

Cardiovascular Health by Life's Essential 8 and Associations With Coronary Artery Calcium in South Asian American Adults in the MASALA Study



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South Asian Americans experience high cardiovascular disease risk. We evaluated the distribution and correlates of cardiovascular health (CVH) summarized by the Life's Essential 8 (LE8) score among South Asian adults. In participants of the MASALA (Mediators of Atherosclerosis in South Asians Living in America) study, the association of demographic, social, and cultural factors with LE8 score was evaluated with *t* tests and analysis of variance. The association of LE8 score with coronary artery calcium (CAC) was evaluated with adjusted logistic regression. There were 556 women (mean age 55.9 years [SD 8.7], mean LE8 score 67.2 (SD 12.6) and 608 men (mean age 57.5 years [SD 9.9], mean LE8 score 61.9 (SD 13.1). Among women and men, the LE8 CVH score was higher in participants with higher annual family income, higher educational attainment, and fewer depressive symptoms. Overall, there was 26% lower odds of any CAC for each 10-point higher LE8 score (odds ratios [OR] 0.74, 95% confidence intervals [CI] 0.66 to 0.83), with similar magnitude of association in women and men. Participants with a high LE8 CVH score had 82% lower odds of CAC (OR 0.18, 95% CI 0.09 to 0.33), and participants with an intermediate LE8 CVH score had 38% lower odds of CAC (OR 0.62, 95% CI 0.41 to 0.94) than did participants with a low LE8 CVH score, with similar findings stratified by gender. In conclusion, in this cohort of South Asian Americans, most adults had suboptimal CVH assessed by the LE8 score. Higher LE8 score correlated with lower odds of any CAC. © 2023 Elsevier Inc. All rights reserved. (Am J Cardiol 2023;199:71–77)

Subjects of South Asian ancestry (from Bangladesh, India, Pakistan, Sri Lanka, and Nepal) experience higher rates of cardiovascular disease than do adults of other racial and ethnic groups.¹ The burden of cardiovascular risk factors is frequently described with a summary construct termed “cardiovascular health” (CVH). In 2010, the American Heart Association (AHA) defined CVH as a composite measure of poor, intermediate, or ideal levels of 7 CVH factors and behaviors (blood pressure, blood glucose, blood cholesterol, body mass index [BMI], smoking, dietary quality, and physical activity), commonly referred to as the “Life's Simple 7” (LS7) score.² Among South Asian

American adults in the MASALA (Mediators of Atherosclerosis in South Asians Living in America) cohort, higher LS7 scores were associated with lower odds of coronary artery calcium (CAC)³ and upstream social factors such as social networks and discrimination.^{4,5}

However, the LS7 score had suboptimal sensitivity to intersubject differences and differences over time in CVH because each CVH factor is characterized only into poor, intermediate, or ideal levels. In 2022, the AHA updated the CVH score (now termed “Life's Essential 8,” [LE8]) by enhancing the definitions of each CVH factor to account for greater variability in each measure and by adding sleep duration to the score as another CVH risk factor.⁶ To better characterize CVH prevalence and its associations with demographic and sociocultural factors and CAC in South Asian American adults, we calculated the LE8 CVH score in South Asian American adult participants in the MASALA study. Updating the CVH definition in South Asian American adults using the LE8 definitions will facilitate better understanding of suboptimal cardiovascular risk factors in the South Asian population and more accurately assess the burden of suboptimal CVH in this group with enhanced cardiovascular risk, particularly given the updated LE8 now accounts for ethnicity-specific definitions of risk factors such as BMI.

Methods

The MASALA study is a community-based cohort of South Asian American adults free from cardiovascular

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See page 76 for Declaration of Conflict of Interest.

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disease at enrollment. The LE8 CVH score was calculated in participants in the MASALA study with baseline data available from study examination 1 (enrolled 2010 to 2013, $n = 906$) and examination 1A (enrolled 2017 to 2018, $n = 258$) which are combined into a baseline group ($n = 1,164$). Detailed MASALA study design and data collection methods have previously been presented.⁷ The MASALA study was conducted at 2 sites (University of California—San Francisco in San Francisco, California; and Northwestern University in Chicago, Illinois) and was approved by the institutional review board at both institutions. Participants provided written informed consent.

Definitions and scoring of the individual CVH factors and behaviors followed the recommendations of the AHA LE8 guideline, adapted to the available data in the MASALA study (Supplementary Table 1).⁶ Each component LE8 CVH metric was scored between 0 and 100, with 0 indicating the lowest level and 100 indicating the highest level. Calculation of the LE8 diet score was based on quintiles of Dietary Approaches to Stop Hypertension-style diet adherence assessing dietary intake in the past year. The LE8 physical activity score was determined on the basis of minutes of moderate- (or greater) intensity intentional physical activity per week. The LE8 nicotine exposure score was calculated on the basis of self-reported smoking history and secondhand smoke exposure. Use of non-cigarette nicotine delivery systems (eg, electronic cigarettes) was not queried in MASALA. The LE8 BMI score was calculated on the basis of objectively measured height and weight and scored using the AHA advisory-recommended levels for subjects of Asian ancestry.⁶ The LE8 lipids score was calculated on the basis of levels of non-high-density lipoprotein cholesterol, calculated from laboratory-measured total cholesterol minus high-density lipoprotein cholesterol. The LE8 blood glucose score was calculated on the basis of history of diabetes, fasting glucose levels, and hemoglobin A1c levels. The LE8 blood pressure score was calculated on the basis of seated systolic and diastolic blood pressure measurements. Sleep duration assessment was not collected at MASALA study examinations 1, 1A, or 2 to calculate the LE8 sleep score.

The composite LE8 CVH score was calculated for all MASALA study participants, without any participants excluded owing to missing data. This was possible because the LE8 CVH score can be calculated even when individual CVH factors or behaviors are missing, as recommended by the AHA advisory for the LE8 score.⁶ The composite LE8 score is an unweighted average of the available individual CVH component scores. For example, if a participant is missing data on dietary pattern and sleep duration, their LE8 CVH score is an average of the component scores of the 6 available CVH factors. Because the sleep duration measures are not currently available, the overall LE8 CVH score was calculated as the unweighted average of up to 7 CVH factors and behaviors in all participants in MASALA.

Demographic variables included age, gender, annual family income (less than or \geq \$75,000 per year), and educational attainment (at least Bachelor's degree vs lower attainment). Participants self-reported their country of birth (Bangladesh, India, Pakistan, United States, or another country) and number of years lived in the United States

(less than or \geq 28 years, the median number of years lived in the United States in the overall sample). Depression symptoms were measured using the Center for Epidemiologic Studies—Depression scale (score \geq 16 indicating more depression symptoms, $<$ 16 indicating fewer depression symptoms). Traditional cultural beliefs were measured using a previously developed and validated cultural beliefs scale for South Asian adults that indicates participants' preferences for how often they wished several traditions from South Asia (such as fasting on specific occasions, living in a joint family, or using spices for health and healing) would be practiced in America (categorized into a little or none of the time [weakest traditional beliefs], some of the time [moderate traditional beliefs], or most or all of the time [strongest traditional beliefs]).⁸ Total CAC score from computed tomography measurement was reported in Agatston units. Because the purpose of the MASALA study is to understand factors associated with cardiovascular disease risk, all participants had CAC scores obtained but may not have had indications for a CAC score per prevailing clinical guidelines.

Participant characteristics were calculated as mean (SD) or frequency (percentage). The Pearson correlation coefficient of the LS7 score and LE8 score was calculated. The median and interquartile range (twenty-fifth and seventy-fifth percentile) of the LE8 score was calculated for each level of the LS7 score to compare the score distributions. Mean LE8 score was compared across levels of demographic, psychosocial, and sociocultural factors using *t* tests and analysis of variance.

Overall and gender-stratified multivariable logistic regression was used to estimate the odds of non-zero CAC associated with the LE8 score, first with the LE8 score evaluated as a continuous measure (odds per 10-point higher LE8 score) and second with the LE8 score categorized (high: score 80 to 100, intermediate: score 50 to 79, low: score 0 to 49). Overall and gender-stratified multinomial logistic regression was also used to evaluate the association between a 10-unit higher LE8 score and the odds of a CAC score of 1 to 99, 100 to 399, or \geq 400 each versus a CAC score of 0. In both analyses, first, unadjusted odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. Second, OR were adjusted for age, gender (in the overall sample analysis), and study site. Third, OR were additionally adjusted for income, education, length of residence in the United States, and traditional cultural beliefs. Two-sided $p < 0.05$ indicated statistical significance. Analyses were conducted with SAS version 9.4.

Results

MASALA Exams 1 and 1A included 556 women (mean age 55.9 years [SD 8.7]) and 608 men (mean age 57.5 years [SD 9.9]). Annual family income, educational attainment, depression symptoms, cultural beliefs, length of residence in the United States and birthplace are presented in Table 1. At examinations 1 and 1A, 29% of women and 63% of men had a non-zero CAC score. The mean LE8 CVH score in women was 67.2 (SD 12.6) and in men was 61.9 (SD 13.1). The distribution of the LE8 CVH score is shown in Supplementary Figure 1. Median levels of the LE8 score at each

Table 1
Life's Essential 8-defined cardiovascular health in participants of the Mediators of Atherosclerosis in South Asians Living in America study

	Exam 1/1A – Women	Exam 1/1A – Men	Exam 1/1A – Overall
N	556	608	1,164
Age	55.9 (8.7)	57.5 (9.9)	56.7 (9.4)
Site			
UCSF	308 (55%)	305 (50%)	613 (53%)
Northwestern	248 (45%)	303 (50%)	551 (47%)
Annual family Income \geq \$75,000	373 (68%)	427 (70%)	800 (69%)
Education (at least Bachelor's)	461 (83%)	545 (90%)	1,006 (86%)
CES-D depression scale score	8.2 (7.5)	7.1 (6.5)	7.6 (7.0)
Self-rated health (high)	443 (80%)	517 (85%)	960 (82%)
Traditional cultural beliefs	13.4 (6.6)	13.8 (6.3)	13.6 (6.4)
Years in the US	26.8 (11.4)	28.2 (11.7)	27.5 (11.6)
Place of birth			
India	456 (82%)	509 (84%)	965 (83%)
Pakistan	35 (6%)	32 (5%)	67 (6%)
United States	10 (2%)	11 (2%)	21 (2%)
Hypertension medication use	155 (28%)	233 (38%)	388 (33%)
Diabetes medication use	79 (14%)	130 (21%)	209 (18%)
Lipid lowering medication use	142 (26%)	222 (37%)	364 (31%)
LE8 overall CVH score	67.2 (12.6)	61.9 (13.1)	64.4 (13.2)
LE8 diet score	34.9 (26.2)	23.7 (24.3)	29.2 (25.9)
LE8 physical activity score	77.4 (37.0)	80.4 (36.4)	78.9 (36.7)
LE8 nicotine exposure score	95.5 (17.1)	79.5 (32.0)	87.1 (27.1)
LE8 BMI score	59.9 (26.8)	62.7 (25.5)	61.4 (26.2)
LE8 cholesterol score	65.1 (27.1)	64.1 (26.6)	64.6 (26.9)
LE8 glucose score	68.0 (24.0)	62.0 (24.5)	64.9 (24.4)
LE8 blood pressure score	69.3 (30.5)	59.0 (29.3)	63.9 (30.3)
LS7 CVH score	9.1 (2.0)	8.3 (2.1)	8.7 (2.1)
LS7 x LE8 score correlation coefficient	0.76*	0.74*	0.76*
CAC score			
CAC = 0	392 (71%)	223 (37%)	615 (53%)
CAC = 1-99	103 (19%)	182 (30%)	285 (25%)
CAC = 100-399	40 (7%)	118 (20%)	158 (14%)
CAC > 400	19 (3%)	79 (13%)	98 (8%)

* Correlation coefficient $p < 0.001$. Data are mean (standard deviation) or frequency (percentage).

BMI = body mass index; CAC = coronary artery calcium; CES-D = Center for Epidemiologic Studies Depression scale; CVH = cardiovascular health; LE8 = Life's Essential 8; LS7 = Life's Simple 7; UCSF = University of California – San Francisco.

level of LS7 score are shown in [Supplementary Figure 2](#). The LS7 and LE8 score correlation coefficient was 0.76 among women and 0.74 among men ($p < 0.001$ for both). Overall, 15% of participants had a low LE8 CVH score; 73% of participants had an intermediate LE8 CVH score, and 13% of participants had a high LE8 CVH score ([Figure 1](#)).

Among women, the LE8 CVH score was higher in participants who had annual family income \geq \$75,000 per year (vs $<$ \$75,000 per year), had attained a Bachelor's degree or higher education (vs less than a Bachelor's degree), had more (vs fewer) depression symptoms, and who reported fewer traditional cultural beliefs ([Figure 2](#)). There were also significant differences in the LE8 CVH score by place of birth, with those born in India with a higher LE8 score than that of participants born in Pakistan. Among men, the LE8 CVH score was higher in participants who had annual family income \geq \$75,000 per year (vs $<$ \$75,000 per year), had attained a Bachelor's degree or higher education (vs less than a Bachelor's degree), and had more (vs fewer) depression symptoms. As with the women, there were also

significant differences in the LE8 CVH score by place of birth among men.

The adjusted odds of having CAC associated with the LE8 CVH score are shown in [Table 2](#). Overall, there were 26% lower odds of CAC for each 10-point higher LE8 score (OR 0.74, 95% CI 0.66 to 0.83). Participants with a high LE8 CVH score had 82% lower odds of CAC (OR 0.18, 95% CI 0.09 to 0.33) and participants with an intermediate LE8 CVH score had 38% lower odds of CAC (OR 0.62, 95% CI 0.41 to 0.94) than did participants with a low LE8 CVH score. Gender-stratified analysis showed similar magnitudes of association in women and men. The odds of CAC score categories associated with a 10-point higher LE8 score are shown in [Supplementary Table 2](#). Overall, relative to a CAC score of 0, a 10-point higher LE8 score was associated with 23% lower odds of a CAC score 1 to 99 (OR 0.77, 95% CI 0.68 to 0.88), a 35% lower odds of a CAC score 100 to 399 (OR 0.65, 95% CI 0.55 to 0.77), and 26% lower odds of a CAC score \geq 400 (OR 0.74, 95% CI 0.60 to 0.91), with similar magnitudes of association in women and men.

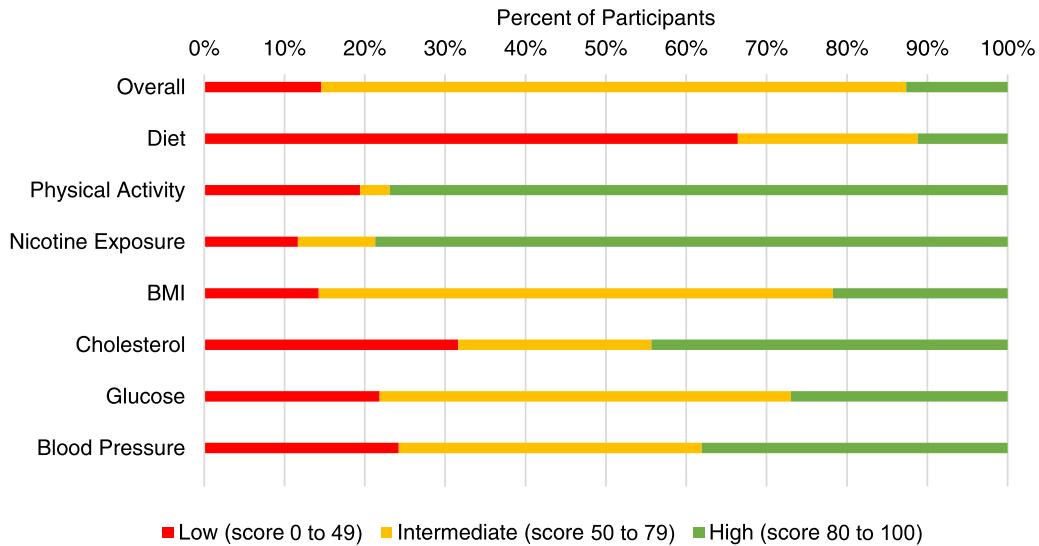


Figure 1. Distribution of Life's Essential 8 cardiovascular health score percent of MASALA participants at low, intermediate, and high scores overall and for each Life's Essential 8 component.

Discussion

In this evaluation of CVH defined by the AHA LE8 score among predominantly immigrant South Asian American adults, most subjects (87%) had low or intermediate CVH. The LE8 CVH score was higher, with more favorable social determinants and better psychosocial health. There were differences in the LE8 CVH score based on place of birth (particularly among adults born in India compared with adults born in Pakistan), though no differences based on years lived in the United States. In addition, the LE8 CVH score was strongly associated with the likelihood of having CAC after accounting for age, gender, and several social and cultural determinants.

The LE8 CVH score provides a more detailed and tailored evaluation of CVH among adults than does the previous LS7 score. Beyond a more detailed scoring of each LE8 component, the scoring of specific components (namely, BMI) better accounts for the cardiovascular risk experienced by subjects of Asian ancestry. Comparing ideal CVH calculated by the LS7 score (vs "high CVH" calculated using the LE8 score) in participants in MASALA, 80% of participants had LS7-defined ideal levels of smoking (compared with 79% by LE8 CVH score); 65% met ideal levels of physical activity (compared with 77% by LE8 CVH score); 44% had ideal BMI (compared with 22% by LE8 CVH score); <3% met ideal criteria for dietary quality (compared with 11% by LE8 CVH score); 56% had ideal levels for fasting glucose (compared with 27% by LE8 score); 40% had ideal levels for cholesterol (compared with 44% by LE8 score); and 33% had ideal levels for blood pressure (compared with 38% by LE8 score).³ Given that the updated CVH definition may more accurately and granularly reflect CVH in adults, our findings show that some CVH factors (physical activity, dietary quality) may be more favorable than previously estimated, and others (BMI, fasting glucose) may be less favorable.

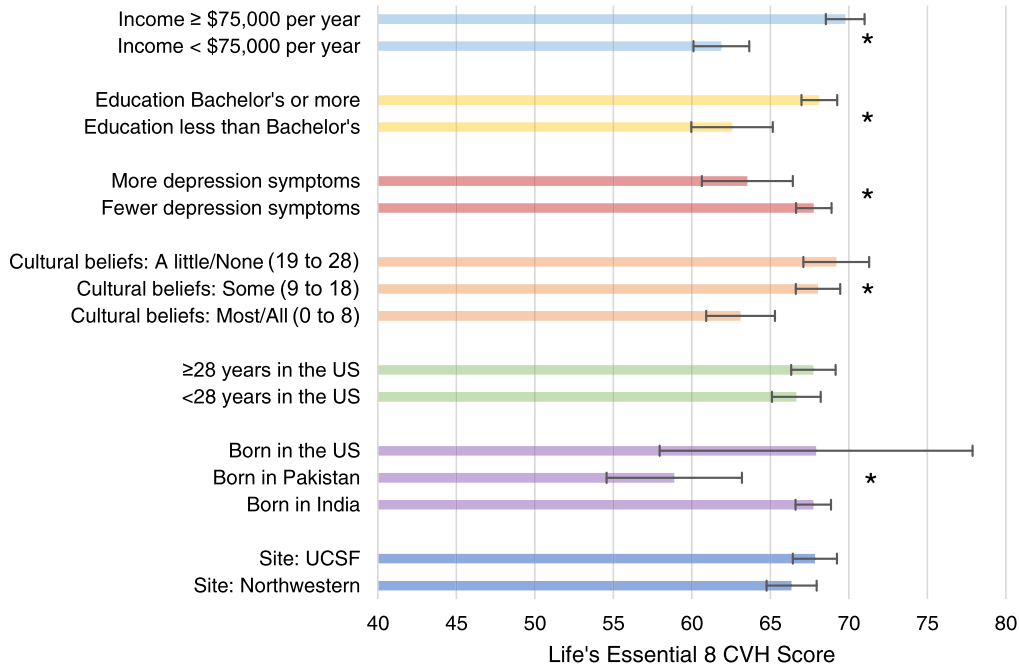
The LE8 CVH scores of South Asian American adults in MASALA align with findings among US adults as

characterized in the National Health and Nutrition Examination Survey (NHANES) between 2013 and 2018, which showed an overall mean LE8 score among US adults of 64.7, compared with 64.4 in the participants in MASALA. The NHANES data also found that adults who identified as non-Hispanic Asian had a mean LE8 score of 69.4 (although mean age of Asian Americans in NHANES is lower than in MASALA), and 65.0 in non-Hispanic White, 64.7 in other Hispanic, 61.6 in Mexican, and 60.0 in non-Hispanic Black adults.⁹

It was observed that the most suboptimal LE8 component score among MASALA participants was for dietary quality, with 66% of South Asian adults having a low diet score. This finding aligns with national data on dietary quality in the United States, which shows that dietary quality is the least optimal CVH metric among US adults.¹⁰ Several other LE8 score components had high prevalence of low levels, including blood pressure (24%) and glucose (22%), identifying targets for potential tailored and adapted intervention to improve CVH among South Asian Americans. Conversely, MASALA participants had overall favorable levels of nicotine exposure (79% with high LE8 nicotine score) and physical activity (77% with high LE8 physical activity score).

The LE8 physical activity assessment is particularly notable in comparison with previous characterization of physical activity among MASALA participants. Although previous investigations of physical activity that accounted for both minutes spent doing physical activity and activity intensity (units Metabolic Equivalent Task-minutes per week) showed that South Asian adults participated in less moderate and vigorous physical activity than did adults of other groups in the Multi-Ethnic Study of Atherosclerosis,¹¹ the LE8 physical activity score shows relatively favorable physical activity participation among South Asian adults. The discrepancy may be due in part to the LE8 definition, which accounts only for minutes of activity per week and not activity intensity, suggesting that although South Asian adults partake in intentional physical activity, the activity intensity may be relatively low.

A. Female participants



B. Male participants

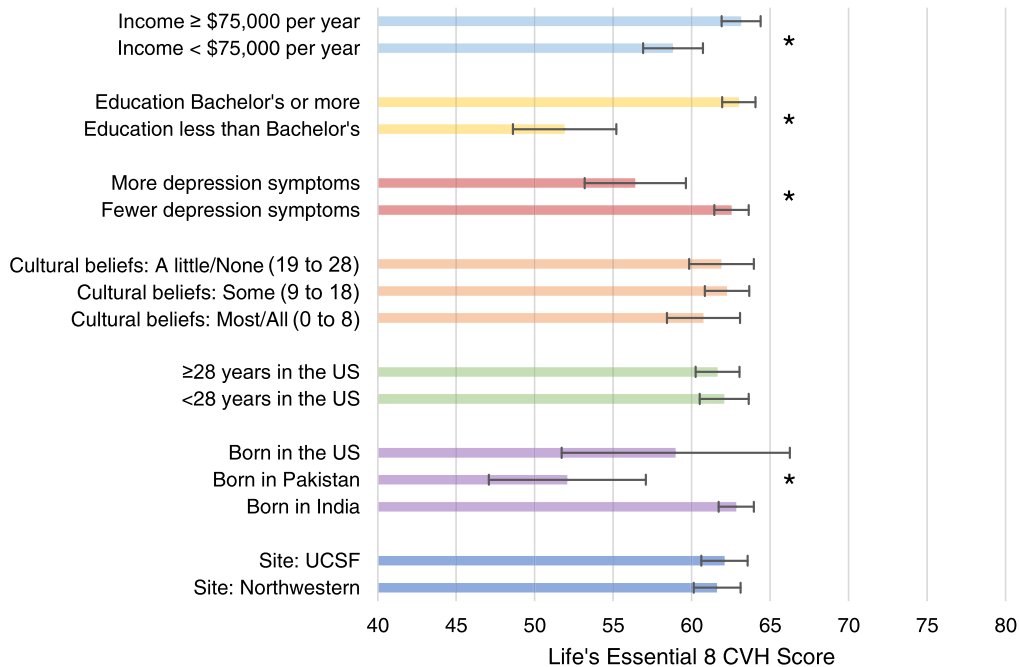


Figure 2. Differences in Life's Essential 8 score across social, psychosocial, and cultural factors. *p < 0.05 for unadjusted comparisons from *t* tests and analysis of variance. UCSF = University of California – San Francisco.

The strong association of higher LE8 score with lower odds of CAC among MASALA participants is consistent with the direction and magnitude of association of the LS7 score with CAC in this sample,³ and aligns with findings in other populations that also show that better CVH is associated with lower likelihood of CAC.^{12,13} Although assessment of cardiovascular disease outcomes in the MASALA study is in progress, optimizing the overall burden of

cardiovascular risk factors is likely to reduce the risk of cardiovascular disease among South Asian Americans because previous findings have shown that CVH scores are also strongly associated with the risk for cardiovascular disease events and life expectancy free of cardiovascular disease.¹⁴

We found that several demographic, social, and cultural factors were associated with differences in the LE8 CVH score. Social determinants of health, which include factors

Table 2
Association of Life's Essential 8 Cardiovascular Health score with Presence of Coronary Artery Calcium

	Overall OR (95% CI)	Female OR (95% CI)	Male OR (95% CI)
<i>Unadjusted</i>			
Continuous LE8 score*	0.68 (0.62, 0.75)	0.66 (0.57, 0.77)	0.79 (0.69, 0.90)
LE8 score categories			
Low CVH (score 0-49)	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>
Intermediate CVH (50-79)	0.59 (0.42, 0.83)	0.65 (0.35, 1.20)	0.80 (0.51, 1.23)
High CVH (80-100)	0.13 (0.07, 0.21)	0.12 (0.05, 0.31)	0.21 (0.11, 0.42)
<i>Adjusted for age, sex, study site</i>			
Continuous LE8 score*	0.75 (0.67, 0.84)	0.72 (0.61, 0.86)	0.77 (0.67, 0.89)
LE8 score categories			
Low CVH (score 0-49)	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>
Intermediate CVH (50-79)	0.64 (0.43, 0.95)	0.68 (0.34, 1.26)	0.62 (0.38, 1.02)
High CVH (80-100)	0.18 (0.10, 0.33)	0.18 (0.07, 0.50)	0.18 (0.08, 0.41)
<i>Multivariable adjusted[†]</i>			
Continuous LE8 score*	0.74 (0.66, 0.83)	0.71 (0.58, 0.86)	0.75 (0.64, 0.87)
LE8 score categories			
Low CVH (score 0-49)	<i>Reference</i>	<i>Reference</i>	<i>Reference</i>
Intermediate CVH (50-79)	0.62 (0.41, 0.94)	0.70 (0.34, 1.43)	0.54 (0.32, 0.92)
High CVH (80-100)	0.18 (0.09, 0.33)	0.19 (0.07, 0.53)	0.17 (0.07, 0.38)

Bold indicates statistical significance with $p < 0.05$.

* Odds of a CAC score > 0 per 10-unit higher Life's Essential 8 score.

[†] Adjusted for age, income, education, length of residence in the US, traditional cultural beliefs, and study site. In the overall sample analysis, also adjusted for sex.

CAC = coronary artery calcium; CI = confidence interval; CVH = cardiovascular health; LE8 = Life's Essential 8; OR = odds ratio.

related to socioeconomic status, neighborhood and physical environment, education, food access and nutrition security, community safety, social contexts, and health care access contribute to racial and ethnic differences in CVH.¹⁵ Greater adherence to traditional South Asian cultural values was associated with lower LE8 scores, suggesting that health behaviors tied to cultural beliefs may contribute to lower CVH among South Asian Americans. LE8 scores were also lower for South Asian participants who were born in Pakistan than for those born in India, which may be due to differences in underlying structural, social, cultural, and behavioral factors or differences in early life environments that influenced trajectories of CVH.¹⁶ The MASALA study is currently enrolling more participants of Pakistani and Bangladeshi background, which will help better characterize the underlying contributors to differences in CVH in these communities.¹⁷

Strengths of this analysis include robust characterization of CVH factors in a population underrepresented in health research, including assessment of dietary quality based on culturally adapted dietary assessment tools. There are also limitations. First, sleep measures are not yet available in the MASALA cohort to calculate the full LE8 score. Sleep duration is being queried in MASALA study participants in Exam 3, for which data collection is ongoing. Second, the observational nature of the data limits causal inference, although previous work shows that the cardiovascular risk factors included in the LE8 CVH score are all direct causal risk factors for cardiovascular disease. Third, cardiovascular disease outcomes are not yet available in the MASALA cohort. In conclusion, in this community cohort of South Asian Americans, most adults had suboptimal CVH as assessed by the LE8 score. These findings support the

development and implementation of tailored and adapted interventions to promote CVH among this high-risk group.

Declaration of Competing Interest

The authors have no conflicts of interest to declare.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at <https://doi.org/10.1016/j.amjcard.2023.05.004>.

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