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Social Determinants of Health, Cardiovascular Risk Factors, and Atherosclerotic Cardiovascular Disease in Individuals of Vietnamese Origin

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Abstract

In 2022, the Vietnamese population in the United States (US) comprises 2.2 million individuals, and Vietnam ranks as the sixth most frequent country of origin among immigrants in the US. The American Heart Association and the National Institutes of Health have called for research to define the burden of cardiovascular risk factors, cardiovascular disease, and their determinants across Asian American subgroups, including Vietnamese Americans. Despite these calls, Vietnamese Americans remain remarkably overlooked in cardiovascular research in the US.

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Studies in Vietnam, small cross-sectional surveys in the US, and research using US mortality data point to a high prevalence of hypertension and tobacco use among men and a high incidence of gestational diabetes among women. Moreover, Vietnamese Americans have one of the highest rates of cerebrovascular mortality in the country. Adverse social determinants of health—including frequent language barriers, limited health literacy, and low average income—have been suggested as important factors that contribute to cardiovascular risk in this group. In this narrative review, we summarize the existing knowledge in this space, highlight the distinct characteristics of cardiac risk in both Vietnamese and Vietnamese American individuals, discuss upstream determinants, and identify key knowledge gaps. We then outline several proposed interventions and emphasize the need for further studies in this underrepresented population. Our aim is to increase awareness of the significant burden of risk factors and cardiovascular disease shouldered by this large—but thus far overlooked—population in the US, boost research in this space, and help inform tailored, effective preventive interventions.

In 2022, individuals of Asian ancestry who are living in the United States (US) comprise a population of 22 million.¹ There is increasing interest in understanding the cardiovascular health of Asian Americans subgroups; the American Heart Association (AHA) and National Institutes of Health (NIH) have called for further cardiovascular disease (CVD) research across Asian American populations, with an emphasis on use of disaggregated data to uncover differences between subgroups.^{2,3} One large subgroup that remains understudied includes Vietnamese men and women, who currently comprise 2.2 million individuals in the US.⁴ Data from Vietnam, relatively small cross-sectional studies conducted in the United States, and analyses using US population surveillance mortality data suggest that Vietnamese individuals have a significant burden of cardiovascular risk factors, premature CVD, and premature cardiovascular mortality. In this narrative review, we discuss currently available data, factors that may contribute to CVD risk in the Vietnamese and Vietnamese American populations, and prevailing research gaps. We aim to increase awareness of the significant burden of cardiovascular risk factors and CVD in this expanding—but thus far overlooked—population, boost research in this space, and inform tailored, effective preventive interventions in the future.

Discussion

Vietnam is a Southeast Asian country that shares its borders with Cambodia, Laos, the South China Sea, and the Indochinese peninsula⁵ (Figure 1). Since the 2nd century BC, Vietnam had been ruled by many different Chinese dynasties until it developed into its own independent state in 938 AD.⁶ From 938 to the mid-1500s, Vietnam experienced a period of renaissance and was ruled under the Ly, Tran, Ho, and Le So dynasties. It was not until the early 19th century that Western countries first entered Vietnam. The French colonized Vietnam from 1862 to 1954, when they were defeated by Ho Chi Minh and the Indochinese Communist Party.⁷ The Vietnam War ensued as Communist forces moved throughout the country from 1956 to 1975. Therefore, the North Vietnamese seized control of South Vietnam in April 1975 and established a unified country under the Socialist Republic of Vietnam.⁷ The Vietnamese Communist Party remains the sole source of leadership in the

country.⁸ Financially, the country's current gross domestic product is \$262 billion,³ and Vietnam ranks 59th in education metrics in international rankings.⁹

As of 2021, the population of Vietnam reached approximately 98.3 million, with a nearly even split between women and men.¹⁰ Vietnam consists of a relatively young population, with a median age of 32.5 years; only 8% of the population is >65 years of age.¹⁰ Ethnically, Vietnamese make up approximately 85.7% of the population; smaller subgroups such as Tay, Thai, Muong, Khmer, Hmong, Nung, and Hoa compose the remainder of the population.⁸ The primary language spoken in the country is Vietnamese.

Among immigrants in the US, Vietnam ranks as the sixth most frequent country of origin (Table 1). According to the US Immigration and Naturalization Services, from 1961 to 1970 (before the end of the Vietnam War in 1975) only 4,561 Vietnam-born persons were admitted into the US.¹¹ After the fall of Saigon, which marked the end of the War, many Vietnamese individuals immigrated to the US in 4 distinct waves.¹² Many fled their home country because of the uncertain future and fears of retaliation—and even death—by the Communist government.¹¹ In the initial wave, the US government allowed entry to approximately 130,000 Vietnamese refugees; these consisted mostly of members of the elite and middle classes and those who feared reprisals because of close American ties.^{11,13,14}

The second wave occurred soon after 1978 and lasted into the mid-1980s. This population of refugees, known as the “boat people,” packed into boats and fled to neighboring Southeast Asian countries—Thailand, Indonesia, Malaysia, the Philippines, and Hong Kong—to escape the Communist regime and the 1979 Chinese invasion of Vietnam.^{11,13} After it recognized the Vietnamese refugee crisis, the US agreed to become a country for resettlement, allowing those displaced from their homeland to safely seek refuge. The third wave occurred in the late 1980s and consisted of remaining family members and offspring of former US servicemen in Vietnam. In 1989, the US and the Socialist Republic of Vietnam agreed to allow former detainees to leave for the US under the Humanitarian Operation program.¹¹ This program allowed for the fourth wave of immigrants, which consisted mostly of political prisoners and their families, to arrive in the US. A total of 759,482 Vietnamese individuals arrived in the US as refugees from 1975 to 2002.¹³

With the arrival of Vietnamese refugees to the US in 1975, 5 major reception centers were created by the US government: Camp Pendleton, California; Fort Indiantown Gap, Pennsylvania; Fort Chaffee, Arkansas; Elgin Air Force Base, Florida; and Guam.¹¹ To prevent concentration of Vietnamese individuals in a single geographic area, the refugees were intentionally dispersed across the country; however, many eventually found their way to California and Texas, where there were already strong Vietnamese presences.¹³ The rate of Vietnamese immigration to the US has been decreasing over the past 2 decades; the 26% growth rate from 2000 to 2010 decreased to 12% in the subsequent decade¹⁴ (Figure 2). The largest communities of Vietnamese Americans are currently located in California (38.5% of the total Vietnamese population in the US), Texas (13.0% of the total), and Washington (4.3% of the total) (Figure 3).

Vietnamese individuals constitute approximately 10% of all Asian Americans; this translates to 2.2 million individuals.⁴ As of 2019, 38% of all Vietnamese persons in the US were US-born.⁴ Per the 2020 US Census, Vietnamese Americans are the fourth-largest ethnic group in the US¹⁵ and are one of the fastest-growing minority groups in the US, with a projected population of 3.9 million by 2030.¹⁶ The Vietnamese American population is relatively young, with a median age of 37 years. Of those who are foreign-born, median age is 49 years (compared with 17 years for US-born Vietnamese individuals).⁴ In 2019, approximately 90% of US-born Vietnamese persons were proficient in English, whereas only 35% of foreign-born Vietnamese American individuals were proficient in English.¹⁷

In 2019, life expectancy in Vietnam was 79.5 years for women and 71.3 years for men.¹⁸ The current average life expectancy in Vietnam is 75.7 years; it has increased slightly (by 0.13%) since 2021.¹⁹ For reference, life expectancy in the US in 2022 is higher, at 79.1 years. In European countries such as France, Spain, Italy, and the United Kingdom, average life expectancy is approximately 7 years higher, at 83 years.¹⁹ Despite these variations in life expectancy, CVD consistently remains the leading cause of mortality worldwide; incidence increased from 270 million in 1990 to 523 million in 2019.²⁰ According to the World Health Organization (WHO), CVD was responsible for 31% of all deaths in Vietnam in 2016²¹ (Table 2). Specifically, stroke is the leading cause of death in Vietnam; it is followed by congenital heart disease (CHD) (although CHD mortality has been increasing recently).²² This is in contrast with most Western countries—where CHD is the leading cardiovascular cause of death—and is consistent with trends observed in other Southeast Asian countries such as the Philippines, Singapore, and Thailand. The total burden of disease in Vietnam was a staggering 12.3 million disability-adjusted life years in 2008; CVD was the leading cause of premature death.²³

The Southeast Asia region is home to a growing, relatively young population of >600 million; this population exhibits an increasing prevalence of hypertension, smoking, and diabetes.²⁴ Alarmingly, a 2009 study by Nguyen et al²² revealed that 20.4% of Vietnamese adults aged ≥25 years had >4 of the 9 major CVD risk factors, which include hypertension, diabetes, hyperlipidemia, obesity, and behavioral factors such as smoking, excessive alcohol intake, unhealthy diet, physical inactivity, and stress.

According to the Global Burden of Diseases (GBD) Risk Factors Collaborators report, smoking was the leading cause of disability-adjusted life years lost in Vietnam in 2015.²⁵ Importantly, this habit concentrates mostly in men; it is nearly negligible among women. In a nationally representative survey in 2015, the prevalence of smoking was found to be 22.5% overall, 45.3% among men, and 1.1% among women.²⁶ Even higher rates were reported in a 2009 cross-sectional study in Hanoi and Thai Binh (n = 2,130), in which 54% of male participants and 4% female participants reported being active smokers.²² Furthermore, nearly 34.5 million nonsmokers are exposed to secondhand smoke in Vietnam.²⁷ According to the WHO, nearly 40,000 individuals in Vietnam die each year from tobacco-related complications such as stroke and CHD.²⁷

Hypertension is also increasing as a public health issue in Vietnam and is considered a key risk factor for CVD in the country.²⁸ In 2005, the National Adult Overweight Survey, which

involved nearly 18,000 individuals, revealed hypertension and prehypertension prevalence of 20.7% and 41.8%, respectively, among Vietnamese individuals.²⁹ The prevalence of both were higher in men. According to the GBD, hypertension is the risk factor in Vietnam that drives the most death and disability (combined), and its prevalence increased by 21.3% from 2009 to 2019.³⁰ Based on the World Health Statistics in 2020, the age-standardized prevalence of hypertension in Vietnam was 23.4%.³¹ This estimate was roughly consistent with those of other small-scale studies; for example, a cross-sectional survey of 9,832 participants aged ≥ 25 years revealed that the overall prevalence of hypertension in Vietnam was 25.1%.²⁸ Numbers were higher in the 2009 study in Hanoi and Thai Binh, in which the prevalence of hypertension was 25% in women and 31% in men.²² Concerningly, approximately 25% of Vietnamese individuals—particularly those in rural areas—with hypertension are unaware of their condition.³²

The prevalence of type 2 diabetes continues to increase rapidly in Southeast Asia because of urbanization and adoption of “Western” lifestyles. According to the International Diabetes Federation, in 2015 nearly 56% of all individuals with diabetes were living in Southeast Asian or Western Pacific regions, and the prevalence of diabetes in Vietnam is projected to increase further (by 92%) by 2035.³³ In 2009 the prevalence of diabetes was 6% in women and 8% in men in the Hanoi/Thai Binh study²²; in 2019 the GBD ranked diabetes as the third-most-common cause of death in Vietnam.³⁰ Additionally, over the past 10 years the number of Vietnamese individuals with prediabetes has become >3 times the number of those with diabetes.³⁴

Although obesity is a risk factor for development of diabetes, obesity (by standard definitions of body mass index [BMI]) is not common in Vietnam. According to the World Health Statistics report, the age-standardized prevalence of obesity in Vietnam in 2020 was only 2.1%, which was the lowest percentage among the Asian countries.³¹ However, it is important to note that Asian adults have an increased risk for type 2 diabetes and CVD at BMIs that are lower than the existing WHO cutoff for overweight (≥ 25 kg/m²); the cutoff for observed risk varies from 22 to 25 kg/m² in different Asian subpopulations.³⁵ Also, as Vietnam continues to develop into a middle-income country, the prevalence of obesity is rising. Based on the Asian BMI cutoffs for overweight (23 to 27.4 kg/m²) and obesity (≥ 27.5 kg/m²), the prevalence of overweight and obesity among Vietnamese adults in Ho Chi Minh City were 27.5% and 5.7%, respectively.³⁶

In the 2009 Hanoi/Thai Binh study, which defined obesity by either BMI ≥ 25 kg/m² or abdominal obesity, 17% of female participants and 15% of male participants qualified as obese.²² Concerning trends are also being reported among children; in the Vietnamese capital of Hanoi, overweight and obesity in primary school children increased from 7.9% in 2003 to a glaring 40.7% in 2011.³⁴ Finally, a study by Ta et al³⁷ in Ho Chi Minh City revealed that the risk of developing diabetes was fourfold to sixfold higher in adults with both central obesity and hypertension.

Hyperlipidemia also is an important cardiovascular risk factor in Vietnam. The 2015 national survey on the risk factors of noncommunicable diseases (STEPwise approach to surveillance) revealed a 30.2% prevalence of high total cholesterol levels.³⁸ In the

2009 Hanoi/Thai Binh study, 52% of female participants and of 63% male participants had dyslipidemia, which was defined as either self-reported use of cholesterol-lowering medications or presence of high total cholesterol, high low-density lipoprotein cholesterol, high triglycerides, and/or low high-density lipoprotein cholesterol.²² Diet is an upstream contributing factor, and 52%–59% of participants reported unhealthy diets.²²

Bui et al³⁹ observed that 7/10 Vietnamese adults aged 25 to 64 years met WHO recommendations for total physical activity (largely from work activities). Similarly, the rates of physical inactivity in the 2009 Hanoi/Thai Binh study were low.²² These observations suggest that at the population level, physical activity may not be as relevant a risk factor as in other countries and groups.

Similar to the population in Vietnam, the Vietnamese American population has increased CVD risk and increased prevalence of cardiac risk factors; this situation deserves further attention. After malignant neoplasms, diseases of the heart and cerebrovascular disease are the next-leading causes of death in Vietnamese Americans (Table 2). Despite a large and growing population size, currently there is a lack of large-scale studies on CVD in Vietnamese American men and women. The existing studies largely involve mortality data and relatively small cross-sectional analyses based on surveys (such as the California Health Interview Survey). Notably, although major US cross-sectional health surveys (such as National Health and Nutrition Examination Survey [NHANES], National Health Interview Survey, and Behavioral Risk Factor Surveillance System) do include Asian American participants, and some authors have published results for Chinese, Indian, and Filipino Americans, these surveys have (thus far) failed to generate reliable disaggregated data for Vietnamese American participants because of enrollment of a very small number of participants. However, as highlighted by the AHA, there is significant heterogeneity in CVD and risk factors among individual Asian American subpopulations that deserves further investigation and should prevent extrapolation of the findings in other US Asian subgroups to Vietnamese Americans.² Despite these limitations, published studies reveal important trends in the cardiovascular health of the Vietnamese American population.

In a study conducted by Hastings et al⁴⁰ that examined national mortality records from 2003 to 2011, diseases of the heart and cerebrovascular diseases were responsible for 17.7% and 7.8%, respectively, of deaths in Vietnamese American males and for 19.1% and 10.7%, respectively, of deaths in Vietnamese American females. Although the Vietnamese American population has lower proportionate mortality from ischemic heart disease than the non-Hispanic White (NHW) adult population, the Vietnamese American group had higher mortality rates from all cerebrovascular disease.⁴¹ All Asian American subgroups had consistently lower CVD mortality rates compared with NHW adults.⁴² Another study from 2003 to 2012 that examined years of potential life lost because of CVD highlighted variations in mean age of death because of CVD across Asian American subgroups.⁴³ A significant incidence of premature death from CVD was found among Vietnamese American individuals; the lowest mean age of death (72.5 years) was for death because of cerebrovascular disease, and the second-lowest mean age of death (74.1 years) was for death because of ischemic heart disease.⁴³ Data recently published by Shah et al⁴⁴ confirmed that the age-standardized mortality rates for cerebrovascular accidents were higher in Vietnamese

American men (46 of 100,000) and women (47 of 100,000) than in any other US group that was evaluated (Figure 4).

Among all Asian American groups that were evaluated in the National Latino and Asian American Study (n = 2,073), Vietnamese men had the highest prevalence of current smoking (29.5%) and the second-highest lifetime smoking prevalence (51%); they were exceeded in lifetime smoking prevalence only by Filipinos (52%).⁴⁵ As in Vietnam, many more Vietnamese men are current smokers compared with women.^{45,46} A 1996 study among middle- and high- school-aged adolescents in Worcester, Massachusetts showed that the prevalence of cigarette smoking among Vietnamese boys was similar to that among White boys and higher than that among Hispanic and African American boys.⁴⁷ The increased prevalence of tobacco smoking in this population is believed to be multifactorial; factors may include (but are not limited to) the impression of the act of smoking as a symbol of strength and power, peer pressure (particularly among the youth), lack of awareness of negative health effects, and the US tobacco industry's active targeting of this minority group.⁴⁸

Few large-scale studies have evaluated the prevalence of hypertension in Vietnamese American individuals. Collectively, non-Hispanic Asian Americans (Asian Indian, Chinese, Filipino, Japanese, Korean, and Vietnamese/other) seem to have a lower prevalence of hypertension (20.8%) compared with NHWs (33.5%).⁴⁹ In analyses that used disaggregated data, Vietnamese Americans had both clinic-measured⁵⁰ and self-reported prevalence of hypertension that were slightly lower compared with NHW adults.⁵¹ In a 2013 to 2014 study in the Washington-Baltimore area that examined 600 foreign-born Asian Americans (of whom 201 were Vietnamese), the age-adjusted prevalence of hypertension was 22.9%, which was slightly lower than the 2014 California Health Interview Survey prevalence estimate of 25.8%.⁵² Finally, in Santa Clara—a Northern California county with one of the largest populations of Vietnamese Americans—a higher proportion of Vietnamese adults (29%) had been diagnosed with hypertension than any other Asian and non-Asian group that was evaluated.⁵³ Although these studies are relatively small, they provide insight into a larger underlying issue that needs further attention: although they are a relatively young population, nearly 1/3 to 1/4 of Vietnamese Americans have hypertension.

A cross-sectional study from 2011 to 2016 in NHANES revealed that the prevalence of diabetes among Southeast Asian individuals was 22.4%.⁵⁴ Furthermore, the prevalence of undiagnosed diabetes among all non-Hispanic Asian adults was 7.5%.⁴⁹ However, analyses specifically among Vietnamese participants were not pursued. Nonetheless, the Santa Clara study in California demonstrated that a higher proportion of Vietnamese adults had been diagnosed with diabetes (10%) compared with NHW, other Asian Americans, and adults as a whole.⁵³ Other studies in California have also reported a significant prevalence of diabetes in the Vietnamese population.¹⁶

Diabetes is typically associated with obesity; however, similar to the data from Vietnam, a study by De Souza et al⁵⁵ revealed that only 9% of Vietnamese Americans with diabetes are obese. The 2013 to 2014 California Health Interview Survey showed that the prevalence of obesity in Asian individuals was 23.3%; however, when compared with NHW

adults, individuals of Vietnamese descent were associated with lower odds of obesity.⁵⁶ Nevertheless, nonobese Vietnamese Americans have a 60% higher risk of developing diabetes compared with nonobese NHW adults.⁵⁵ However, although BMI is used widely as a surrogate marker for obesity, waist circumference may be more important than BMI in predicting diabetes and heart disease in Asian Americans (including Vietnamese Americans).^{37,57} In NHANES (2011 to 2018), Liu et al⁵⁸ observed that the age-adjusted waist circumference increased among Asian Americans from 87.4 cm in 2011 to 90.6 cm in 2018. Unfortunately, the study did not examine trends in waist circumference in Vietnamese American participants or in any other Asian American subgroups.

Similarly, hyperlipidemia has been poorly studied in the Vietnamese American population. Southeast Asians had the highest prevalence of hyperlipidemia (36%) in the National Health Interview Survey 2010 to 2018; however, the study did not examine Vietnamese participants separately.⁵⁹ In contrast, in another study by Nguyen et al⁵¹ in 2009 that involved participants from the Santa Clara, California area, Vietnamese Americans had similar self-reported prevalence of hypercholesterolemia compared with NHW adults.

On average, US Asian individuals tend to report less physical activity than NHW individuals.⁶⁰ Consistent with this, Vietnamese Americans in Santa Clara, California were less likely to partake in moderate or vigorous physical activity than were NHWs.⁵¹ Focus group participants from the Vietnamese community in Houston, Texas reported that many Vietnamese Americans are capable of achieving 30 min of exercise on most days of the week; however, they choose not to do so (for various reasons).⁴⁸ These participants and key leaders stated that within the Vietnamese community, exercise is often viewed as a means to improve one's image and restore good health rather than to prevent bad health. Because of this mindset (coupled with low awareness of the effects of exercise and with time-consuming daily tasks), these participants did not tend to prioritize physical activity in their daily routines.⁴⁸ Nevertheless, data from the Health of Houston Survey 2010 showed that among Asian groups in the area, Vietnamese adults had more physical activity minutes and days than did Chinese participants.⁶⁰

Awareness of the importance of women-specific cardiovascular risk factors, and particularly of the impact of pregnancy-related risk factors on the health of both mother and child, is increasing. In this context, a recent study by Shah et al⁶¹ showed that Vietnamese American women have the second-highest rate of gestational diabetes in the US, exceeded only by Asian Indian women. The rate of hypertensive disorders of pregnancy in Vietnamese American women is similar to or lower than that observed in other Asian groups in the US.⁶²

Components of social determinants of health (SDOH) may pose as upstream factors that can potentially contribute to CVD risk in Vietnamese Americans. The AHA identifies socioeconomic position, race/ethnicity, culture/language, access to care, social support, and residential environment as important social determinants of CVD.⁶³ A wealth of studies have highlighted the upstream effects of SDOH on CVD across multiple populations; adverse SDOH is linked with higher burden of risk factors and CVD and with poorer outcomes.⁶⁴ Importantly, many Vietnamese immigrants come to the US with very limited

resources. This fact, coupled with limited knowledge of the English language and American culture, often puts this population in a bracket of poor SDOH.

One major SDOH that may contribute to adverse cardiovascular health in Vietnamese Americans is a lower average educational attainment, which influences health literacy, professional growth, access to wealth, and access to care. Sorkin et al¹⁶ reported that 48% of older Vietnamese American adults (> 55 years of age) had less than a high school education, compared with only 11% of NHW individuals of the same age. Additionally, across all Asian American subgroups, Vietnamese adults were the least likely to obtain a bachelor's degree or higher.⁶⁵ Two national surveys that examined 1 Cambodian and 3 Vietnamese communities from 2001 to 2002 revealed that both Cambodian and Vietnamese groups had lower average levels of educational attainment than the aggregate Asian American population and the general US population.⁶⁶

Limited fluency in English also represents an important barrier for Vietnamese Americans. Approximately 50% to 60% report that they “do not speak English very well,” which is the highest percentage among all Asian Americans.^{2,67} In this context, Tang et al⁶⁸ observed that Asian men who had high English proficiency were less likely to be smokers than those with lower proficiency. Also, Vietnamese Americans who spoke less English ate fruits and vegetables less frequently and engaged less frequently in moderate or vigorous physical activity compared with NHW adults.⁵¹ Nguyen et al⁵¹ revealed that only 59% of Vietnamese Americans knew that chest pain was a symptom of a heart attack, and further highlighted that there were significant disparities in risk factors and knowledge of CVD symptoms in this population. Furthermore, Vietnamese American individuals are in the lower range for most socioeconomic indicators²; most have low income and are in fair or poor health compared with other Asian American subgroups.⁶⁵

Vietnamese American adults also have the least access to a personal doctor, and Asian individuals in general receive fewer written heart disease care plans compared with NHW individuals.⁶⁹ Older Vietnamese American adults (> 55 years of age) are also less likely to have a health insurance plan.¹⁶ Similarly, Adia et al⁷⁰ showed that Vietnamese individuals in California reported higher rates of lacking a source of care compared with NHW individuals and with Asian American individuals overall. The lack of knowledge, resources, and access to care puts this population at increased risk for development of CVD. Accordingly, in 2010 the AHA considered Vietnamese Americans to be an “underserved population” that may benefit significantly from SDOH-based interventions.²

Cultural ideals and traditional health beliefs may influence the risk of developing CVD and its risk factors among Vietnamese Americans. According to Ton et al,⁷¹ focus groups of Vietnamese immigrant participants revealed that they had poor insight into how lack of exercise, poor diet, older age, and high cholesterol could contribute to heart disease. Also, these participants' current knowledge on this topic was influenced primarily by non-Western paradigms—that is, by their cultural views on prevention and medicine.⁷¹ In a survey by the National Heart, Lung, and Blood Institute that involved 41 Vietnamese individuals from the Houston community, participants reported that individuals who attended regular medical

checkups were perceived as having too many problems, and other focus group participants believed that it was unnecessary to see a doctor unless one was ill.⁴⁸

Despite the cultural differences between Vietnamese American individuals and the general American population, Vietnamese individuals in the US are assimilating into modern American society. In the late 1990s, Jenkins et al⁷² observed that although many Vietnamese individuals in the San Francisco Bay area possessed traditional beliefs and practices that differ from those of the general US population, such beliefs did not act as barriers for access to medical care. Nevertheless, in some Vietnamese American communities, cultural differences may be contributing to poor insight or lack of acceptance of Western medicine and therefore influencing access and adherence to interventions that are beneficial for cardiovascular health.

Table 3 summarizes important knowledge gaps that are relevant to the cardiovascular health of Vietnamese American populations and that were emphasized by the AHA in 2010 and, most recently, by the NIH. Unfortunately, identification of the priority areas described by Palaniappan et al² has had limited impact on cardiovascular research in the Vietnamese American group. We describe additional knowledge gaps in this space; these may be used to inform additional research efforts.

We also propose several constructive approaches to help mitigate the burden of CVD, premature CVD, and premature cardiovascular mortality in Vietnamese Americans (Table 4). Despite important knowledge gaps, these proposed approaches are informed by the most consistent signals observed to date in the existing international and US data. The approaches focus on tobacco cessation, hypertension screening, prevention and detection of gestational diabetes, upstream SDOH interventions, and enhancing access to health knowledge and affordable medical care.

Conclusions

Vietnamese American men and women represent a sizable and growing proportion of the US population and have one of the highest cerebrovascular mortality rates in the country. Adverse SDOH, high rates of tobacco use among men, high rates of gestational diabetes among women, and hypertension seem to be important determinants of cardiovascular risk in this group. However, many of these findings have been informed by relatively small studies, and there is a need to better understand the contemporary cardiovascular health of Vietnamese Americans through enrollment of larger numbers of Vietnamese Americans. Dedicated research that includes adequate representation (and even oversampling) in national health surveys, analyses of disaggregated data with a focus on Vietnamese Americans, and inclusion of Vietnamese Americans in cardiovascular prospective cohort studies and clinical trials will help to improve our ability to understand, predict, and prevent the onset of CVD in this understudied group. These efforts will be critical to inform targeted, culturally adapted preventive interventions that may ultimately help reduce the burden of CVD and cardiovascular mortality in this group.

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Vietnam Map and Demographics

98.3M Population (2020)	~1:1 Male:Female Ratio	32.5 years Median Age	8% Age 65+
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Figure 1.
Vietnam: map and demographic data.

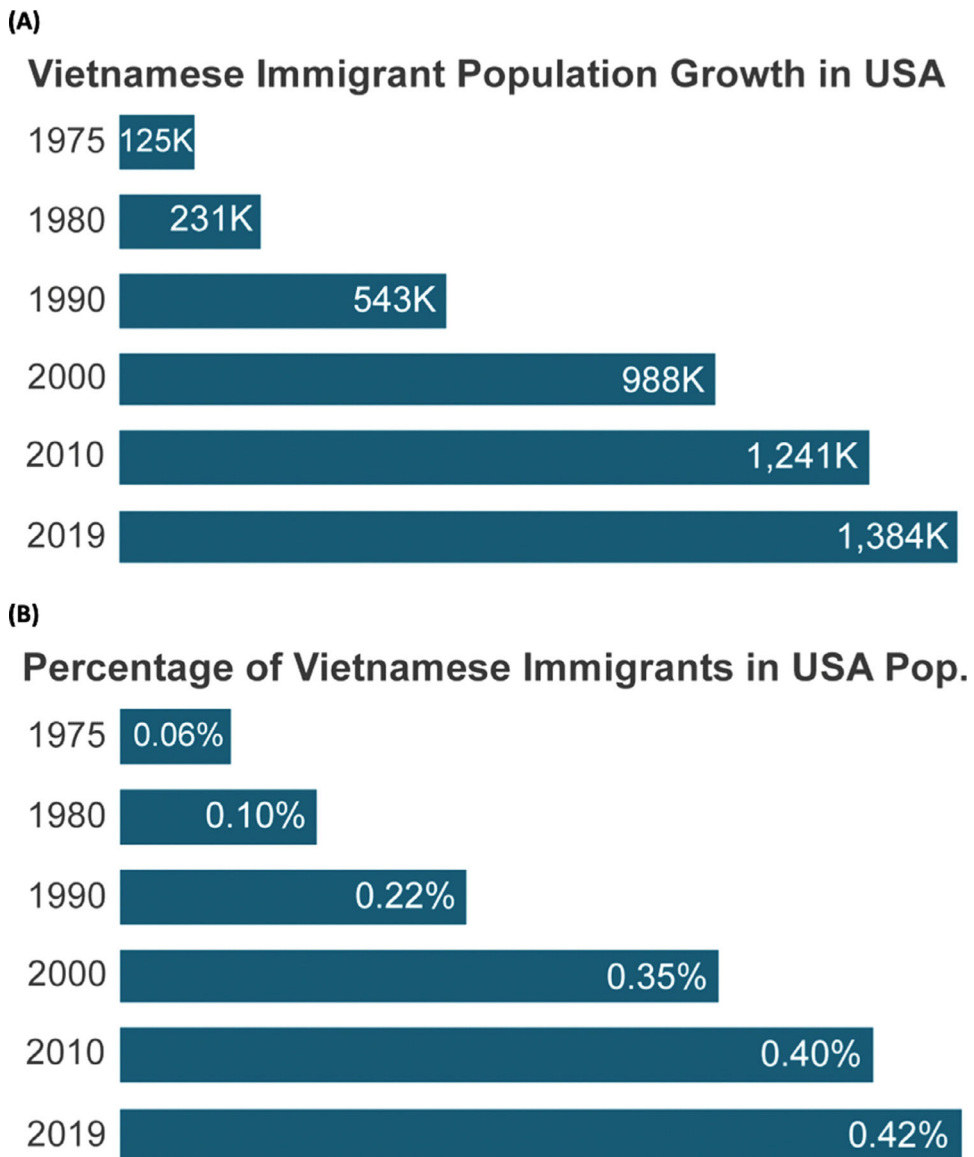


Figure 2. Size and growth of the Vietnamese immigrant population in the US. (A) The number of first-generation immigrants who were born in Vietnam and are living in the US. (B) The number of first-generation immigrants who were born in Vietnam and are living in the US in proportion to the total US population. Data source(s): <https://www.migrationpolicy.org/article/vietnamese-immigrants-united-states> and <https://data.worldbank.org/indicator/SP.POP.TOTL?end=2021&locations=US&start=2000>. K = thousand.

Vietnamese Immigrant Residence in USA (2010)

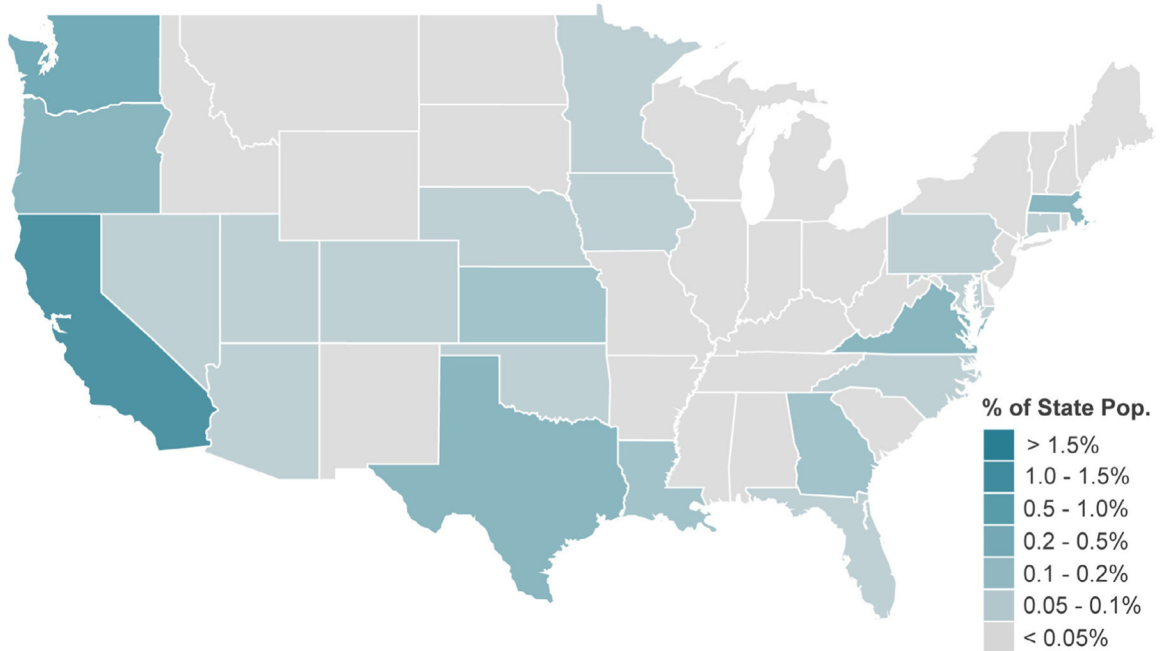


Figure 3.

Top states of residence for Vietnamese American immigrants. The proportion refers to the percentage of Vietnamese American immigrants in a given state population.

Data source(s): <http://www.usa.com/rank/us-vietnamese-population-percentage-state-rank.htm?hl=&hlst=&wist=&yr=8000&dis=&sb=DESC&plow=&phigh=&ps=>, based on 2010 US Census data; https://vacoc.org/wp-content/uploads/2018/05/The-Vietnamese-Population-2010_July-2.2011.pdf.

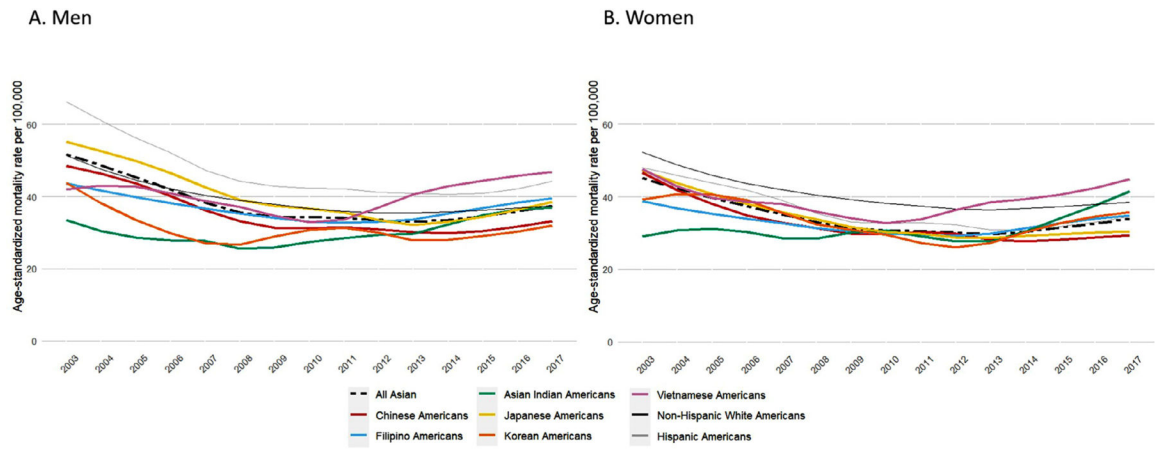


Figure 4. Age-standardized rates of mortality from cerebrovascular disease in Asian American men and women, 2003 to 2017. Source: National Center for Health Statistics. Reproduced, with permission, from: Shah et al. Cardiovascular and cerebrovascular disease mortality in Asian American subgroups. *Circ Cardiovasc Qual Outcomes* 2022;15:e0086.

Countries of origin among immigrants living in the US, and most immigrants by country of origin since year 2010

Table 1

Countries of origin among 1 st generation immigrants in the US (2010 Census)		Countries of origin with most immigrants to the US between 2011 and 2020			
Rank	Country	Million	Rank	Country	Million
1	Mexico	11.7	1	Mexico	1.4
2	China	2.2	2	China	0.7
3	India	1.8	3	India	0.6
4	Philippines	1.8	4	Dominican Republic	0.5
5	El Salvador	1.2	5	Cuba	0.5
6	Vietnam	1.2	6	Vietnam	0.3
7	Cuba	1.1	7	El Salvador	0.2
8	Korea	1.1	8	Korea	0.2
9	Dominican Republic	0.9	9	Jamaica	0.2
10	Guatemala	0.8	10	Haiti	0.2

Sources: 2010 US Census (left panel) and US Department of Homeland Security (right panel).

Table 2
 Leading causes of death in Vietnamese, Vietnamese Americans, and the general US population

Rank	Vietnamese	Vietnamese Americans	General US Population
1	Cerebrovascular disease	Malignant neoplasms	Diseases of the heart
2	Ischemic heart disease	Diseases of the Heart	Malignant neoplasms
3	Lung cancer	Cerebrovascular disease	Accidents
4	Chronic obstructive pulmonary disease	Accidents	Chronic lower respiratory disease
5	Alzheimer's dementia	Chronic lower respiratory disease	Cerebrovascular disease
6	Diabetes	Diabetes	Alzheimer's dementia
7	Cirrhosis	Influenza and Pneumonia	Diabetes
8	Road injuries	Alzheimer's dementia	Influenza and pneumonia
9	Lower respiratory infections	Nephritis, nephrotic syndrome, nephrosis	Nephritis, nephrotic syndrome, nephrosis
10	Tuberculosis	Suicide (men)/septicemia (women)	Suicide

Sources: GBD Compare 2018, Vietnam (left panel), Leading Cause of Death Among Asian American Subgroups (2003 – 2011), K. Hastings, et al (central panel), and NVSS – Leading Causes of Death 2017, Melanie Heron, PhD (right panel).

Table 3

Current key knowledge gaps in the cardiovascular health of Vietnamese Americans.

Knowledge gaps
<p>Current research needs in Vietnamese Americans highlighted by the AHA[*]</p> <ul style="list-style-type: none"> More sampling of Asian Americans specifically across the 6 largest subgroups (Chinese, Korean, Japanese, Filipino, Vietnamese, Asian Indian) Socioeconomic status of Asian American subgroups, including Vietnamese Americans More Vietnamese Americans represented on data registries (stroke, myocardial infarction) Development of adapted CVD risk prediction models Identifying cultural and lifestyle practices that may impact CVD risk factors <p>Current research needs in Vietnamese Americans highlighted by the NIH[†]</p> <ul style="list-style-type: none"> Understanding variations in prevalence for heart disease and stroke compared to other Asian American subgroups Prevalence of cardiovascular risk factors across different Asian American subgroups including Vietnamese Americans Reliable and standardized subclinical disease measures (e.g., coronary imaging using computed tomography) More data on incidence, risk factors, awareness, management, socioeconomic status for CVD <p>Other research gaps and needs</p> <ul style="list-style-type: none"> Dedicated cohort studies of Vietnamese Americans for an improved understanding of upstream determinants, subclinical disease, and natural history of disease in this group Improve representation of Vietnamese Americans in relevant clinical trials Enhance community engagement in research involving Vietnamese American communities Validation of the Pooled Cohort Equations in Vietnamese Americans Epidemiology and prognosis of carotid plaque and validation of carotid ultrasound imaging in Vietnamese Americans Epidemiology and prognosis of coronary calcification and validation of the coronary artery calcium score in Vietnamese Americans Implementation research for CVD prevention and management among Vietnamese Americans Assess cultural practices and beliefs which may influence lifestyle habits (e.g., smoking) Characterize cultural practices and beliefs regarding reasons for not seeking health care on a regular basis and preventive cardiology assessments specifically Analysis of effects of acculturation to the US and of differences in risk factors and CVD between first and subsequent generations of Vietnamese Americans, with special attention to changes in physical activity

^{*} Source: Palaniappan LP et al. Call to action: cardiovascular disease in Asian Americans: a science advisory from the American Heart Association. *Circulation* 2010;122:1242–1252.

[†] Source: Kanaya AM et al. Knowledge gaps, challenges, and opportunities in health and prevention research for Asian Americans, Native Hawaiians, and Pacific Islanders: a report from the 2021 National Institutes of Health Workshop. *Ann Intern Med.* 2022;175:574–589.

AHA = American Heart Association; CVD = cardiovascular disease; NIH = National Institutes of Health.

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Table 4

Proposed multilevel recommendations to improve CVD prevention in Vietnamese American men and women

Proposed recommendations

Inform and educate
 Importance of CVD and its risk factors in the health and life expectancy of Vietnamese Americans
 Emphasize health risks of tobacco products, particularly among men
 Emphasize importance of high blood pressure screening; education on home monitoring
 Impact of gestational diabetes on the health of both mother and child
 Educate on early detection of stroke signs
 Emphasize importance of establishing consistent medical care and follow up
 Enhance provision of public health and health information in Vietnamese using culturally competent and language-accessible approaches

Engage
 Vietnamese American communities
 Community leaders, relevant media, cultural and scientific organizations, and family members of patients
 Healthcare providers serving large Vietnamese American communities
 Local and State Governments

Interventions
 Policies aimed at improving life conditions of Vietnamese communities, including enhanced access to education, English proficiency, and to affordable medical care
 Incentivize tobacco cessation through additional taxation, anti-tobacco laws, package messaging translated to Vietnamese
 Community based hypertension screening programs
 Community based education and screening programs for prevention and early detection of gestational diabetes among Vietnamese American women
 Health- and cardiovascular prevention-oriented partnerships with Vietnamese American cultural and scientific organizations
 Congressional/NIH and AHA dedicated funds to support research in this group
 Tackle research gaps (Table 3), e.g., oversampling of Vietnamese individuals and other Asian subgroups in national surveys to ensure sufficient numbers in disaggregated analyses

These proposed recommendations are informed by the current understanding of the key upstream determinants and risk factors of CVD among Vietnamese Americans.

AHA = American Heart Association; CVD = cardiovascular disease; NIH = National Institutes of Health.

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