Cardiovascular Risk Management in the South Asian Patient: A Review

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Abstract

South Asians represent a growing percentage of the diverse population in the U.S. and are disproportionately impacted by a greater burden of aggressive and premature cardiovascular disease. There are multiple potential explanations for these findings including a high prevalence of traditional risk factors (particularly diabetes, dyslipidemia, and obesity), a genetic predisposition, and unique lifestyle factors. In this review, we discuss the cardiovascular risk stratification and disease management goals for South Asian adults. We review the pharmacologic and non-pharmacologic interventions studied in this population and discuss the role of specialized clinics and digital outreach to improve care for this vulnerable group of patients.

Keywords

Introduction

South Asians residing within the United States (SAUS) represent one of the largest growing portions of the diverse population, having grown over 40% within the past ten years [1]. SAs are those who themselves or their ancestors originate from the countries of Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka and/or the Maldives [2]. While this represents a group with a heterogeneous background of cultural and genetic differences, SAs are disproportionately impacted by a greater burden of premature and aggressive cardiovascular

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disease (CVD) when compared to other ethnicities.3 The reasons for these findings may represent a combination of high burden of comorbidities, lifestyle factors, and genetics. The cardiovascular care of the SA patient has many unique considerations. In this review, we will discuss the epidemiology and clinical management goals to reduce the burden of CVD for SAUS. Lastly, we will discuss the future steps to improve CVD care including digital health, community outreach, and specialized clinics.

Epidemiology

Historic data regarding CV risk and outcomes in SAs has not been readily available given broad racial/ethnic categorizations frequently utilized in clinical research. The categorization framework originates from the U.S. Census and Office and Management and Budget which provided guidance on clinical research groupings for racial/ethnic categories, in which the term "Asian Indian" is used [4,5]. Other SAUS such as people originating from Pakistan or Bangladesh may be grouped into the "Asian Indian" category, or categorized as "Other Asian". Even within SAs as a group, there exists some heterogeneity; for example, there exists a higher odds of dyslipidemia among South Indians when compared to North Indians [6].

Asians with origins from different countries have varying metabolic, genotypic and phenotypic traits that can impact risk for specific health outcomes especially cancer, diabetes and coronary artery disease (CAD). For instance, Asian Indian and Filipino have an increased risk of mortality due to heart disease and also higher prevalence of diabetes mellitus when compared to other Asians [7,8]. The proportionate mortality burden of hypertensive heart disease and cerebrovascular disease, especially seen in hemorrhagic stroke, is higher in every Asian-American subgroup in comparison to the non-Hispanic white population [3]. Asian Indians have earlier onset and more severe CVD than any other racial/ethnic groups [3,9]. Strong relationships among elevated blood pressure, increased levels of lipoproteins, obesity, physical inactivity, high occurrence of coronary heart disease, and type 2 diabetes cases align with this increased risk [10]. Genetic and phenotypic differences within Asians populations can also impact disease burden as the body is not able to optimally metabolize drugs. For instance, CYP2C19 metabolizes the antiplatelet and alteration in its activity may influence therapeutic efficacy of drugs[11]. Loss-of-function variants have been shown to increase the risk for adverse cardiovascular outcomes, and there are multiple variants that are key pharmacogenetic determinants in Indians [11,12].

Sociodemographic factors such as household income, level of education, diet, and immigration status are all components of social determinants of health which impact both access to and quality of care. Previous studies looking at SA diets have shown a division between two patterns ("Western" and "Vegetarian") and that individuals with the vegetarian diet had lower insulin resistance and lower high-density lipoprotein cholesterol[13]. Despite numerous studies showing the heterogeneity within Asian subgroups, targeted care to these specific diseases is lacking for most Asian subgroups.

Risk factors

SAUSs have unique risk profiles for CVD including both contemporary and novel risk factors[14]. Common findings in population studies have demonstrated a greater number of lipid abnormalities and glucose intolerance. Asian Indians have demonstrated earlier onset and more severe cardiovascular disease than any other racial/ethnic groups [15].

Much of the contemporary data regarding cardiovascular risk factors originates from cohort as well as electronic health record (EHR) studies. The Mediators of Atherosclerosis in South Asians Living in America (MASALA) study[16] is a cohort study investigating the prevalence, correlates, and outcomes associated with subclinical CVD among SAUS men and women. Beyond MASALA, other important findings have originated from sources including the UK BioBank[17] and the INTERHEART study. The INTERHEART study compared cardiovascular (CV) risk factors in 52 different countries including India, Pakistan, Bangladesh, Nepal, and Sri Lanka[18]. EHR studies have also shown substantive differences in prevalence of conditions including coronary artery disease (CAD), diabetes mellitus (DM), and hypertension, across Asian-American ethnic groups [19].

Coronary artery disease (CAD)

SAs are generally younger at the time of their first myocardial infarction (MI) and in some studies have been shown to have more severe CAD at angiography [20,21]. Asian Indians in the US seem to be especially vulnerable to CAD with several studies demonstrating an earlier onset of acute coronary syndromes compared to White/European populations, increased severity of CAD at initial presentation, more frequent hospitalizations for ischemic heart disease and higher CAD-related mortality in younger patients [2]. The proportionate mortality burden from ischemic disease, as reflected by the proportional mortality rates, was highest in Asian Indian men (1.4) and women (1.1), followed by Filipino men, compared with non-Hispanic White men and women[5]. The MASALA Study has shown that SAUSs and Asian Indians have a high prevalence of coronary artery calcium on computed tomography (CT) scan despite having a lower prevalence to some of the more traditional CAD risk factors[16]. CAD has been shown not only to develop at a younger age among SAs compared to other populations, but also to be more severe and malignant, resulting in death at younger age [22].

The greater susceptibility within the SA population to CAD cannot be explained entirely by conventional risk factors alone. Elevated Lipoprotein(a) (Lp(a)) levels are a major determinant of CAD, myocardial infarction, and stroke, especially at younger ages. The impact of elevated Lp(a) level on CAD risk is heterogeneous across ethnic groups, with greater risk imposed on Asian Indians [23]. To accurately reflect these risks, providers should develop consensus risk and diagnosis guidelines for CAD tailored to the SAUS population.

Insulin resistance and diabetes mellitus

There exists a disproportionately high age-adjusted prevalence of impaired glucose tolerance and type 2 diabetes mellitus (DM) among SAUS, with estimates ranging from 14 to 33% [24].⁻[25] SAs have higher fasting insulin levels and greater insulin resistance compared to

non-Hispanic White individuals [14,25]. Reasons for these findings include the possibility of low muscle mass and poor pancreatic insulin secretion among SAs. It is theorized that reduced beta-cell mass and/or function may predispose to an inability to adequately compensate for higher glucose levels in the setting of insulin resistance [26,27]. This may be compounded by lifestyle choices related to culture and migration, epigenetic and metabolic mechanisms as well as ectopic fat deposition within the liver that is greater within SAs [28]. Additionally, migrant SAs appear to develop DM earlier (on average 9 years) than White individuals, highlighting the need for earlier screening and interventions [29]. There have not yet been specific race or ethnic specific cut-offs developed to consider diagnosing and managing DM earlier in this population.

Hypertension

Hypertension is a common risk factor among SAs and is associated with a greater likelihood of myocardial infarction. [20]. In the MASALA study, the prevalence of hypertension was found to be 43% in SAUS males and 35% among females. SAUSs have a significantly higher prevalence of hypertension when compared to European counterparts in the UK BioBank study [17]. In one cross-section study from an ambulatory care setting, most minority subgroups including Asian Indians had lower or similar odds of having hypertension compared with non-Hispanic White individuals (except for Filipinos and non-Hispanic Black individuals) [30].

According to current US guidelines, normal blood pressure is defined as <120 over <80 mmHg. Patients with a blood pressure between 130 and 139/80–89 mmHg and with a CV risk of 10% using the pooled Cohort risk calculator are often treated pharmacologically. Hypertension in the SA population is rarely isolated, as these individuals often carry additional atherosclerotic risk factors. In the California Health Interview Survey, SA immigrants with hypertension had a 2-fold greater odds of being overweight or obese [31]. The association between body mass index (BMI) and hypertension is greater among SAs, even at lower cut-off points for "overweight" and "obese."[32] Within the SA population, hypertension is also strongly associated glucose intolerance[33] and other risk factors which may not be adequately captured by current screening methods. These include tobacco use which is likely underreported as smokeless tobacco (i.e. paan) may not be routinely assessed or reported [34].

Drivers of hypertension may include ethnic foods of higher sodium content (e.g. some lentils, fenugreek, amaranth)[35]. Dietary choices (Mediterranean diet or a diet high in fruits, vegetables, nuts and legumes) and social connectedness have been associated with improved control of hypertension in SAs suggesting that medical treatment as well as addressing social determinants of health both play important roles in addressing the hypertension epidemic [13,36]. Addressing cultural dietary preferences, the importance of physical activity, health literacy about hypertension, and the role of medications is considered essential to improving the health of the SA population [37].

Obesity

Traditional obesity metrics have recently been reclassified among SA patients due to emerging data on the substantially higher prevalence of DM that occurs at a lower BMI when compared to patients of European Ancestry. The World Health Organization (WHO) and National Institute for Health and Care Excellence (NICE) recommend a BMI cut-off of 27.5 kg/m^2 as the definition of obesity in SAs (vs. 30 kg/m^2 in individuals of European Ancestry). This cut point suggests not only the classification of obesity but the point at which measures should be taken to prevent DM [38,39]. Similarly, the American Diabetes Association has also recommended clinicians consider testing for DM in all Asian American adults who present with a BMI 23 kg/m^2 [40]. An equivalent risk of DM occurs in SAUSs at lower BMI thresholds suggesting a more aggressive, ethnicity specific cutoff for obesity [41].

Tobacco use

Tobacco use is strongly associated with the development of CAD and has been reproduced in multiple studies. Within INTERHEART, current and prior tobacco use were strongly associated (odds ratio 2.6) with a risk of acute MI in SAs[18]. The Bangladesh Risk of Acute Vascular Events study enrolled patients after their first MI and evaluated the impact of smokeless tobacco use (jarda or gul) on outcomes. Current tobacco consumption (79 vs. 63%) was higher in the group with MI compared with controls[42]. Other forms of tobacco consumption include paan masala, which is a mixture of herbs, nuts, and seeds along with tobacco. Data from California demonstrates Asian Indians utilize cultural smokeless tobacco (i.e. jarda or gul) with a greater prevalence than cigarette use [43]. In one study, mean blood pressure, total cholesterol, triglycerides, and LDL were found to be greater in those who use paan masala compared to those who do not[44] Questions regarding both traditional tobacco use (cigarettes) as well as smokeless and consumed tobacco products (paan, jarda, gul) should be asked when performing CV risk screening.

Risk assessment tools

Risk calculators serve as important tools for the clinician to both understand the potential impact of lifestyle modifications as well as to counsel decision-making regarding risk versus harm of interventions. Atherosclerotic CVD (ASCVD) risk estimation remains an important early step in the clinician-patient risk discussion. Accuracy of ASCVD event rates is essential to balance the benefits and risks of treatment so that preventive medications are allocated to those who would benefit the most [45]. Current commonly used ASCVD risk calculators have not included or been prospectively validated among SAs and therefore there is the potential for risk misclassification, risk underestimation, and undertreatment. Furthermore, calculators such as the Pooled Cohort Equation (PCE) have been shown to generally overestimate most racial and ethnic groups for ASCVD risk, with marked heterogeneity by disaggregated Asian subgroups [46].

Recognizing the higher risk among SAs, the European Society of Cardiology guidelines recommends multiplying the Systematic Coronary Risk Evaluation risk estimate by 1.4 for SA individuals. The QRISK3 score, developed with large-scale electronic medical record

data, similarly incorporates variable multiplication factors ranging from approximately 1.3 to 1.7 for individuals of Indian, Pakistani, or Bangladeshi origin [47]. The American Heart Association/American College of Cardiology/Multisociety cholesterol guideline recommends using equations for Non-Hispanic Whites (NHW) in deriving risk for SA but makes no specific recommendations for an adjustment factor. The guideline does recognize SA ethnicity as a risk enhancing factor which theoretically should increase estimated ASCVD to a higher risk stratum for those at estimating borderline or intermediate risk. However, the guideline gives no specific guidance of the magnitude increased risk the SA ethnicity confers. As such, alternative methods for estimating ASCVD risk among SAs such as measurement of subclinical atherosclerosis may be beneficial.

Computed tomography imaging

The measurement of coronary artery calcium (CAC), a highly specific marker of subclinical atherosclerosis, may be a useful test to improve risk stratification and guide preventive efforts for SAs [15]. Importantly, SAs have a greater burden of coronary plaque (both obstructive and nonobstructive) compared to other ethnicities in age-matched analyses [48,49]. The extent of ASCVD-risk overestimation using the Pooled Cohort Equations (PCE) is greater among SA adults considered at low/intermediate risk than among White adults, such that intermediate-risk SA individuals have a 73% higher odds of CAC score of 0 [15]. With respect to hypertension management, incorporation of CAC measurement may help identify those SAs who would best qualify for aggressive lifestyle optimization and anti-hypertensive pharmacotherapy [50]. CAC scoring is likely to be of benefit to SA with a family history of any CVD (first degree relative – father/mother/sibling), considering a higher burden of CAC (>300) in this population [49]. When compared to available non-traditional risk markers, CAC scoring is the preferred noninvasive modality for further risk refinement in SAUS as noted by available recent expert consensus [48,51].

Genetics and family history

The prevalence of family history of heart disease in SA ranges between 40 and 50% based on data from epidemiologic cohorts. Genetic studies have found high rates of homozygosity among SA individuals living in SA as a result of high rates of reproductive isolation, endogamy and consanguinity [49]. Prior cohort studies have demonstrated that family history is associated with higher risk of subclinical and clinical coronary events independent of traditional cardiovascular risk factors. A recent publication from the UK Biobank confirmed that SA ancestry is a risk-enhancing factor and that residual risk persisted after accounting for mediators, suggesting the role of genetics warrants future investigation [17]. SAs individuals had substantially higher risk of atherosclerotic cardiovascular disease compared with individuals of European ancestry, and this risk was not captured by the Pooled Cohort Equations. Ultimately, family history may point to shared genetic pathways that are unique to SA and not adequately captured by traditional risk factors in addition to shared environment. Genomic studies should help identify novel therapies in the future among SA and can open the door for more precise treatment in this group.

Lipids

All of the burden of CVD in SAs cannot be attributed solely to established atherosclerotic risk factors, particularly in younger individuals. LDL-C and total cholesterol level may markedly underestimate CAD risk in SAs. Nearly a quarter of Indian patients with CAD have a total cholesterol less than 150 mg/dL and/or LDL less than 100 mg/dL [52]. Although significant if elevated, normal levels of these lipid values do not translate to low risk in the SA population. Lp(a) is a strong genetic risk factor for premature CAD and may be elevated independent of significant LDL elevation. Lp(a) is well established as an independent risk factor for cardiovascular disease in non-Hispanic whites [53]. Importantly, SAUSs in the MASALA study had a higher median Lp(a) concentration compared with whites, Hispanics, and Chinese Americans, though lower than Blacks [54].

Lp(a) concentrations are high in SAUS (particularly Asian Indians) and across the diaspora and relate directly to increased incidence of CAD [23,55]. The INTERHEART Study revealed that the population-attributable risk of high Lp(a) for MI varied from 0% in Africans to 9.5% in SAs, with double the attributable risk for future MI in SAs when compared to White participants [56]. Approximately 25% of Asian Indians and other SAs have elevated Lp(a) levels (50 mg/dl), rendering Lp(a) a risk factor of great importance, similar to or surpassing diabetes. LDL particles that are highly enriched with apoB and Lp(a)may explain some of the risk of CAD from Lp(a) among SAs [20]. SAs have higher apoB/apoA1 ratio (1.53 vs 1.47) than whites, despite having a lower total cholesterol level (184 mg/dl vs. 204 mg/dl). SAs have both lower levels of high density lipoprotein (HDL) particles which also appear to be smaller, dysfunctional, and proatherogenic in South Asians. In African Americans and Non-Hispanic White cohorts, Lp(a) and family history have independent and additive joint associations with cardiovascular risk and may be useful concurrently for guiding primary prevention therapy decisions in SAUS [57].

Cardiovascular risk reduction and therapies

Lifestyle

Optimizing lifestyle behaviors is a robust opportunity for health improvement among the SA community. While underlying physiologic and genetic risk factors play a significant role in elevating the risk for CVD, physical inactivity and unhealthy dietary patterns superimposed upon this further heighten the risk. When compared to other ethnicities, SAs tend to have lower rates of reported physical activity [2]. Additionally, the dietary patterns of SAUS often consist of an unhealthy combination of traditional and Western foods. Many of the traditional SA snacks, sweets, and entrees are rich in refined carbohydrates, are fried, and contain a high content of saturated fat [51]. These include items such as mithai, jalebi, paneer, ghee, and tropical cooking oils. Furthermore, many cooking styles incorporate deep frying and overcooking vegetables in oil, both of which reduce their nutritional content and increase the amount of fat and sodium intake.

In order to optimize lifestyle modifications for SAUS, the areas for improvement must be targeted in a culturally sensitive and appropriate manner. The 2019 ACC/AHA Prevention guidelines recommend a minimum of 150 min of moderate intensity physical activity

per week [45]. While traditional Western modes of physical activity such as running, weight lifting, etc., are less common among SAs, culturally tailored and more social methods may be used to motivate increased physical activity. Dietary modifications should focus on increasing the consumption of fresh fruits and vegetables instead of overcooking vegetables, consuming more whole grains instead of simple carbohydrates (i.e. substitution of carbohydrate rich foods which as white rice and white bread with brown rice, quinoa, oatmeal, and whole grain bread), consuming a diet that is low in saturated fat and high in lean proteins. In conjunction, the use of tropical oils, fried, salty, sugary or processed foods, and refined carbohydrates should be limited or discouraged [51].

Complementary and alternative medicines (CAAM)

Non-traditional SA medicines include ayurveda, sowa rigpa, siddha, unani and region specific herbal traditions [58]. Ayurveda medicine, for example, emphasizes the intrinsic relationship between the body, mind, and consciousness; treatment consists of the use of herbal preparations, diet, yoga, and meditation [59]. However, limited data is available on these approaches with respect to the cardiovascular outcomes. Alternatively, yoga in particular has been shown to lower body weight, reduce blood pressure, and improve lipid levels [59]. Ultimately, more rigorous research is required to determine the precise physiologic effects and long-term benefits on cardiovascular morbidity and mortality of these interventions.

Pharmacologic interventions

We will discuss specific desirable levels of risk markers for the SA patient. (Table 1 - adapted from Kalra et al.) [51]. The strategy on how to get to these goals in terms of specific pharmacotherapeutic interventions will be discussed as well.

Dyslipidemia

The AHA/ACC cholesterol guideline makes no specific recommendations on statin dosing among SA. The use of moderate or high-intensity statin should be aligned with guidance made for primary or secondary ASCVD prevention. Similarly, no race-specific recommendations are established for other non-statin therapies including ezetimibe and PCSK9 inhibitors which are currently endorsed for secondary prevention of ASCVD [45]. While the use of fibrates may purportedly be beneficial for SA given their preferential effects on lowering triglycerides and raising HDL-C, no major trial has recruited SA to evaluate efficacy in this group. The measurement of Lp(a) remains an important test particularly as RNA-based therapies (antisense oligonucleotides, i.e. APO(a)L$_{rx}$) which are able to reduce Lp(a) from 35% to over 80%, continue to undergo testing in trials for clinical outcome improvement [60].

Diabetes/Insulin resistance

As insulin resistance appears to be a major contributor to metabolic abnormalities in SA, there are few dedicated studies focusing on a SA population from a therapeutic perspective. The use of incretin-based therapies such as dipeptidyl peptidase-4 inhibitors and glucagon-like peptide-1 analogs may be especially useful for SAs [61]. It may also

be reasonable to initiate therapy with glucose-lowering agents that have proven efficacy for both improving DM as well as reducing CVD risk sodium glucose cotransporter-2 inhibitors. Further research regarding individualized targets and specific agents for SAs remain to be investigated.

Hypertension

The efficacy of all classes of antihypertensive medications is likely similar for SA compared to other race/ethnic groups but this cannot be conclusively determined as no major trial has recruited a majority of SA participants. Treatment of hypertension should follow recommendations made by major guidelines. As noted, most data on pharmacologic treatments for SA have relied on studies that have largely excluded this racial/ethnic group. Future trials should focus on increasing representation of SA to evaluate efficacy in this subgroup. Furthermore, pharmacogenomic studies are needed to not only understand genetic contributions to various disease pathways but also to evaluate individual variability in response to pharmacologic agents. This approach could potentially help tailor therapies that are expected to yield greatest benefit in this racial/ethnic group.

Fig. 1 summarizes risk stratification considerations, tools, and therapeutics for the care of the SA patient.

Future steps

Increasing awareness & digital outreach

SAs represent one-quarter of the world's population and account for 60% of the world's CVD burden. It is important for advocacy to prioritize SA CV health as part of their culturally-equitable strategy to ensure primary and secondary prevention across communities. Methods of engagement by national and international societies can and should include funding for research in specific populations, community education regarding nutrition, SA specific nutrition habits and encouragement of exercise, and promoting prevention for the next generation who face an increasing threat of being sedentary due to our digital lifestyle. In 2005, the "Walk with a Doc" program (http://www.walkwithadoc.org) was started to model physical activity and encourage patients to become physically fit with their communities. The program has since expanded to hundreds of chapters in the US, underscoring a need and desire to increase fitness in an engaging, community-centric way. In the era of a global pandemic, patients have faced increasing isolation, but also have increased access to digital connectedness. The use of technology in our daily life offers the opportunity to help individuals know their numbers, engage in better understanding their CV fitness through digital platforms connected to the medical record, track progress and see their successes reflected in real time, as well as communicate more efficiently with their clinical teams. Technology has been leveraged to increase access to exercise classes of any type, utilizing live streaming or pre-recorded workouts, and facilitate community-building along with digital health education.

The role of digital health as a prescribed therapeutic continues to expand. Recent trials reveal that blood pressure management in the post-partum setting can be better monitored

(and achieved) by using text messaging rather than in-office appointments [62]. Mobile health (text messaging) interventions have shown some promise for improving diabetes-related health behaviors in countries like India [63]. Innovative mechanisms that use digital technology to enable patients to monitor their CV risk factors may therefore be an essential mechanism for the infrastructure to build digital health for primary CV prevention in SAs.

South Asian CVD risk identification and management programs

Given that SAs are the fastest growing ethnic group with the SAUS population nearly doubling between 2010 (3.5 million) and 2017 (5.4 million), it is critical that the looming rising tide of CVD in this growing segment of the population is recognized[1]. The AHA has defined metrics for ideal, intermediate and poor cardiovascular health based on achievement of 7 modifiable health behaviors and indicators ("Life's Simple Seven"), including smoking, diet, physical activity, body mass index, blood pressure, total cholesterol, and fasting glucose. It is particularly striking that in the MASALA study, none of the participants achieved ideal levels for all 7 metrics[64]. Further, less than 3% of the MASALA participants were able to achieve an optimal diet. The diversity of cultures, diet, and beliefs among SAs makes it difficult to crystallize risk on a population level, with 2nd generation SAUS adding a layer of complexity, as they adhere variably to both western and South Asian cultural norms. Therefore, there is a need for focused clinics to recognize and address risk factors in SAs to facilitate achievement of optimal risk factors, with attention to cultural preferences and nutritional requirements unique to this population. Many centers have emerged in urban areas, such as Baltimore, Boston, Plano, Chicago, Houston, New Jersey and San Francisco, from which data will be critical to further clarify the burden and mechanism of CVD risk enhancement in SAs. Data from the South Asian Heart Lifestyle Intervention (SAHELI) group[65] and South Asians Active Together (SAATH) Study[66] will be instrumental in beginning to evaluate the efficacy of lifestyle intervention on ASCVD outcomes.

Future studies and clinical efforts

As the number of SAUS grows over time, we anticipate a greater use of digital health for both increasing awareness and outreach of both the risk of cardiovascular disease as well as for opportunities regarding participating in and funding research efforts. We anticipate a greater number of focused clinics which pay greater attention to both ancestry of patients as well as the relationship between cultural behaviors and impact on cardiovascular health. There will be more focused studies, including most recently Our Health (https://ourhealthstudy.org/), which aims to "build a coalition of researchers and participants to better understand – and ultimately overcome – the persistently high rates of cardiovascular diseases among South Asian populations through the creation and study of a new cohort." Beyond the SAUS population, we anticipate continued growth of research and clinical efforts focused on high-risk minority populations, as we continue to learn more regarding the impact of ancestry, genetics, cultural practices, and social determinants of health, on disease.

Conclusion

SAs represent a large and growing portion of the US population. While this population remains heterogeneous in terms of its religions, languages, and cultures, there appear to be many common traits in terms of CVD risk and adverse CV outcomes. Lifestyle intervention studies as well as dedicated pharmacotherapeutic studies will have a significant impact on reducing the burden of disease among this population. Furthermore, an increased awareness along with specialized SA CVD dedicated programs will be critical steps to help reduce the burden of CVD.

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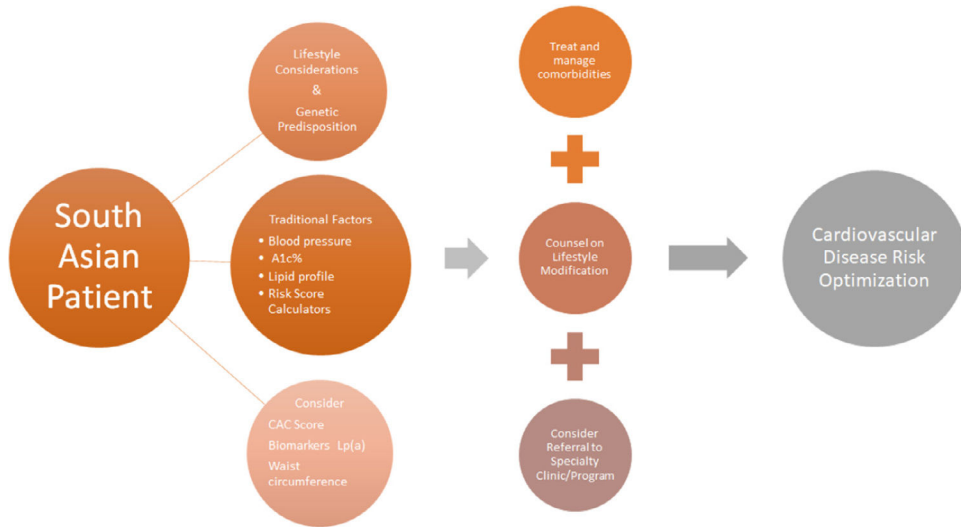[66]. Kandula N, A Multilevel Physical Activity Intervention for South Asian Women and Girls (SAATH), 2021 https://clinicaltrials.gov/ct2/show/NCT04400253.

Fig. 1.
A framework for the CVD management of the SA patient.

Table 1

Recommended desirable levels for CVD risk factors for SAUS [51].

Risk Factor	Desirable Goal		
	High Risk	*Very High Risk*	*Extreme Risk*
Total Cholesterol	< 160 mg/dL		
LDL-C	< 70 mg/dL	< 50 mg/dL	< 30 mg/dL
Non-HDL-C	< 100 mg/dL	< 80 mg/dL	> 60 mg/dL
HDL-C	> 40 mg/dL (men) and > 50 mg/dL (women)		
Triglycerides	< 150 mg/dL		
HBA1c%	< 6.0%		
Lp(a)	< 100 nmol/L		
Waist Circumference	< 35″ (men) and < 31″ (women)		
Body Mass Index	< 23 kg/m2		