll, Freedman, & Ogden, 2018). In a survey taken by Americans, 81% considered obesity to be the most serious health issue facing the nation (Rosenthal, et al., 2017). According to the Center for Disease Control and Prevention (CDC), the prevalence of obesity in the United States was 39.8% and affected about 93.3 million US adults between 2015 and 2016. Likewise, similar rates can be observed in California where the prevalence of obesity increased almost three-fold among California residents. Obesity prevalence more than doubled from 8.6% between 1985-1990 to 22.8% from 2006 to 2011 (Wong, Chou, & Ahmed, 2014). By 2030, approximately 65 million more adults will become obese (Wang, McPherson, Marsh, Gortmaker, & Brown, 2011).

When examining obesity rates among different ethnic groups, Asian Americans are usually less overweight and obese than their counterparts (Albrecht, & Gordon-Larsen, 2013; Bates, Acevedo-Garcia, Alegría, & Krieger, 2008; Nam, 2013). Consequently, Asians have become an understudied population within obesity research (Cook, Tseng, Bautista, & John, 2016; Cook, Tseng, Tam, John, & Lui, 2017; Nam, 2013). To remedy this, the current study focuses on the determinants and health consequences of adulthood overweight and obesity among the U.S. Asian population. By studying obesity in an unconventional way, profound insight towards understanding this epidemic can be achieved.

Obesity Among Asian American Populations

Despite Asian Americans being frequently reported as having low overweight and obesity rates as compared to other major racial/ethnic groups, the rates of obesity are increasing (Singh & Lin, 2013). Using National Health Interview Survey (NHIS) data, Singh and Lin (2013) examined adult overweight and obesity prevalence among Asian American subgroups. From 1992-2011, obesity prevalence tripled from 3.7% to 13.3% and overweight prevalence

doubled from 23.2% to 43.1% among Asian adults (Singh & Lin, 2013). Specifically, obesity and overweight prevalence doubled for the Chinese and Japanese, and tripled for Filipinos (Singh & Lin, 2013). Filipinos were 3.8 times more likely to be obese than their Chinese counterparts (Singh & Lin, 2013). Additionally, Jih and colleagues (2014) found that among Asian subgroups (Vietnamese, Chinese, Korean, Filipino, South Asian and Japanese), overweight/obesity was highest among Filipinos. This notion that Filipinos, as compared to their Asian counterparts, are at a higher risk of becoming obese is further supported by a systematic review conducted by Staimez and colleagues (2013). Staimez and colleagues (2013) found that among Asian subgroups, Filipinos had the highest reported mean BMI. Collectively, these studies illustrate the increasing rates of obesity among ethnically diverse groups of the U.S. Asian population and characterize Filipinos as a particularly high-risk subpopulation. With the rise in the U.S. Asian population, it is imperative that researchers address obesity among Asian Americans.

U.S. Asian Population Trends

Asians have become the fastest growing population of any major racial or ethnic group. In the past two decades, the U.S. Asian population grew from 11.9 million in 2000 to 20.4 million in 2015, totaling a 72% increase (Lopes, Ruiz, & Patten, 2017). Among the U.S. Asian population, 56% are foreign-born individuals. Among adults, this number rises to 73% (Lopes, Ruiz, & Patten, 2017). By 2065, the U.S. Asian population is projected to rise from 6% to 14% (Lopes, Ruiz, & Patten, 2017). Asians are estimated to make up 38% of all U.S immigrants, exceeding Hispanics which are projected to make up 31%, making them the nation's largest immigrant group (Lopes, Ruiz, & Patten, 2017). Together, the rising rates of obesity among Asian Americans and the projected expansion of the U.S. Asian population stress the need to

focus on the determinants of health behaviors that are prevalent to the etiology and health outcomes of obesity within this population.

Theoretical Framework

In order to gain a holistic understanding of the etiology and outcomes of obesity, the use of an integrative model concerned with multiple factors that affect health is essential. Therefore, the Social Ecological Model of Health (SEM) is often used to understand obesity. The SEM is an integrative model that considers context to be a critical factor in both the development of health problems and efforts to address these problems. The SEM framework seeks to understand the complex interaction of personal and environmental factors, thereby creating a better understanding of obesity and potential leverage points or intermediaries for intervention. The Centers for Disease Control and Prevention (CDC) often uses a four-level adaptation of this model, consisting of the following levels: individual, relationship, community, and societal (Centers for Disease Control and Prevention, 2019). Of these levels, much of the existing literature have paid particular attention to the individual and community level. The individual level is concerned with individual traits and personal identities that increase the likelihood of becoming obese (Centers for Disease Control and Prevention, 2019). Whereas, the community level is concerned with obesogenic settings such as neighborhoods and characteristics of the built environment within these settings. Due to the importance of community and individual level factors in determining where health behaviors originate, both factors will be considered in this study.

Obesogenic Risk Factors

Development of obesity is evident when the individual and community level characteristics are taken into consideration. Subsequently, much of the efforts to determine

predictors of obesity have focused on these two factors. Individual characteristics such as demographic (e.g. socioeconomic status, gender) and behavioral (e.g. diet and exercise) factors have been found to affect an individual's probability of being overweight and obese (Yen, Chen, & Eastwood, 2009). Often, health is viewed as a matter of personal choice. However, our ability to make healthy choices is largely determined by the environments or conditions in which we live. Therefore, an individual's food (Cobb, Appel, Franco, Jones-Smith, Nur, & Anderson, 2015; Jilcott, Keyserling, Crawford, McGuirt, & Ammerman, 2011; Morland et al., 2006) and social environment (Borrell, Graham, & Joseph, 2016; Lumeng, Appugliese, Cabral, Bradley, & Zuckerman, 2006) play an influential role in their likelihood of becoming obese. In all, the current literature suggests the importance of taking into consideration individual and community level factors when studying the etiology of obesity. For this reason, the present study specifically focuses on factors within these two levels. Since existing literature provides a limited understanding of obesity among Asians, the predictors and outcomes that are included in this study are guided by those that have been well established by current literature.

Individual Level

Socioeconomic Status (SES)

Among the existing literature, SES is a well-established predictor of obesity. However, few studies have examined socioeconomic status as a risk factor for obesity among Asian American adolescents, and even fewer for adults. Low family income has been found to be positively associated with Asian adolescent overweight (Cook, Tseng, Bautista, & John, 2016). Furthermore, ethnic-group SES has also been found to be associated with obesity among Asian American adolescents such that, low-income ethnic groups were more likely to be overweight or obese than high- or mid- income ethnic groups (Cook, Tseng, Tam, John, & Lui, 2017).

Additionally, Cho and Juon (2006) found that Korean American adults below the 100% federal poverty level were approximately 2.8 times more likely to be overweight or obese than adults who were at or above the 300% federal poverty level. Although the existing literature suggest there is a relationship between socioeconomic status and obesity among Asian Americans, most of the literature focuses on adolescents whereas very little has empirically tested this relationship among Asian American adults.

Diet

The link between an individual's quality of diet and obesity have been well established. Among California adults, higher rates of obesity were associated with increased consumption of soda and decreased consumption of fruits and vegetables (Wolstein et al., 2015). Similarly, researchers found that California adults who drank one soda or more a day were 27% more likely to be overweight as compared to those who did not drink sodas (Babey, Jones, Yu, & Goldstein, 2009). A meta-analysis conducted by Ruanpeng and colleagues (2017) found across 11 studies, consuming artificially sweetened soda increased an individual's risk of becoming obese. Furthermore, in a longitudinal study of 133,468 men and women living in the U.S., increased consumption of fruits and non-starchy vegetables was inversely associated with weight change over a 24-year period (Bertoia et al., 2015). In line with these findings, Heo and colleagues (2011) identified a significant inverse association between fruit and vegetable intake and obesity, indicating that lower fruit or vegetable intake is correlated with rates of greater obesity. A study done by Liou and Bauer (2007) identified unhealthy dietary habits as a major contributor to weight gain in Chinese American adults living in the New York City metropolitan area. Together, these studies suggest a link between diet and obesity and posits further investigation among Asian Americans.

Physical Activity

Physical activity is a commonly recognized risk factor for adult obesity. A study of counties in Kentucky, Florida, Georgia, and California showed that decreases in obesity prevalence was associated with increases in physical activity (Dwyer-Lindgre et al., 2013). A nationwide study revealed a strong association between a state's prevalence of obesity and lack of physical activity (Brock et al., 2009). Sharpe and colleagues (2004) found that lower odds of meeting the daily physical activity recommendations as suggested by the Centers for Disease Control and American College of Sports Medicine (CDC-ACSM) and the Institute of Medicine (IOM) were associated with higher BMIs. Furthermore, adults who walked for leisure were less likely to be obese than those who did not (Wolstein, Babey, & Diamant, 2015). Although these studies demonstrate the important relationship between obesity and physical activity, this relationship has been seldom looked at among Asian American adults.

Community Level

Food Environment

The link between obesity and an individual's food environment, specifically availability of outlets that carry affordable fresh produce, have been well established (Cobb, Appel, Franco, Jones-Smith, Nur, & Anderson, 2015). The prevalence in rates of obesity increased among communities who did not live within walking distance of a store that sold fresh produce compared to those who did (Jilcott, Keyserling, Crawford, McGuirt, & Ammerman, 2011). Morland and colleagues (2006) examined food store proximity across Mississippi, North Carolina, Maryland, and Minnesota. The increased presence of supermarkets was associated with lower rates of obesity, whereas an increased presence of convenience stores was associated with higher rates of obesity (Morland, Roux, & Wing, 2006). In a study done among New York City

neighborhoods, availability of small grocery stores was associated with lower obesity rates (Black & Macinko, 2010). Based on the results of the 2007 California Health Interview Survey, adults who lacked access to affordable fresh produce had a higher prevalence of obesity than those who reported having access (Wolstein, Babey, & Diamant, 2015). In all, existing literature suggests a link between obesity and inequalities in access and affordability to fresh produce. Essentially, demonstrating the need to investigate this relationship among Asian Americans.

Social Environment

The relationship between obesity and characteristics of the social environment, such as neighborhood safety and cohesion has been explored. Among the existing literature this relationship has been primarily researched among children and adolescents. The literature suggests that homicide rate (Lovasi et al., 2013), living in an unsafe and unsupportive neighborhood (Borrell, Graham, & Joseph, 2016; Lumeng, Appugliese, Cabral, Bradley, & Zuckerman, 2006), and negative parental perceptions of safety (Cecil-Karb & Grogan-Kaylor, 2009) are associated with higher rates of obesity in children and adolescents. However, this relationship has been looked at less extensively among adults. Burdette and colleagues (2006) examined perceptions of neighborhood safety among women in various U.S. cities. Results showed increases in prevalence of obesity as perceptions of neighborhood safety decreased. In congruence, another study examined perceptions of neighborhood safety and BMI among adults living in Los Angeles and found that individuals who perceived their neighborhoods as unsafe had a higher BMI than those who did perceive their neighborhood as safe (Fish et al., 2010)). Together, these studies demonstrate a link between obesity and characteristics of the social environment, such as neighborhood safety and cohesion. However, these relationships have been less extensively studied among adults and to an even lesser extent among Asian Americans.

Health Consequences

The dramatic trend of increasing obesity rates among Asian Americans represent a serious health concern, especially since there is a strong association of obesity to several health risks. Adults who are obese or overweight have increased probabilities of premature death (death before the age of 70 years) than adults who are of normal weight (Peeters et al., 2003). The reduction in life expectancy is a result of the increased risk of developing a number of chronic illnesses including type 2 diabetes and cardiovascular disease (CVD) that people who are overweight or obese face (Mokdad et al., 2003). For this reason, the present study specifically focuses on the following health-related outcomes: type 2 diabetes and CVD.

Obesity has been identified as the leading risk factor for type 2 diabetes and CVD (Barnes, 2011; Hubert, Feinleib, McNamara, & Castelli, 1983). Abdullah and colleagues (2011) found that the duration of obesity is associated with an increased risk of developing type 2 diabetes. Specifically, for men each additional 2-year increase in the duration of obesity there was an 11% increased likelihood of developing type 2 diabetes. Furthermore, those who are obese and have diabetes are at a higher risk of developing CVD (Barnes, 2011). This is concerning because in 2015, diabetes was the second leading cause of BMI-related deaths and more than two thirds of deaths related to high BMI were due to CVD (GBD 2015 Obesity Collaborators, 2017). These studies demonstrate the fatal consequences of diabetes and CVD and the increased risk obese individuals face. Several studies have shown that Asian Americans are at an especially higher risk of developing type 2 diabetes and CVD.

An analysis of the 2004 New York City Health and Nutrition Examination Survey (NYC HANES) revealed that, among those in the normal-weight range, Asians had higher levels of diabetes as compared to their white counterparts (Rajpathak et al., 2010). Lee and colleagues

(2011) used the United States National Health Interview Survey data from 1997-2008 to examine the prevalence of type 2 diabetes in Asians versus Whites. Results showed that throughout the time period, Asian Americans had higher prevalence of type 2 diabetes (Lee, Brancati, & Yeh, 2011). Additionally, Asian Americans were up to 20–40% more likely to have type 2 diabetes than their white counterparts (Lee, Brancati, & Yeh, 2011). After adjustment for BMI (normal, overweight, and obese categories using Asian specific cutoffs) Asian Americans were up to 70% more likely to have type 2 diabetes than their white counterparts (Lee, Brancati, & Yeh, 2011). Further analysis of subgroup data revealed that Filipinos had one of the highest prevalence of type 2 diabetes (Lee, Brancati, & Yeh, 2011). Similarly, Wang and colleagues (2011) found that across Asian American subgroups, the odds of having type 2 diabetes were significantly higher in Filipinos before and after adjustment for BMI. With regards to CVD, Asian-American subgroups had a higher mortality burden across various types of CVD including hypertensive heart disease as compared to their white counterparts. (Jose et al., 2014). Across Asian American subgroups, Filipinos were found to be at a particularly high risk for various types of CVD including hypertension (Holland, Wong, Lauderdale, & Palaniappan, 2011; Klatsky & Armstrong, 1991; Wu, Hsieh, Wang, Yao, & Oakley, 2011; Ye, Rust, Baltrus, & Daniels, 2009).

Altogether, these studies demonstrate that in addition to the already high risk of developing diabetes and CVD that overweight and adults face, Asian Americans-especially Filipinos- are at an even higher risk. Although studies have categorized Asian Americans as a high-risk group for type 2 diabetes and CVD, studies which investigate the role of obesity in this relationship is sparse. As a result, it is imperative that future studies examine the relationship between obesity, type 2 diabetes, and CVD among Asian Americans.

Current Study

The present study seeks to expand the limited literature on obesity among Asian adults. Scholars have noted gaps in the existing literature suggesting there is a lack of and need for use of WHO-recommended Asian-specific BMI cut points and data disaggregation by Asian American subgroups (Lu, Diep, & McKyer, 2015; Mui et al., 2018). Different BMI ranges are recommended for Asians because when compared to their White counterparts of the same BMI, Asians have 3 to 5 percent higher total body fat (Deurenberg, Deurenberg-Yap, & Guricci, 2002). Furthermore, Asians are at a higher risk of weight-related diseases at a lower BMI (Who, 2004). Therefore, using these specific cutoffs will provide accurate definitions of obesity among Asians. In line with recommendations by scholars in the field, the present study uses WHO-recommended BMI cut points for Asians to define obesity and disaggregates the data by the following Asian American subgroups: Filipino, Chinese, Japanese, Korean, and Vietnamese. Keeping this in mind, my study aims are to identify, 1) the prevalence of overweight, obesity and obesity-related diseases such as type 2 diabetes and CVD in Asian Americans, and 2) risk factors related to obesity among Asian Americans using the social ecological model of health. Specifically, I focus on individual level factors (e.g., socioeconomic status, diet, and physical activity) and community level factors (e.g., neighborhood safety and access to fresh fruit and vegetables). By capturing subgroup differences and using specific BMI cut points for Asians, a more accurate and holistic depiction of the causes and consequences of obesity among Asian Americans can be understood. Ultimately, the findings of this study will be essential in developing obesity prevention strategies and interventions that ensure Asian Americans receive equitable and appropriate care.

Hypotheses

Based on the studies presented, I hypothesize the following:

Aim 1: Identify prevalence of obesity and obesity-related diseases such as type 2-diabetes and CVD among Asian American populations.

Hypothesis 1a: Among Asian American subpopulations, Filipinos will have the highest prevalence of obesity, type 2-diabetes, and CVD.

Hypothesis 1b: Across all subpopulations, obesity will be associated with higher prevalence of type 2 diabetes and CVD.

Aim 2: Examine the association between individual level (i.e., socio-economic status, gender, diet, sedentary behavior, and physical activity) and community level (access and affordability fresh produce, neighborhood cohesion, and neighbor safety) and obesity.

As mentioned earlier, ethnically specific data for Asian American subgroups are sparse. Therefore, this section is exploratory. Consequently, I am unable to accurately predict trends that may emerge among the different subgroups. However, due to differences in ancestry, culture, and genetics among subgroups I predict trends should vary between subgroups.

METHODS

Sample

Data came from the 2017 California Health Interview Survey (CHIS) obtained from the UCLA Center for Health Policy Research. CHIS is the nation's largest state health survey and a critical source of credible and comprehensive data on the health of Californians. A total of 21,153 adults were included in the 2017 CHIS. However, for the purposes of this study only those who did identified as one of the following races were included: Filipino, Chinese, Japanese, Korean, and Vietnamese. Furthermore, individuals who identified as more than one type of Asian or were underweight were excluded. Therefore, a total of 1,057 Asian Americans (Chinese: N=410, 38.8%; Filipinos, N=265, 25.1%; Japanese: N=141, 13.3%; Vietnamese: N=137, 13%; Korean: N=104, 9.8%) residing across California were included in the study. Majority of Asians included in the study were female (52.5%), aged 18-29 years (23.1%), making a yearly income of more than 300% of the FPG (60.5%), and born outside of the U.S. (57.1%). Ethnic group demographic descriptions are listed in Table 1.

Table 1.

Socio-demographic information of respondents included in statistical analyses.

	All Asian (N=1057)		Chinese (N=410)		Filipinos (N=265)		Japanese (N=141)		Vietnamese (N=137)		Korean (N=104)	
	N	%	N	%	N	%	N	%	N	%	N	%
AGE												
18-29	244	23.1	89	21.7	76	28.7	16	11.3	36	26.3	27	11.1
30-39	130	12.3	52	12.7	36	13.6	11	7.8	14	10.2	17	13.1

40-49	161	15.2	76	18.5	35	13.2	14	9.9	20	14.6	16	9.9
50-59	157	14.9	70	17.1	32	12.1	27	19.1	22	16.1	6	3.8
60-69	181	17.1	62	15.1	40	15.1	37	26.2	26	19	16	8.8
70-79	114	10.8	37	9	30	11.3	16	11.3	16	11.7	15	13.2
80+	70	6.6	24	5.9	16	6	20	14.2	3	2.2	7	10
GENDER												
Female	555	52.5	204	49.8	138	52.1	85	60.3	72	52.6	56	53.8
NATIVITY												
Born in US	445	42.1	157	38.3	104	39.2	120	85.1	30	21.9	34	32.7
Born Outside US	612	57.9	253	61.7	161	60.8	21	14.9	107	78.1	70	67.3
POVERTY LEVEL												
0-99% FPL	140	13.2	49	12	33	12.5	12	8.5	32	23.4	14	13.5
100-199% FPL	152	14.4	35	8.5	42	15.8	14	9.9	41	29.9	20	19.2
200-299% FPL	126	11.9	60	14.6	29	10.9	14	9.9	12	8.8	11	10.6
300% FPL	639	60.5	266	64.9	161	60.8	101	71.6	52	38	59	56.7

Measures

Body Mass Index (BMI)

Self-reported height and weight were used to calculate body mass index (BMI; defined as weight in kilograms divided by the square of height in meters). Based on World Health Organization (WHO) Asian BMI cut points, respondents were categorized as one of the following: normal weight, overweight, and obese. Respondents with a BMI between 17.5-22.9 kg/m^2 were defined as normal weight, those with a BMI between 23-27.99 kg/m^2 were defines as overweight, and those with a BMI greater than or equal to 28 kg/m^2 were defined as obese.

Type 2 Diabetes

Self-report measures were used to identify individuals with diabetes with the following question: "Has a doctor ever told you that you have diabetes?" Individuals who chose "yes" were then asked, "Were you told that you had Type 1 or Type 2 diabetes?" Individuals who chose type 2 diabetes were coded as a 1 whereas individuals who did not were coded as a 0.

CVD

Self-report measures were used to identify individuals with some type of CVD with the following question: "Has a doctor ever told you that you have any kind of heart disease?" Respondents who gave a "yes" response were coded as a 1 whereas individuals who gave a "no" response were coded as a 0.

Poverty Level

Socioeconomic status was measured using reported total annual income of the household as a percent of the Federal Poverty Level (FPL). Using respondent's self-reported annual household income and number of persons in household, respondents were placed in one of four categories based on the 2007 Census poverty thresholds by size of family and number of related children under 18 years: 0-99% of FPL, 100-199% of FPL, 200-299% of FPL, and 300% and above of FPL.

Physical Activity

An individual's physical activity engagement was determined by their response to the following continuous item: "Sometimes you may walk for fun, relaxation, exercise, or to walk the dog. In the past 7 days, how many times did you do that for at least 10 minutes?"

Diet

Diet was measured using continuous items assessing their dietary behaviors in the past month. Frequency of intake of the following foods were included: fruit, vegetables, soda, and sweet fruit drinks (e.g., Kool-Aid and Red Bull). Each individual received a composite score which consisted of adding the number of fruits and vegetable intake and subtracting the number of soda and sweet fruit drinks intake. Scores ranged from -16.58 to 16.82, with higher scores indicating healthier diets.

Food Environment

An individual's access to fresh fruits and vegetables was determined by their response to the following question: "How often can you find fresh fruits and vegetables in your neighborhood?" Response choices were presented on a Likert-type scale including the following choices: 1=never, 2=sometimes, 3=usually, 4=always, and 5=doesn't eat/shop for fruits and vegetables.

Social Environment

An individual's social environment was measured using two constructs, neighborhood safety and neighborhood cohesion. Neighborhood safety was determined by their response to the following question: "Do you feel safe in your neighborhood?" Response choices were presented on a Likert-type scale including the following choices: 1= all of the time, 2= most of the time, 3= some of the time, 4=none of the time. Neighborhood cohesion was determined by their response

to the following statements: “People in my neighborhood are willing to help each other” and “People in this neighborhood generally do NOT get along with each other” Response choices were presented on a Likert-type scale including the following choices: 1= strongly agree, 2= agree, 3= disagree, 4= strongly disagree. The following statement was reverse coded: “People in this neighborhood generally do NOT get along with each other.” Each individual received a composite score which consisted of the sum of their scores on each of the aforementioned statements. Scores ranged from 2 to 8, with higher scores indicating greater neighborhood safety and cohesion.

Plan of Analysis

Descriptive analyses were conducted via crosstabs to assess the distribution of obesity and obesity-related health outcomes (e.g., Type 2 Diabetes and CVD) across the Asian subgroups. Furthermore, multivariate analyses (MANOVAs) were used to assess group differences among BMI categories on five outcomes: diet, SES, physical activity, food environment, and neighborhood environment across aggregated and disaggregated data

RESULTS

Hypothesis 1:

BMI Categories

To examine if there were ethnic group differences across BMI categories of overweight and obese, crosstab analyses were conducted. Based on the crosstabs analysis, a total of 410 individuals (38.8%) were considered normal weight, 452 individuals (42.8%) were considered overweight, and 195 individuals (18.4%) were considered obese across all ethnic groups. Japanese (24.1%) and Filipino (23.8%) respondents had a higher proportion of individuals who were categorized as obese as compared to Chinese (16.1%), Korean (13.5%), and Vietnamese (13.1%) respondents. Additionally, Filipino respondents (49.1%) had a higher proportion of individuals who were overweight as compared to Chinese (41.2%), Japanese (40.4%), Korean (41.3 %), and Vietnamese (38.7%) respondents. Table 2 provides a summary of these analyses.

Health Outcomes

Type 2 Diabetes

Within the sample, to study ethnic group differences, crosstabs analyses were conducted on type 2 diabetes across all ethnic groups. Based on crosstabs analysis, a total of 105 individuals (9.9%) self-reported as having type 2 diabetes. Of the 105 individuals, 32 (30.5%) were obese and 44 (41.9%) were overweight, and 29 (27.6%) were normal weight. Overall, Filipino respondents (14.7%) had a higher proportion of individuals who were diagnosed with type 2 diabetes as compared to Japanese (12.8%), Chinese (7.6%), Vietnamese (8%), and Korean (5.7%) respondents. Within the normal weight BMI category, Filipino respondents (15.3%) had a higher proportion of individuals with type 2 diabetes as compared to Korean (8.5%), Vietnamese (7.6%), Japanese (6%), and Chinese (3.4%) respondents. Whereas within the overweight BMI

category, Japanese respondents (15.8%) had a higher proportion of individuals with type 2 diabetes as compared to Filipino (10.8%), Chinese (9.5%), Vietnamese (7.5%), and Korean (2.3%) respondents. Within the obese BMI category, Filipino respondents (22.2%) had a higher proportion of individuals with type 2 diabetes as compared to Japanese (17.6%), Chinese (13.6%), Vietnamese (11.1%), and Korean (7.1%) respondents. Table 2 provides a summary of these analyses.

CVD

Within the sample, to study ethnic group differences, crosstabs analyses were conducted on cardiovascular disease (CVD) across all ethnic groups. Based on crosstabs analysis, there were a total of 65 individuals (6.1%) who self-reported as having some type of CVD. Of the 65 individuals, 25 (38.5%) were normal weight, 23 (35.4%) were overweight, and 17 (26.2%) were obese. Overall, Japanese respondents (9.9%) had a higher proportion of individuals who were diagnosed with some type of CVD as compared to Korean (8.7%), Vietnamese (5.8%), Chinese (5.4%), and Filipino (4.5%) respondents. Within the normal weight BMI category, Japanese respondents (10%) had a higher proportion of individuals with some type of CVD as compared to Vietnamese (9.1%), Korean (6.9%), Chinese (4.6%), and Filipino (4.2%) respondents. Within the overweight BMI category, Japanese respondents (8.8 %) also had a higher proportion of individuals with some type of CVD as compared to Korean (7%), Filipino (5.4%), Vietnamese (3.8%), and Chinese (3.6%). Within the obese BMI category, Korean respondents (21.4%) had a much higher proportion of individuals with some type of CVD as compared to Chinese (12.1%), Japanese (11.8%), and Filipino (3.2%) respondents. Surprisingly, no Vietnamese respondents were both obese and had some type of CVD. Table 2 provides a summary of these analyses.

Table 2.

Distribution of BMI, type 2 diabetes, and CVD across Asian American subgroups.

	All Asians N=1057)		Chinese (N=410)		Filipinos (N=265)		Japanese (N=141)		Vietnamese (N=137)		Korean (N=104)	
	N	%	N	%	N	%	N	%	N	%	N	%
BMI Category												
Normal	410	38.8	175	42.7	72	27.2	50	35.5	66	48.2	47	45.2
Overweight	452	42.8	169	41.2	130	49.1	57	40.4	53	38.7	43	41.3
Obese	195	18.4	66	16.1	63	23.8	34	24.1	18	13.1	14	13.5
Type 2 Diabetes												
Overall	105	9.9	31	7.6	39	14.7	18	12.8	11	8	6	5.8
Normal	29	7.1	6	3.4	11	15.3	3	6	5	1.7	4	8.5
Overweight	44	9.7	16	9.5	14	10.8	9	15.8	4	7.5	1	2.3
Obese	32	16.4	9	13.6	14	22.2	6	17.6	2	11.1	1	7.1
Cardiovascular Disease (CVD)												
Overall	65	6.1	22	5.4	12	4.5	14	9.9	8	5.8	9	8.7
Normal	25	6.1	8	4.6	3	4.2	5	10	6	9.1	3	6.4
Overweight	23	5.1	6	3.6	7	5.4	5	8.8	2	3.8	3	7

Obese	17	8.7	8	12.1	2	3.2	4	11.8	0	0	3	21.4

Hypothesis 2:

A series of multivariate analysis of variance (MANOVAs) were performed on five dependent variables for all Asians aggregated as well as disaggregated by ethnic group (Chinese, Filipino, Japanese, Korean, and Vietnamese). The dependent variables were comprised of physical activity, diet, socio-economic status, access to fresh produce, and neighborhood safety and cohesion. The independent variable was BMI category (normal, overweight, and obese). A total of six MANOVAS were run using IBM SPSS (version 26) MANOVA. Results of these analyses are summarized in Tables 3-8. Evaluations of assumptions of normality, homogeneity of variance– covariance matrices, linearity, and multicollinearity were satisfactory.

All Asians

Analyses indicated that there were statistically non-significant differences in the risk factors based on an individuals ’BMI category, ($F[10, X] = 1.43$; p=ns; Wilks $\Lambda = .986$, partial η 2 =0.007). Because the MANOVA was not statistically significant, univariate ANOVAs should be viewed with caution. As seen in Table 3, only diet was significantly different for individuals of different BMI categories, ($F [2, 1057] = 3.632$; $p < .05$, partial η 2 = .007). Post-hoc analysis (Fisher’s LSD) was performed to examine individual mean difference comparisons across all levels of BMI range and diet. The results revealed that obese individuals, as compared to normal weight individuals, had a significantly worse quality of diet ($p<.01$).

Table 3

MANOVA results for all Asians.

	BMI Category *M(SD)*				
Dependent Variables	Overall Mean	Normal N=410	Overweight N=452	Obese N=195	F (*df*=2, 1,057)
Poverty Level	3.2 (1.11)	3.12 (1.17)	3.23 (1.08)	3.28 (1.05)	1.61
Physical Activity	2.92 (3.55)	3.03 (3.39)	2.99 (3.9)	2.52 (3.55)	1.51
Diet	.029 (2.18)	.188 (2.12)	.035 (2.25)	-0.321 (2.09)	3.63*
Access to fresh produce	3.64 (.773)	3.63 (.788)	3.64(.782)	3.67 (.722)	0.2
Neighborhood safety/cohesion	3.66 (1.06)	3.65 (1.05)	3.68 (1.08)	3.62 (1.01)	0.238

Note: *=p<.05

Chinese

Analyses indicated that there were statistically non-significant differences in the risk factors based on an individuals ’BMI category, (F[10, X] =.722; p=ns; Wilks Λ=.022, partial η 2 =0.009). As seen in Table 4, none of the dependent variables were significantly different for individuals of different BMI categories.

Table 4

MANOVA results for the Chinese subgroup.

	BMI Category *M(SD)*

Dependent Variables	Overall Mean	Normal N=175	Overweight N=169	Obese N=66	F (*df*=2, 410)
Poverty Level	3.32 (1.05)	3.31 (1.1)	3.28 (1.07)	3.47 (.881)	0.856
Physical Activity	2.81 (3.57)	3.09 (4.19)	2.54 (3.0)	3.73 (3.2)	1.03
Diet	.368 (2.14)	.45 (1.86)	.437 (2.25)	-.028 (2.53)	1.35
Access to fresh produce	3.63 (.777)	3.68 (.720)	3.59 (.849)	3.64 (.737)	0.631
Neighborhood safety/cohesion	3.62 (1.00)	3.63 (.99)	3.64 (3.55)	3.55 (1.06)	0.219

*Note=There were no significant results

Filipinos

Analyses indicated that there were statistically non-significant differences in the risk factors based on an individuals ’BMI category, (F[10, X] =1.28; p=ns; Wilks Λ=.952, partial η 2 =.024). As seen in Table 5, none of the dependent variables were significantly different for individuals of different BMI categories.

Table 5

MANOVA results for the Filipino subgroup.

	BMI Category *M(SD)*				
Dependent Variables	Overall Mean	Normal N=72	Overweight N=130	Obese N=63	F (*df*=2, 265)
Poverty Level	3.2 (1.11)	2.97 (1.26)	3.29 (1.04)	3.27 (1.05)	2.11

Physical Activity	3.09 (4.23)	2.71 (2.41)	3.47 (5.29)	2.75 (3.27)	1.03
Diet	-.333 (2.48)	-.244 (2.89)	-.281 (2.53)	-.546 (1.81)	0.305
Access to fresh produce	3.63 (.787)	3.47 (.934)	3.67 (.751)	3.75 (.647)	1.56
Neighborhood safety/cohesion	3.74 (1.04)	3.92 (1.00)	3.68 (1.06)	3.64 (1.04)	0.737

*Note=There were no significant results

Japanese

Analyses indicated that there were statistically non-significant differences in the risk factors based on an individuals ’BMI category, (F[10, X] =1.62; p=ns; Wilks Λ=.889, partial η 2 =.057). Because the MANOVA was not statistically significant, univariate ANOVAs should be viewed with caution. As seen in Table 6, only diet was significantly different for individuals of different BMI categories, (F [2, 141] = 3.196; p < .05, partial η 2 = .004. Post-hoc analysis (Fisher’s LSD) was performed to examine individual mean difference comparisons across all levels of BMI range and diet. The results revealed that obese individuals, as compared to normal weight and overweight individuals, had a significantly worse quality of diet (p<.05).

Table 6

MANOVA results for the Japanese subgroup.

	BMI Category *M(SD)*				
Dependent Variables	Overall Mean	Normal N=50	Overweight N=57	Obese N=34	F (*df*=2, 141)

Poverty Level	3.45 (.981)	3.44 (.972)	3.53 (.928)	3.32 (1.09)	0.453
Physical Activity	2.89 (2.98)	2.92 (2.49)	3.37 (3.67)	2.06 (2.12)	2.09
Diet	0.15 (1.91)	.394 (1.46)	.36 (2.23)	-.561 (1.79)	3.2*
Access to fresh produce	3.7 (.725)	3.6 (.833)	3.82 (.468)	3.65 (.884)	1.42
Neighborhood safety/cohesion	3.52 (1.03)	3.38 (.987)	3.65 (1.17)	3.53 (.825)	0.905

Note: *=p<.05

Vietnamese

Analyses indicated that there were statistically non-significant differences in the risk factors based on an individuals 'BMI category, (F[10, X] =.702; p=ns; Wilks Λ= .029, partial η 2 =.026). As seen in Table 7, none of the dependent variables were significantly different for individuals of different BMI categories.

Table 7

MANOVA results for the Vietnamese subgroup.

	BMI Category *M(SD)*				
Dependent Variables	Overall Mean	Normal N=66	Overweight N=53	Obese N=18	F (*df*=2, 137)
Poverty Level	2.61 (1.21)	2.48 (1.23)	2.75 (1.18)	2.67 (1.28)	0.743
Physical Activity	3.16 (3.1)	3.68 (3.22)	2.58 (2.87)	2.94 (3.17)	1.91

Diet	-.196 (2.09)	-.184 (2.35)	-.296 (1.64)	.05 (2.33)	0.183
Access to fresh produce	3.64 (.785)	3.67 (.791)	3.58 (.842)	3.67 (.594)	0.174
Neighborhood safety/cohesion		3.64 (1.21)	3.7 (1.26)	4.06 (1.16)	0.835

*Note=There were no significant results

Korean

Analyses indicated that there were statistically non-significant differences in the risk factors based on an individuals 'BMI category, (F[10, X] =1.34; p=ns; Wilks Λ= .028, partial η 2 =.065). Because the MANOVA was not statistically significant, univariate ANOVAs should be viewed with caution. As seen in Table 8, only physical activity was significantly different for individuals of different BMI categories, (F [2, 104] = 3.339; p < .05, partial η 2= .062. Post-hoc analysis (Fisher's LSD) was performed to examine individual mean difference comparisons across all levels of BMI range and physical activity. The results revealed that obese individuals exercised significantly less than overweight individuals (p<.05).

Table 8

MANOVA results for the Korean subgroup.

	BMI Category *M(SD)*				
Dependent Variables	Overall Mean	Normal N=47	Overweight N=43	Obese N=14	F (*df*=2, 104)
Poverty Level	3.11 (1.14)	3.21 (1.12)	3.00 (1.16)	3.07 (1.21)	0.394
Physical Activity	2.64 (2.79)	2.51 (2.17)	3.28 (3.45)	1.14 (1.66)	3.34*

Diet	-.251 (1.73)	.181 (1.77)	-.614 (1.73)	-.584 (1.29)	2.77
Access to fresh produce	3.63 (.778)	3.66 (.731)	3.6 (.849)	3.57 (.756)	0.093
Neighborhood safety/cohesion	3.69 (1.09)	3.64 (1.15)	3.81 (1.12)	3.5 (1.09)	0.539

Note: *=p<.05

DISSCUSSION

The goal of this study was to expand the limited literature on obesity among Asian Americans by using WHO Asian recommended BMI cut points and disaggregating the data by different ethnic groups. With this in mind, the study had the following two aims: 1) Identify prevalence of obesity and obesity-related diseases (type 2 diabetes and CVD) among Asian American ethnic groups and 2) examine the association between individual level (socio-economic status, diet, and physical activity) and community level (access to fresh produce, neighborhood safety and cohesion) factors on obesity. For the first aim, I hypothesized that Filipinos will have the highest prevalence of obesity, type 2 diabetes, and CVD. For the second aim, I predicted that lower socioeconomic status, quality of diet, engagement in physical activity, access to fresh produce, and perceived neighborhood safety and cohesion would be associated with a higher risk of obesity. Due to the limited literature on the different ethnic groups, aim 2 was exploratory.

Hypothesis 1:

BMI Categories

Altogether, more than half of the sample was either overweight or obese (61.2%). Although less than one fourth of the sample was obese (18.4%), nearly half was overweight (42.8%). Across all subgroups, the percentage of overweight individuals were very similar. Whereas, the percentage of obese individuals were more spread out. The high rates of overweight reported across all subgroups is problematic, as overweight is a precursor to obesity (Guo, Wu, Chumlea, & Roche, 2002). Rather than dichotomizing obesity (obese vs non-obese) these findings suggest the importance of the inclusion of an exclusive overweight category that is

separate from normal and obese individuals. By doing this, we are able to target health behaviors that will be critical to keeping those who are overweight from becoming obese.

After disaggregation, Filipino respondents, in particular, had the highest prevalence of overweight individuals and the second highest prevalence of obese individuals. In line with previous studies, these results identify Filipinos as a particularly high risk for overweight and obesity (Jih et al., 2014; Singh & Lin, 2013; Staimez et al., 2013). Jih and colleagues (2014), found that overweight/obesity was highest among Filipinos (78.6%). Furthermore, their percentage was higher than non-Hispanic whites but similar to African Americans and Hispanics. In the current sample, Japanese respondents had the highest prevalence of obese individuals but the second lowest prevalence of overweight individuals. Furthermore, Chinese respondents had the third highest prevalence of overweight and obese individuals. From 1992-2011, obesity and overweight prevalence doubled for the Chinese and Japanese, but tripled for the Filipinos (Singh & Lin, 2013). The current results further support Singh and Lin's (2013) finding that, in addition to Filipinos, Chinese and Japanese ethnic groups are at a high risk for overweight and obesity. Vietnamese respondents had the lowest prevalence of both overweight and obese individuals. Similar to the aforementioned studies, overweight and obesity does not seem to be as much of a concern for the Vietnamese ethnic group. Together, these findings stress the need to focus on Filipinos, Chinese, and Japanese ethnic groups in future obesity research. By addressing obesity among these high-risk groups, we may be able to slow down the rapid increase in overweight and obesity among Asians as a whole.

In contrast with the findings discussed above, the present study has identified Koreans as a high-risk group. In the current sample, Korean respondents had the second highest prevalence of overweight individuals, but the second lowest prevalence of obese individuals. In Korea,

prevalence of obesity in adults and children has increased rapidly from the 1990s (Kim, Ahn, & Nam, 2005). This is important to consider because nearly three fourths of the Korean respondents in this sample were born outside of the U.S (67%). The high rates of overweight and low rate of obesity reported highlight a critical need for intervention for this ethnic group. To keep the rates of obesity low among this ethnic group, action needs to be taken in order to prevent those who are overweight from becoming obese.

Health outcomes

Based on aggregated and disaggregated data, type 2 diabetes was more prevalent than CVD. Thus, type 2 diabetes seem to be impacting Asians at a greater rate than CVD. Furthermore, these obesity-related diseases are impacting Asian individuals at a greater rate in individuals with lower BMIs. Across the different groups, the majority of individuals diagnosed with type 2 diabetes were overweight. Therefore, Asians have a higher propensity for obesity-related complications at much lower BMIs. Early intervention for type 2 diabetes and CVD should be emphasized for this population.

Contrary to previous studies which have demonstrated a positive association in BMI and prevalence of type 2 diabetes (Bao et al., 2001; California Department of Public Health Chronic Disease Control Branch, 2014; Looker, Knowler, & Hanson, 2001), these findings suggest this is not the case for Asians. Rather than a positive linear relationship between BMI and type 2 diabetes, Asians exhibit more of a u-shape trend. Specifically, prevalence of type 2 diabetes increases as BMI increase until BMIs pass the overweight range, then prevalence begins to decrease. The present findings have been corroborated by prior studies that have shown a relationship between BMI and diabetes risk in Asians at lower BMIs (Chan et al., 2009). Nonetheless, the present study's findings further support the notion that, for Asians, BMI is a

strong risk factor for type 2 diabetes and CVD, and place overweight individuals at the greatest risk.

Type 2 Diabetes

Altogether, less than one tenth (9.9%) of the sample self-reported as being diagnosed with type 2 diabetes. Of the individuals diagnosed with type 2 diabetes, nearly three fourths (72.4%) of were either overweight or obese. After disaggregation, Filipino respondents, had the highest prevalence of individuals with type 2 diabetes. In line with previous studies, these results identify Filipinos at a particularly high risk for type 2 diabetes (Lee, Brancati, & Yeh, 2011; Wang et al., 2011). Additionally, Filipino respondents had the highest prevalence of individuals diagnosed with type 2 diabetes who were obese, and the second highest prevalence individuals diagnosed with type 2 diabetes who were overweight. The literature available on BMIs of type 2 diabetic individuals from different ethnic groups are sparse (Sone, Ito, Ohashi, Akanuma, & Yamada, 2003). Of the existing literature, majority focus on Filipinos. The ethnically diverse sample in this study provide an opportunity to examine this relationship among different groups.

With only a 2% difference, Japanese respondents had the second highest prevalence of individuals diagnosed with type 2 diabetes. This finding suggests that, in addition to Filipinos, Japanese individuals are a high-risk group for developing type 2 diabetes. Although not as high in prevalence, the proportion of individuals diagnosed with type 2 diabetes in Chinese, Korean, and Vietnamese respondents were not far off from those of the Filipino and Japanese respondents. Nonetheless, these findings categorize Filipinos and Japanese at a particularly higher risk, as compared to the other ethnic groups, for type 2 diabetes and stress the need to focus on interventions within these population.

CVD

Altogether, 6.1% of the sample self-reported being diagnosed with some type of CVD. Of these individuals, over three fourths (82%) were either overweight or obese. After disaggregation, Japanese and Korean respondents had the highest prevalence of individuals with some type of CVD (9.9%and 8.7%, respectively). Whereas, Filipino and Chinese respondents had the lowest prevalence of individuals with some type of CVD (4.5% and 5.4%, respectively). This is in contrast with previous studies that have identified Filipinos and Chinese ethnic groups as high-risk groups (Holland et al., 2011; Klatsky & Armstrong, 1991; Wu et al., 2011; Ye et. al., 2009). These findings suggest that Japanese and Korean individuals, as compared to other Asian ethnic groups are at an elevated risk for CVD. Therefore, future studies should focus on the risk factors and prognosis of CVD within these subpopulations.

Hypothesis 2:

As discussed earlier, there were very little significant effects found. For aggregated data, BMI groups were significantly different on the diet variable. Specifically, obese individuals, as compared to normal weight individuals, had a significantly worse quality of diet. Whereas, all other variables were found to be statistically non-significant. Other studies have identified similar trends in the broader population (Babey, Jones, Yu, & Goldstein, 2009; Bertoia et al., 2015; Heo et al., 2011; Ruanpeng et al., 2017; Wolstein et al., 2015). Thus, these findings identify diet quality as a potential risk factor of obesity for Asian Americans. After disaggregation, however, only diet was significant for Japanese respondents. Specifically, obese individuals, as compared to normal weight and overweight individuals, had a significantly lower quality diet. Additionally, physical activity was only significant for Vietnamese respondents such that obese individuals exercised significantly less than overweight individuals. Whereas, the

dependent variables of SES, access to fresh produce, and neighborhood safety/cohesion were not significant across aggregated and disaggregated data.

Overall, the set of dependent variables (i.e., SES, physical activity, diet, access to fresh produce, and neighborhood safety/cohesion) were poor predictors of differences between individuals of varying BMI categories. Although the outcomes included in this study have been well-established risk factors for obesity, this may not apply for Asian populations. This highlights the complex nature of this epidemic within this population and stress the need for inclusion in future research.

Limitations

There are limitations to this study that must be taken into consideration when interpreting these results. First, these findings may not be generalizable outside of California. In other words, these findings are not representative of the entire Asian American population. Therefore, there should be strides made to assess risk factors and outcomes of obesity in other states with high Asian populations. Second, there was an oversampling of Chinese individuals. Third, the measures included in this study were exclusively based on self-report. A study done by Newell and colleagues (1999) examined the accuracy of self-reported health behaviors and risk factors. Their results identified that self-report data consistently underestimated the proportion of individuals considered "at-risk." The discrepancies were attributed to a number of reasons: 1) trouble remembering when they last engaged in a specific behavior, 2) lack the appropriate knowledge to accurately answer the questions, 3) poorly designed measures prevent the respondent from understanding the questions being posed, and 4) attempt to respond in a socially desirable way. This is problematic because inaccurate self-report could lead to "underestimation or overestimation of the prevalence of risk factors or health behaviors in the community or to the

misclassification of risk status at the individual level, which could obscure causal relationships between risk factors and subsequent disease" (Newell et al., 1999; pg 212). Therefore, multimethod assessment approaches (objective and subjective measures) should be used to provide a more accurate understanding of health behaviors and risk factors.

Future Directions

As previously mentioned, the rate of the U.S Asian population is rapidly increasing. By 2065, the U.S. Asian population is projected to rise from 6% to 14% (Lopes, Ruiz, & Patten, 2017). Furthermore, the majority of the Asian population are foreign-born (56%). Asians are estimated to make up 38% of all U.S immigrants (Lopes, Ruiz, & Patten, 2017). The projected increase in Asian immigrants stress the need for future studies to examine the role of nativity status in the relationship between obesogenic risk factors, for instance those included in the study, and obesity among Asian Americans.

Although this study included various Asian ethnic groups, the present study did not include South Asian populations (Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka, and the Maldives). The data included an "Other Asian Group" category, however it could not be ascertained whether an individual actually considered themselves as a part of the South Asian category. With over 3.4 million South Asians living in the United States, they make up one of the largest Asian American ethnic groups in the country (S. A. A. L. Together, 2015). Their projected growth rate exceeds that of the Asian American population as a whole (S. A. A. L. Together, 2015). California has one of the largest South Asian populations (S. A. A. L. Together, 2015). Accordingly, the inclusion of an exclusive category for the South Asian population in CHIS is critical. Ultimately, the inclusion of South Asians in future studies will be vital in gaining a holistic understanding the complex nature of obesity among Asian Americans.

The present study examined obesogenic risk factors and outcomes prevalent in adulthood. Although, there was little to no evidence to support the relationship between the selected risk factors and obesity in adulthood, they may play a role in childhood and adolescence. Previous studies have looked at Asian American adolescents and have identified obesogenic risk factors including low SES and unhealthy food choices (Chen et al., 2011; Cook, Tseng, Tam, John, & Lui, 2017). Therefore, longitudinal studies starting as early as adolescence are needed to see if BMI indicators change over time.

Implications

Overall, the present findings advocate for data disaggregation in future research to support the development of interventions tailored to the needs of specific Asian populations. In the current study, disaggregation identified heterogeneity across Asian subgroups-particularly for the prevalence of obesity and obesity-related diseases. For that reason, disaggregation is critical for the identification of health disparities across Asian populations that may be otherwise masked by aggregation. Aggregation leads to inaccurate conclusions which characterize Asian Americans (as a whole) healthy and well. Ultimately, perpetuating Asian Americans as a 'model minority ' with few physical, social, and psychological problems (Crystal, 1989). Aggregate reporting promotes homogenization and subsequently ignores the ways in which Asian sub-groups are distinct.

A major challenge in research on Asian Americans is their diversity. Asian Americans are comprised of dozens of ethnic subgroups, each with its own language, culture, values, religious beliefs, and immigration history. Unfortunately, existing research lacks representative data that contain diverse Asian subgroups and sufficient numbers of participants within each group. To remedy this, national surveys need to consider oversampling Asian American subgroups and

providing surveys in Asian languages to ensure appropriate sample sizes (Crystal, 1989; Yu, Huang, & Singh, 2010). Considering the heterogeneity of Asian American subgroups, disaggregation studies will be essential to identify variability that may exist in health behavior and risk factors for obesity among these groups. Furthermore, it is vital for health care providers to be culturally competent and considerate of the diverse needs of Asian American subgroups and take action accordingly. The future of equitable health and care for Asian Americans rely on the propagation of disaggregated data, as it will ensure the development of appropriate interventions that address the diverse needs of Asian American communities throughout the U.S.

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