### Title

Health determinants and risk factors for coronary artery disease among older Filipinos in rural communities.




### Journal

European Journal of Cardiovascular Nursing, 20(6)

### ISSN

1474-5151



### Authors

Cacciata, Marysol C
Alvarado, Irma
Jose, Mini M
et al.



### Publication Date

2021-08-20

### DOI

10.1093/eurjcn/zvaa039

Peer reviewed

ESC European Society of Cardiology

European Journal of Cardiovascular Nursing (2021) **20**, 565–571
doi:10.1093/eurjcn/zvaa039

**ORIGINAL ARTICLE**

# Health determinants and risk factors for coronary artery disease among older Filipinos in rural communities

**Marysol C. Cacciata [1]*, Irma Alvarado [2], Mini M. Jose [2], and Lorraine S. Evangelista [2]**

[1]Nurse Scientist, Veterans Affairs Long Beach Healthcare System, Tibor Rubin VA Medical Center, 5901 East 7th St., Long Beach, CA 90822, USA; and [2]School of Nursing, University of Texas Medical Branch, Galveston, TX, USA

*Received 22 May 2020; revised 18 December 2020; accepted 3 January 2021; online publish-ahead-of-print 31 January 2021*

**Aims** Lifestyle modifications and healthy behavioural regimens are critical in preventing coronary artery disease (CAD) and other important health conditions. Little is known about the risk for CAD and health behaviour among older adults (>60 years) living in rural areas in the Philippines. Compare risk profiles and health behaviours of Filipinos at low- vs. moderate-to-high-risk for CAD and examine the association between demographic variables, risk profiles, and health behaviours.

**Methods and results** A comparative, cross-sectional study was conducted using a convenient sample of 427 Filipinos (≥60 years old). Data on sociodemographic characteristics, risk profiles, and health behaviours (e.g. diet, physical activity, smoking status, and alcohol use) were collected. Ten-year CAD risk was estimated using the non-laboratory-based Framingham algorithm. Of the 427 participants [mean age was 69.2 ± 6.7 years, primarily women (65%), married (52.8%)], 319 (75%) were at low risk, and 108 (25%) were at moderate-to-high-risk for CAD. Filipinos at moderate to high risk were more likely to have cardiometabolic diseases (e.g. hypertension, hyperlipidaemia, diabetes, and obesity, all *P*'s < 0.001). Health behaviours did not differ between the two groups except for the consumption of ≥5 servings of fruit, higher in the low-risk group.

**Conclusion** Data showed highly consistent and convergent evidence among older Filipinos living in rural areas at high risk for CAD and other health conditions. These findings underscore the need for culturally sensitive guidance to improve CAD outcomes for moderate to high-risk older adults living in rural areas, including education and counselling on risk and risk-reducing strategies.

**Keywords** Coronary artery disease • Health determinant • Cardiometabolic risks • Filipinos • Philippines

## Implications for practice

- Implementation of effective and equitable prevention strategies needs to be in place to prevent and reduce coronary artery disease (CAD) prevalence among older rural dwellers in the Philippines.
- Targeted prevention and disease management strategies for cardiometabolic disease such as hypertension need special attention as more Filipinos in their native country and abroad appeared to be at very high risk.
- Lifestyle modification and other healthy behaviour programs need to be promoted and implemented to reduce premature deaths associated with CAD.

* Corresponding author. Email: Marysol_cacciata@yahoo.com

# Introduction

Coronary artery disease (CAD) is a chronic disease that globally affects morbidity and quality of life of all racial and ethnic populations.[1] Globally, 17.9 million people succumbed to CAD, accounting for 31% of deaths worldwide. More than 75% of these deaths occur in low- and middle-income countries.[2] Moreover, by 2025, 80–90% of people in low- and middle-income countries are projected to die from CAD, making it one of the leading causes of death worldwide.[3] In the Philippines, CAD, is the third leading cause of cardiovascular disease.[4]

Premature deaths associated with CAD in low- and middle-income countries are associated with abysmal prevention and treatment efforts.[3,5,6] Specifically, a study among Chinese and Filipino Americans reported that the increasing number of premature deaths in low- and middle-income countries is attributable to the suboptimal implementation of prevention strategies by healthcare providers to reduce CAD risk factors such as hypertension, diabetes, elevated cholesterol, tobacco use, overweight/obesity—also referred to as cardiometabolic diseases (CMD).[7] Likewise, increased risk for CAD is also associated with poor access to effective and equitable healthcare services (including early detection services) in individuals from these countries.[3,8] Older adults are at greater risk for CAD and CMD.[9] Given the high prevalence of CAD among older adults in low- and middle-income countries like the Philippines, the projected increase in this population will be a significant challenge for the country's healthcare system.[10]

Poor health behaviours (e.g. poor eating habits, high sedentary behaviours, smoking and alcohol use, and overweight and obesity) are positively linked to CAD.[10] However, millions of older adults worldwide do not receive critical evidence-based preventive services[5] to eat healthier, increase physical activity levels, avoid or stop alcohol and/or smoking, weight maintenance, and early detection services as recommended by the World Health Organization (WHO) for the prevention of CAD.[3] Rural populations are especially disadvantaged with multiple healthcare disparities, resulting in lower rates of primary and secondary risk prevention measures.[10] Given the growing prevalence of CAD and a lower level of CAD health awareness in low- and middle-income countries, it is likely that such initiatives may have beneficial effects. A robust and appropriate evidence base that would equip low- and middle-income countries to take informed action, as recommended by the WHO, is crucial in improving this situation. Components of WHO health promotion guidelines and practices include (i) dietary advice to encourage healthier eating habits, (ii) minimizing unhealthy alcohol intake, (iii) smoking cessation advice, (iv) advice on increasing daily physical activity, and (v) weight reduction.[11]

Filipinos living in the USA are at higher risk for both CAD and CMD. A study conducted among older Filipinos in the USA showed a high risk of hypertension, diabetes mellitus, coronary heart disease, and other metabolic problems at mid-life and old age.[12] Similarly, research has shown that Filipinos living in California and their Vietnamese counterparts tended to have poorer physical health and reported the greatest number of chronic diseases, including asthma, high blood pressure, heart disease, and the highest level of disability.[13] While there have been many studies exploring Filipino Americans' health characteristics compared across different subcategories of Asian Americans in the USA,[13] there is a lack of research examining health behaviours among Filipinos in their native country.

Lifestyle modification and a healthy behavioural regimen are critical in preventing CAD and other necessary health conditions.[5,7,14] Observational data suggest a link between healthier lifestyle adherence and lower risk for CAD.[15] Likewise, a high-quality diet, regular exercise, and smoking cessation are associated with lower morbidity and mortality.[16] The literature is replete with studies examining prevention strategies focused on improving diet, physical activity, avoidance of alcohol and tobacco use, and weight management.[9,14] However, there is a shortage of studies examining these health behaviours and their association with CAD risks in low-income countries like the Philippines. This study was conducted to address the current gaps in research as clearly depicted in the foregoing sections. The specific aims of this comparative, cross-sectional study were to (i) compare health behaviours of older Filipinos at low- vs. high-risk for CAD; and (ii) examine the relationships between sociodemographic characteristics, risk profiles, and health behaviours.

# Methods

A secondary analysis was conducted using data from a nationally representative cohort of Filipinos living in underserved rural communities in the Philippines who participated in extensive interviews with trained bilingual (English and Tagalog, the official language spoken by 90% of Filipinos in the Philippines) community health workers. The choice of language for administering the surveys was based on participants' preferences. Community health workers from selected communities were chosen to administer surveys engaged in a one-to-one training session with an investigator on administering surveys related to CAD risk reduction. Likewise, all community health workers attended a 4-h workshop on taking blood pressure and measuring weight, height, and waist circumference, including practicing the skills and checking inter-rater reliability by comparing measures obtained by each worker with the values obtained by the trainer. One of the investigators shadowed each community health worker to test their communication skills before performing the surveys independently. All community health workers had at least 4 years of high school education.

This comparative, cross-sectional design used a methodological approach, including interviews and survey guides were developed by the US Department of Health and Human Services (DHHS). The DHHS has enhanced its efforts to build partnerships within the Filipino communities in the USA and focuses local community action on creating heart disease prevention activities.[1] The parent study's overall goal was to examine perceptions and knowledge of heart disease and motivation to change lifestyles among the Filipinos in rural communities in the Philippines.

In the parent study, 1203 participants aged between 18 and 83 years were recruited from the underserved communities identified by the local governments of the National Capital Region, Cordillera Administrative Region, Ilocos Region, Central Luzon, and Western and Central Visayas regions. Data collection occurred at the Barangay Health Centers through the National Health Sector Reform Agenda by the Philippines Department of Health in 1999 to provide better health care access to underserved communities.[17] Only data from 427 older participants (≥60 years of age, which is based on the definition of 'senior citizen' in the

Philippines) were included in this secondary analysis. The study received Institutional Review Board approval from the University of California, Irvine, and the University of the Philippines, Manila. Written informed consent was waived due to the low-risk nature of the study, and data were de-identified.

## Sociodemographic variables and cardiometabolic risk factors

Sociodemographic characteristics, including age, gender, marital status, education, and income, were collected using a standardized form created for this study. Community workers conducting the interviews helped assess each participants' risk for CAD using the non-lab Framingham algorithm, which substituted body mass index (BMI) for lipids in the laboratory-based Framingham algorithm. The non-lab algorithm was previously tested in a cohort of African Americans and Asians and shown to have higher sensitivity, leading to better detection of at-risk cases and higher specificity, leading to fewer false-positive cases.[18,19] The ten-year risk for CAD was categorized as low risk (< 5%), borderline risk (5–7.4%), moderate risk (7.5–19.9%), and high risk (≥20%).[11] For the current study, participants at low- and borderline risk ($n = 319$), were compared to those considered at moderate and high risk ($n = 108$), defined as a ≥10% chance of developing CAD.[20]

Data on the presence or absence (i.e. yes/no) of cardiometabolic risk factors were obtained using self-report. They included (i) hypertension, defined as systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg and/or self-reported treatment with antihypertensive medication(s) during the 2 weeks before the interview;(ii) type 2 diabetes, defined as the previous diagnosis based on a fasting plasma glucose level of ≥126 mg/dL, random plasma glucose, or 2-h plasma glucose level of ≥200 mg/dL during a 75-g oral glucose tolerance test, or glycosylated haemoglobin ≥6.5%; (iii) hyperlipidaemia, based on lipid profile lab values—total cholesterol ≥ 200, low-density lipoprotein ≥ 100 mg/dL, high-density lipoprotein < 40 for men or <50 for women, and triglycerides ≥ 140 mg/dL; and (iv) overweight and obesity, defined as ≥ 23 kg/m$^2$ based on standards for Asian populations.[21]

## Obtaining weight, height, blood pressure, and waist circumference

Community health workers measured height, weight, waist circumference, and vital signs. Participants were weighed in their clothing without shoes using the Ozeri Rev Digital Bathroom Scale with Electro-Mechanical Weight Dial provided by the investigator for use at the Barangay health clinics where participants were seen. The scale was used by the researchers in a clinical trial and was capable of not only detecting change as small as a couple of tenths of a pound or kilogram but also consistently giving the same measurements for test objects of known weights on different days.[22] Height was determined using a measuring board mounted to the wall with an attached measuring tape and moveable right angle headpiece available in each Barangay Health Center. Waist circumference was obtained by applying the tape across the waist at the level of the narrowest section of the torso between the ribs and iliac crests, as recommended in the Anthropometric Standardization Reference Manual.[23] This uniform measurement was taken at the end of the normal expiration and calibrated to the nearest centimetre using an anthropometric tape measure. The tape was carefully placed across the body to avoid indenting the skin or compressing the subcutaneous tissue.

## Health behaviours

Health behaviours were collected using a general health survey. To simplify choices for participants, we used binary variables similar to data collection for cardiometabolic risk factors. For example, physical activity was defined as engaging in ≥150 min/week of accumulated moderate-intensity or 75 min/week of vigorous-intensity aerobic physical activity, based on the American Heart Association Guidelines.[9] Healthy dietary patterns were defined as consuming five or more servings of fruits (at least 200 g/day) and five or more servings of vegetables (at least 200 g/day); fewer than five servings of fruits and vegetables were categorized as insufficient.[24] Tobacco use was classified as never, previous smoker, or current smoker, while alcohol consumption was based on the presence or absence of moderate drinking defined as up to one drink per day for women and up to two drinks per day for men.[24]

## Data analysis

Comparisons of demographics, risk profiles, and health behaviours by low vs. moderate to high-risk groups were assessed with $\chi^2$ or Fisher's exact tests for categorical data and *t*-tests or Wilcoxon Rank Sum tests for continuous data, as appropriate. Correlations between risk profiles and health behaviours were obtained by using Spearman Rho correlation coefficients. The significance level was set *a priori* at $P \leq 0.05$. All data were analysed using Statistical Package for the Social Sciences 25 (SPSS, Chicago, IL, USA).[25]

# Results

Of the 427 participants (mean age was 69.2 ± 6.7 years, primarily women [65%], married [52.8%]), 319 (75%) were low-risk, and 108 (25%) were moderate to high-risk for CAD. Demographic characteristics were comparable between the two groups (*Table 1*). Differences in risk profiles between those at low- and moderate-to-high risk are also illustrated in *Table 1*. Those at moderate to high-risk were more likely to have cardiometabolic diseases [e.g. hypertension, hyperlipidaemia, diabetes, and obesity (i.e. measured by BMI and waist circumference)] (all *P*'s < 0.001). Health behaviours did not differ between the two groups except for the consumption of ≥5 servings of fruit, higher in the low-risk group (*Table 2*).

Moderate to high-risk status was associated with adiposity (e.g. BMI, waist circumference), elevated systolic blood pressure, and a history of hypertension, hyperlipidaemia, and diabetes (*Table 3*). Female gender was associated with higher waist circumference and BMI but lower systolic blood pressure; being female was also associated with having a higher risk for diabetes. Low fruit consumption, below the recommended intake of ≥5 servings per day, was associated with female gender, higher BMI, and a lower likelihood of having a history of hypertension.

# Discussion

In 2010, the World Health Organization (WHO) reported that older people, ≥ 60 years of age, made up 13% of the Western Pacific Region's (WPR) population, with 78% living in low- and middle-income countries.[26] The Philippines, belonging to this region, reported 5.7% older persons in its general population in the same year. Non-communicable diseases account for 90% of the overall disease burden of men and women ≥70 years of age in the WPR in 2012. Of the non-communicable diseases, CAD was the leading cause of morbidity in WPR including the Philippines, with more men inflicted by this condition than women.[26,27] As the number of older

**Table 1 Demographic and risk profile of low- vs. moderate to high-risk older adults**

| | All participants (*N* = 427) | Low-risk group (*n* = 319) | High-risk group (*n* = 108) | *P*-value |
|---|---|---|---|---|
| Age, years (Mean ± SD) | 69.2 ± 6.7 | 69.1 ± 7.0 | 69.5 ± 6.4 | 0.588 |
| Female, *N* (%) | 277 (64.9) | 201 (63.0) | 76 (70.4) | 0.166 |
| Married, *N* (%) | 230 (52.8) | 176 (55.2) | 54 (50.0) | 0.278 |
| ≤High school education, *N* (%) | 324 (75.9) | 243 (76.2) | 81 (75.0) | 0.919 |
| Waist circumference, inches (mean ± SD) | 34.2 ± 3.7 | 33.2 ± 3.5 | 35.2 ± 4.0 | <0.001 |
| Body mass index (mean ± SD) | 24.5 ± 4.9 | 22.3 ± 4.5 | 26.8 ± 5.3 | <0.001 |
| Body mass index categories, *N* (%) | | | | <0.001 |
| Underweight | 45 (11.0) | 44 (13.2) | 1 (0.9) | |
| Normal weight | 258 (60.4) | 220 (69.0) | 38 (35.2) | |
| Overweight or obese | 124 (29.0) | 55 (17.2) | 69 (63.9) | |
| Systolic blood pressure (mean ± SD) | 131.2 ± 15.3 | 127.6 ± 15.2 | 134.8 ± 15.4 | <0.001 |
| Diastolic blood pressure (mean ± SD) | 84.5 ± 12.8 | 84.6 ± 15.7 | 84.4 ± 10.0 | 0.958 |
| Hypertension, *N* (%) | 313 (73.3) | 207 (64.9) | 106 (98.1) | <0.001 |
| Hyperlipidaemia, *N* (%) | 145 (33.9) | 66 (20.7) | 79 (73.1) | <0.001 |
| Diabetes mellitus, Type 2 *N* (%) | 130 (30.4) | 52 (16.3) | 78 (72.2) | <0.001 |
| Depression, *N* (%) | 91 (23.1) | 65 (21.4) | 26 (24.1) | 0.567 |

**Table 2 Health behaviours of low- vs. moderate to high-risk older adults**

| Affirmative response to the following (yes) | All participants (*N* = 427) | Low-risk group (*n* = 319) | High-risk group (*n* = 108) | *P*-value |
|---|---|---|---|---|
| ≥150 min physical activity/week, *N* (%) | 280 (65.6) | 214 (67.1) | 66 (61.1) | 0.259 |
| <4 h of sedentary activity/day, *N* (%) | 74 (37.5) | 51 (16.0) | 23 (21.5) | 0.110 |
| ≥5 servings of vegetables/day, *N* (%) | 48 (22.7) | 34 (10.7) | 14 (12.0) | 0.431 |
| ≥5 servings of fruits/day, *N* (%) | 39 (17.3) | 31 (9.8) | 8 (7.5) | 0.001 |
| 1 drink/day—women/2 drinks/day—men, *N* (%) | 34.2 ± 3.7 | 73 (23.0) | 20 (18.5) | 0.812 |
| Current smoker, *N* (%) | 100 (23.4) | 77 (24.1) | 23 (21.1) | 0.240 |

**Table 3 Correlation matrix for key variables (*N* = 427)**

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 1 Risk status (↑ risk) | 1.000 | | | | | | | | |
| 2 Gender | 0.067 | 1.000 | | | | | | | |
| 3 Waist Circ. | 0.231** | 0.096* | 1.000 | | | | | | |
| 4 Body mass index | 0.387** | 0.129** | 0.383** | 1.000 | | | | | |
| 5 Systolic BP | 0.201** | -0.095* | 0.262** | 0.160** | 1.000 | | | | |
| 6 Hx., hypertension | 0.327** | 0.044 | 0.144** | 0.107* | 0.290** | 1.000 | | | |
| 7 Hx., hyperlipidaemia | 0.482** | -0.032 | 0.166** | 0.170** | 0.200** | 0.232** | 1.000 | | |
| 8 Hx., diabetes | 0.528** | 103* | 0.094 | 0.093 | -0.012 | 0.250** | 0.095* | 1.000 | |
| 9 ≤5 servings of fruit | 0.019 | 0.098* | 0.031 | 0.181** | -0.003 | -0.127** | 0.044 | -0.038 | 1.000 |

*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).
Circ., circumference, Hx., history.

adults worldwide is projected to increase from 1 billion in 2019 to 1.4 billion by 2030, strategic measures are needed to prepare for this aging population's challenges.[28] The WHO's recommendations for improving cardiovascular health and reducing the rates of premature deaths associated with CAD is through prevention, early recognition, and treatment of CMD.[6]

In 2013, the prevalence rates of the significant CMD risk factors among adults ≥ 20 years old in the Philippines included: diabetes (5.4%), hypertension (22.3%), dyslipidaemia, low high-density lipoprotein (71.3%), obesity, BMI >25 kg/m$^2$ (31.1%), and smoking (25.4%).[29] An unpublished report in 2016 revealed a 27% prevalence of metabolic syndrome.[30] In 2008, Sy *et al.* conducted the National Nutrition and Health Survey II (NNHeS II), a survey assessing the prevalence of non-communicable or lifestyle-related conditions and corresponding risk factors among Filipino adults ≥20 years old.[31] This succeeds two other national surveys done in 1998 and 2003. The 2008 survey showed a 4.2% increase in the prevalence of hypertension in the general adult population compared to 2003 of 16.4%; older adults (≥65 years) were three times more likely to be diagnosed with hypertension,[31] which is consistent with studies conducted in the USA.[32]

As with hypertension, type 2 diabetes places a person at greater risk for CAD.[33] The prevalence of type 2 diabetes is associated with increased morbidity and mortality, increased risk for CAD and other complications, increased risk of hospitalization or institutionalization, decreased functional status, and increased economic losses.[34] Globally, the incidence of diabetes increased four-fold from 108 million in 1980 to 422 million in 2014.[30] More than 25% of adults, ≥65 years old in the USA, have type 2 diabetes.[35] Astoundingly, the rates of type 2 diabetes among older Filipinos in this study was 5% higher than older adults in the USA and almost six-fold higher than the latest 2013 Philippine NNHeS of the general adult population. This poses a significant problem in our already limited resources. A recent study in Manila showed that adults diagnosed with type 2 diabetes also had more significant diabetic complications and CMD risk factors.[36]

Unlike studies with Caucasian cohorts, where obesity is positively associated with type 2 diabetes, type 2 diabetes among Filipinos is not commonly associated with obesity. The prevalence of obesity in the Philippine NNHeS of 2008 was less than 10%. Still, visceral adiposity was observed in 65.5% of women, suggesting that visceral adiposity and not obesity *per se* was a more influential risk factor for type 2 diabetes.[31] In this study, diabetes was associated with hypertension, gender, and dyslipidaemia. However, there was no significant association between diabetes, BMI, and waist circumference. This may be attributed to the varied topography and cultural milieu of the Philippines' different regions, shaping Filipinos' various lifestyles, activities, and food preferences. These variations have to be considered in developing strategies for preventing disease.[34,37]

The WHO has the following estimates in 2016: (i) there are 1.9 billion adults, ≥18 years old, who are overweight, 650 million of whom are obese; (ii) the adult prevalence of obesity is 13%, with the women at 4% higher prevalence than men; and, (iii) the prevalence of obesity has increased by almost three-fold from 1975 to 2016.[38] The prevalence of obesity in this study is five-fold more than the general adult population. Our findings are consistent with the increasing prevalence of obesity worldwide, as demonstrated by numerous studies.[39] Data from the Philippines NNHeS showed an upward trend in overweight and obesity in their surveys from 1987 to 2008. General Filipino adult prevalence of obesity almost doubled from 11.8% in 1987 to 21.4% in 2008, while overweight prevalence tripled from 1.7% in 1987 to 5.2% in 2008.[40] Hyperlipidaemia was reported in approximately one-third of the sample for the current study and is consistent with a global prevalence of hyperlipidaemia of 39%, as reported by the WHO.[41] However, data from the NNHeS from 2008 showed that 72% of the sample had hyperlipidaemia.[31] This inconsistency may be related to the age, where younger adults may have had higher levels of hyperlipidaemia, which increased the overall prevalence. Our findings corroborate that hyperlipidaemia is associated with higher risks of CAD, overweight or obesity, and hypertension.[7]

Lifestyle changes such as a healthy diet, physical activity or exercise, and smoking cessation are needed to reduce CMD risk factors. Estimates indicate that 44% of the decrease in CAD death rates were due to changes in CAD-related lifestyle and behavioural factors, including improved smoking rates, physical inactivity, and regulation of systolic blood pressure and total cholesterol. However, the decrease in the prevalence of these risk factors is offset by the growing prevalence of obesity and diabetes mellitus as previously described and smoking behaviours.[42] Smoking prevalence among older adults in this study was lower (7.6%) than the NNHeS study of the Philippines' general adult population (31%).[31] The WHO reported a declining trend in smoking rates worldwide, except for data from the Eastern Mediterranean and African regions.[43] The prevalence of smoking among Filipino adults also decreased by 4.9% in 2008 compared to the 2003 NNHeS.[31] Given that poor lifestyle behaviours are vital contributors to the risk of death, it is crucial to continue to investigate the association of CAD risk factors with individuals' lifestyle-related risk factors. Moreover, it is necessary to perform gender-specific and geographical-specific analyses to assess whether the higher baseline CAD risk in Filipinos' specific subgroups varies with healthy lifestyle behaviours in other subgroups.

The prevalence of CMD risk factors increases with age and can partially explain CAD's high prevalence rates in this study. National and global trends are also showing an increase in prevalence among the general adult population. These CMD risk factors, either on their own or in conjunction with others, all have significant physical, psychological, social, and economic implications for individuals, families, society, and the world. Additional strategies are needed that target unhealthy lifestyle behaviours (e.g. poor eating habits, high sedentary behaviours, smoking and alcohol use, and overweight and obesity) of older Filipinos living in underserved areas in the Philippines.[10] Programs that support primary and secondary risk prevention measures for CAD (e.g. eating healthier, increasing physical activity levels, avoidance of alcohol use and/or smoking or its cessation, and weight maintenance)[5] should be recognized as a healthcare priority in the Philippines, especially in older adults living in rural areas where healthcare access is problematic.[10]

It is essential to recognize that although we had a reasonably large sample, we were limited in terms of the geographic areas where participants were recruited. We could not recruit from any of the Mindanao regions because of the current political and social disarray

on the island. The results should, therefore, not be generalized to the broader Filipino community in the Philippines. Likewise, our results must be interpreted with caution since we do not have any details about whether subjects have been explicitly advised of their CAD risk using available risk scores, and there is limited research to support the validity of the non-laboratory Framingham risk assessment score. Any history of CAD risk factors was defined by subjects who have been advised to do so by a doctor or other health professional. The use of the specified risk assessment score may have overestimated the risk for CAD.[44] Thus, epidemiological studies and qualitative research to assess the Framingham CAD prediction functions are warranted. Likewise, there is a need to evaluate the performance of the non-laboratory Framingham risk assessment score and the use of BMI in Filipinos with smaller statures than Caucasians. Additional research is needed to test the validity and transportability of the risk score in Filipinos. Mixed-methods research, in particular studies conducted in partnership with health clinics and the Department of Health, would enhance the capacity to develop more informed and effective prevention programs for CAD. This is especially justified in low-and middle-income countries such as the Philippines, where some of the WHO's suggested recommendations on healthy lifestyle actions[11] cannot be seen as significant to the healthcare climate and system.

# Conclusion

Our findings confirm the Health Department's reports that CAD risks are highly prevalent in older Filipinos living in rural areas. Coronary artery disease is the leading cause of death for Filipinos, accounting for about 32% of all Filipino deaths.[45] Hypertension is one of the significant risk factors that are quite prevalent among Filipinos in both the USA and in the Philippines and increases their risk of CAD.[13] Seventy-three percent of older Filipinos who participated in the current study suffer from hypertension. Approximately one-third suffer from hyperlipidaemia and diabetes. Also, one-fourth of the sample was current or previous smokers. Thus, community-based programs to promote healthy eating patterns and improve screening, referral, and follow-up for hypertension as well as smoking cessation programs may help reverse the increasing prevalence of CAD in this population. By conducting risk behaviour studies among a subgroup of older Filipinos living in low-income communities in the Philippines, we were able to gain a better understanding of the heart health problems that afflict this population and how to prevent them from enhancing the overall well-being of older Filipinos nationwide.

## Funding

The National Institute on Aging (1R21AG053162). The content is solely the authors' responsibility and does not necessarily represent the official views of the funding agencies listed.

**Conflict of interest**: none declared.

**Disclaimer:** The contents do not represent the views of the U.S. Department of Veterans Affairs or the United States Government.

## References

1. Arnett DK, Blumenthal RS, Albert MA, Buroker AB, Goldberger ZD, Hahn EJ, Himmelfarb CD, Khera A, Lloyd-Jones D, McEvoy JW, Michos ED, Miedema MD, Muñoz D, Smith SC Jr, Virani SS, Williams KA Sr, Yeboah J, Ziaeian B. 2019 ACC/AHA guideline on the primary prevention of cardiovascular disease: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation* 2019;**140**:e563–e595.
2. World Health Organization. Cardiovascular disease. 2018. https://www.who.int/health-topics/cardiovascular-diseases/#tab=tab_1 (1 July 2019).
3. Global Burden of Metabolic Risk Factors for Chronic Diseases Collaboration. Cardiovascular disease, chronic kidney disease, and diabetes mortality burden of cardiometabolic risk factors from 1980 to 2010: a comparative risk assessment. *Lancet Diabetes Endocrinol* 2014;**2**:634–647.
4. Sison J, Divinagracia R, Nailes J. Asian management of hypertension: Current status, home blood pressure, and specific concerns in Philippines (a country report). *J Clin Hypertens (Greenwich)* 2020;**22**:504–507.
5. Teo K, Lear S, Islam S, Mony P, Dehghan M, Li W, Rosengren A, Lopez-Jaramillo P, Diaz R, Oliveira G, Miskan M, Rangarajan S, Iqbal R, Ilow R, Puone T, Bahonar A, Gulec S, Darwish EA, Lanas F, Vijaykumar K, Rahman O, Chifamba J, Hou Y, Li N, Yusuf S, Pure Investigators OBOT. Prevalence of a healthy lifestyle among individuals with cardiovascular disease in high-, middle- and low-income countries: the prospective urban rural epidemiology (PURE) studyhealthy lifestyle and cardiovascular disease. *JAMA* 2013;**309**:1613–1621.
6. Reddy KS. Global burden of disease study 2015 provides GPS for global health 2030. *Lancet* 2016;**388**:1448–1449.
7. Lee M, Hu D, Bunney G, Gadegbeku CA, Edmundowicz D, Houser SR, Wang H, Ma GX. Health behavior practice among understudied Chinese and Filipino Americans with cardiometabolic diseases. *Prev Med Rep* 2018;**11**:240–246.
8. Uthman OA, Hartley L, Rees K, Taylor F, Ebrahim S, Clarke A. Multiple risk factor interventions for primary prevention of cardiovascular disease in low- and middle-income countries. *Cochrane Database Syst Rev* 2015;**2015**:CD011163.
9. Arnett DK, Blumenthal RS, Albert MA, Buroker AB, Goldberger ZD, Hahn EJ, Himmelfarb CD, Khera A, Lloyd-Jones D, McEvoy JW, Michos ED, Miedema MD, Muñoz D, Smith SC Jr, Virani SS, Williams KA Sr, Yeboah J, Ziaeian B. 2019 ACC/AHA guideline on the primary prevention of cardiovascular disease: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *J Am Coll Cardiol* 2019;**74**:1376–1414.
10. Ruan Y, Guo Y, Zheng Y, Huang Z, Sun S, Kowal P, Shi Y, Wu F. Cardiovascular disease (CVD) and associated risk factors among older adults in six low-and middle-income countries: results from SAGE wave 1. *BMC Public Health* 2018;**18**:778–778.
11. Van Camp G. Cardiovascular disease prevention. *Acta Clinica Belgica* 2014;**69**:407–411.
12. McBride M. Health and health care of Filipino American elders. 2019. http://www.stanford.edu/group/ethnoger/filipino.html. (1 July 2019).
13. Kim G, Chiriboga DA, Jang Y, Lee S, Huang C-H, Parmelee P. Health status of older Asian Americans in California. *J Am Geriatr Soc* 2010;**58**:2003–2008.
14. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, Das SR, de Ferranti S, Després J-P, Fullerton HJ, Howard VJ, Huffman MD, Isasi CR, Jiménez MC, Judd SE, Kissela BM, Lichtman JH, Lisabeth LD, Liu S, Mackey RH, Magid DJ, McGuire DK, Mohler ER, Moy CS, Muntner P, Mussolino ME, Nasir K, Neumar RW, Nichol G, Palaniappan L, Pandey DK, Reeves MJ, Rodriguez CJ, Rosamond W, Sorlie PD, Stein J, Towfighi A, Turan TN, Virani SS, Woo D, Yeh RW, Turner MB. Executive summary: heart disease and stroke statistics – 2016 update: a report from the American Heart Association. *Circulation* 2016;**133**:447–454.
15. O'Donnell MJ, Xavier D, Liu L, Zhang H, Chin SL, Rao-Melacini P, Rangarajan S, Islam S, Pais P, McQueen MJ, Mondo C, Damasceno A, Lopez-Jaramillo P, Hankey GJ, Dans AL, Yusoff K, Truelsen T, Diener H-C, Sacco RL, Ryglewicz D, Czlonkowska A, Weimar C, Wang X, Yusuf S. Risk factors for ischaemic and intracerebral haemorrhagic stroke in 22 countries (the INTERSTROKE study): a case-control study. *Lancet* 2010;**376**:112–123.
16. Chow CK, Jolly S, Rao-Melacini P, Fox KAA, Anand SS, Yusuf S. Association of diet, exercise, and smoking modification with risk of early cardiovascular events after acute coronary syndromes. *Circulation* 2010;**121**:750–758.
17. Shimkhada R, Peabody JW, Quimbo SA, Solon O. The Quality Improvement Demonstration Study: an example of evidence-based policy-making in practice. *Health Res Policy Syst* 2008;**6**:5.
18. Kariuki JK, Gona P, Leveille SG, Stuart-Shor EM, Hayman LL, Cromwell J. Cost-effectiveness of the non-laboratory based Framingham algorithm in primary prevention of cardiovascular disease: a simulated analysis of a cohort of African American adults. *Prev Med* 2018;**111**:415–422.

19. D'Agostino RB Sr., Grundy S, Sullivan LM, Wilson P. for the CHD Risk Prediction Group. Validation of the Framingham coronary heart disease prediction scores: results of a multiple ethnic groups investigation. *JAMA* 2001;**286**:180–187.
20. Jain A, Persaud JW, Rao N, Harvey D, Robertson L, Nirmal L, Nirmal D, Thomas M, Mikhailidis DP, Nair DR. Point of care testing is appropriate for National Health Service health check. *Ann Clin Biochem* 2011;**48**:159–165.
21. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet* 2004;**363**: 157–163.
22. Motie M, Evangelista LS, Horwich T, Hamilton M, Lombardo D, Cooper DM, Galassetti PR, Fonarow GC. Pro-HEART - a randomized clinical trial to test the effectiveness of a high protein diet targeting obese individuals with heart failure: rationale, design and baseline characteristics. *Contemp Clin Trials* 2013;**36**: 371–381.
23. Heyward W, Wanger D. *Applied Body Composition Assessment*, 2nd ed. Champaign, IL: Human Kinetics, 2004.
24. Eckel RH, Jakicic JM, Ard JD, de Jesus JM, Houston Miller N, Hubbard VS, Lee I-M, Lichtenstein AH, Loria CM, Millen BE, Nonas CA, Sacks FM, Smith SC, Svetkey LP, Wadden TA, Yanovski SZ. 2013 AHA/ACC Guideline on lifestyle management to reduce cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines. *J Am Coll Cardiol* 2014;**63**:2960–2984.
25. *IBM SPSS Statistics for Windows, Version 25.0 [Computer Program]*. Armonk, NY: IBM Corp, 2017.
26. World Health Organization. Ageing and health. https://www.who.int/westernpacific/health-topics/ageing (1 July 2019).
27. World Health Organization. Cardiovascular diseases in the Western Pacific. https://www.who.int/westernpacific/health-topics/cardiovascular-diseases. (1 July 2019).
28. World Health Organization. Ageing. https://www.who.int/health-topics/ageing#tab=tab_3 (1 July 2019).
29. Paz-Pacheco E, Jimeno C, Philippine Society of Endocrinology, Diabetes and Metabolism. Diabetes care in the Philippines. *J ASEAN Fed Endoc Soc* 2015;**30**:118–123.
30. World Health Organization. Global report on diabetes. 2016. https://www.who.int/publications/i/item/9789241565257 (1 July 2019).
31. Sy RG, Morales DD, Dans AL, Paz-Pacheco E, Punzalan FER, Abelardo NS, Duante CA. Prevalence of atherosclerosis-related risk factors and diseases in the Philippines. *J Epidemiol* 2012;**22**:440–447.
32. Lionakis N, Mendrinos D, Sanidas E, Favatas G, Georgopoulou M. Hypertension in the elderly. *World J Cardiol* 2012;**4**:135–147.
33. Bayog MLG, Waters CM. Cardiometabolic risks, lifestyle health behaviors and heart disease in Filipino Americans. *Eur J Cardiovasc Nurs* 2017;**16**:522–529.
34. World Health Organization. Diabetes: Key Facts 2020. https://www.who.int/news-room/fact-sheets/detail/diabetes (18 December 2020).
35. Halter JB, Musi N, McFarland Horne F, Crandall JP, Goldberg A, Harkless L, Hazzard WR, Huang ES, Kirkman MS, Plutzky J, Schmader KE, Zieman S, High KP. Diabetes and cardiovascular disease in older adults: current status and future directions. *Diabetes* 2014;**63**:2578–2589.
36. Fojas M, Lantion-Ang FL, Jimeno CA, Santiago D, Arroyo M, Laurel A, Sy H, See J. Complications and cardiovascular risk factors among newly-diagnosed type 2 diabetics in Manila. *Philipp J Intern Med* 2009;**3**:99–105.
37. World Health Organization. Philippines embraces efforts to step up cardiovascular disease care. 2017. https://www.who.int/news-room/feature-stories/detail/philippines-embraces-efforts-to-step-up-cardiovascular-disease-care (18 December 2020).
38. World Health Organization. Obesity and overweight. 2020. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight (18 December 2020).
39. Samper-Ternent R, Al Snih S. Obesity in older adults: epidemiology and implications for disability and disease. *Rev Clin Gerontol* 2012;**22**:10–34.
40. Jasul GV, Sy RAG. Obesity treatment recommendations in the Philippines: Perspective on their utility and implementation in clinical practice. *J ASEAN Fed Endocr Soc* 2014;**26**:122.
41. World Health Organization. Raised Cholesterol. https://www.who.int/data/gho/data/themes/topics/indicator-groups/indicator-group-details/GHO/-cholesterol—raised-total-cholesterol-5-0-mmol-l (1 July 2019).
42. Morris AA, Ko YA, Hutcheson SH, Quyyumi A. Race/ethnic and sex differences in the association of atherosclerotic cardiovascular disease risk and healthy lifestyle behaviors. *J Am Heart Assoc* 2018;**7**:e008250.
43. World Health Organization. Global health observatory data: prevalence of tobacco smoking. https://www.who.int/gho/tobacco/use/en/ (1 July 2019).
44. Kent DM, Griffith J. The Framingham scores overestimated the risk for coronary heart disease in Japanese, Hispanic, and Native American cohorts. *ACP J Club* 2002;**136**:36.
45. Diza FC. *Cadiovascular Disease*. Department of Health; 2018.