Circulation

AHA SCIENTIFIC STATEMENT

Epidemiology of Diabetes and Atherosclerotic Cardiovascular Disease Among Asian American Adults: Implications, Management, and Future Directions: A Scientific Statement From the American Heart Association

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ABSTRACT: Asian American individuals make up the fastest growing racial and ethnic group in the United States. Despite the substantial variability that exists in type 2 diabetes and atherosclerotic cardiovascular disease risk among the different subgroups of Asian Americans, the current literature, when available, often fails to examine these subgroups individually. The purpose of this scientific statement is to summarize the latest disaggregated data, when possible, on Asian American demographics, prevalence, biological mechanisms, genetics, health behaviors, acculturation and lifestyle interventions, pharmacological therapy, complementary alternative interventions, and their impact on type 2 diabetes and atherosclerotic cardiovascular disease. On the basis of available evidence to date, we noted that the prevalences of type 2 diabetes and stroke mortality are higher in all Asian American subgroups compared with non-Hispanic White adults. Data also showed that atherosclerotic cardiovascular disease risk is highest among South Asian and Filipino adults but lowest among Chinese, Japanese, and Korean adults. This scientific statement discusses the biological pathway of type 2 diabetes and the possible role of genetics in type 2 diabetes and atherosclerotic cardiovascular disease among Asian American adults. Challenges to provide evidence-based recommendations included the limited data on Asian American adults in risk prediction models, national surveillance surveys, and clinical trials, leading to significant research disparities in this population. The large disparity within this population is a call for action to the public health and clinical health care community, for whom opportunities for the inclusion of the Asian American subgroups should be a priority. Future studies of atherosclerotic cardiovascular disease risk in Asian American adults need to be adequately powered, to incorporate multiple Asian ancestries, and to include multigenerational cohorts. With advances in epidemiology and data analysis and the availability of larger, representative cohorts, furthering refining the Pooled Cohort Equations, in addition to enhancers, would allow better risk estimation in segments of the population. Last, this scientific statement provides individual- and community-level intervention suggestions for health care professionals who interact with the Asian American population.

Key Words: AHA Scientific Statements ■ Asian ■ atherosclerosis ■ diabetes mellitus, type 2 ■ heart disease risk factors ■ prevalence

Asian American (AsA) individuals make up the fastest growing ethnic group in the United States.[1] Type 2 diabetes (T2D) is a major risk factor for atherosclerotic cardiovascular disease (ASCVD). Together, T2D and ASCVD are the leading causes of mortality and morbidity in AsA adults. Nevertheless,

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significant variability in T2D and ASCVD prevalence and risk factors exists within the different subgroups of AsA people. Most literature to date aggregates AsA subgroups into a single racial and ethnic group and fails to distinguish AsA subgroups individually, which may mask T2D and ASCVD disparities that exist between these different subgroups.[2,3] Despite the success of many AHA campaigns focusing on primary and secondary T2D and ASCVD prevention, including Life's Essential 8[4] and Know Diabetes by Heart,[5] many clinical and research disparities continue to exist among AsA adults. The purpose of this AHA scientific statement is to summarize the existing literature on the demographics and biological and social mechanisms that contribute to T2D and ASCVD among AsA adults. It also examines acculturation in the context of culturally appropriate strategies in the prevention and management among this diverse ethnic group. Last, this scientific statement focuses on future research directions and clinical strategies that can help reduce T2D and ASCVD among AsA adults.

HISTORY OF IMMIGRATION

According to the 2020 US census, the Asian population makes up 7.2% of the US population, with the largest subgroups represented by Chinese (4.1 million), Asian Indian (4 million), Filipino (2.9 million), Vietnamese (1.8 million), Korean (1.5 million), and Japanese (0.8 million) Americans, accounting for 87% of the AsA population (Figure 1).[1,6] The countries of origin of other Asian subgroups include Pakistan, Cambodia, Nepal, Indonesia, and Burma.[6] AsA adults, as defined by the census, are projected to be the largest immigrant group, making up 36% of all US immigrants by 2050.[7] However, this growth differs greatly among AsA subgroups.[7] Immigration has been largely influenced by policy; few Asian people migrated to the United States before the 1965 Immigration Act.[8,9] Focusing on the largest Asian ethnic populations in the United States shows that the effect of legislation on AsA communities can be seen across American history. Chinese American immigrants migrated in 2 waves: 1 in the 1800s under labor contracts and another in the 1970s after the establishment of temporary employment programs for skilled workers.[10] Roughly half of the Chinese American immigrants reside in either California or New York.[10] Many Asian Indian immigrants came from the educated middle class and settled primarily in California, New York, and New Jersey working management positions.[9,11] Filipino American immigrants initially arrived in the early 1900s to work in agriculture, but immigration increased 5-fold in the 1900s as a result of Filipino policies encouraging labor emigration.[12] Korean American immigrants migrated to fill labor positions vacated by Japanese and Chinese American immigrants in the early 1900s.[9] As of 2017, Korean American individuals reside mostly in New York, New Jersey, and Southern California.[13] Japanese American individuals migrated primarily to Hawaii and California in the late 1800s under labor contracts as well. Most Vietnamese immigrants arrived after the Vietnam War and resided in refugee centers, and 52% of Vietnamese American individuals resided in California and Texas as of 2019.[14] Given the varying immigration histories and patterns, percent foreign born can vary widely among the AsA subgroups.[15,16]

SOCIAL ECONOMICS OF AsA SUBGROUPS

The differing patterns of immigration are influential factors for the differences in socioeconomic status seen among

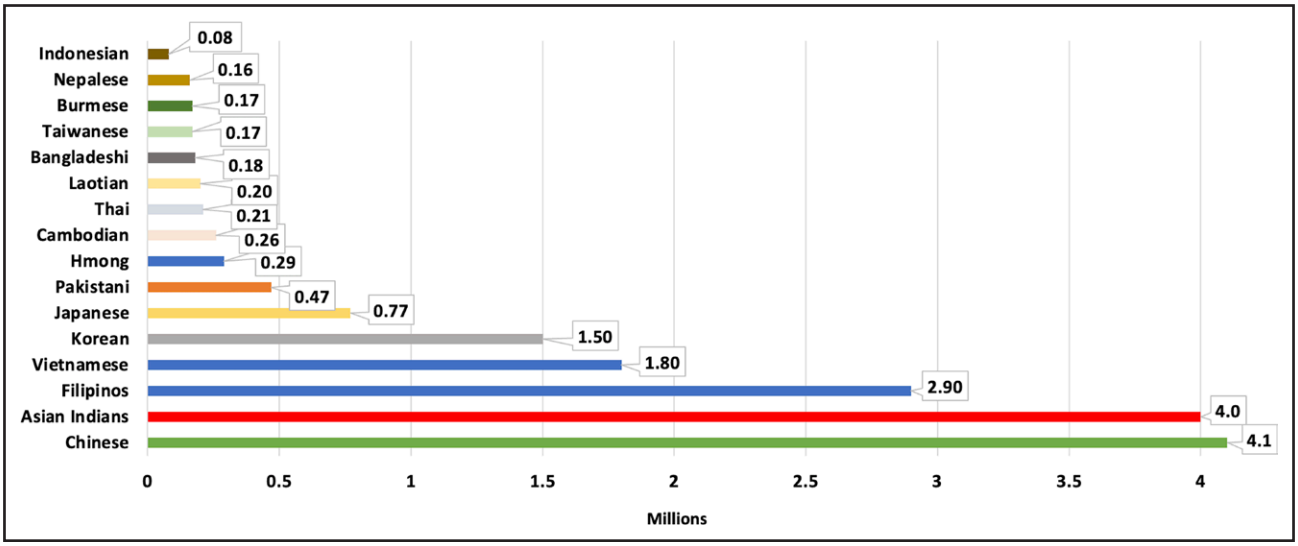

Figure 1. AsA individuals in the 2020 census.
AsA indicates Asian American. Data derived from the 2020 US census.[1,6]

AsA subgroups. In 2019, AsA households possessed a median annual income of $93 759 compared with $69 823 among non-Hispanic (NH) White households.[17] There is wide variation in income among the subgroups, with Filipino and Asian Indian individuals earning a median household income of more than $90 000, and other more recent Asian immigrants such as Burmese and Nepalese American individuals earning less than $60 000.[7,18,19] The many complex immigration factors, income variation, and variable sociodemographic characteristics collectively influence the social determinants of health in this population, which may in turn affect the different patterns of T2D and ASCVD risk observed among AsA adults.

EPIDEMIOLOGY IN AsA SUBGROUPS

Type 2 Diabetes

Diabetes epidemiology among AsA adults and its subgroups has consisted primarily of prevalence estimates using data from health systems, a handful of cohort studies, and a few state-level and national surveillance surveys. Unfortunately, many of these data sources include only aggregated data combining all AsA adults. The NHANES (National Health and Nutrition Examination Survey) started oversampling AsA adults in 2011 through 2018, with 4 waves of data collection biennially, and assessed diabetes prevalence comprehensively by using self-reported diagnosis of diabetes, elevated fasting glucose, hemoglobin A1c (HbA1c), and 2-hour glucose tolerance test criteria. However, each wave included only ≈300 Asian adults with origins from 23 Asian countries. These sparse data required combining AsA data across several NHANES waves and aggregating Asian subgroups by geographic origin (East Asian: Chinese, Japanese, and Korean; South Asian: Asian Indian, Pakistani, Sri Lankan, Bangladeshi, Nepali, and Bhutanese; Southeast Asian: Filipino, Vietnamese, Cambodian, Laotian, Thai, Indonesian, Malaysian, Singaporean, and Hmong; and other Asian categories).[20] With these caveats, the NHANES reported the weighted age- and sex-adjusted prevalence of diabetes as 23.3% (95% CI, 15.6%–30.9%) for South Asian, 22.4% (95% CI, 15.9%–28.9%) for Southeast Asian, and 14.0% (95% CI, 9.5%–18.4%) for East Asian subgroups between 2011 and 2016.[20] Similarly, other data sources have shown a marked heterogeneity of diabetes prevalence across AsA subgroups.[21–25] In a 2016 Kaiser Permanente Northern California health-delivery system study, there was a significant difference in the age- and sex-adjusted diabetes prevalence that ranged from 15.6% (99% CI, 15.2%–15.9%) in Chinese to 18.0% (99% CI, 17.0%–19.0%) in Korean, 18.1% (99% CI, 17.4%–18.9%) in Japanese, 18.7% (99% CI, 18.1%–19.4%) in Southeast Asian, 29.1% (99% CI, 28.7%–30.0%) in South Asian, and 31.9% (99% CI, 31.5%–32.3%) in Filipino adults compared with 12.8% (99% CI, 12.7%–12.9%) in NH White, 24.9% (99% CI, 24.5%–25.2%) in Black, 25.3% (99% CI, 25.0%–25.5%) in Latino, and 34.5% (99% CI, 33.1%–35.9%) in Native Hawaiian/Pacific Islander adults (Figure 2).[26]

T2D incidence among AsA subgroups has been reported by few studies.[27–29] An earlier study from Kaiser Permanente Northern California found marked heterogeneity in overall diabetes incidence from 2010 to 2011 among 6 different AsA subgroups: South Asian adults had the highest incidence (17.2 cases per 1000 person-years) and Vietnamese adults had the lowest incidence (4.6 cases per 1000 person-years) among the Asian subgroups.[30] Similar patterns are observed in the incidence of gestational diabetes, which is an important risk factor for T2D.[31]

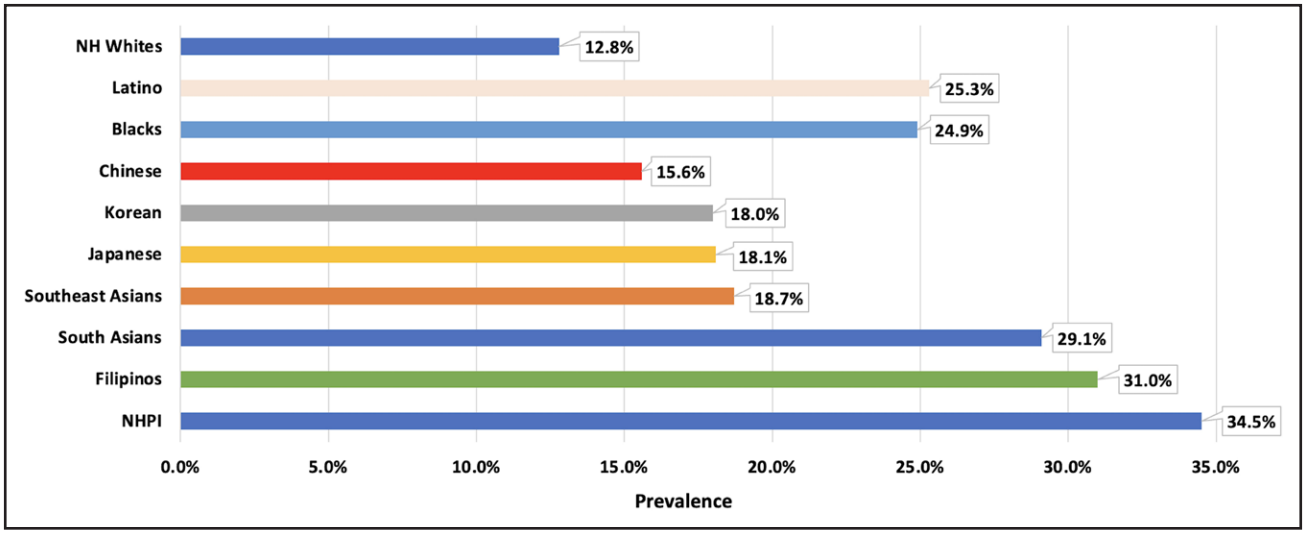

Figure 2. Prevalence of T2D among individuals 45 to 84 years of age in AsA subgroups vs other ethnic groups.
AsA indicates Asian American; NH, non-Hispanic; NHPI, Native Hawaiian/Pacific Islander; and T2D, type 2 diabetes. Data derived from the 2020 US census.[1,6]

Diagnostic Tests and Screening

T2D is defined as a fasting glucose ≥126 mg/dL, a 2-hour postchallenge glucose ≥200 mg/dL, an HbA1c ≥6.5%, or a random glucose ≥200 mg/dL in a patient with classic symptoms of hyperglycemia.[32] The American Diabetes Association (ADA) guidelines extend the recommendation to screen all AsA adults for T2D with a body mass index (BMI) ≥23 kg/m^2 with at least 1 additional risk factor (eg, physical inactivity, first-degree relative with T2D, history of coronary artery disease [CAD], hypertension, high-density lipoprotein cholesterol <35 mg/dL or triglycerides >250 mg/dL, polycystic ovary syndrome, other clinical condition associated with insulin resistance).[32] Similarly, the US Preventive Services Task Force recently updated its screening recommendation from 40 to 35 years of age for adults with BMI ≥23 kg/m^2 for AsA people.[33] Screening can include fasting glucose, 2-hour postchallenge glucose, hemoglobin, or random glucose.

Mechanistic Pathway

It is well established that both visceral fat and hepatic fat are key drivers of insulin resistance and T2D. Compared with Chinese American, Latino, Black, and NH White adults from the MESA study (Multi-Ethnic Study of Atherosclerosis), South Asian adults from the MASALA study (Mediators of Atherosclerosis in South Asians Living in America) had more hepatic and intermuscular fat and less lean mass.[34] A similar UK study found that South Asian adults had 30% higher intramuscular triacylglycerol, which is triglyceride deposited in the muscle, than BMI-matched European adults (72.1±7.5 mmol/kg dry weight versus 53.6±4.9 mmol/kg dry weight; P=0.046).[35] The lower muscle mass[36] and more intramyocellular fat deposition[34,35,37] lead to a lower ability of muscle to oxidize fat, thus leading to insulin resistance. Many studies have suggested that South Asian adults may have reduced beta cell function, which leads to less ability to secrete insulin with unhealthy lifestyles.[37–40] Abdominal visceral fat area and hepatic fat were independently associated with glycemic progression.[28] However, hepatic fat was more closely linked to the progression of prediabetes to T2D, suggesting that it may be more important than visceral fat once prediabetes is present.[41] Thus, the ectopic fat in muscle and reduced beta cell function combined with hepatic fat may increase susceptibility of T2D in South Asian adults.

ATHEROSCLEROTIC CARDIOVASCULAR DISEASE

Coronary Artery Disease

Asian subgroups differ substantially in their CAD risk. In the INTERHEART study, South Asian adults are found to have an earlier occurrence of CAD, with a median age at first presentation of acute myocardial infarction of 53.0 compared with 58.8 years for individuals from other countries, including Western Europe or East Asia.[42] A study using a large US health care organization sample of 1.4 million adults in 2016[26] found that the prevalence of CAD in Asian Indian men was the highest (13.0% [99% CI, 11.7%–14.4%]), followed by Filipino men (9.2% [99% CI, 8.5%–10.0%]) and Korean women (1.7% [99% CI, 0.9%–2.5%]). A retrospective study of South Asian patients hospitalized for CAD found that the prevalence is not only 4 times higher compared with NH White, Japanese, and Filipino adults but also 6 times higher compared with Chinese adults.[43] Similar results were found in the Study of Health Assessment and Risk in Ethnic Groups,[44] in which a higher prevalence of subclinical atherosclerosis was identified by carotid plaque in South Asian (11%) compared with European (5%) and Chinese (2%) adults (P=0.0004).[44] These patterns are consistent with findings from the MASALA study,[45] which showed that South Asian men have an increased incidence of coronary artery calcium compared with Black, Latino, and Chinese American men and that the incidence is similar to that of NH White adults. These data collectively suggest that there is a wide variation in the prevalence of CAD in AsA subgroups, with South Asian adults bearing the highest risk compared with East Asian adults.

Using mortality data from the National Center for Health Statistics from 2003 to 2017,[46] we found significant heterogeneity in the mortality rate among the various disaggregated AsA subgroups. The ischemic heart disease proportionate mortality ratio (PMR), which estimates the relative burden of mortality in AsA subgroups with the NH White population used as the reference, was found to be highest in Asian Indian men (1.33) and women (1.33) and lowest in Vietnamese men and women (0.78 and 0.80). Prior assessment indicated that CAD mortality rates were often higher in NH White adults compared with AsA subgroups in the preceding decade.[47] However, this changed in 2017: The most recent mortality rates in certain AsA subgroups were as high as those in NH White adults.[46] This change in patterns may be the result of a combination of declining mortality rates in NH White adults and increasing mortality rates in certain AsA subgroups. In particular, the absolute age-specific mortality rate was higher in Asian Indian women compared with NH White women but similar in Asian Indian and NH White men.

The age- and sex-adjusted prevalence of ASCVD by US birth was studied in the NHIS (National Health Interview Survey) 2006 to 2015.[48] Foreign-born South Asian and Chinese adults were more likely to have CAD or ASCVD. However, US-born Filipino adults were more likely to have CAD and ASCVD. This might be influenced by different acculturation levels and socioeconomic statuses.

Kaiser Permanente Northern California data from 2006 to 2016 showed a 2.04-fold (95% CI, 1.83–2.28) higher rate of incident CAD in South Asian compared with NH White adults.[49] A study that used NHIS study from 2006 to 2015 data[50] found that risk of premature CAD was higher among Asian Indian than NH White adults. Compared with Chinese adults, the risk of premature CAD was significantly higher for Asian Indian adults.

Assessment of ASCVD risk remains the foundation of primary prevention. According to the "2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease,"[51] the use of the ASCVD risk estimator is recommended to help guide decision-making when considering whether potential benefits from pharmacotherapy are likely to outweigh potential harms for individual patients based on absolute risk (rather than relative risk). The Pooled Cohort Equations, originally derived from 5 prospective community-based cohorts, are best validated in NH Black and NH White adults 40 to 75 years of age. In other racial and ethnic groups, the Pooled Cohort Equations were less extensively studied. They may systematically underestimate risk, particularly in patients from certain racial and ethnic groups (eg, South Asian people), those with lower socioeconomic status, and individuals with chronic inflammatory diseases, and they may overestimate risk in East Asian adults, patients with higher socioeconomic status, and individuals who have been closely engaged with preventive health care services.[52]

Although it was not validated in Asian populations, the AHA/ACC released a special report in 2018 for lipid guideline to recommend "risk-enhancing factors," among which identifying high-risk racial and ethnic groups such as South Asian should be considered to affect the 10-year risk estimate for individual patients.[52] In adults 40 to 75 years of age without diabetes, South Asian individuals are identified as at heightened or enhanced risk for ASCVD; therefore, the initiation of statin therapy may be favored (ASCVD intermediate risk, 7.5%–20%).

Stroke

Strokes, also known as cerebrovascular disease, are more prevalent in Asian compared with European or NH White populations.[53] Hemorrhagic stroke is more common among AsA individuals; this includes Chinese, Japanese, and Filipino adults.[53] A higher prevalence of hypertension is thought to be responsible for the greater proportion of hemorrhagic stroke in Asian populations (relative risk, 1.6 [95% CI, 1.1–2.3]).[53] In addition, the high risks in Filipino adults for intracranial hemorrhage (relative risk, 2.3 [95% CI, 1.4–3.8]) and in Japanese adults for subarachnoid hemorrhage (relative risk, 5 [95% CI, 2.0–12.7]) are striking.[53] For ischemic stroke, an outpatient database[54] of 400 000 patients in California found that Filipino adults had the highest age-adjusted overall stroke prevalence rate (1.8% [95% CI, 1.0%–2.6%]), followed by Chinese (1.1% [95% CI, 0.8%–1.3%]) and Asian Indian (1.0% [95% CI, 0.5%–1.0%]) adults. This trend is seen in the stroke mortality data showing that both men and women across every AsA subgroup have a higher PMR compared with their NH White counterparts.[46] Stroke accounted for 7.4% to 10.2% of deaths in AsA women and for a PMR of 1.42 compared with NH White adults.[46] A similar pattern was observed in AsA men with a PMR of 1.60. Stroke accounted for 5.1% to 7.5% of deaths, with the highest PMR of 1.84 among Vietnamese men.[46] In particular, compared with NH White adults, AsA individuals were more likely to experience severe strokes (National Institutes of Health Stroke Scale score ≥16 at presentation; odds ratio [OR], 1.35 [95% CI, 1.30–1.40]), more likely to experience more disability and less likely to ambulate independently (OR, 0.84 [95% CI, 0.79–0.90]) after a stroke, less likely to receive thrombolysis (OR, 0.95 [95% CI, 0.91–0.98]), and more likely to experience intracerebral hemorrhage (OR, 1.36 [95% CI, 1.20–1.55]) and other complications (OR, 1.31 [95% CI, 1.18–1.46]) when they did receive thrombolysis.[55] Unsurprisingly, they also tend to have longer lengths of hospital stay (OR, 1.17 [95% CI, 1.14–1.20]) and higher mortality rates in the hospital (OR, 1.14 [95% CI, 1.09–1.19]).[55]

Peripheral Artery Disease

Although data on peripheral artery disease (PAD) in Asian adults are limited, the prevalence of PAD remains low according to available data.[56,57] Three multiethnic cohorts (NHANES, San Diego Population Study, and MESA) found that Black adults have the highest rates of PAD, followed by NH White adults; rates in Hispanic American and AsA individuals were the lowest.[58] From a California outpatient health care organization database,[54] the prevalence of PAD in Asian Indian adults (1.4% [95% CI, 0.8%–2.1%]) was the highest among AsA subgroups, and the prevalence of PAD in Chinese adults was only 0.9% (95% CI, 0.7%–1.1%).[54] Results from the MESA study showed that even after adjustment for traditional and novel risk factors, PAD prevalence remains low among in Chinese American adults compared with their NH White counterparts.[59] Despite the low prevalence of PAD observed, data from the National Inpatient Sample[60] showed that Asian or Pacific Islander people had higher all-cause mortality (OR, 1.20 [95% CI, 1.01–1.43]), more prolonged length of stay (relative risk, 0.14 [95% CI, 0.09–0.18]), and higher overall inpatient cost (margin, $30 093.01 [95% CI, 28 827.55–31 358.48]) compared with NH White adults. More studies are warranted to better understand the biological mechanisms of how PAD may present itself differently in AsA individuals.

We summarize the prevalence and PMR of ASCVD among AsA subgroups in Table 1.

ATHEROSCLEROTIC CARDIOVASCULAR RISK FACTORS

Obesity

Maintenance of a healthy BMI across the life course is a key component of optimal cardiometabolic health for the prevention of ASCVD in the overall population and in the AsA population.[61,62] Distribution of BMI in the US population differs across AsA subgroups.[63] Among adults ≥20 years of age,[20] mean BMI was lower in Asian subgroups (East Asian adults, 23.4 kg/m^2 [95% CI, 22.9–23.9]; South Asian adults, 25.9 kg/m^2 [95% CI, 25.2–26.6]; and Southeast Asian adults, 23.9 kg/m^2 [95% CI, 23.1–24.6]) compared with NH White adults (29.2 kg/m^2 [95% CI, 28.8–29.6]) in representative data from NHANES 2011 to 2016. Although multiple studies have identified higher risks for T2D and ASCVD in AsA compared with NH White adults, the World Health Organization Expert Consultation[64] suggested that lower BMI thresholds may be used as trigger points for public health, screening, and clinical care for increased risk for BMI ≥23 to 27.4 kg/m^2 and high risk for BMI ≥27.5 kg/m^2. However, it did not recommend personalizing the BMI cutoff point for overweight (BM I≥23 kg/m^2) or obesity (BMI ≥27.5 kg/m^2) for all Asian adults. This was driven largely by the heterogeneity observed among different Asian populations and highlights that better understanding of how ASCVD risk changes across BMI categories in disaggregated AsA population is needed to limit underestimation of cardiometabolic risk. According to data from NHANES 2011 to 2016,[20] ≈48% of East Asian, 71% of South Asian, and 59% of Southeast AsA adults were estimated to have BMI ≥23 kg/m^2 (Supplemental Figure 1S [A]). Another study from the California Health Interview Survey[65] also showed that Chinese, Japanese, and Filipino American individuals were more likely to self-report as overweight or obese. Specifically, among participants from the MASALA and MESA[66] studies, the prevalence of ≥2 cardiometabolic abnormalities (high fasting glucose [≥100 mg/dL or any use of glucose-lowering medication], low high-density lipoprotein cholesterol [<40 mg/dL in men and <50 mg/dL in women], high triglycerides [≥150 mg/dL], and hypertension [≥130/85 mm Hg or use of antihypertensive medication]) was similar at a BMI threshold of 19.6 kg/m^2 in South Asian and 20.9 kg/m^2 in Chinese American adults compared with a BMI of 25.0 kg/m^2 in NH White adults.

Hypertension

High blood pressure is a leading risk factor for ASCVD in the overall US population and AsA subgroups. Data from the NHIS 2010 to 2016[67] showed that adults residing in the United States who were born outside of the United States identified a higher prevalence of hypertension based on self-report among Southeast Asian adults (29.1% [95% CI, 27.6%–30.6%]) compared with the lowest prevalence of hypertension among South American adults (20.0% [95% CI, 18.5%–21.5%]). Similar estimates of hypertension were observed in the New York Community Health Survey,[68] with a higher age-adjusted prevalence of self-reported hypertension in South Asian immigrants (27.1% [95% CI, 22.8%–31.9%]) compared with NH White adults (23.1% [95% CI, 22.3%–23.9%]) or Chinese immigrants (22.2% [95% CI, 20.3%–24.3%]) despite the younger mean age of South Asian adults

Table 1. ASCVD Prevalence and PMR Among AsA Subgroups

	NH White	All Asian	Asian Indian	Filipino	Chinese	Japanese	Korean	Vietnamese
Prevalence, %								
CAD[26]	8.5 (M) 3.7 (W)	8.0 (M) 3.3 (W)	13.0 (M) 4.4 (W)	9.2 (M) 4.3 (W)	6.4 (M) 2.5 (W)	6.9 (M) 2.7 (W)	5.9 (M) 1.7 (W)	5.6 (M) 3.8 (W)
CVA[54]								
Overall	1.2	1.2	1.0	1.8	1.1	1.2	0.3	1.7
Hemorrhagic	0.2	0.3	0.1	0.3	0.2	0.4	0.3	0.7
PAD[54]	1.9	0.9	1.4	1.3	0.9	0.5	0.8	0.5
PMR								
CAD[46]	Ref (M) Ref (W)	1.04 (M) 1.07 (M)	1.33 (M) 1.33 (W)	1.14 (M) 1.16 (W)	0.96 (M) 1.08 (W)	1.01 (M) 0.95 (W)	0.82 (M) 1.02 (W)	0.78 (M) 0.80 (W)
CVA[46]	Ref (M) Ref (W)	1.60 (M) 1.42 (W)	1.25 (M) 1.22 (W)	1.71 (M) 1.46 (W)	1.68 (M) 1.36 (W)	1.75 (M) 1.50 (W)	1.32 (M) 1.37 (W)	1.84 (M) 1.69 (W)

AsA indicates Asian American; ASCVD, atherosclerotic cardiovascular disease; CAD, coronary artery disease; CVA, cerebrovascular disease; M, men; NH, non-Hispanic; PAD, peripheral arterial disease; PMR, proportionate mortality ratio; Ref, reference; and W, women.

Source: Data derived from Gordon et al,[26] Holland et al,[54] and Shah et al.[46]

(49.5 years) compared with NH White adults or Chinese immigrants (62.1 and 61.3 years, respectively; Supplemental Figure 1S [B]). Significant heterogeneity also exists among pregnant AsA populations in the United States in de novo hypertension in pregnancy, with the highest rate observed among Filipino adults[69] compared with other Asian subgroups. This is particularly important in that the risk of chronic hypertension and later-life ASCVD is higher among individuals who experienced hypertension during pregnancy[70] compared with individuals who did not have hypertension during pregnancy.

Hyperlipidemia

Dyslipidemia is one of the most common risk factors for ASCVD, and significant heterogeneity exists among AsA subgroups. A cross-sectional analysis of the 2010 to 2018 NHIS among 508 941 adults[71] demonstrated a higher prevalence of self-reported high cholesterol among Asian immigrants who were born in Southeast Asia (33.4% [95% CI, 31.4%–35.4%]) compared with those born in the Indian subcontinent (20.8% [95% CI, 18.5%–23.1%]) or East Asia (21.9% [95% CI, 19.9%–23.9%]) or NH White adults (31.7% [95% CI, 31.3%–32.1%]; Supplemental Figure 1S [C]). One study leveraging data from patients in a Northern California health system identified a predominant pattern of lower high-density lipoprotein cholesterol and higher triglycerides in Asian Indian, Chinese, Filipino, and Korean men and women compared with NH White adults from a sample of 169 430 patients.[72] In addition, lipoprotein(a) [Lp(a)] may be an important risk factor, and it is found to be higher among South Asian adults compared with NH White adults.[73]

OTHER MODIFIABLE AND NONMODIFIABLE ATHEROSCLEROTIC RISK FACTORS

Genetics

Given the diverse backgrounds of AsA communities, a natural question that arises is whether differences in prevalence of ASCVD risk factors and ASCVD are attributable in part to unique genetic risk factors. In fact, ASCVD risk factors and ASCVD are heritable traits, including in Asian adults.[74,75] Migrations between Asian and European adults have led to the current genetic diversity, with at least 3 likely genetic gradients in the South Asian region, at least 4 genetic populations in Southeast Asia, and at least 3 in East Asia.[76] Of course, this does not incorporate complex admixture in AsA diaspora. Regardless, it is important to note that race and ethnicity are social (not biological) constructs and that racial groups are genetically heterogeneous.[77] Thus, genetic studies of AsA adults need to be interpreted carefully through that lens given that many rely on self-reported race and ethnicity, not genetic ancestry.

With this caveat, known risk factors for ASCVD can be mediated in significant part by genetic factors and help explain heterogeneity in risk of ASCVD in AsA adults. For example, Lp(a) levels are genetically determined in large part, and data suggest that Lp(a) may be a stronger risk factor in South Asian adults.[78] Conversely. a recent study of the UK Biobank showed differences in Lp(a) concentrations across races but found that the risk of incident ASCVD per 50–nmol/L increase in Lp(a) appeared similar with hazard ratios of ≈1.1 in individuals of self-reported NH White and South Asian races.[79]

Substantive advances in human genetic technologies and analytics and collaboration across scientific communities have expedited our understanding of the genetics of ASCVD over the past 2 decades beyond genetic risk related to these more traditional risk factors such as Lp(a). Historically, these studies were conducted primarily in individuals of European ancestry, but more recent studies have included individuals of diverse ancestries. Many diabetes and ASCVD risk genes and related biological pathways are common between ancestral backgrounds, albeit characterized by allelic heterogeneity.[80] For example, *TCF7L2* has the most consistent and strongest association with T2D for a single gene, and common variants in *TCF7L2* have been shown to be associated in Asian populations.[81] Similarly, most BMI genetic risk loci identified in European cohorts, including the *FTO* locus, have been replicated in individuals of Asian ancestry[76] but characterized by heterogeneity in the risk conferred in different ancestries. Data suggesting that the association between *FTO* and T2D remains significant even after adjustment for BMI in South Asian adults may support differences in underlying biological mechanisms in the relationship between BMI and T2D risk in South Asian adults.[82]

A growing number of studies focused on non-European ancestry cohorts have uncovered genetic variants that appear to be unique to ASCVD risk in certain Asian ancestries.[83,84] For example, a genome-wide association study of T2D in individuals of South Asian ancestry discovered 6 new genetic loci not previously associated with T2D in primarily European ancestry individuals: *GRB14*, *ST6GAL1*, *VPS26A*, *HMG20A*, *AP3S2*, and *HNF4A*.[83] Another study of coding regions in a large cohort of individuals within PROMIS (Pakistan Risk of Myocardial Infarction Study) identified homozygous loss-of-function mutations, including *APOC3*, a gene known to harbor variants protective for coronary heart disease.[85]

Further supporting the potential unique genetic architecture of ASCVD risk in individuals with Asian ancestry is the emerging knowledge that polygenic risk scores (PRSs; composed of a combination of many genetic variants) developed in European ancestry cohorts may not perform as well in cohorts of other ancestral backgrounds. For example, a study of a simple coronary

heart disease PRS developed in individuals of European ancestry confirmed association with increased risk across ancestries, but with heterogeneity of the risk estimate and lowest risk association in individuals of East Asian ancestry.[86] Conversely, a recent study of a multiethnic PRS for T2D found that the risk conferred by this PRS was highest in individuals of Asian ancestry (OR, 3.08 [95% CI, 2.40–3.95] for top 10% of PRSs compared with average 40%–60% PRS category) compared with those of Hispanic or African ancestry but similar to European ancestry populations.[87] Another recent study assessed the incremental predictive capability of multiethnic ASCVD PRSs to clinical risk prediction tools. Specifically, addition of the PRS improved predictive performance of the Pooled Cohort Equations across all ethnicities, including in individuals with self-reported South Asian ethnicity (net reclassification index, 8.7% [95% CI, 3.1%–14.4%]),[88] suggesting that genetic risk may have clinical utility in South Asian adults. However, in another study of a simple coronary heart disease, a PRS validated in European adults confirmed an association with increased risk in East Asian adults.[86] These results support that although there may be potential utility of PRSs in risk prediction, this is unlikely to be fully realized without evaluation of ancestry-specific PRSs.

Although these studies have provided important insights into the common but also unique genetic architecture of ASCVD and related risk factors in Asian cohorts, many were conducted in individuals residing in their native countries. Therefore, better evaluation of genetic factors of ASCVD risk is necessary in cohorts of Asian diaspora, including evaluation of gene-environment interactions. For example, such studies may uncover risk genes that exponentiate risk in the background of Western diet and lifestyle. Accordingly, a study in the UK Biobank found interactions between the BMI *FTO* locus and lifestyle and environmental factors, including diet, sleep, and physical activity.[89] Analysis of other omics technologies such as epigenetics and metabolomics may also provide more insight into the biology of ASCVD risk in AsA adults.

ACCULTURATION AND LIFESTYLE

Acculturation is the process of learning and incorporating the values, beliefs, language, customs, and mannerisms of the new country in which immigrants and their families are living, including behaviors that affect health such as dietary habits, activity levels, and substance use.[90] Birthplace and length of US residency are the most frequently used indicators of acculturation in studies about immigrant health. Studies of AsA immigrants have shown that risk factors for ASCVD, including diet and physical activity, differ by acculturation.[91,92] Greater US acculturation has been associated with increased ASCVD risk[91,93] and poorer cardiovascular health (CVH) as measured by AHA's CVH metrics.[94] More recently, data from NHIS 2014 to 2018[95] found that acculturation levels and cardiovascular risk factor prevalence differ significantly among AsA subgroups (Supplemental Table 1S). Filipino American adults had a higher prevalence of obesity and tobacco use associated with higher acculturation level, but this was not observed in other Asian subgroups. A recent study[96] using data from NHANES 2011 to 2016 found that AsA adults with T2D were significantly less likely to meet glycemic, cholesterol, and blood pressure goals compared with their White counterparts, and those AsA adults who are more acculturated demonstrated better glycemic goal achievement. Similar results among Chinese American adults also showed that acculturation was significantly associated with T2D self-management.[97] These results suggested that more aggressive diet education may be needed for AsA adults who are less acculturated to improve the health of this population.

Dietary acculturation is a complex, dynamic, and multidimensional process that occurs when members of an immigrant group adopt the eating patterns and food choices of the host country.[98] Research has supported many beneficial aspects of the Asian dietary pattern, including the use of unsweetened tea, consumption of fresh fruits and vegetables, and use of soybeans and plant-based products.[99] Unfortunately, the Asian diets also have drawbacks, including high refined grains (such as white rice and noodles) as a main staple,[100] excessive sodium intake,[101] use of animal protein and organ meats,[100] and cooking oils that are high in saturated fat (eg, palm, coconut, and ghee). These have collectively been associated with weight gain, increased cardiovascular risk, and insulin resistance.[102,103] After Asian people migrate to the United States, they may adopt a Western dietary pattern while maintaining traditional eating habits, which may affect their cardiovascular risk factors or CVH.[91,104] A small study of Asian Indian adults found a positive association between dietary acculturation and T2D risk.[105] Racial and ethnic disparities in glycemic control and diabetes-related health outcomes have been well documented in the primary care setting.[106] Dietetic professionals are in a unique position to provide culturally sensitive dietary interventions in the various AsA subgroups. The Academy of Nutrition Dietetics has Dietetic Practice Groups that specialize in cultural competency, as well as diabetes, CVH, and weight management. The ability to accurately assess the level of dietary acculturation can help registered dietitians tailor nutrition education and intervention for their patients by selecting healthier food choices within the traditional, ethnic food groups while adopting healthful food choices in the mainstream country.

A physically active lifestyle is the foundation of maintaining and improving CVH, and vast observational data support the recommendation for aerobic physical activity to help lower the risk for T2D and ASCVD.[51,107–109] Resistance exercise should also be encouraged because of its several health benefits, including improving physical functioning, improving glycemic control in individuals with

diabetes, and possibly lowering blood pressure.[109] Accordingly, acculturation is positively associated with physical activity levels among AsA adults.[109–111] More acculturated AsA adults are likely to perform more moderate to vigorous physical activity than less acculturated AsA adults.[112] Interventions targeted to address this disparity are critical to promote physical activity among non–English-speaking Asian immigrants and recent immigrants.

Acculturation has also been found to influence smoking behaviors among Asian immigrants, and studies have found that the magnitude of influence appears to be larger in women and adolescents than in men.[113,114] Of note, the prevalence of smoking differs by sociodemographic factors in Asian immigrants, with data indicating higher rates in Vietnamese and Korean male immigrants, particularly among those with limited English proficiency. Cessation programs focused on Asian immigrants should consider and leverage characteristics of social networks as part of tailored and culturally appropriate interventions.

SOCIAL NETWORKS

Social networks, through their structural and functional characteristics, have been shown to influence smoking behaviors, dietary patterns, and physical activity in adults and adolescents from diverse populations.[115] Functional characteristics of social networks (ie, size, density, interconnectedness among members) have been hypothesized to shape an individual's health behaviors and attitudes by influencing access to resources, opportunities, and constraints, whereas functional aspects of social networks (ie, social and peer support, social norms, social cohesion, and social capital) have been observed to shape health behaviors and physical health outcomes.[115] Specific to Asian immigrants, a central component of social networks relevant to health behaviors is the family. Data from the population-based California Vietnamese Adult Tobacco Survey found that family factors, including interactions among family members, are related to smoking behaviors in Vietnamese male smokers.[116] Findings also underscore the importance of designing strategic interventions that meet the needs of smokers at both the individual and family level to facilitate successful quitting in this population. A recent study that examined the efficacy of a family-based smoking cessation intervention targeting Chinese and Vietnamese male smokers with limited English proficiency and their nonsmoking family members[117] found that higher frequency of receiving praise and encouragement for one's efforts to quit smoking was positively associated with readiness to consider cessation. Taken together, findings point to the need for family- and social network–focused strategies to promote smoking cessation among AsA smokers.

Data from a cross-sectional analysis demonstrated the beneficial effects on increased moderate to vigorous physical activity of having network members who exercised or who were exercise partners. Of note, for women, the association was significant only if the exercise partner was a spouse.[118] Another recent report from MASALA indicated that a 1-person-larger social network was observed to be associated with higher odds of ideal CVH.[119] Engaging social networks has potential to promote CVH in AsA populations and merits further study. Other data from MASALA study point to the importance of older South Asian immigrants having an adult child in their network providing positive role modeling and support as a facilitator of behavioral change in patterns of dietary intake and physical activity.[115] Research focused on the beneficial and adverse effects of social networks on health behaviors in AsA subgroups has been limited to date and suggested as an important area of inquiry.[115]

INTERVENTIONS

Lifestyle Interventions

Dietary Intake

Although there are many similarities among Asian cuisines, major differences exist given the wide geographic base of Asia, including countries as diverse as Bangladesh, Cambodia, China, India, Indonesia, Japan, Laos, Malaysia, Mongolia, Myanmar, Nepal, North Korea, South Korea, Philippines, Singapore, Taiwan, Thailand, and Vietnam. Consequently, the term Asian diet is an overarching term that attempts to cover a large territory in both a geographic sense and a culinary sense. In this scientific statement, we attempt to divide Asian cuisines by 3 main regions (Table 2) and outline the key highlights from each of these regions, as well as weaknesses and diet recommendations. Understanding the characteristics of diets in these Asia regions is critical to better understand the types of food that make up each food group, which would be helpful for menu planning and improve dietary adherence.

Dietary patterns encompass the balance, variety, and combination of foods and beverages habitually consumed at home or outside the home.[120] Adherence to heart-healthy dietary patterns is associated with optimal CVH.[104,121] As outlined in the ACC/AHA prevention guidelines[51] and the ADA standard of care,[122] the quality of carbohydrate intake is especially important for control of T2D, and focus should be placed on the intake of whole grains with minimized refined carbohydrates and red meat consumption in AsA subgroups.[51,120,123,124] For individuals who are overweight or obese, weight loss is an essential treatment component for T2D management and ASCVD prevention. Weight loss has been shown to decrease fatty liver, even among normal-weight Asian people,[125] and modest weight loss can decrease visceral fat.[126] Last, culturally sensitive dietary recommendations should be considered for weight management.

Because dietary practices are related to dietary acculturation, the ability to assess the level of dietary

Table 2. Description of Asian Diets by Regions, Their Weaknesses, and Dietary Suggestions

Asian country regions	Regional diet highlights	Diet weaknesses	Dietary suggestions
Southeast Asian diet (Cambodia, Vietnam, Thailand, Indonesia, Laos, Malaysia, and Singapore)	Strong emphasis on aroma and incorporates the balance of grilling, stir-frying, braising, and deep-frying in palm and coconut oil Use of discrete herbs and spices, including lemongrass, tamarind, cilantro, basil, mint leaves, and citrus juice Dishes often call for coconut milk, fish sauce, shrimp paste, and meat broth Animal protein, including beef, lamb, pork, and poultry Staple foods include rice (glutinous sticky rice, rice vermicelli), fish (fresh and salted fish), vegetables, and animal protein	Low intake of dietary fiber from refined grains such as white rice and products made from refined-grain flour High intake of saturated fat and dietary cholesterol intake from animal protein and animal fat Unhealthy fat from cooking oils such palm oil and coconut oil High intake of saturated fat from high use of coconut milk and other coconut-containing products High sodium intake from high-sodium condiments such as fish sauce, soy sauce, and sambal Low intake of fresh fruits Low intake of calcium and vitamin D	Increase the use of whole-grain products, including brown rice and whole-grain flour Increase the use of lean and plant-based proteins Use low-fat coconut milk or substitute with other nondairy alternatives Replace cooking oil from high-saturated-fat options to those with lower saturated fat and higher polyunsaturated and monounsaturated fats Cut down on sodium by using low-sodium alternatives or less per serving Maintain the use of fresh herbs and spices Increase the use of dairy or fortified nondairy products for calcium and vitamin D
South Asian diet (India, Pakistan, Sri Lanka, Nepal, Bangladesh, and Burma)	Well known for its richness, aroma, color, and unique taste Strong spices are at the heart of most dishes such as hot peppers, cumin, curry, and cloves Kebabs and naan are common with Persian Arabian roots, but vegetables and vegetarians are also common Deep-frying is common for meats Pickle fruits and vegetables Some may be vegetarian because of personal choice and some for religious reasons Lentils, peas, and beans are commonly used Vegetables are common in mixed dishes and are often added in stews Staple foods include rice (dosa and vada), flour (naan and rotis), vegetables, and animal proteins	Low intake of dietary fiber from refined grains such as white rice and products made from refined-grain flour High saturated fat and dietary cholesterol intake from animal protein and animal fat High saturated fat intake from coconut oil use Low intake of fresh fruits Low intake of calcium and vitamin D	Increase the use of whole-grain products, including brown rice and whole-grain flour Replace cooking oil from high-saturated-fat options to those with lower saturated fat and higher polyunsaturated and monounsaturated fats Reduce the amount of red meat and increase the use of lean and plant-based proteins Focus on cooking methods other than deep-frying Increase the use of fresh vegetables in stews Maintain the use of herbs and spices Increase the use of dairy or fortified nondairy products for calcium and vitamin D
Northeastern Asian diet (China, Taiwan, Japan, Korea)	Wide variety of cooking methods that focus on the freshness of the ingredients, including steaming, boiling, stewing, roasting, and sauteing White rice and rice products are a huge staple and an integral part of each meal Live fish and seafood, animal protein, poultry, and organ meats are common Soy and soy-based protein are common Seasonal fruits and vegetables are essential in most meals Concepts of healthy eating based on the concept of "yin" (feminine) and "yang" (masculine), and the maintenance of this is the root to disease prevention Pickled and fermented meat and vegetables are common	Lack of dietary fiber from refined grains such as white rice and products made from refined-grain flour High saturated fat and dietary cholesterol intake from animal protein and organ meats High sodium intake from preserved meats, pickled vegetables, and condiments (soy sauce, oyster sauce, hoisin sauce, miso, etc)	Increase the use of whole-grain products, including brown rice and whole-grain flour Reduce the amount of red meat and organ meat consumption and increase the use of lean and plant-based proteins Decrease sodium intake with the use of fresh herbs and spices and low-sodium alternatives Increase the use of dairy or fortified nondairy products for calcium and vitamin D

Source: Data derived from Lichtenstein et al.[120]

acculturation is vital to provide the appropriate nutrition education and intervention in this population. In general, a heart-healthy dietary pattern should emphasize a dietary pattern beyond individual foods or nutrients, that is, one that is characterized by an abundance of fruits and vegetables, whole grains, lean or vegetable protein (mostly plants, fish and seafood, low-fat or fat-free dairy products, and, if meat or poultry is desired, lean cuts and unprocessed forms), liquid plant oils, and minimally processed foods.[51,120] These dietary patterns would be naturally high in dietary fiber and low in added sugars, saturated fat, dietary cholesterol, and sodium. The food environment, food access, food insecurity, and neighborhood segregation are all important considerations when providing diet and nutrition education.[120] Improving diet quality and health conditions within each AsA subgroup will require addressing these upstream systematic problems. Culturally relevant food choices within each food group

should be carefully evaluated and replaced with healthier options to help AsA adults to adhere to a heart-healthy dietary pattern.

Physical Activity, Tobacco Use, Sleep, and Stress Reduction

Physically active lifestyles are critically important in the prevention and management of chronic conditions, including T2D and ASCVD. Evidence indicates that a low level of physical activity is independently associated with T2D in South Asian adults.[127] Although there are minimal data on the specific levels or types of physical activity performed by AsA adults, available evidence suggests that they are less active than individuals from other ethnic groups and points to the importance of increasing awareness of physical activity in health promotion and prevention of chronic conditions.[128] Both aerobic and resistance exercise and high-intensity interval training have shown similar effects on reducing hepatic fat independently of weight loss.[129,130] Interventions that resulted in increasing levels of physical activity should also encompass cultural factors, acculturation level, health literacy, and other resources or social network/social support.[131,132] Existing data also suggest that effective approaches to changing adverse patterns of these behaviors differ by specific behavior and sociodemographics of the target AsA population. For example, efficacious smoking cessation interventions can benefit from multilevel strategies that include individual factors (age, health literacy), family support/encouragement, and community-based efforts to deter smoking initiation and persistence.

Tobacco use is a major modifiable risk factor for ASCVD. Although numerous smoking cessation and strategies in the US population exist,[51,133] little information is available on how successful they may be for AsA individuals. On an individual level, cognitive behavioral therapy and counseling on the health benefits of smoking cessation have been shown to be effective in promoting cessation in Korean male smokers.[134] A study that examined the associations between social network characteristics and social support and cigarette use across Native Hawaiian, Filipino, and East Asian young adults found that ethnic differences exist in pathways linking social network characteristics and cigarette use.[115] Specifically, higher perceived social support was associated with lower recent smoking among East Asian and Filipino but not Native Hawaiian adults. Findings related to East Asian adults highlight how social networks function to provide social capital; in Hawaii, East Asian individuals are reported to have higher socioeconomic status, better health outcomes, and lower prevalence of adverse health behaviors than their counterparts. Culturally relevant smoking prevention and cessation interventions should incorporate strategies based on social network and social support.[115]

Community-based efforts can have the potential to educate Asian immigrants on the health risks behaviors associated with tobacco products use. Central to these efforts are consideration of family characteristics, social networks, and community resources and supports.

Sleep is an integral part of overall health, particularly CVH. AHA has recently added sleep to its definition of CVH as part of the Life's Essential 8, and sleep is now part of the metrics in assessing CVH across the life course.[4] Racial and ethnic minorities experience more adverse patterns of sleep duration and more sleep disorders than their White counterparts, which may increase their ASCVD risk.[135] Minimal data are available on sleep disorders in AsA adults. Results of a recent study suggest that acculturative stress, defined as the psychological impact or stress reaction of adapting to a new cultural content, can be a major contributor to sleep disturbance and point to intervention programs for Asian immigrants on minimizing acculturative stress and enhancing protective factors that have the potential to decrease the risk for poor sleep outcomes.[136]

Lifestyle interventions in Asian populations have been shown to be effective internationally[137,138] and in the United States.[139] Lifestyle interventions are also an important aspect of the Diabetes Prevention Program, which demonstrated greater efficacy at preventing diabetes compared with pharmacological agents such as metformin. Larger AsA representation can help provide additional insights because AsA adults account for <5% of the study population.[140] Although not specifically tested in AsA women, the ADA recommends the Diabetes Prevention Program lifestyle intervention or metformin because it was associated with a significantly lower risk of incident diabetes in women at high risk attributable to prior gestational diabetes.[141,142] This should be considered routinely given the high prevalence of gestational diabetes in this population, particularly Asian Indian adults.

Pharmacological Interventions to Reduce Cardiovascular Outcomes in T2D

Different pathophysiological mechanisms of T2D between Asian and non-Asian adults have been proposed to cause defects in insulin secretion and insulin resistance.[143,144] Currently, the pharmacological management of Asian patients with T2D is similar to the approach used for non-Asian patients with T2D based on ADA and European Association for the Study of Diabetes guidance.[145,146] Most Asian countries recommend metformin as the first line of T2D medication because it is cost-effective and is used extensively in the Asian population.[138,147–149] However, Asian adults may also benefit from the newer medications in place of metformin monotherapy or in combination with metformin.[150–152] According to the 2022 ADA standard of care,[153,154] newer classes of drugs such as sodium-glucose cotransporter-2 inhibitors, glucagon-like peptide-1 receptor

agonists, and the nonsteroidal, selective mineralocorticoid receptor antagonist finerenone[155–160] provide several additional beneficial metabolic actions and cardiorenal protective effects. These medications are encouraging as a potential therapeutic choice in AsA adults because these medication classes are insulin independent and their use is likely not associated with hypoglycemia risk, a side effect that is common among the AsA population. Although there is a lack of randomized controlled trials that included significant numbers of AsA adults, subanalyses among Asian patients participating outside of the United States demonstrated that the efficacy and safety in Asian patients were comparable to those in the total study population evaluated in many of these trials and have demonstrated promising results.[161–166]

Recently, significant weight reduction was found in the STEP 1 trial[167] (Research Study Investigating How Well Semaglutide Works in People Suffering From Overweight or Obesity; glucagon-like peptide-1 receptor agonist) and the SURMOUNT-1 study[168] (A Study of Tirzepatide [LY3298176] in Participants With Obesity or Overweight; glucose-dependent insulinotropic polypeptide and glucagon-like peptide-1 receptor agonist). Both studies enrolled slightly more than 10% of Asian patients; however, limited data for AsA disaggregated subgroups are noted.

Cholesterol-lowering therapies are the cornerstone of ASCVD risk reduction in T2D. Studies from East Asian populations have suggested an increase in serious adverse events resulting from reduced statin metabolism relative to NH White adults.[169] However, studies of same dose of statins in South Asian adults have demonstrated similar efficacy and safety as in NH White adults.[170] Moreover, proprotein convertase subtilisin/kexin type 9 inhibitor is equally effective and safe in Asian and non-Asian adults in the FOURIER trial (Further Cardiovascular Outcomes Research With PCSK9 Inhibition in Subjects With Elevated Risk).[171]

Blood pressure management is important in patients with T2D. Substantial racial and ethnic variations in hypertension prevalence and treatment modalities in the AsA subgroups have been reported.[172] Because of a lack of evidence, there is no specific recommendation on antihypertensive drugs for AsA adults.

Role of Complementary and Alternative Medicines in T2D

Patients with poor glycemic control or those who are unsatisfied with the side effects of hypoglycemic medication will often self-prescribe and resort to complementary and alternative medicines (CAMs). Between 25% and 57% of people with T2D reported using CAMs in North America.[173–175] A national survey in the United States showed that the use of CAMs was as high as 57%.[176] Several CAM approaches have been evaluated for their effects in patients with T2D. These included traditional Chinese medicine, yoga, and reflexology.[173] Although no large-scale, randomized, long-term study has evaluated the effects of CAMs in the treatment of T2D, some dietary or herbal supplements (defined as vitamins and minerals, herbal remedies, homeopathic medicines, traditional medicines such as traditional Chinese medicines, probiotics, and other products such as amino acids and essential fatty acids) have shown to lower HbA1c by ≥0.5%, but most are single, small trials.[173,174] In a systematic review and meta-analysis of South Asian adults, yoga was found to have positive effects on reducing HbA1c and fasting and postprandial glucose values, but the risk of bias was high.[177] Although transcendental meditation has been showed to reduce blood pressure,[178] there is little evidence on the benefit of Tai Chi (mind/body techniques combining breathing, gentle body movements, and mental focus) in improving glycemic control in T2D.[173] In a small randomized study in Asia, acupuncture did not improve HbA1c in patients with T2D.[173]

Most patients do not report over-the-counter medication and dietary supplement use.[179] Thus, it is important for health care professionals to inquire about their use, consider any potential herb-drug interactions, and encourage patients to report any self-prescription of these products. Despite some consistencies in the benefit effects of CAMs, many AsA patients with T2D use these approaches. Health care professionals who are taking care of AsA adults should always ask about CAM use because some CAMs may result in unexpected side effects or interactions with traditional pharmacotherapies.

FUTURE DIRECTIONS FOR PUBLIC HEALTH AND HEALTH CARE PROFESSIONALS AND RESEARCH OPPORTUNITIES

Surveillance data related to T2D and ASCVD between AsA adults and other racial and ethnic subgroups are scarce. The limited data available are based largely on a single AsA aggregated, with much less information on individual AsA subgroups. Current evidence shows large variations in T2D and ASCVD risk and disease outcomes. Specifically, cardiometabolic health complications differ at different BMI thresholds between AsA individuals and people of other races and ethnicities.[180,181] Adverse cardiometabolic health profiles, in aggregate, collectively account for similar population-attributable risk of ASCVD globally.[42] The high prevalence of poor cardiometabolic health in certain AsA subgroups likely has multifactorial origins, including health behaviors (eg, high rates of sedentary behavior and poor-quality diet) and a wide range of social health determinants. Patterns in overweight and obesity, hypertension, and dyslipidemia may differ uniquely in AsA adults related to nativity[182] and length of residence in the United States and across different generations. Most data examine BMI or visceral fat cross-sectionally and fail to measure the long-term

Table 3. Specific Attentions for AsA Individuals in Public Health and Clinical Health Care

Public health	
National Surveillance System	AsA subgroups should be identified on hospital discharge information, and population-based studies and these subgroup data should be reported when possible.
	National surveys should oversample AsA individuals and ensure representation across at least the 6 largest subgroups of country of origin of themselves or their ancestries. Sampling should recognize the wide range of socioeconomic status and other population descriptors among AsA subgroups and focus on underresourced populations.
Major registries	Nationwide registries such as ACC's Chest Pain–MI registry, AHA's GWTG–Stroke registry, and the Diabetes Collaborative Registry should identify specific AsA subgroups on data collection forms, and these subgroup data should be reported when possible.
Community-based intervention	Community-based intervention to improve nutrition health and physical activity environment in AsA population–concentrated districts should be designed and evaluated.
Clinical health care	
Awareness[26,46,47,54]	Different AsA subgroups have different T2D and ASCVD risks.
	Asian Indian immigrants have the highest CAD risk and mortality among all AsA subgroups.
	Chinese American individuals and Japanese immigrants have a lower CAD risk, lower PAD risk, but higher hemorrhagic stroke risk compared with NH White individuals. Japanese immigrants have a higher prevalence of subarachnoid hemorrhage compared with NH White, Chinese, or Filipinos individuals.
	Filipino immigrants have a higher CAD risk and mortality and higher intracranial hemorrhagic and ischemic stroke risks compared with NH White adults.
Detection[32]	A lower threshold of BMI ≥23 kg/m^2 for overweight and BMI ≥27.5 kg/m^2 for obesity should be used for AsA people.
	AsA individuals should be screened for T2D if BMI ≥23 kg/m^2.
Intervention	Lifestyle interventions should be tailored to the different cultures of different AsA subgroups.
	CAMs and self-prescriptions are common in AsA subgroups; caution should be used for potential interactions with prescription medicine.
	Those who serve the Asian populations should become more involved in promoting community-based health promotion efforts.

ACC indicates American College of Cardiology; AHA, American Heart Association; AsA, Asian American; ASCVD, atherosclerotic cardiovascular disease; BMI, body mass index; CAD, coronary artery disease; CAM, complementary alternative medicine; GWTG, Get With The Guidelines; MI, myocardial infarction; NH, non-Hispanic; PAD, peripheral arterial disease; and T2D, type 2 diabetes.

Source: Data derived from "Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes–2022,"[32] Gordon et al,[26] Shah et al.,[46] Jose et al,[47] and Holland et al.[54]

change patterns (eg, trajectories, cumulative exposure) in adiposity, blood pressure, and cholesterol values across the life course. This change in pattern can be an important area for future investigation of T2D and ASCVD risk prediction in AsA populations.

In addition, we observed a paucity of pharmacological intervention data on AsA adults, and it is unclear whether there are intraethnicity differences among the AsA subgroups. Because of the high incidence and prevalence of T2D in AsA adults, there is an urgent need for specific physiological studies and long-term, prospective, randomized controlled trials that include large AsA subgroup patient samples to demonstrate their safety and efficacy. Future studies of ASCVD risk in AsA adults also need to be adequately powered, to incorporate multiple Asian ancestries, and to include multigenerational cohorts. With advances in epidemiology and data analysis and the availability of larger, representative cohorts, further refining the Pooled Cohort Equations, in addition to enhancers, would allow better risk estimation in segments of the population, including underrepresented racial and ethnic groups and those with social deprivation, and may allow more targeted risk assessment within diverse racial and ethnic groups.

Furthermore, AsA patients and health care professionals should be encouraged to use resources such as the joint AHA/ADA initiative Know Diabetes by Heart,[5] for which significant clinical updates are provided for controlling blood pressure, lipids, and glucose to reduce ASCVD risk in patients with T2D.

Last, this scientific statement outlines the specific areas to which public health and health care professionals should pay attention and future research opportunities to improve the prevention and management of T2D and ASCVD risk among AsA subgroups (Tables 3 and 4). This scientific statement offers important guidance for future directions for T2D and ASCVD research among AsA individuals as a population and as distinct subgroups.[183]

CONCLUSIONS

This AHA scientific statement summarizes available evidence on T2D and ASCVD among AsA adults and

Table 4. Research Opportunities

Culturally tailored measurement tools	Food frequency questionnaires that are comparable across Asian subgroups to adequately assess dietary factors related to ASCVD
	Physical activity instruments that can validate and expand existing self-reported data
	More accurate measures of body fat (other than BMI) that capture differences in adiposity between subgroups
Novel risk factors/risk prediction	Novel genetic mutations and differences in allelic frequency in AsA subgroups
	Biological and social factors that act independently and in combination to modify cardiovascular risk in AsA subgroups
	Risk prediction models that account for the difference in prevalence and relative importance of ASCVD risk factors in AsA subgroups
Potential mechanistic pathways	Specific physiological studies and long-term, prospective, randomized controlled trials of recently approved drugs among AsA patients for their safety and efficacy
	Impact of diet, physical activity, and sleep on regulation of novel phenotypes measured with continuous glucose-monitoring instruments
	Well-designed studies on unexpected side effects of CAM and interactions with regular pharmacotherapies
Disease outcome research	Disparities in access to care among different AsA subgroups with or without similar social or demographic status
	Impact of acculturation and social network on T2D and ASCVD

AsA indicates Asian American; ASCVD, atherosclerotic cardiovascular disease; BMI, body mass index; CAM, complementary alternative medicine; and T2D, type 2 diabetes.

their subgroups (Figure 3). Particular attention should focus on the T2D and ASCVD risk differences among the different AsA subgroups because they may affect the precision in clinical and health outcomes. Challenges to providing evidence-based recommendations include the limited data on AsA adults in risk prediction models, national surveillance surveys, and clinical trials, leading to significant research disparities in this population. Last, culturally specific recommendations and interventions across the different AsA subgroups related to T2D and

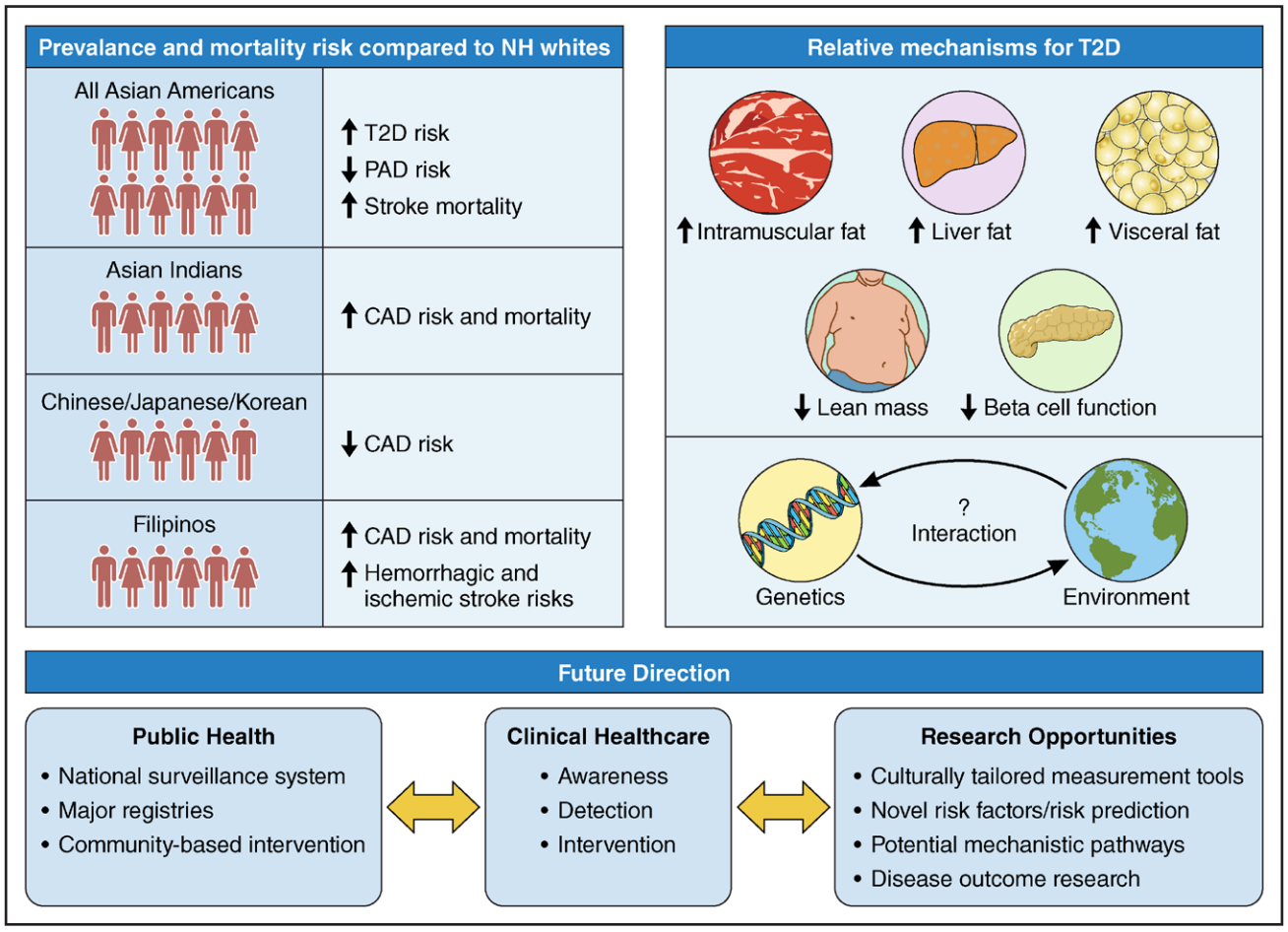

Figure 3. Summary of available evidence and future direction for T2D and ASCVD among AsA subgroups.
AsA indicates Asian American; ASCVD, atherosclerotic cardiovascular disease; CAD, coronary artery disease; NH, non-Hispanic; PAD, peripheral artery disease; and T2D, type 2 diabetes.

ASCVD will help improve primary and secondary prevention and health outcomes in this population.

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The American Heart Association makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest.

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Latha P. Palaniappan	Stanford University	None	None	None	None	None	None	None
Prakash C. Deedwania	University of California at San Francisco School of Medicine, Fresno	None	None	None	None	None	None	None
Laura L. Hayman	UMass Boston Manning College of Nursing and Health Sciences	None	None	None	None	None	None	None
Yuling Hong	NHLBI/NIH	None	None	None	None	None	None	None
Alka M. Kanaya	University of California, San Francisco	NIH (several of her grants are on the topic of diabetes in Asian populations)*; DSMB for NIH trials (she is on the DSMB for a behavioral trial testing dietary interventions for diabetes patients)*	None	None	None	None	None	None
Asma Khaliq	Lenox Hill Hospital/ Hofstra North Shore–LIJ School of Medicine	None	None	None	None	None	None	None
Sadiya S. Khan	Northwestern University, Feinberg School of Medicine	None	None	None	None	None	None	None
Svati H. Shah	Duke University Medical Center	None	None	None	None	Unlicensed patents held by Duke University*	None	Duke University School of Medicine (professor)†
Francine K. Welty	Beth Israel Deaconess Medical Center	None	None	None	None	None	None	None
Sally S. Wong	American Heart Association	None	None	None	None	None	None	None

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 $5000 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 $5000 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
Vijay Nambi	Michael E. DeBakey Veterans Affairs Hospital, Baylor College of Medicine, and Methodist DeBakey Heart and Vascular Center, Houston, TX	None	None	None	None	Abbott Labs*	None	None
Liming Pei	Children's Hospital of Philadelphia/University of Pennsylvania	NIH (R01 DK111495, U54HL156090 and P30 DK019525)†; US Department of Defense (W81XWH20-1-0042, W81XWH20-1-0089, W81XWH-221-0058, and PR210230P2)†	Pfizer (antibody for basic research)*	None	None	None	None	None
Nilay S. Shah	Northwestern University Feinberg School of Medicine	NHLBI (K23HL157766)†	None	None	None	None	None	None
Nathan D. Wong	University of California	Novo Nordisk (research support through institution)†	None	None	None	None	Amgen*; I-Heath*	None

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 $5000 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 $5000 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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