



## Health behavior practice among understudied Chinese and Filipino Americans with cardiometabolic diseases

Minsun Lee<sup>a</sup>, Danielle Hu<sup>a,b</sup>, Gabrielle Bunney<sup>a,b</sup>, Crystal A. Gadegbeku<sup>a,c</sup>, Daniel Edmundowicz<sup>d,e</sup>, Steve R. Houser<sup>f</sup>, Hong Wang<sup>g</sup>, Grace X. Ma<sup>a,h,\*</sup>

<sup>a</sup> Center for Asian Health, Lewis Katz School of Medicine, Temple University, Philadelphia, PA, USA

<sup>b</sup> Lewis Katz School of Medicine, Temple University, Philadelphia, PA, USA

<sup>c</sup> Section of Nephrology, Hypertension and Kidney Transplantation, Lewis Katz School of Medicine, Temple University, Philadelphia, PA, USA

<sup>d</sup> Temple Heart and Vascular Institute, Temple Health Care System, Philadelphia, PA, USA

<sup>e</sup> Section of Cardiology of Department of Medicine, Lewis Katz School of Medicine, Temple University, Philadelphia, PA, USA

<sup>f</sup> Cardiovascular Research Center, Department of Physiology, Lewis Katz School of Medicine, Temple University, Philadelphia, PA, USA

<sup>g</sup> Center for Metabolic Disease Research, Department of Microbiology and Immunology, Lewis Katz School of Medicine, Temple University, Philadelphia, PA, USA

<sup>h</sup> Department of Clinical Sciences, Lewis Katz School of Medicine, Temple University, Philadelphia, PA, USA

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### ABSTRACT

Lifestyle modification and health behavior practice among the individuals with cardiometabolic diseases (CMD) are important for secondary prevention and disease control. This study was designed to investigate and compare health behavior practices among Chinese and Filipino Americans with CMD. Three hundred seventy-four Asian Americans (211 Chinese and 163 Filipino) who reside in the greater Philadelphia region and had either CMD or no identified disease were included in the study. Information on smoking, alcohol intake, physical activity, and salt and sweets consumption was collected, as well as demographic and acculturative characteristics. Of the 374 participants, 241 (64.4%) had CMD and 133 (35.6%) had no identified disease. The majority of Chinese and Filipino Americans with CMD failed to meet the dietary and physical activity guidelines, and only a small percentage of them restricted their amount of salt added to food and amount of sweets consumption. Compared to participants with no disease, Chinese participants with CMD were more likely to “never” add salt to food (AOR 4.42 compared to “frequently”). Filipino Americans with CMD were less likely to be those who “never” consume sweets than those who frequently consume sweets (AOR = 0.12). Among the participants with CMD, Chinese participants with CMD were less likely to restrict drinking (AOR 0.11) than Filipinos with CMD. The findings suggest that tailored interventions for Chinese and Filipino Americans with CMD should be developed to enhance their compliance to behavioral guidelines to prevent further disease progression and complications.

### 1. Introduction

Cardiometabolic diseases (CMD), a term referring to a cluster of closely interrelated diseases including cardiovascular disease, diabetes mellitus, and dyslipidemia, is a leading cause of death worldwide (Hou et al., 2016; Katare P & Banerjee S, 2016; Mozaffarian et al., 2015). In the United States (US), over 65 million adults are affected with hypertension, over 28 million with diabetes, including those undiagnosed, and > 2150 Americans die of cardiovascular disease each day (Fields et al., 2004; Go et al., 2014). In addition to the high prevalence, control rates of these diseases is suboptimal, with only 59.1% of diabetics achieving glycemic control, 56.0% of hypertensives achieving blood pressure control, and 63.0% of those with coronary heart disease

achieving total cholesterol control (McWilliams, 2009). Left uncontrolled, CMDs can progress to serious complications such as stroke, myocardial infarction, or cardiometabolic multimorbidity, which can reduce life expectancy by an estimated 15–40 years (Angelantonio et al., 2015; Huang et al., 2014; Ndisang & Rastogi, 2013).

Lifestyle modifications such as smoking cessation, physical exercise, and healthy food choices are important in secondary, as well as primary prevention of cardiovascular risk factors and cardiac events (Dallongeville et al., 2012; Eckel et al., 2013; McGuire et al., 2009). Studies have demonstrated that patients who adhere to the behavioral guidelines have better blood sugar and blood pressure control than those who do not (Cleroux et al., 1999; Franz et al., 2003; Serour et al., 2007; Wessel et al., 2004). According to guidelines from the American

\* Corresponding author at: Lewis Katz School of Medicine, Temple University, Philadelphia, PA, USA.  
E-mail address: [grace.ma@temple.edu](mailto:grace.ma@temple.edu) (G.X. Ma).

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College of Cardiology/American Heart Association, patients diagnosed with CMDs are recommended the following: diet restrictions in sodium and sugar; higher intake of fruits and vegetables, whole grains, and low-fat milk products; at least 150 min per week of moderate intensity physical activity; alcoholic drinks limited to 1 to 2 per day; and smoking cessation. However, health behavior practice following these guidelines have been reported to be more difficult to adhere to than to medication regimens, (Chan, 1999; Sohng & Lee, 2000; Teo et al., 2013; Xu et al., 2010) partly because lifestyle habits are hard to change and requires time, motivation, and social support (Condon & McCarthy, 2006; Serour et al., 2007; Thomas et al., 2004).

Prevalence of hypertension and diabetes is growing rapidly in Asian countries, (Ramachandran et al., 2012; Whelton et al., 2004) and Asian Americans in the US have a higher BMI-adjusted prevalence of metabolic syndrome than non-Hispanic whites (Mcneely & Boyko, 2004; Palaniappan et al., 2011). In addition, both hypertension and diabetes control rates are low among various Asian American ethnic groups compared to members of the general U.S. population (Han et al., 2007; Hsu et al., 2006; Xu et al., 2010). For example, one study found only 31.2% of middle-aged Asian Americans with known hypertension had blood pressure control compared to 41.6% of the general U.S. population of a similar age range (Han et al., 2007). The low rates of chronic disease control may partly be due to poor practice in healthy behaviors among Asian Americans. However, few studies have evaluated health-related behaviors among Asian Americans, including smoking, alcohol consumption, physical activity, and diet. Further, the studies about health behaviors mainly focused on the general Asian American population (Martell, 2016; Maxwell et al., 2005; Maxwell et al., 2012; Wang et al., 2011) leaving a knowledge gap about the specific health behavior practices of Asian American individuals with chronic diseases such as CMD. Moreover, most studies about Asian Americans aggregated all Asian subgroups, ignoring heterogeneity and the diversity of Asian subethnic groups (Ye et al., 2009). The lack of studies about modifiable health behaviors among the people with chronic conditions make it difficult to develop interventions to address the issues surrounding secondary prevention and disease control among high risk Asian Americans. In the era of personalized and precision medicine, it is important to evaluate subethnic differences to tailor their unique needs in health and health management.

Chinese and Filipino Americans are the two largest Asian ethnic subgroups with a large number of first generation immigrants in the US and have substantial differences in cultural background and health outcomes (Hoeffel et al., 2012). Culturally, Filipinos in the US tend to acculturate faster and have higher English proficiency than the Chinese (Eng et al., 2008). Regarding health status, Filipino Americans have higher rates of hypertension, obesity and diabetes compared to other Asian ethnic groups and Non-Hispanic whites (Ma et al., 2017; Wang et al., 2011; Ye et al., 2009). However, no study has examined the differences of health behaviors between Chinese and Filipino Americans among the individuals living with CMD. It is unknown whether the ethnic differences in health behaviors among the general Asian American population exist among the sample with CMD as well. Therefore, the purpose of this study was to investigate the patterns of health behaviors of Chinese and Filipino Americans with CMD for secondary prevention and disease control. Specifically, the present study examined 1) whether the Chinese and Filipino Americans with CMD followed the behavioral guidelines, 2) whether they engaged in healthier lifestyles compared to those with no disease, and 3) whether there was sub-ethnic differences in the engagement of health behavior practice among those with CMD.

## 2. Methods

### 2.1. Participants and recruitment

First generation Chinese and Filipino Americans aged 18 years or

older residing in the greater Philadelphia region ( $n = 419$ ) were recruited for health needs assessments through community-based organizations. Among them, 374 (Chinese  $n = 211$ , Filipino  $n = 163$ ) who reported either being diagnosed with CMD or having no identified disease were included in the study. The remaining 45 individuals were excluded because they reported having diseases other than CMD including cancer ( $n = 26$ ), arthritis ( $n = 11$ ), and asthma ( $n = 8$ ). The Center for Asian Health, Temple University, and the community-based organizations collaborated in recruiting participants and collecting data. Both English and native language (Chinese, Tagalog) versions of instruments were provided. This research study was reviewed and approved by the Institutional Review Board (IRB).

### 2.2. Measures

The current study is based on the health needs assessment among Chinese and Filipino Americans conducted for the purpose of the study. The needs assessment consists of a set of self-administered questionnaires measuring demographic, degree of acculturation, health condition, health behaviors, and perceived health issues. The majority of the questions to assess health and health behaviors were adapted from the Center for Disease Control's (CDC) Behavioral Risk Factor Surveillance System (BRFSS). Specific measures about disease status and health behaviors used for this study are as follows:

### 2.3. Cardiometabolic disease status

*Individuals with CMD* were classified as participants who answered “yes” to the question asking whether they have ever been informed by a health care provider that they had the following conditions: coronary heart disease, heart attack, hypertension, diabetes mellitus (type 2), and high blood cholesterol. *Individuals with no disease* were defined as those who answered “no” for all of the following conditions: coronary heart disease, heart attack, hypertension, high blood cholesterol, stroke, asthma, COPD, arthritis, major depressive disorder, kidney disease, diabetes mellitus (types 2), oral cancer, breast cancer, hepatitis B, liver cancer, or any other type of cancer/chronic health conditions.

### 2.4. Health behaviors

*Smoking* behaviors were measured by the question, “Do you currently smoke?” Responses were categorized to either “currently smoking” or “not smoking.”

*Drinking* behaviors were measured by questions regarding the number of consumed drinks equivalent to a 12-oz beer, a 5-oz glass of wine, or one shot of liquor, usually 1.5 oz, on an average day. Consuming greater than the recommended amount of 2 alcoholic drinks per day for men and one alcoholic drink for women (Eckel et al., 2013) was categorized as *high* alcoholic consumption, and consuming the recommended amount of or less drink was categorized as *low* alcoholic consumption.

*Physical activity* level was measured by asking participants the number of minutes of moderate to vigorous physical activity performed in a typical week. Based on the physical activity guidelines from the AHA, (Eckel et al., 2013) 150 or more minutes per week of moderate to vigorous physical activity was considered *active*, and < 150 min of moderate to vigorous physical activity was considered *inactive*.

*Salt consumption* was measured by asking “Over the past week, how often did you add salt to your food?” The responses for salt addition were grouped into three categories: never, often (1–7 times per week), and every meal based on the United States Department of Health and Human Services' Dietary Guidelines for Americans that recommends not adding additional salt to food.

*Sweet consumption* was measured by asking “Over the past week, how often did you eat sweets?” Responses were grouped into three categories: “never,” “often” classified as 1–7 times per week, and

“frequent” classified as > 7 times per week.

Fruit and vegetable consumption was assessed as a continuous value by questions asking about the number of servings consumed in a normal week. Based on AHA recommendations, (Eckel et al., 2013) responses were categorized into < 4 servings of fruits and vegetables per day, and those who had at least 4–5 servings of fruit and/or vegetables per day.

### 2.5. Statistical analysis

A series of Chi-square tests were used to compare the health behaviors or lifestyle practice: 1) between the CMD and no-disease groups for Chinese and Filipino Americans separately, and 2) between Chinese with CMD and Filipinos with CMD. Logistic regression was used to determine which health behaviors were associated with 1) CMD status in Chinese and Filipino Americans separately, and 2) ethnicity among the individuals with CMD, controlling for demographics and acculturation variables. The demographic and acculturation variables found to be associated with CMD in previous studies (Bhimla et al., 2017; Fulop et al., 2010; Koya & Egede, 2007; Teppala et al., 2010) (i.e., age, gender, marital status, education, income, and year in the US) were included as covariates in logistic regression analyses. Because a small number of frequency count in some cells were noticed, we used penalized logistic regression method, instead of maximum-likelihood estimation method, to reduce the bias resulting from the presence of small sample cells. Analysis was performed using Stata version 14 (StataCorp, 2015).

## 3. Results

### 3.1. Participant characteristics and health behavior practice

As shown in Table 1, Chinese participants were significantly younger than Filipinos ( $\chi^2$  (3,  $N = 355$ ) = 44.40,  $p < .001$ ), less educated ( $\chi^2$  (2,  $N = 369$ ) = 180.21,  $p < .001$ ), and earned a lower annual income ( $\chi^2$  (2,  $N = 351$ ) = 175.91,  $p < .001$ ) than Filipino Americans. Chinese participants also lived in the US for a significantly shorter period of time than Filipino participants ( $\chi^2$  (2,  $N = 356$ ) = 124.82,  $p < .001$ ), and significantly more Filipinos rated themselves as having ‘very high’ English proficiency ( $\chi^2$  (2,  $N = 369$ ) = 177.96,  $p < .001$ ).

With regard to health behaviors, Chinese Americans had higher drinking (45.0% vs. 15.3%) and smoking rates (23.2% vs. 6.7%) compared to Filipino Americans. Despite a non-significant group difference, the majority of both Chinese and Filipino American participants (68.4% of Chinese and 76.9% of Filipinos) failed to meet the recommended guidelines for physical activity. Salt addition to food was also high in both Chinese and Filipino Americans. Approximately 85% of Chinese and 78% of Filipino participants reported adding salt to their food, either ‘often’ or ‘every meal’. However, more people added salt to ‘every meal’ in the Chinese group (51.4%), and more people added salt ‘often’ in the Filipino group (61.7%;  $\chi^2$  (2,  $N = 372$ ) = 50.35,  $p < .001$ ). Regarding sweet consumption, Filipino Americans consumed sweets more ‘frequently’ than Chinese Americans (21.5% vs. 9.6%;  $\chi^2$  (2,  $N = 370$ ) = 23.74,  $p < .001$ ). Fruit and vegetable consumption was extremely low for both Chinese and Filipino Americans, with only 0.3% of participants eating the AHA recommended servings per day, and thus this variable was excluded in the following analyses.

### 3.2. Comparison between individuals with CMD and those with no disease

Two hundred forty one out of 347 participants reported having CMD (90 Chinese, 151 Filipinos) and 133 had no disease (121 Chinese, 12 Filipinos). Filipino Americans were significantly more likely to have CMD than Chinese Americans (AOR 5.78, 95% CI 3.06–13.54) controlling for all demographic, acculturation, and behavioral variables. When covariates were controlled for in the multivariate regression

**Table 1**  
Distribution of demographic, acculturation, and health behavior variables in the Chinese and Filipino Americans ( $N = 374$ ).

Variables	Chinese Americans n (%)	Filipino Americans n (%)	p
<b>Demographic</b>			
Age (years)			< 0.001
≤ 30	14 (6.9)	9 (5.8)	
31–45	70 (34.9)	14 (9.1)	
46–65	86 (42.8)	70 (45.5)	
> 65	31 (15.4)	61 (39.6)	
Gender			n.s.
Male	100 (47.4)	67 (41.1)	
Female	111 (52.6)	96 (58.9)	
Marital status			0.003
Married	150 (71.1)	122 (76.7)	
Never married	16 (7.6)	22 (13.8)	
Divorced, widowed, other	45 (21.3)	15 (9.4)	
Level of education			< 0.001
High school or below	162 (77.5)	14 (8.8)	
University (college, associate)	40 (19.1)	85 (53.1)	
Graduate (masters, doctorate)	7 (3.3)	61 (38.1)	
Employment status			n.s.
Employed	139 (65.9)	102 (62.6)	
Not currently employed	72 (34.1)	61 (37.4)	
Annual household income			< 0.001
Less than \$19,999	102 (52.3)	14 (9.0)	
\$20,000–\$40,000	79 (40.5)	24 (15.4)	
Above \$40,000	14 (7.2)	118 (75.6)	
Acculturation			< 0.001
Years living in the US			< 0.001
< 20	153 (76.1)	30 (19.4)	
20–30	34 (16.9)	48 (31.0)	
≥ 31	14 (7.0)	77 (49.7)	
English proficiency			< 0.001
Low	142 (68.9)	3 (1.8)	
High	41 (19.9)	70 (42.9)	
Very high	23 (11.2)	90 (55.3)	
Health behaviors			< 0.001
Level of alcohol consumption			< 0.001
Low	116 (55.0)	138 (84.7)	
High	95 (45.0)	25 (15.3)	
Current smoking status			< 0.001
No smoking	162 (76.8)	152 (93.3)	
Currently smoking	49 (23.2)	11 (6.7)	
Exercise (minutes per week)			n.s.
(Inactive) < 150 min	128 (68.4)	120 (76.9)	
(Active) 150 min or more	59 (31.6)	36 (23.1)	
Salt added to food			< 0.001
Never	32 (15.2)	36 (22.3)	
Often (1–7 times/week)	70 (33.3)	100 (61.7)	
Every meal	108 (51.5)	26 (16.0)	
Sweets consumed			< 0.001
Never	43 (20.7)	9 (5.7)	
Often (1–7 times/week)	145 (69.7)	118 (72.8)	
Frequently (7 or more/week)	20 (9.6)	35 (21.5)	
Servings of fruit and vegetables			n.s.
7 servings or more/day	1(0.6)	0 (0.0)	
< 7 servings/day	169 (99.4)	152 (100.0)	

analysis (Table 3), compared to those with no disease, Chinese Americans with CMD were significantly more likely to “never” add salt to food. Specifically,

those who “never” add salt had 4.4 times the odds of having CMD compared to those who “frequently” add salt to food (AOR 4.42; 95% CI 1.28–15.25). Smoking level approached statistical significance ( $p = .06$ ) with non-smokers having 67% the odds of reporting CMD among smokers.

Compared to those with no disease, Filipino Americans with CMD consumed sweets significantly more frequently: those who “never”

**Table 2**  
Comparison of disease status in health related behaviors among Chinese and Filipino Americans.

Categorical variables	Chinese Americans (n = 211)			Filipino Americans (n = 163)			CMD (n = 241)		
	CMD (n = 90)		p	No disease (n = 121)		p	Chinese (n = 90)		Filipino (n = 151)
	n (%)	n (%)		n (%)	n (%)		n (%)	n (%)	
Age			< 0.001			< 0.001			n.s.
≤ 30	2 (2.3)	12 (10.4)		5 (3.5)	4 (33.3)		2 (2.3)	5 (3.5)	
31–45	13 (15.1)	57 (49.6)		11 (7.7)	3 (25.0)		13 (15.1)	11 (7.7)	
46–65	46 (53.5)	40 (34.8)		66 (46.5)	4 (33.3)		46 (53.5)	66 (46.5)	
> 65	25 (29.1)	6 (5.2)		60 (42.3)	1 (8.4)		25 (29.1)	60 (42.3)	
Gender			0.026			n.s.			0.034
Male	51 (56.7)	49 (40.5)		64 (42.4)	3 (25.0)		51 (56.7)	64 (42.4)	
Female	39 (43.3)	72 (59.5)		87 (57.6)	9 (75.0)		39 (43.3)	87 (57.6)	
Marital status			0.001			0.011			< 0.001
Married	67 (74.4)	83 (68.6)		117 (79.6)	5 (41.7)		67 (74.4)	117 (79.6)	
Never married	0 (0.0)	16 (13.2)		18 (12.2)	4 (33.3)		0 (0.0)	18 (12.2)	
Divorced, widowed, other	23 (25.6)	22 (18.2)		12 (8.2)	3 (25.0)		23 (25.6)	12 (8.2)	
Education level			n.s.			n.s.			< 0.001
High school or below	62 (70.5)	100 (82.6)		11 (7.4)	3 (25.0)		62 (70.5)	11 (7.4)	
University (college, associate)	21 (23.9)	19 (15.7)		78 (52.7)	7 (58.3)		21 (23.9)	78 (52.7)	
Graduate (masters, doctorate)	5 (5.6)	2 (1.7)		59 (39.9)	2 (16.7)		5 (5.6)	59 (39.9)	
Employment status			< 0.001			n.s.			n.s.
Employed	44 (48.9)	95 (78.5)		92 (60.9)	10 (83.3)		44 (48.9)	92 (60.9)	
Not currently employed	46 (51.1)	26 (21.5)		59 (39.1)	2 (16.7)		46 (51.1)	59 (39.1)	
Annual household income			n.s.			n.s.			< 0.001
Less than \$19,000	48 (58.5)	54 (47.8)		11 (7.6)	3 (25.0)		48 (58.5)	11 (7.6)	
\$20,000–\$40,000	27 (32.9)	52 (46.0)		21 (14.6)	3 (25.0)		27 (32.9)	21 (14.6)	
Above \$40,000	7 (8.6)	7 (6.2)		112 (77.8)	6 (50.0)		7 (8.6)	112 (77.8)	
Years living in the US			< 0.001			0.003			< 0.001
< 20	51 (61.5)	102 (86.4)		24 (16.6)	6 (60.0)		51 (61.5)	24 (16.6)	
20–30	24 (28.9)	10 (8.5)		46 (31.7)	2 (20.0)		24 (28.9)	46 (31.7)	
≥ 30	8 (9.6)	6 (5.1)		75 (51.7)	2 (20.0)		8 (9.6)	75 (51.7)	
English proficiency			n.s.			n.s.			< 0.001
Low	63 (71.5)	79 (66.9)		3 (2.0)	0 (0.0)		63 (71.5)	3 (2.0)	
High	18 (20.5)	23 (19.5)		66 (43.7)	4 (33.3)		18 (20.5)	66 (43.7)	
Very high	7 (8.0)	16 (13.6)		82 (54.3)	8 (66.7)		7 (8.0)	82 (54.3)	
Level of alcohol consumption			n.s.			n.s.			< 0.001
Low	43 (47.8)	73 (60.3)		128 (84.8)	10 (83.3)		43 (47.8)	128 (84.8)	
High	47 (52.2)	48 (39.7)		23 (15.2)	2 (16.7)		47 (52.2)	23 (15.2)	
Current smoking status			0.022			n.s.			< 0.001
No smoking	62 (68.9)	100 (82.6)		141 (93.4)	11 (91.7)		62 (68.9)	141 (93.4)	
Currently smoking	28 (31.1)	21 (17.4)		10 (6.6)	1 (8.3)		28 (31.1)	10 (6.6)	
Exercise (minutes per week)			0.038			0.032			0.003
Inactive (< 150 min)	46 (59.7)	82 (74.5)		114 (79.2)	6 (50.0)		46 (59.7)	114 (79.2)	
Active (150 min or more)	31 (40.3)	28 (25.5)		30 (20.8)	6 (50.0)		31 (40.3)	30 (20.8)	
Salt added to food			0.012			n.s.			< 0.001
Never	20 (22.2)	12 (10.0)		31 (20.7)	5 (41.7)		20 (22.2)	31 (20.7)	
Often (1–7 times/week)	33 (36.7)	37 (30.8)		95 (63.3)	5 (41.7)		33 (36.7)	95 (63.3)	
Every meal	37 (41.1)	71 (59.2)		24 (16.0)	2 (16.6)		37 (41.1)	24 (16.0)	
Sweets consumed			n.s.			n.s.			< 0.001
Never	15 (16.9)	28 (23.5)		7 (4.7)	2 (16.7)		15 (16.9)	7 (4.7)	
Often (1–7 times/week)	69 (77.5)	76 (63.9)		109 (72.7)	9 (75.0)		69 (77.5)	109 (72.7)	
Frequently (> 7/week)	5 (5.6)	15 (12.6)		34 (22.6)	1 (8.3)		5 (5.6)	34 (22.6)	
Servings of fruit and vegetables			n.s.			n.s.			n.s.
7 servings or more/day	1 (1.4)	0 (0.0)		0 (0.0)	0 (0.0)		1 (1.4)	0 (0.0)	
< 7 servings/day	70 (98.6)	99 (100.0)		141 (100.0)	11 (100.0)		70 (98.6)	141 (100.0)	

consume sweets had 12% the odds of having CMD among those who consume sweet “frequently” (AOR 0.12; 95% CI 0.02–0.90). Tendency to be physically inactive among Filipino CMD approached significance ( $p = .08$ ).

### 3.3. Comparison between Chinese with CMD and Filipinos with CMD

Univariate comparison between Chinese with CMD and Filipinos with CMD was presented in the right side of Table 2. Controlling for the demographic and acculturation related covariates, the only significant difference between Chinese and Filipinos with CMD was the level of drinking: those who reported low levels of alcohol consumption had

one tenth the odds of being Chinese with CMD compared to those who reported high levels of drinking (AOR 0.11; 95% CI 0.01–0.80). In other words, those who drink heavily, compared to those who drink lightly, had 9 times the odds of being Chinese with CMD.

## 4. Discussion

The present study examined health behavior practices among Chinese and Filipino Americans with CMD and compared whether they engaged in healthy behaviors or healthy lifestyle practices more than their counterparts with no disease. We also investigated whether there were subethnic differences in health behavior practice between Chinese

**Table 3**  
Logistic regression of health behaviors on CMD status and ethnic group.

	CMD vs. no disease: Chinese	CMD vs. no disease: Filipino	Chinese CMD vs. Filipino CMD
Variables	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Alcohol consumption			
Low	0.497 (0.201–1.233)	2.400 (0.527–10.925)	0.105* (0.014–0.798)
High (ref.)	1	1	1
Smoking status			
No smoking	0.326 <sup>†</sup> (0.108–1.025)	0.022 (0.000–2.042)	0.264 (0.027–2.564)
Smoking (ref.)	1	1	1
Physical activity			
Inactive	0.752 (0.291–1.949)	2.723 <sup>†</sup> (0.778–9.592)	1.144 (0.179–7.311)
Active (ref.)	1	1	1
Salt added to food			
Never	4.415* (1.278–15.252)	0.461 (0.066–3.243)	0.232 (0.015–3.615)
Often	1.981 (0.666–5.891)	1.572 (0.234–10.580)	0.745 (0.056–9.949)
Every meal (ref.)	1	1	1
Sweets consumed			
Never	0.938 (0.163–5.409)	0.123* (0.017–0.901)	5.569 (0.062–53.019)
Often	2.482 (0.548–11.252)	0.841 (0.192–3.689)	0.186 (0.006–5.479)
Frequently (ref.)	1	1	1

AOR = adjusted odds ratio, CI = confidence interval.

Models were adjusted for age, gender, marital status, education, income, and years in the US.

\*  $p < .05$ .

<sup>†</sup>  $p < .1$ .

and Filipino Americans with CMD. Overall, Filipino Americans were more likely to have CMD than Chinese Americans, which is consistent with current literature (Maxwell et al., 2012; Wang et al., 2011; Ye et al., 2009) and our previous study (Bhimla et al., 2017). Given that age (Fulop et al., 2010) and acculturation (Koya & Egede, 2007; Teppala et al., 2010) have been reported to be related to increased risk of chronic diseases, the higher prevalence of CMD in Filipinos in our study may be attributed to the fact that our Filipino sample was significantly older and more acculturated than the Chinese sample. However, it is noteworthy that the subethnic difference in CMD prevalence was significant even after controlling for all other demographic, acculturation, and behavioral factors.

Regarding health behavior practice, the majority of Chinese and Filipino Americans with CMD failed to meet the dietary and physical activity guidelines and only a small percentage of them restrict salt addition to food and sweets consumption. Compared to their counterparts with no disease, Chinese participants with CMD showed better compliance in salt restriction, but worse compliance in smoking, while Filipinos with CMD were less likely to restrict sweets consumption.

The finding that Chinese Americans with CMD consume less sodium than individuals with no disease is consistent with a Hong Kong-based study (Chan, 1999) reporting that patients with diabetes or hypertension adhered to a lower-sodium diet. The restricted salt intake among Chinese CMD participants could be attributed to widespread awareness of the relationship between salt intake and increased risk of heart disease around the world (Sarmugam & Worsley, 2014). However, it is noteworthy that 41% of Chinese with CMD still reported adding salt to every meal, suggesting that the significant difference of salt consumption between CMD and no disease groups in Chinese sample occurred not because Chinese with CMD participants consumed low level of salt, but because Chinese participants with no disease consumed a high level of salt.

The high level of salt consumption among Chinese Americans, even among those with CMD, would be supported by the comparison of salt consumption pattern between Chinese and Filipinos with CMD. Although Chinese with CMD participants added salt significantly less frequently than Chinese participants with no disease, when they were compared with Filipinos with CMD, they appeared to be less likely to restrict salt consumption, implying the possibility of high level of salt consumption among Chinese with CMD, as well as those with no disease. Despite the potentially significant pattern, the possibility was not

supported by a statistical significance in our study partly due to a small sample size. Thus, it needs to be confirmed in future studies with a larger sample size. Given that Asian diets are in general high in sodium (Dela Cruz & Galang, 2008; Ma et al., 2018; Zhai et al., 2014) and substantial portions of Chinese and Filipino Americans with CMD still add salt to food ‘often’ or ‘every time,’ issues regarding salt consumption needs to be assessed and addressed for secondary prevention in these populations.

Regarding the health behaviors of Filipinos with CMD in comparison to those with no disease, they had significantly lower odds of “never” eating than “frequently” eating sweets. Potential reasons for this could have to do with the greater degree of dietary acculturation of Filipino Americans. Studies have found that first generation Filipino immigrants were faster to assimilate to American values and eating practices than other first generation Asians (Eng et al., 2008; Serafica et al., 2013; Serafica et al., 2015). Dietary acculturation to a Western diet is associated with higher intake of fat and sugar, (Serafica et al., 2013) possibly explaining the high level of sweet consumption among Filipino Americans in our study. Given that the American Diabetes Association recommends a moderation of sweets consumption for managing diabetes, (Franz et al., 2003) these findings highlight a possible need for sweets education and intervention among Filipino Americans with CMD.

Although not statistically significant, it is noteworthy that Chinese participants with CMD reported tendency to have higher smoking rates than those with no disease, while Filipinos with CMD tended to be more inactive than their counterparts with no disease. Smoking prevalence was lower than the national average in our total sample (Agaku & Alpert, 2016). However, Chinese participants were significantly more likely to smoke than Filipino participants. Considering that smoking is a well-known major risk factor for cardiovascular disease, (Ambrose & Barua, 2004) it is possible that Chinese with CMD in our sample had been smoking for a long period of their life, leading to the development of CMD disease. In one study on patients’ perspectives, smoking cessation was perceived to be one of the most challenging lifestyle changes, second to stress management (Condon & McCarthy, 2006). Because smoking can be an important social medium among Asian men, (Kim et al., 2005; Mao et al., 2014) first generation Asian Americans may find it difficult to quit in spite of their condition, particularly if they still socialize with other first generation individuals (Garcia et al., 2010a). Since culturally tailored smoking intervention is known to

facilitate smoking cessation across ethnic groups, (Lee & Kahende, 2007; Maxwell et al., 2005) intervention including culturally appropriate strategies may help Chinese Americans with CMD modify their smoking behaviors.

Filipinos with CMD tended to be more inactive. This tendency is consistent with previous studies reporting that Filipinos with hypertension participated less in physical activity per day than non-hypertensives (Garcia et al., 2010b; Lee & Kahende, 2007) and that their exercise levels failed to meet national guideline recommendations (Angosta & Serafica, 2017). Studies have shown that physical activity levels among the general population of Filipinos tend to be lower than those of other Asian subgroups (Ye et al., 2009). Even after the diagnosis of CMD, Filipinos may have experienced reduced motivation to exercise instead of modifying behaviors to increase their activity levels. Previous studies have noted that motivation to exercise is limited in those suffering from coronary heart disease and cardiovascular disease, and many patients drop out of exercise rehabilitation programs due to lack of motivation and fatigue (Godin et al., 1991; Oldridge, 1982). Innovative intervention approaches to enhance the motivation to exercise among Filipinos with CMD is in need.

Comparison between Chinese participants with CMD and Filipinos with CMD revealed that significantly more Chinese participants with CMD reported noncompliance to the drinking guidelines compared to Filipinos with CMD. This may be due to overall high levels of drinking among the Chinese American population and suggest a need for alcohol reduction interventions for Chinese Americans with CMD.

The present study provides important implications for general health practitioners and public health researchers involved in CMD care. For both Chinese and Filipinos with CMD, clinicians may want to emphasize their approach towards salt restriction and encourage patients with CMD to continue to be cautious about their salt intake. In addition, because smoking and drinking are the main challenges for Chinese participants with CMD and physical inactivity is the prominent issue for Filipinos with CMD, clinicians and researchers need to focus on addressing these issues to improve secondary prevention and disease control in these populations.

There are limitations to this study that should be taken into consideration. First, this was a cross-sectional study, and thus, it could not be determined whether any of the health behaviors preceded the development of CMD or whether there were any changes in behavior after participants knew about their diagnosis. Second, measurements of this study were adapted from the CDC's Behavioral Risk Factor Surveillance System (BRFSS). We acknowledge that the assessment measures and tools can be more comprehensive or inclusive. However, we believe that the findings from this study will serve as a foundation to inform future tailored interventions or cohort longitudinal observation research. Future studies with more refined and validated measurement combined with clinical and laboratory data for each health behavior are needed to validate our findings. Third, the study included relatively small number of participants residing in the greater Philadelphia region. Thus, to generalize the results of this study, future studies with a larger sample from geographically diverse areas are warranted. Despite the limitations, our study serves as valuable pioneering research on lifestyle behaviors among Chinese and Filipino Americans with CMD, and pinpoints a few important subethnic differences for further investigation. Future directions would involve examining attitudes towards and barriers to health care behaviors among CMD patients of these ethnic populations to understand reasons for the findings of this study.

Overall, this study is the first to explore health behaviors among Chinese and Filipino Americans with CMD, adding to the largely sparse literature on disease management and lifestyle modifications for secondary prevention among patients with diabetes, hypertension, cardiovascular disease, or dyslipidemia. This study focused on understudied foreign-born Chinese and Filipino American populations, highlighting the heterogeneity of their health and health behavior statuses. The

community-based participatory research and patient-centered approach used in this study make our findings applicable to the general Asian American population at risk for CMD.

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## Conflicts of interest

None of the authors declare a conflict of interest.

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