

Call to Action: Cardiovascular Disease in Asian Americans A Science Advisory From the American Heart Association

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In 2009, President Obama signed an Executive Order calling for strategies to improve the health of Asian Americans and to seek data on the health disparities in Asian American subgroups.¹ Data on Asian American subgroups are scarce and many health disparities remain unknown. The purpose of this Advisory is to highlight the gaps in existing research on cardiovascular disease (CVD) among Asian Americans, and to serve as a call to action on behalf of the American Heart Association to address these areas of need.

Asian Americans are the fastest growing racial/ethnic group in the United States, representing 25% of all foreign-born people in the United States.² They are projected to reach nearly 34 million by 2050.³ Several major Federal surveys (eg, the American Community Survey, the National Health Interview Survey, and the Behavioral Risk Factor Surveillance Survey) only recently started to classify Asian Americans into 7 subgroups: Asian Indian, Chinese, Filipino, Korean, Japanese, Vietnamese, and Other Asian. The first six of these subgroups together constitute >90% of Asian Americans in the United States.⁴ Although some data are available on Asian subgroups from these major federal surveys, in general, these data are not available for public use because of the privacy concerns resulting from the small sample sizes

within subgroups. This situation limits their utility for health-related research.

Demographic Characteristics and Immigration History

Because health surveys and questionnaires almost universally combine persons of Asian ancestry into a single group, the heterogeneity within this classification is masked. Socioeconomic and cultural factors have been found to be associated with CVD and its risk factors, which is why it is important to understand these differences among Asian subgroups. The Table shows the number of persons in each group based on the most recent US Census data available (American Community Survey, 2008), with the recognition that the census is likely to underestimate the number of undocumented immigrants and those who cannot complete a form written in English. The 3 largest Asian subgroups are Asian Indian, Chinese, and Filipino. The groups with the largest proportion of foreign-born members are Asian Indian and Korean, whereas the Japanese have the smallest proportion of foreign-born. Approximately half of all Vietnamese, Chinese, and Korean “speak English less than very well.”⁵ Korean (36%) and Vietnamese (18%) are most likely to be uninsured, and

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This statement was approved by the American Heart Association Science Advisory and Coordinating Committee on June 8, 2010. A copy of the statement is available at <http://www.americanheart.org/presenter.jhtml?identifier=3003999> by selecting either the “topic list” link or the “chronological list” link (No. KB-0078). To purchase additional reprints, call 843-216-2533 or e-mail kelle.ramsay@wolterskluwer.com.

The American Heart Association requests that this document be cited as follows: Palaniappan LP, Araneta MRG, Assimes TL, Barrett-Connor EL, Carnethon MR, Criqui MH, Fung GL, Narayan K MV, Patel H, Taylor-Piliae RE, Wilson PWF, Wong ND; on behalf of the American Heart Association Council on Epidemiology and Prevention, Council on Peripheral Vascular Disease, Council on Nutrition, Physical Activity, and Metabolism, Council on Clinical Cardiology, and Council on Cardiovascular Nursing. Call to action: cardiovascular disease in Asian Americans: a science advisory from the American Heart Association. *Circulation*. 2010;122:1242–1252.

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(*Circulation*. 2010;122:1242–1252.)

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Circulation is available at <http://circ.ahajournals.org>

DOI: 10.1161/CIR.0b013e3181f22af4

Table. Demographic Characteristics of Single Race Asian Subgroups in the United States⁵

Subgroup	Total Population (Margin of Error)	Foreign-Born Population, n (%)	Bachelor's Degree or Higher,* n (%)	Median Household Income (Margin of Error)
Asian Indian	2 495 998 (±40 554)	1 828 381 (73.3)	1 174 852 (70.1)	\$90 528 (±1539)
Chinese	3 077 783 (±42 257)	2 133 367 (69.3)	1 119 349 (52.1)	\$68 202 (±1607)
Filipino	2 425 697 (±36 981)	1 608 949 (66.3)	837 167 (48.0)	\$79 840 (±1157)
Japanese	710 063 (±18 966)	303 029 (42.6)	265 778 (46.3)	\$61 743 (±1448)
Korean	1 344 267 (±26 878)	977 262 (72.7)	466 816 (49.8)	\$53 887 (±2431)
Vietnamese	1 431 980 (±32 667)	984 626 (68.8)	266 734 (27.8)	\$55 667 (±1302)

*Based on the population >25 years of age.

Filipino (14%) and Japanese (9%) are least likely to be uninsured.⁶ There is a wide spectrum of education and household income: Asian Indians are in the higher range and Koreans and Vietnamese are in the lower range of these standard socioeconomic indicators. Reporting data on Asian Americans collectively in national datasets often masks this heterogeneity across Asian American subgroups.

The pattern of migration to the United States has been different for each Asian subgroup. It is not surprising that this often influences geographic concentration and other characteristics of each subgroup. Therefore, we review, in brief, the migration history of each subgroup here.

Asian Indian

Few Asian Indians migrated to the United States before the passage of the 1965 Immigration Act.^{6a} The more recent immigrants characteristically came from the educated middle class, spoke English, and settled mostly in California, New York, and New Jersey. Of the 34 recognized languages in India, Hindi, Gujarati, and Urdu are spoken the most in the United States. South Asians are defined as those who trace their origins to Bangladesh, India, Pakistan, Sri Lanka, and Nepal.⁷ More than 85% of South Asians in the United States are Asian Indian.⁸ Some surveys in the United States use the term Asian Indian (National Health Interview Survey, US Census), whereas others use South Asian (California Health Interview Survey). Most studies in the United States focus on Asian Indians, so this term will be used throughout the rest of this Advisory.

Chinese

Many of the first early Chinese immigrants, who moved to the West Coast of the United States between 1820 and 1880, were poorly educated, Cantonese-speaking men from the southern province of Guangdong. As a result of the Chinese Exclusion Act of 1882,^{8a} there was little further immigration until the 1970s. After 1970, most Chinese entering the United States came from Hong Kong and Taiwan. Since the 1980s more Mandarin speakers have emigrated from mainland China. Of the Chinese (both Cantonese- and Mandarin-speaking) living in the United States, most are Han Chinese, originating from mainland China, Hong Kong, or Taiwan. The largest Chinese populations in the United States are found in California, New York, and Texas.

Filipinos

The first of 4 waves of Filipinos migrated to the United States beginning in the 1760s, settling in the Louisiana bayous when the Philippines and Louisiana were both Spanish colonies. The United States assumed control of the Philippines between 1898 and 1946, and during this time many Filipinos came to Hawaii and California as agricultural workers. When Japan occupied the Philippines (then a US colony) during World War II, Filipinos were actively recruited to the US military and offered citizenship and migration privileges. Between 1945 and 1965, this third wave of migrants settled near US Navy bases, including San Diego. Thereafter, a dramatic increase in the US Filipino population occurred, and many settled in California, Hawaii, Illinois, New York, and New Jersey. As a result of the colonial history of the Philippines, many Filipinos are multilingual and are fluent in English and Spanish, as well as Tagalog and/or one of the other 87 Philippine languages.

Japanese

Japanese first migrated to Hawaii and San Francisco in the late 1800s as a labor force. However, immigration was subsequently severely curtailed owing to key pieces of US legislation (ie, Gentlemen's Agreement and Immigration Act of 1924^{8b}). During World War II, the US government relocated >100 000 Japanese to wartime communities on the Pacific Coast. The Japanese population in the United States doubled between 1950 and 1960, mostly because of the growth of the US-born third generation. Immigration increased after 1965, but the number of Japanese entering the United States has remained much lower than that of other Asian subgroups. Currently, the largest numbers of Japanese Americans live in Hawaii and California.

Korean

Korean immigrants first came to Hawaii and San Francisco in the early 1900s to fill the labor positions vacated by the Japanese and Chinese. Like the Chinese and Japanese, Korean immigration was restricted by US legislation. It was not until 1965 that a significant influx began, and Koreans became one of the fastest growing subgroups of Asian Americans. Korean immigrants tended to cluster in ethnic enclaves located in large cities. The largest numbers of Korean Americans are located in California, New York, and New Jersey.

Vietnamese

Before 1975, most Vietnamese immigrants in the United States were spouses or children of US servicemen in Vietnam. After the Vietnam War ended in 1975, >125 000 Vietnamese came to the United States, residing in government bases and refugee centers. The Refugee Act of 1980^{8c} provided prescribed pathways to US citizenship, and laws were passed that allowed children of American servicemen and former political prisoners to enter the United States. In total, >500 000 refugees and asylum seekers from Vietnam were accepted between 1981 and 2000, with the largest numbers residing in California and Texas.

Cardiovascular Disease Incidence and Prevalence

Few studies examine Asian American subgroups separately, despite the suggestion that substantial variability exists in cardiovascular risk and incidence of coronary artery disease (CAD), stroke, and peripheral arterial and venous disease across subgroups.

Coronary Artery Disease

The limited data on CAD in Asian Americans strongly suggest that some subgroups are at increased risk. Recent epidemiological studies in California have demonstrated significant mortality in the younger Asian Indian population compared with other racial/ethnic groups.⁹ However, self-reported data on prevalence of CAD from a small sample of Asian Indians in the National Health Interview Study are conflicting.¹⁰ Higher rates of hospitalization for ischemic heart disease have been shown in Asian Indians (relative risk [RR]=3.7), and lower rates in Chinese (RR=0.6).¹¹ Some of the racial/ethnic differences in CAD prevalence may be related to differences in presentation and detection of vascular disease in patients with CAD. Left ventricular mass and volume may differ in aggregated Asian Americans compared with other groups.¹²

Treatment patterns and outcomes for CAD in Asian Americans have been studied only in aggregate Asian American groups, because information regarding Asian subgroups was not collected in these studies. Asian Americans may have significantly higher bleeding risk even after adjusting for risk factors such as aspirin use.¹³ Similarly, Asian Americans and Pacific Islanders may have longer “door-to-drug” times for acute interventions after correction for confounding risk factors.¹⁴ Male Asian Americans are less likely to undergo percutaneous coronary intervention and more likely to undergo coronary artery bypass grafting than whites.¹⁵ In addition, the expected rate of coronary artery bypass grafting mortality appears to be higher in Asian Americans compared with whites.¹⁶

Stroke

Some Asian Americans have a greater incidence of hemorrhagic stroke than whites, including both subarachnoid and intracerebral hemorrhage subtypes.¹⁷ Klatsky and colleagues¹⁷ report that Japanese Americans are more likely to have a subarachnoid hemorrhage (RR=3.7),

compared with whites, whereas Filipino Americans were more likely to have an intracerebral hemorrhage (RR=2.8). Chinese Americans were found to have more hemorrhagic strokes, as well as a higher prevalence of poorly controlled hypertension and left ventricular hypertrophy, compared with whites.¹⁸ Further, aggregated Asian Americans have more severe stroke complications, such as dysphasia, hemiplegia, and aphasia, compared with whites.¹⁹ Stroke prevalence has been reported to decrease with duration of residence in the United States among Japanese men²⁰ and among Chinese immigrants.¹⁸

Peripheral Arterial and Venous Disease

In the Multiethnic Study of Atherosclerosis (MESA), Chinese Americans were found to have a low (2%) prevalence of peripheral arterial disease (ankle brachial index of ≤ 0.9) compared with non-Hispanic whites.²¹ Other studies that have aggregated Asian/Pacific Islanders have shown less visible and functional chronic peripheral venous disease,²² and lower incidence of first-time idiopathic or secondary venous thromboembolism compared with non-Hispanic whites.²³ It is unknown whether this aggregation (because of limitations in data collection methods) may mask higher risks in some subgroups.

In summary, few studies of CVD have examined Asian American subgroups separately. The studies that have examined specific subgroups have shown higher rates of CAD in Asian Indians, higher rates of hemorrhagic stroke among Japanese and Chinese Americans, more intracerebral hemorrhage in Filipino Americans, and lower rates of CAD and peripheral arterial disease among Chinese Americans.

Traditional Risk Factors

Most studies that have examined classical CVD risk factors (blood pressure, cholesterol, smoking, and diabetes) in Asians abroad and in the United States have found associations similar to those reported in whites.²⁴ However, the prevalence of these risk factors and their relative importance varies greatly across the Asian subgroups, which affects risk prediction models commonly used in the United States. For example, the Framingham risk score, derived from a white cohort, has been shown to systematically overestimate CAD events among Japanese American men. This overestimation is mitigated when the lower prevalence of specific risk factors and CAD incidence in Japanese men is taken into account.^{25,26} Similar results have been found in studies of Asian populations in China, Singapore, and Japan.²⁷

Few studies have reported rates of traditional CVD risk factors across Asian subgroups in the United States. Hypertension rates are higher in Filipinos than in other Asian American subgroups as evidenced in studies using data from clinical populations in northern California,^{28,29} as well as self-reported data from the National Health Interview Survey.³⁰ High cholesterol rates, when examining self-reported rates, in aggregated Asian Americans are similar to the general US population,³¹ although some studies have noted higher total cholesterol in Japanese compared with Chinese.²⁸ This may be explained in part by the higher high-density

lipoprotein cholesterol concentration in Japanese.²⁹ Smoking prevalence is high in Korean,³² Vietnamese,³² and Filipino³⁰ male populations. Vietnamese adults (68%) have the highest percentage of lifetime abstinence from alcohol use; rates for adults in other Asian subgroups range from 32% for Japanese to 57% for Asian Indian.⁶

Prevalence of traditional CVD risk factors varies widely among Asian American subgroups. Previous validation studies of the Framingham risk score have been undertaken in Japanese and Chinese populations, which show a lower prevalence of traditional risk factors in Japanese and Chinese populations. Although some modifications to the Framingham risk score have been recommended in other countries,^{33,34} risk prediction models should be developed and validated for Asian American subgroups in which CVD outcome, incidence, and risk factor prevalence is higher (ie, Asian Indian, Filipinos, and Koreans).

Insulin Resistance/Type 2 Diabetes Mellitus

Type 2 diabetes mellitus (diabetes) is a risk factor that is especially prevalent among Asian Indians^{35,36} and Filipinos.^{37,38} Prevalence of insulin resistance is also believed to be higher in some Asian groups. Studies have shown higher insulin resistance in Asian Indians³⁹ and higher prevalence of metabolic syndrome among Filipino⁴⁰ and Japanese populations.⁴¹ Several hypotheses exist for this observation, including increased visceral fat distribution among Filipino³⁸ and Asian Indians⁴² and atherogenic lipoproteins³⁹ in Asian Indians. Most of this research has been conducted in Filipino, Japanese, and Asian Indian populations.^{37,39,43}

Differential Body Fat Distribution

International studies comparing the association of body mass index (BMI) with cardiometabolic disorders commonly report similar or stronger positive associations, despite the lower mean BMI in Chinese and Indian populations.⁴⁴ Studies have demonstrated that Chinese⁴⁵ and Asian Indians³⁵ have lower BMI compared with whites with similar body fatness. These and other comparisons of Chinese, Japanese, and Asian Indians with Europeans underlie World Health Organization recommendations to lower the BMI thresholds defining overweight and obesity in Asians worldwide.⁴⁶

Lower BMI cut points for Asian Americans would be an improvement over a single cut point, but may still underestimate cardiometabolic risk. BMI fails to account for differences in body fat distribution in Asian populations compared with other racial/ethnic groups. A greater proportion of body fat in Chinese, Filipinos, and Asian Indians, versus whites and other racial/ethnic groups, is distributed centrally in potentially metabolically more active visceral depots.^{38,47} Other well accepted anthropometric measures including waist circumference, waist-to-hip, and trunk-to-total height distribution may provide a better measure of the overall distribution of fatness in Chinese and Asian Indians.⁴⁸ Race/ethnicity and sex-specific cut points are recommended for waist circumference.⁴⁹ However, to adequately characterize health risks, more detailed body composition studies using more sophisticated imaging tools are needed. It is not known

whether differential body fat stores are associated with an adverse cardiovascular risk factor burden in all Asian Americans.

Emerging Risk Factors

Inflammation/Thrombosis

Lipoprotein (a) [Lp(a)] is an independent risk factor for CVD,⁵⁰ and >90% of the variation is accounted for by the apo(a) gene.⁵¹ Lp(a) levels differ significantly by racial/ethnic group; for example, African Americans have higher Lp(a) levels than whites do, but nevertheless they have a lower risk of CVD.⁵² The distribution of Lp(a) levels in Asians in the United States is poorly characterized, because most studies have failed to distinguish Asian subgroups. Higher Lp(a) levels have been reported in Asian Indians compared with other Asian populations and whites.⁵² Some reports have found no association between Lp(a) and CVD in Chinese.⁵³ A proposed possible reason for these conflicting results is that Lp(a) interacts with age with respect to further cardiovascular events. Sex, age, and the presence of high low-density lipoprotein-cholesterol and triglyceride concentrations may modify the association between Lp(a) and CVD.⁵³ Therefore, study samples that differ with respect to those characteristics may report different results.⁵³

High-Sensitivity C-Reactive Protein

In the Women's Health Study, Asian women overall were found to have the lowest median high-sensitivity C-reactive protein levels compared with non-Hispanic white, black, and Hispanic women.⁵⁴ International studies of Asian subgroups demonstrated that Japanese men and women had much lower C-reactive protein levels,⁵⁵ and Asian Indians in the United Kingdom were found to have higher levels of C-reactive protein compared with their European counterparts.⁵⁶ No prospective studies of Asian American subgroups have examined the effects of aspirin and statin use on high-sensitivity C-reactive protein levels. The recent international Justification for the Use of Statins in Primary Prevention: An Intervention Trial Evaluating Rosuvastatin (JUPITER) trial for treatment of elevated high-sensitivity C-reactive protein expressly limited recruitment of Asians because of concerns regarding rosuvastatin safety in the context of dosages administered.⁵⁷ These studies highlight the need to study emerging risk factors in Asian subgroups, because the levels of association and treatment may differ.

Coronary Artery Calcification

Studies on the prevalence of coronary artery calcification (CAC) in Asian Americans yield inconsistent results. Differences in sampling, analysis, and reference group make it difficult to compare existing studies. In one study, Asian Americans (excluding Asian Indians) were less likely to have any CAC than whites, despite a higher prevalence of diabetes.⁵⁸ Asian Indians had higher median CAC scores compared with whites, Hispanics, African Americans, and Asians, despite having younger age and lower hypertension prevalence.⁵⁸ Chinese Americans had lower CAC scores than non-Hispanic whites, but higher scores than Hispanics and

blacks.⁵⁸ Filipino women in San Diego showed no higher prevalence of CAC than their white counterparts, despite higher rates of diabetes, hypertension, and dyslipidemia.⁵⁹ In a northern California study, East Asian (Japanese and Chinese) women were more likely to have any CAC, and East Asian men were less likely to have any CAC compared with white women and men, respectively, after adjustment for multiple CVD risk factors.⁶⁰ Prospective studies have confirmed the prognostic value of CAC in Chinese²⁴ and Asian Americans (excluding Asian Indians).⁵⁸

Using Genetics to Understand Prevalence of and Risk Factors for CVD

The genetics of CVD is complex, and most of the gene and gene-environment interactions that influence risk of disease among various racial/ethnic groups remain unknown.⁶¹ Genetic research to date has focused on white populations in the United States and Europe. The study of genetic determinants of CVD in Asian subgroups is important, because allele frequencies may vary, affecting the population-attributable risk. As a result, less common causative or protective mutations may be present only in some subgroups. Toward this end, the Human Genome and international HapMap projects completed over the past decade have been valuable. Through large-scale sequencing efforts, these projects catalogued most of the common variants (ie, those with a minor allele frequency of $\geq 5\%$) across the entire genome in 4 racial/ethnic groups, including East Asians (Chinese and Japanese), African Americans, and whites.

Genome-wide association studies have been fairly successful in identifying regions of the genome harboring common polymorphisms that predispose to complex traits including cardiovascular disease.⁶² This success comes after 2 decades of frustrating linkage and candidate gene association studies.⁶¹ For CAD and each of its risk factors, at least 10 and up to 30 susceptibility loci have been recently identified using this approach, almost exclusively in white populations.⁶³ However, much work remains because these loci generally explain only a fraction of the genetic variance of each trait.⁶⁴

Intriguing opportunities to disentangle gene-environment interactions exist in Asian populations, given the differences in relative CAD and stroke mortality rates noted above.^{17,35}

Replication studies of genome-wide associations to date suggest that polymorphisms associated with CVD in whites are also associated with CVD in other racial/ethnic groups, often with similar effect sizes. Two good examples include the 9p21.3 susceptibility locus for CAD and the TCF7L2 susceptibility locus for type 2 diabetes.^{65,66} These results support the concept that the same pathways contribute to the manifestation of disease in all racial/ethnic groups. Inherited variability in the rate of disease between racial/ethnic groups is predominantly a consequence of differences in the frequency of disease-causing alleles in these pathways between groups.

As more susceptibility loci are uncovered and tested across various racial/ethnic groups, it is expected that some loci will not have equivalent effects across all racial/ethnic groups.

While some of these differences may be a consequence of interactions with allelic variants at other loci, they also suggest gene-environment interaction, especially when significantly different effect sizes are observed in the same racial/ethnic group raised in 2 different geographic locations (eg, the Chinese in China versus the Chinese in the United States). This is strongly supported by the change in CVD rates (better or worse) after immigration to the United States, as best illustrated by the original Ni-Hon-San study of Japanese.⁶⁷ Thus, the study of the determinants of CVD and its risk factors in Asian Americans will serve as a powerful adjunct to the studies being performed in the same racial/ethnic groups outside of the United States and help in the challenging task of identifying novel environmental risk factors.

Metabolism of Cardiac Medications

Many of the racial/ethnic differences in therapeutic drug response were initially ascribed to individual patient variability and dietary or body mass differences. The first study to adjust for these differences demonstrated that Chinese patients responded to similar doses of propranolol with more bradycardia and hypotension than their white counterparts with similar diets and BMIs.⁶⁸ These differences are due to more rapid drug metabolism and resultant higher concentration of active metabolites.

International data show that there is heterogeneity across Asian subgroups with regard to response to cardiovascular drugs. Asian Indians require higher doses of warfarin than Chinese do for a similar therapeutic effect.⁶⁹ Chinese and Japanese have high sensitivity and Asian Indians demonstrate intermediate sensitivity to rosuvastatin compared with non-Hispanic whites.⁷⁰ Increased sensitivity has been described with nifedipine in Asian Indians and Koreans.^{71,72} Immigration and accompanying dietary changes also have been shown to affect drug metabolism.⁷² These differences support further research on drug metabolism in Asian American subgroups and careful monitoring of Asian American patients when prescribing these and possibly other medications.

Variability in drug metabolism due to genetic polymorphisms is a significantly underrecognized phenomenon in pharmacotherapy. Clinical trials provide an excellent opportunity to detect some of these differences before wide-scale use of these agents. Asian Americans, in particular, the elderly, are underrepresented in clinical trials.⁷³ Barriers to enrollment include lack of information provided to them, language barriers, low health literacy, and cultural beliefs.^{74,75}

Acculturation and Health Behaviors

Acculturation

Acculturation is defined as the process by which foreign-born persons adopt the values, customs, and behaviors of their new environment. Acculturation has generally been associated with the development of CVD and unfavorable changes in CVD risk factors among Chinese and Japanese Americans.^{67,76} The most comprehensive study of immigration, acculturation, and CVD risk in Asian Americans was con-

ducted in Japanese in the Ni-Hon-San study. The Ni-Hon-San study showed that CAD and stroke mortality rates in Hawaii were intermediate between the high rates of stroke in Japan and the high rates of CAD in California. Gradients in CVD risk factors, such as blood pressure and cholesterol, were similar to the gradients in disease rates.⁷⁷

Recent Chinese immigrants report a healthier diet and more physical activity than those who have resided in the United States >10 years.⁷⁶ Recent Japanese immigrants are often still highly traditional in their lifestyle, including dietary practices, and often have lower CVD incidence and risk factors than those born outside of Japan.⁷⁸ Chinese immigrant men were less likely to adhere to antihypertensive medication the longer their length of stay in the United States.⁷⁹ In some cases, higher acculturation to the US lifestyle has been positively associated with more regular physical activity among Korean Americans,⁸⁰ but with less physical activity among Japanese Americans.⁸¹ Sex differences with acculturation within subgroups also seem to exist. Among Korean Americans, men smoked less and women smoked more the longer they lived in the United States.⁸⁰ The same study showed that men had a higher BMI with greater acculturation, although women did not.⁸⁰

The measurement and definition of acculturation is not standardized, and may differ for each Asian subgroup.⁸² Most measures of acculturation among migrant populations (ie, Hispanic/Latino) in the United States have relied on English proficiency and the number of years since immigration. However, English proficiency may not be an accurate estimate of acculturation among immigrants from regions in which English is already widely spoken (eg, Philippines, India, and Hong Kong). Comparisons between existing studies are difficult to interpret, because different instruments are used in a single Asian subpopulation in any single study.⁸² Years since migration also fail to account for age at migration, which is an important contributor to acculturation. The assimilation experience and exposure to American culture may differ significantly between a 10-year-old migrant and her 45-year-old mother, despite identical years since migration. It would be valuable, therefore, to also collect data on length of residence in the United States and age at immigration. In addition, a more comprehensive understanding of the association between specific aspects of acculturation, for example, changes in values and/or belief systems, with cardiovascular health outcomes, rather than reliance on these proxy measures of acculturation is needed.

Diet

The typical East Asian (Chinese, Korean, and Japanese) diet that is lower in total and saturated fat, with less animal protein, and greater consumption of rice, vegetables, tea, garlic, and red yeast rice, appears to be cardioprotective compared with Western diets. Sodium intake is higher in some East Asian diets, in particular, Japanese and Chinese.⁸³ Asian Indian diets have been characterized in the literature as having a high intake of saturated fat (through clarified butter, hydrogenated oils, and coconut products) and refined carbohydrates. Adoption of Western culture may result in un-

healthy dietary and physical activity practices, which has been shown both in Asia⁸⁴ and in the United States.⁷⁶

Naturoceutical/Herbal and Individual Products

A variety of naturoceutical and individual food products have been associated with cardiovascular health benefits seen among East Asians (Chinese, Koreans, and Japanese). Widely used both in traditional and westernized Asian cultures, with a significant base of scientific literature, are soy protein/isoflavones, fish oils, green and black tea, and red yeast rice.

Soy protein or soy isoflavones are used extensively in the diets of Chinese, Koreans, and Japanese. Earlier studies pointed toward modest reductions in total and low-density lipoprotein-cholesterol. However, a later meta-analysis of 22 randomized trials shows that the decrease in low-density lipoprotein-cholesterol is small, with no effects on other lipid fractions or blood pressure.⁸⁵

Fatty fish, such as mackerel and salmon, which are high in omega-3 fatty acids, may also reduce triglyceride levels. A study in King County, Washington showed that seafood consumption was higher among aggregated Asian Americans compared with the general US population,⁸⁶ but fish consumption has decreased among subsequent generations of Asian Americans. Further, a significant inverse association between marine-derived *n*-3 fatty acids and carotid intima media thickness was found among residents of Japan, but not among genetically similar Japanese Americans in Honolulu.⁸⁷ Asian Indians in the United Kingdom had a lower intake of omega-3 fatty acids (*n*-3 polyunsaturated fat) and fiber, and a higher intake of carbohydrate, saturated fat, and trans-fatty acids compared with UK whites.⁸⁸ A study of Asian Indian physicians in the United States found that high carbohydrate intake and uneven diurnal distribution (no breakfast and large evening meals) were associated with atherogenic lipoproteins.⁸⁹

The Canadian Study of Health Assessment and Risk in Ethnic Groups (SHARE) study, where 70% of the 620 participants were either Aboriginal, Chinese, or Asian Indian, showed that higher intake of saturated and trans fats were independently associated with subclinical atherosclerosis among all racial/ethnic groups.⁹⁰ In addition, the association of saturated fat and subclinical atherosclerosis was moderated by alcohol. With the same intake of saturated fat, moderate or heavy drinkers had less subclinical atherosclerosis than people who never or rarely consume alcohol.⁹⁰ Despite frequent seafood consumption, CVD risk may be exacerbated among some Asian American populations because of marginally higher intake of saturated fat, coupled with low alcohol intake.

Both black and green teas have also been implicated in CVD prevention.⁹¹ Black tea has been shown to have positive effects on cholesterol, endothelial function, and blood pressure. The cardioprotective effects of flavonoids from green tea include not only antioxidant, antithrombotic, and anti-inflammatory effects, but also may improve coronary flow velocity reserve. Green tea consumption has been associated with better vascular function and less low-density lipoprotein oxidation.⁹¹ Recent large prospective trials in Japan have

shown a lower incidence of stroke and CVD in those with high (≥ 7 cups per day) intake of green tea.⁹¹

A recently published meta-analysis of 93 randomized controlled trials of red yeast rice extract showed positive effects on all components of cholesterol.⁹² The China Coronary Secondary Prevention Study, which randomly assigned 4870 heart attack survivors to a commercial red yeast rice product, showed significant reductions in fatal and nonfatal myocardial infarction and total mortality,⁹³ but red yeast rice extract consumption among Asian Americans has not been evaluated.

Physical Activity

With few exceptions,⁸⁰ physical inactivity and insufficient activity are reported more often in aggregated Asian Americans compared with US non-Hispanic whites, Hispanics, and African Americans.⁹⁴ The strongest correlates of self-reported activity were socioeconomic status, perceived barriers and benefits of activity, and access to spaces to engage in activity,⁹⁵ many of the same factors associated with activity behaviors in other racial/ethnic groups.

Higher prevalence of obesity, insulin resistance, and hypertension is observed in aggregated Asian Americans who report no or insufficient physical activity.⁹⁶ Longitudinal studies of Japanese American men have shown that lower levels of activity are associated with a higher incidence of diabetes, and cardiovascular and stroke morbidity and mortality.^{97–99} Intervention studies suggest that CVD risk factors can be favorably modified in Chinese Americans, despite generally lower initial BMI in the population.¹⁰⁰

Recommendations for Future Action and Research

Study of Asian Americans offers important opportunities and challenges for CVD research. Much of the existing work highlights the variability among Asian subgroups and reinforces the need to study individual Asian subgroups separately. Specific opportunities to improve the assessment of health disparities among Asian Americans include but are not limited to the following: changes in existing data collection, the development of standard measurement tools, and the development of new research studies. They are detailed below.

Changes in Existing Data Collection

- National surveys should oversample Asian Americans and ensure representation across the 6 largest subgroups of country of origin. Sampling should recognize the wide range of socioeconomic status among Asian American subgroups and focus on underserved populations, such as Korean and Vietnamese, and on very high risk groups such as Asian Indians and Filipinos.
- Existing studies should be expanded to include at least the 6 largest Asian American subgroups. Findings in one Asian subgroup should not be extrapolated to other subgroups.

- Asian American subgroups should be identified on death certificates, hospital discharge information, and population-based studies.
- The National Registry of Myocardial Infarction should identify specific Asian American subgroups on data collection forms.
- A Stroke Registry should be established that identifies the various Asian American subgroups to determine differences in stroke incidence and risk factors.

Development of Standard Measurement Tools

The following measurement tools should be developed:

- A widely applicable and comprehensive acculturation instrument to move research in this field forward.
- Culturally specific food frequency questionnaires that are comparable across Asian subgroups to adequately assess dietary factors related to CVD.
- Physical activity instruments that can validate and expand existing self-report data.
- More accurate measures of body fatness (other than BMI) that capture differences in adiposity between subgroups.

Research Opportunities

Research studies should be developed that examine the following areas, using population-based representative samples whenever possible and known denominators for response rates.

- Treatment patterns and outcomes in specific Asian American subgroups.
- Risk prediction models that account for the difference in prevalence and relative importance of CVD risk factors in Asian American subgroups.
- Body composition, possibly using computed tomography, dual energy x-ray absorptiometry, or MRI to address differences in body fat that are not detectable with BMI measurements.
- Novel genetic mutations and differences in allelic frequency in Asian Americans subgroups.
- Culturally specific lifestyle and medical interventions to address CVD risk factors in Asian American subgroups.
- Biological and social factors that act independently and in combination to modify cardiovascular risk in Asian American subgroups.

As the Asian American population continues to grow, it is imperative to accurately assess and address CVD health disparities in Asian American subgroups. The limited data currently available suggest substantial variability in CVD risk and incidence across Asian American subgroups. Opportunities to study health disparities in this diverse population will improve CVD prevention and treatment in the United States.

Acknowledgments

The authors thank Ariel Holland, BA, for her contributions to the preparation of this manuscript, including editing, proofreading, and reference management.

Disclosures

Writing Group Disclosures

Writing Group Member	Employment	Research Grant	Other Research Support	Speakers' Bureau/Honoraria	Expert Witness	Ownership Interest	Consultant/Advisory Board	Other
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Gordon L. Fung	UCSF Medical Center	Roche*	None	AstraZeneca/GlaxoSmithKline*; CV Therapeutics*; Merck*; Novartis*	None	None	CV Therapeutics*; Novartis*	California State Council of Multicultural Health; University of California Multi-Campus Research Program for the Health of Asian American Pacific Islanders*
K.M. Venkat Narayan	Emory University	None	None	None	None	None	None	None
Hamang Patel	Ochsner Heart and Vascular Institute	None	None	Actelion†; Gilead*; United Therapeutics*	None	None	Actelion†; Gilead*; United Therapeutics*	None
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This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit. A relationship is considered to be "significant" if (a) the person receives \$10 000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns \$10 000 or more of the fair market value of the entity. A relationship is considered to be "modest" if it is less than "significant" under the preceding definition.

*Modest.

†Significant.

Reviewer Disclosures

Reviewer	Employment	Research Grant	Other Research Support	Speakers' Bureau/Honoraria	Expert Witness	Ownership Interest	Consultant/Advisory Board	Other
Enas Enas	CADI Research Foundation	None	None	None	None	None	None	None
Namratha Kandula	Northwestern University	National Heart Lung and Blood Institute†; National Heart Lung and Blood Institute†	None	None	None	None	None	None
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This table represents the relationships of reviewers that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all reviewers are required to complete and submit. A relationship is considered to be "Significant" if (a) the person receives \$10 000 or more during any 12 month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns \$10 000 or more of the fair market value of the entity. A relationship is considered to be "Modest" if it is less than "Significant" under the preceding definition.

*Modest.

†Significant.

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KEY WORDS: AHA Scientific Statements ■ cardiovascular diseases ■ risk factors ■ genetics ■ metabolism ■ nutrition ■ exercise

Call to Action: Cardiovascular Disease in Asian Americans: A Science Advisory From the American Heart Association

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Circulation. 2010;122:1242-1252; originally published online August 23, 2010;
doi: 10.1161/CIR.0b013e3181f22af4

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:

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Correction

In the article by Palaniappan et al, “Call to Action: Cardiovascular Disease in Asian Americans: A Science Advisory From the American Heart Association,” which published ahead of print on August 24, 2010, and appeared in the September 21, 2010, issue of the journal (*Circulation*. 2010;122;1242–1252), several corrections were needed.

1. On page 1242, in the author listing, the “Council on Cardiovascular Nursing” was inadvertently omitted. Therefore, the author listing should read: “... on behalf of the American Heart Association Council on Epidemiology and Prevention, Council on Peripheral Vascular Disease, Council on Nutrition, Physical Activity, and Metabolism, Council on Clinical Cardiology, and Council on Cardiovascular Nursing.”
2. On page 1242, in the footnotes, paragraph 3, the citation information should be as follows: Palaniappan LP, Araneta MRG, Assimes TL, Barrett-Connor EL, Carnethon MR, Criqui MH, Fung GL, Narayan KMV, Patel H, Taylor-Piliae RE, Wilson PWF, Wong ND; on behalf of the American Heart Association Council on Epidemiology and Prevention, Council on Peripheral Vascular Disease, Council on Nutrition, Physical Activity, and Metabolism, Council on Clinical Cardiology, and Council on Cardiovascular Nursing. Call to action: cardiovascular disease in Asian Americans: a science advisory from the American Heart Association. *Circulation*. 2010;122:1242–1252.

These corrections have been made to the current online version of the article, which is available at <http://circ.ahajournals.org/cgi/content/full/122/12/1242>.

DOI: 10.1161/CIR.0b013e3181fe6880