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Association of Life's Simple 7 and ideal cardiovascular health in American Indians/Alaska Natives

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ABSTRACT

Objective American Indians and Alaska Natives (AI/ANs) are an understudied population at high risk for cardiovascular diseases (CVDs); little is known about contextual factors contributing to CVDs in AI/ANs. This study examined the association of Life's Simple 7 (LS7) factors and social determinants of health (SDH) with CVD outcomes in a nationally representative sample of AI/ANs.

Methods We conducted a cross-sectional study of 8497 AI/ANs using 2017 Behavioural Risk Factor Surveillance Survey data. Individual LS7 factors were summarised as ideal and poor levels. Coronary heart disease, myocardial infarction and stroke were defined as CVD outcomes. Healthcare access measures represented SDH. Logistic regression analyses examined associations of LS7 factors and SDH with CVD outcomes. Population attributable fractions (PAFs) quantified individual contributions of LS7 factors to CVD outcomes.

Results N=1,297 (15%) participants with CVD outcomes were identified. Smoking, physical inactivity, diabetes, hypertension and hyperlipidaemia were LS7 factors associated with CVD outcomes. Hypertension was the largest contributor to CVD (aPAF 42%; 95% CI 37% to 51%), followed by hyperlipidaemia (aPAF 27%; 95% CI 17% to 36%) and diabetes (aPAF 18%; 95% CI 7% to 23%). Compared with individuals with poor LS7 levels, participants with ideal levels showed 80% lower odds of CVD outcomes (aOR 0.20; 95% CI 0.16 to 0.25). Access to health insurance (aOR 1.43, 95% CI 1.08 to 1.89) and a regular care provider (aOR 1.47, 95% CI 1.24 to 1.76) were associated with CVD outcomes.

Conclusions Effective interventions are needed to address SDH and attain ideal LS7 factors to improve cardiovascular health among AI/ANs.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ American Indians and Alaska Natives (AI/ANs) are an understudied population at high risk for cardiovascular diseases (CVDs).

WHAT THIS STUDY ADDS

⇒ This study identified lifestyle-related risk factors and social determinants of health associated with poor cardiovascular health in AI/ANs.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Our findings support the need to (1) use Life's Simple 7 metrics to assess CVD risk in AI/ANs and identify individuals who may be candidates for cardiovascular health-promoting interventions and (2) implement culturally adapted approaches for smoking cessation, increasing physical activity, and reducing blood pressure, cholesterol, and haemoglobin A1c levels in tribal or urban Indian health service programmes, primary care, and other healthcare settings serving AI/ANs. Additionally, our findings highlight the need for policies directed at social determinants of health, such as approaches to improving financial resources and providing consistent access to health insurance and providers in this population.

INTRODUCTION

Cardiovascular diseases (CVDs) are the leading cause of death in the USA.[1] About 655 000 Americans die from CVDs each year, which translates to one in every four deaths in US adults.[1] Indigenous minority populations are disproportionately affected by CVDs, with American Indians and Alaska Natives (AI/ANs) showing the highest prevalence of CVDs at 16.4% (95% CI 13.6% to 19.7%) compared with 9.9% (95% CI 8.7% to 11.3%) in blacks, 7.5% (95% CI 5.6% to 10.1%) in Asians and 7.4% (95% CI 6.0% to 9.1%) in Hispanics.[2] In addition, CVD mortality rates were 20% higher in AI/ANs than in the general population.[3] It is therefore important to adequately and comprehensively identify and address contextual risk factors to prevent CVD morbidity and mortality among AI/ANs.

Previous research has documented that AI/ANs have a higher prevalence of lifestyle-related CVD risk factors, including poor diet, low levels of physical activity, smoking, diabetes, obesity, hypertension and an earlier onset of CVD, in addition to genetic predispositions for CVD risk factors.[4–8] A recent scientific statement by the American Heart Association (AHA) highlighted the burden of CVD risk factors and pathogenesis of CVD

in AI/ANs.[6] One of the most important CVD risk factors identified among this population is diabetes mellitus, given the threefold increased age-adjusted diabetes prevalence and the subsequent impact of diabetes mellitus on cardiac structure and function, lower high-density lipoprotein cholesterol, affinity for concomitant hypertension and renal disease diagnoses in AIs.[6] In addition to lifestyle-related risk factors, social determinants of health (SDH), which include barriers to healthcare access, limited health insurance coverage, lower socioeconomical status and exposure to psychosocial stressors, have been found to hinder AI/ANs from achieving optimal health.[6 9] Previous research suggests an association of adverse SDH with both, higher burden of lifestyle-related risk factors and poor CVD outcomes.[10 11] Improving SDH and reducing lifestyle-related risk factors are, therefore, key aspects in improving CVD outcomes among the indigenous population.[10 11]

The AHA 2020 Impact Goals called for improving the cardiovascular health (CVH) of all Americans by 20% while continuing to decrease deaths from CVD and stroke by 20%.[12] To achieve this goal, the AHA identified seven CVH factors to acquiring 'ideal CVH." Coined as Life's Simple 7 (LS7), the metric assesses four health behaviours (smoking, physical activity, body weight and dietary intake) and three clinical health factors (blood pressure, cholesterol and glucose levels) in the US population.[12] Prior research has shown that higher attainment of ideal LS7 metrics is associated with a lower risk of CVDs and all-cause mortality among Whites, Blacks and Hispanics in the USA.[13]

Given the national emphasis on CVH and health equity, a closer look at the relationships among SDH, lifestyle-related LS7 factors and CVD outcomes in AI/ANs is important. To our knowledge, no study to date has examined the association of LS7 factors with CVD outcomes in the AI/AN population. In addition, little is known about the extent to which SDH impact CVD outcomes in AI/ANs.[10] Reliable, current population health data on AI/AN health is limited; this may be in part due to small sample sizes and difficulties aggregating sufficient data, considering high rates of racial underreporting and misclassification of AI/AN race.[14] Given the high prevalence of lifestyle-related CVD risk factors and the influence of SDH on CVD risk factors,[11] and outcomes in this at-risk population, the objectives of this study were to examine the association of (1) LS7 factors with CVD outcomes and (2) SDH with CVD outcomes in a nationally representative sample of AI/ANs (figure 1).

METHODS

Study design and participants

This cross-sectional study used the 2017 wave of the Behavioural Risk Factor Surveillance Survey (BRFSS), a state-based telephone survey conducted in all 50 states, the District of Columbia and 3 US territories to assess health behaviours, chronic health conditions and use of preventive services among non-institutionalised US adults aged ≥18 years.[15] More information regarding the survey methodology is available elsewhere.[15] The validity and reliability of the BRFSS survey have been previously established.[16] Data for the current study were extracted from the core surveys conducted in 2017 because AI/ANs were oversampled that year (N=8497). All responses were self-reported. It was not possible to involve patients or the public in the research.

Measures and variables

Dependent variable

The dependent variable of interest was CVD outcomes. Proxy indicators for CVD outcomes included the following BRFSS questions: (1) 'Has a doctor, nurse or other health professional ever told you that you had angina/coronary heart disease (CHD)', (2) 'Has a doctor, nurse, or other health professional ever told you that you hada heart attack also called a myocardial infarction (MI)' and (3) 'Has a doctor, nurse, or other health professional ever told you that you had a stroke?' Participants who

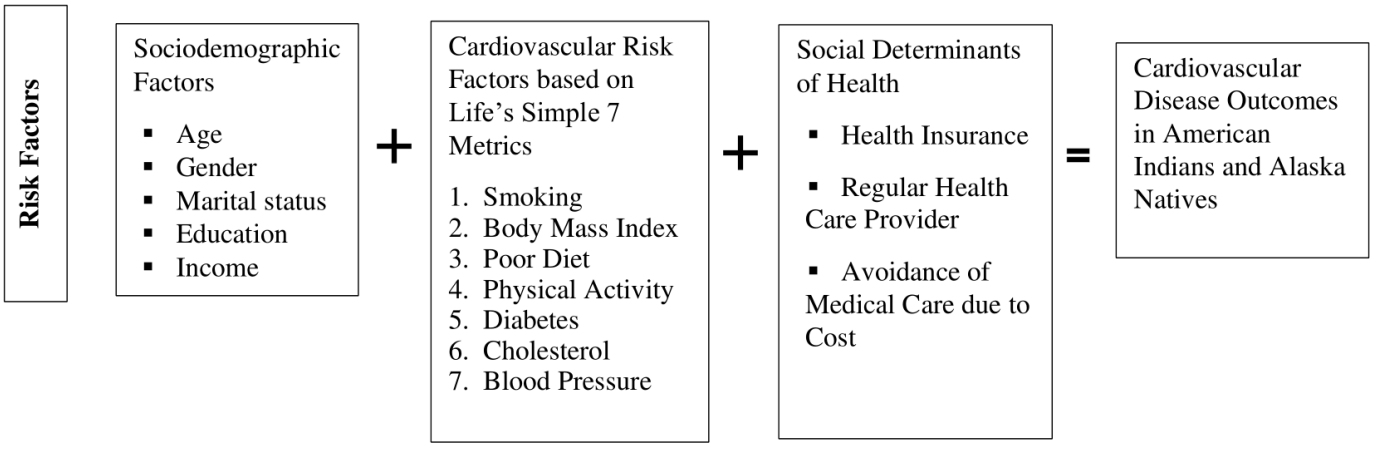

Figure 1 A conceptual framework describing the relationships of sociodemographic, Life's Simple 7 metrics, social determinants of health and cardiovascular disease outcomes in American Indians and Alaska Natives.

Table 1 Definition of components of the American Heart Association's Life's Simple 7*

Life's Simple 7 metrics	Category	Definition
Smoking	Ideal	Never smoker or reported smoking 100 cigarettes in their lifetime but not currently smoking
	Poor	Current smoker
Body mass index	Ideal	<25.0 kg/m^2
	Poor	≥25.0 kg/m^2
Diet	Ideal	Reported intake of fruits and vegetables >1 time/day
	Poor	Reported intake of fruits and vegetables <1 time/day
Physical activity	Ideal	Did enough moderate or vigorous physical activity to meet the recommendation of ≥150 min a week of moderate-intensity activity, ≥75 min of vigorous-intensity activity, or an equivalent combination of aerobic physical activity
	Poor	None
Blood pressure	Ideal	No high blood pressure diagnosis
	Poor	High blood pressure diagnosis by a doctor, nurse or other health professional
Cholesterol	Ideal	No high blood cholesterol diagnosis
	Poor	High blood cholesterol diagnosis by a doctor, nurse or other health professional
Diabetes	Ideal	No diabetes diagnosis
	Poor	Diabetes diagnosis by a doctor

*Adapted from Lloyd-Jones *et al*.[12]

responded affirmatively to either of the three questions were classified as experiencing a CVD outcome.

Independent variables

LS7 metrics

Lifestyle-related CVD risk factors were based on the LS7 metrics[12] and included participants' self-reported body mass index (BMI; kg/m^2), current smoking status (ever-smoked 100 cigarettes; smoking every day; smoking some days; not at all), physical activity participation levelin the last 30 days (participated; did not participate), diet (consumed fruits and vegetables one or more times/day; less than one time/day), diabetes (ever been told to have diabetes: yes, no), blood pressure (told to have high blood pressure by a doctor, nurse or other health professional: yes, no), and cholesterol status (have had their cholesterol checked and have been told by a doctor, nurse or other health professional that it was high: yes, no). In line with previous research,[12 17] a dichotomous measure was derived to group participants into either ideal or poor status for each LS7 component (table 1). To create a composite CVD risk score, responses for each LS7 metrics were given a score of '0' for not meeting or '1' for meeting the ideal status, respectively. The composite CVD risk score ranged from 0 to 7. Participants were then grouped into one of the three categories based on their total score: poor: 0–2, intermediate: 3–4 and ideal: 5–7.[17]

Social determinants of health

Social determinants of health included the following healthcare access measures: access to health insurance, regular healthcare providers and avoidance of medical care due to cost. Having health insurance was assessed among respondents by asking, 'Do you have any kind of healthcare coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare or Indian Health Service?' Having access to a healthcare provider was measured by asking, 'Do you have one person you think of as your personal doctor or healthcare provider?' Responses for both the questions were recorded as 'yes' or 'no'. Avoidance of medical care due to cost was assessed by the following question: 'Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?' Responses were recorded as 'yes' or 'no'.

Sociodemographic and economic variables

The following self-reported sociodemographic variables were considered covariates in the analyses: age (18–24, 25–44, 45–64 and ≥65 years), gender (male, female), marital status (married, not married), education level (high school or less/some college or college graduate) and annual household income (<US$15 000, US$15 000–US$24 999, US$25 000–US$34 99, US$35 000–US$49 999 and US$50 000 or more).

Statistical analysis

Descriptive statistics, including frequencies and percentages, were used to summarise demographic characteristics, LS7 factors, SDH and CVD outcomes. Bivariate (χ^2 tests) and multivariate analyses (logistic regressions) examined the relationships between (A) individual LS7 factors, SDH and CVD outcomes, (B) the LS7 composite score (levels) and overall/individual CVD outcomes (MI, CHD and stroke). We additionally examined relationships between sociodemographic characteristics and ideal versus poor LS7 score levels. ORs and 95% CIs were estimated from logistic regression analyses. Multivariate

analyses were adjusted for age, sex, marital status, educational status and annual household income. Population attributable fractions (PAFs), adjusted for gender, age, marital status, income and education, were calculated to quantify the individual contributions of individual LS7 factors to CVD outcomes. All analyses were weighted and adjusted by using the BRFSS sample weights to account for non-response and BRFSS complex sample survey design. A p<0.05 was considered statistically significant. All analyses were performed using Stata version V.14 (StataCorp).

RESULTS

The frequency of CVD outcomes by sociodemographic characteristics, LS7 factors and SDH in the 2017 BRFSS survey sample are shown in table 2. A total of 8497 AI/AN participants were included in the sample, and n=1297 (15.2%) responded affirmatively to having one or more CVD outcomes. Out of these, 364 (4.3%) reported at least one stroke, 421 (5.0%) reported coronary heart disease and 512 (6.1%) reported having had at least one MI (online supplemental table 1). Among the study participants with CVD outcomes, 44.1% were 65+ years of age, 49.9% were female, 66.1% were not married, more than half had education levels of high school or less (54.4%) and 21.2% had an annual household income of <US$15 000 (table 2).

Among the LS7 factors, the diet category showed the highest proportion of participants in the ideal category (85.2%), followed by diabetes (77.5%), smoking (70.4%), physical activity (67.8%), cholesterol levels (64.8%), blood pressure levels (56.6%) and BMI (25.4%). About 90.3% of study participants had access to health insurance, 70.3% had a regular healthcare provider and 66.2% had access to both provider and health insurance. For 16.3% of participants, cost resulted in an avoidance of medical care (table 2). Among study participants with CVD outcomes, diet showed the highest proportion of participants in the ideal category (84.1%), followed by smoking (62.8%), diabetes (56.8%), physical activity (56.6%), cholesterol levels (38.7%), blood pressure levels (25.4%) and BMI (24.2%) (table 2).

As shown in online supplemental table 2, 11.2%, 38.6% and 50.2% of participants had poor, intermediate and ideal CVD risk levels according to the LS7 composite score categories, respectively. Furthermore, n=260 (38.5%) of individuals in the poor category of the composite LS7 score, n=520 (22.4%) in the intermediate category and n=248 (8.2%) in the ideal category experienced CVD outcomes.

Results from the bivariate and multivariate analysis of associations between LS7 metrics, SDH and CVD outcomes are shown in table 3. In bivariate analyses, five LS7 factors, namely, smoking, low physical activity, diabetes, hypertension and high cholesterol levels, were positively associated with CVD outcomes. After adjusting for age, gender, marital status, education and income; smoking (aOR 1.66, 95% CI 1.40 to 1.98), low physical activity (aOR 1.26, 95% CI 1.06 to 1.49), diabetes (aOR 1.72, 95% CI 1.45 to 2.04), high cholesterol levels (aOR 1.79, 95% CI 1.51 to 2.12) and hypertension (aOR 2.36, 95% CI 1.95 to 2.86) were all positively associated with CVD outcomes. In addition, having access to health insurance (aOR 1.43, 95% CI 1.08 to 1.89) and having a regular care provider (aOR 1.47, 95% CI 1.24 to 1.76) appeared to be associated with CVD outcomes, even after adjusting for age, gender, marital status, education and income. Avoiding medical care due to cost was significantly associated with reduced CVD outcomes in bivariate and multivariate analyses (aOR 0.50, 95% CI 0.42 to 0.59). Poor diet and high BMI were not associated with CVD in crude and adjusted analyses.

Online supplemental table 3a shows the relationships between SDH and individual LS7 factors. Having health insurance coverage, a regular healthcare provider and not avoiding medical care due to cost were significantly associated with diabetes, high cholesterol levels and hypertension in both crude and adjusted analyses. Online supplemental table 3b shows the relationships between sociodemographic characteristics and the composite LS7 score. Compared with younger adults (18–24 years), participants 45–64 and ≥65 years of age had 87% and 89% lower odds of an ideal LS7 score (aOR 0.13, 95% CI 0.09 to 0.20; aOR 0.11, 95% CI 0.07 to 0.17), respectively. Male participants had 23% lower odds of an ideal LS7 score (aOR 0.77, 95% CI 0.67 to 0.88) compared with females, and participants with a high school education or less had 33% lower odds of an ideal LS7 score compared with individuals with at least college education (aOR 0.67, 95% CI 0.58 to 0.77). Similarly, compared with higher income participants (≥50 000), individuals in the lower income categories (<15 000, 25 000–34 999 and 35 000–49 999) had 63% (aOR 0.37, 95% CI 0.29 to 0.48), 55% (aOR 0.45, 95% CI 0.35 to 0.56) and 49% (aOR 0.51, 95% CI: 0.39 to 0.68) lower odds of an ideal LS7 score, respectively.

Table 4 and online supplemental table 4a–c show associations between the LS7 composite score levels and overall/individual CVD outcomes (MI, CHD and stroke) after adjusting for gender, age, marital status, income and education. Compared with individuals in the poor LS7 category, those in the ideal and intermediate categories showed 80% and 50% lower odds of having CVDs (aOR 0.20, 95% CI 0.16 to 0.25; aOR 0.50, 95% CI 0.41 to 0.62), respectively.

Compared with individuals in the poor LS7 category, those in the ideal and intermediate categories showed 82% and 52% lower odds of having an MI (aOR 0.18, 95% CI 0.14 to 0.24; aOR 0.48, 95% CI 0.38 to 0.61) (online supplemental table 4a); 81% and 47% lower odds of having CHD (aOR 0.19, 95% CI 0.14 to 0.26; aOR 0.53, 95% CI 0.40 to 0.68) (online supplemental table 4b); and 68% and 34% lower odds of having stroke (aOR 0.32, 95% CI 0.24 to 0.45; aOR 0.66, 95% CI 0.49 to 0.88) (online supplemental table 4c), respectively. A 1-point

Table 2 Frequency of cardiovascular disease outcomes by sociodemographic characteristics, Life's Simple 7 (LS7) metrics and social determinants of health in the 2017 BRFSS survey sample (N=8497)

Variables	Categories	Overall (n/N)	%	CVD outcome (n/N)	%	Do not have CVD outcome (n/N)	%	P value
Sociodemographic characteristics								
Age (years)	18–24	556/8497	6.5	11/1297	0.84	545/7200	7.6	<0.001*
	25–44	2326/8497	27.3	111/1297	8.50	2215/7200	30.7	
	45–64	3575/8497	42.1	602/1297	46.4	2973/7200	41.2	
	≥65	2040/8497	24.0	573/1297	44.1	1467/7200	20.3	
Sex	Male	3787/8490	44.6	648/1295	50.1	3139/7195	43.6	<0.001*
	Female	4703/8490	55.3	647/1295	49.9	4056/7195	56.3	
Marital status	Married	3054/8431	36.2	437/1288	33.9	2617/7143	36.6	<0.001*
	Not married	5377/8431	63.7	851/1288	66.1	4526/7143	63.3	
Education	High (college)	4273/8490	50.3	589/1294	45.5	3684/7167	51.4	<0.001*
	Low (high school or less)	4188/8490	49.3	705/1294	54.4	3483/7167	48.5	
Annual household income (US$)	<15 000	1756/8497	20.7	372/1756	21.2	1384/6741	20.5	<0.001*
	15 000–24 999	1870/8497	22.0	328/1870	17.5	1542/6627	23.3	
	25 000–34 999	902/8497	10.6	131/902	14.5	771/7595	10.1	
	35 000–49 999	842/8497	9.9	92/842	10.9	750/7655	9.8	
	≥50 000	1755/8497	20.6	159/1755	9.06	1596/6742	23.7	
LS7 Metrics								
Smoking	Ideal	5685/8071	70.4	785/1249	62.8	4900/6822	71.8	<0.001*
	Poor	2386/8071	29.5	464/1249	37.1	1922/6822	28.1	
Physical activity	Ideal	5164/7615	67.8	672/1187	56.6	4492/6428	69.8	<0.001*
	Poor	2451/7615	32.1	515/1187	43.3	1936/6428	30.1	
Diet	Ideal	6537/7669	85.2	997/1186	84.1	5540/6483	85.4	0.752
	Poor	1132/7669	14.7	189/1186	15.9	943/6483	14.5	
Body mass index	Ideal	1991/7826	25.4	301/1241	24.2	1690/6585	25.6	0.729
	Poor	5835/7826	74.5	940/1241	75.7	4895/6585	74.3	
Diabetes	Ideal	6569/8471	77.5	735/1293	56.8	5834/7178	81.2	<0.001*
	Poor	1902/8471	22.4	558/1293	43.1	1344/7178	18.7	
Cholesterol levels	Ideal	4675/7212	64.8	460/1186	38.7	4215/6026	69.9	<0.001*
	Poor	2537/7212	35.1	726/1186	61.2	1811/6026	30.1	
Blood pressure	Ideal	4799/8472	56.6	329/1293	25.4	4470/7179	62.2	<0.001*
	Poor	3673/8472	43.3	964/1293	74.5	2709/7179	37.7	
Social determinants of health								
Avoidance of medical care due to cost	Yes	1385/8484	16.3	306/1294	23.6	1079/7190	15.1	<0.001*
	No	7099/8484	83.6	988/1294	76.3	6111/7190	84.9	
Regular healthcare provider	Yes	5953/8458	70.3	1060/1292	82.1	4893/7166	68.2	<0.001*
	No	2505/8458	29.6	232/1292	17.9	2273/7166	31.7	
Health insurance	Yes	7659/8481	90.3	1212/1295	93.5	6447/7186	89.7	<0.001*
	No	822/8481	9.60	83/1295	6.40	739/7186	10.28	

Categorical variables are shown in per cent (%).
*Indicates statistically significant.
BRFSS, Behavioural Risk Factor Surveillance Survey; CVD, cardiovascular disease.

Table 3 Association between individual Life's Simple 7 (LS7) metrics, social determinants of health and cardiovascular disease outcomes

LS7 metrics	Crude OR (95% CI)	P value	Adjusted OR (95% CI)*	P value
Smoking	1.50 (1.32 to 1.70)	<0.05	1.66 (1.40 to 1.98)	<0.001†
Low physical activity	1.77 (1.56 to 2.01)	<0.05	1.26 (1.06 to 1.49)	0.006†
Elevated body mass index	1.07 (0.93 to 1.24)	0.29	0.89 (0.73 to 1.08)	0.263
Poor diet	1.11 (0.93 to 1.32)	0.21	0.95 (0.76 to 1.19)	0.693
Diabetes	3.29 (2.96 to 3.71)	<0.05	1.72 (1.45 to 2.04)	<0.001†
High cholesterol	3.67 (3.22 to 4.17)	<0.05	1.79 (1.51 to 2.12)	<0.001†
Hypertension	4.83 (4.22 to 5.52)	<0.05	2.36 (1.95 to 2.86)	<0.001†
Social determinants of health				
Avoidance of medical care due to cost	0.57 (0.49 to 0.65)	<0.05	0.50 (0.42 to 0.59)	<0.001†
Regular healthcare provider	1.79 (1.62 to 2.10)	<0.05	1.47 (1.24 to 1.76)	<0.001†
Health insurance	1.67 (1.32 to 2.11)	<0.05	1.43 (1.08 to 1.89)	0.012†

*Adjusted for gender, age, marital status, income and education.
†Indicates statistically significant.

increase in LS7 composite score was associated with a 33% lower risk of MI (aOR 0.67, 95% CI 0.63, 0.71), a 31% lower risk of CHD (aOR 0.69, 95% CI 0.64, 0.74) and a 27% lower risk of stroke (aOR 0.73, 95% CI 0.68, 0.78), respectively (online supplemental table 4d–f).

Figure 2 shows the PAFs adjusted for gender, age, marital status, income and education. We found hypertension to be the largest contributor to CVD among our sample of AI/ANs, with an adjusted PAF of 42% (95% CI 37% to 51%), followed by increased total cholesterol levels with a PAF of 27% (95% CI 17% to 36%), diabetes with a PAF of 18% (95% CI 7% to 23%), smoking with a PAF of 14% (95% CI 3% to 18%) and physical inactivity with a PAF of 8% (95% CI 2% to 13%).

DISCUSSION

To the best of our knowledge, this is the first study to explore the cross-sectional relationship between individual and combined lifestyle-related CVD risk factors and CVD outcomes among AI/ANs using nationally representative data. About 15.2% of the nationally representative sample of AI/ANs experienced at least one CVD outcome. Compared with individuals with poor LS7 metrics, participants in the ideal category showed 80% lower odds of CVD outcomes. Our findings are consistent with previous research, which found an inverse relationship between ideal lifestyle-related CVH behaviours and CVD outcomes in other populations.[13]

Hypertension, increased cholesterol levels, diabetes, smoking and low physical activity were significantly associated with an increased presence of CVD outcomes among AI/ANs. Among these, hypertension was the largest contributor to CVD outcomes, which is in line with previous research that has identified hypertension as a significant risk factor for CVD in this population.[18] Hypertension is common in AIs, as they face barriers to treating hypertension, including scarcity of nearby clinics, overlapping comorbidities and historical mistrust of healthcare services.[18] Furthermore, increased cholesterol levels, diabetes, low physical activity and smoking were identified as significant contributors to CVD outcomes in our sample. These findings are consistent with previous research that identified hypercholesterolaemia,[19 20] diabetes,[19 20] low physical activity[5] and smoking[5 19] as prevalent risk factors for CVDs in the AI/AN population.

As in other populations, comprehensively addressing existing CVD risk factors is an important strategy in improving CVH among AI/ANs. However, unique characteristics and culturally sensitive and adapted practices need to be employed to address lifestyle-related CVD

Table 4 Relationships of Life's Simple 7 (LS7) composite score levels and cardiovascular disease outcomes

LS7 metrics	CVD cases	Crude OR (95% CI)	P value	Adjusted OR (95% CI)*	P value
Poor	260/675	Referent	Referent	Referent	Referent
Intermediate	520/2319	0.46 (0.38 to 0.55)	<0.001†	0.50 (0.41 to 0.62)	<0.001†
Ideal	248/3016	0.14 (0.11 to 0.17)	<0.001†	0.20 (0.16 to 0.25)	<0.001†

*Adjusted for gender, age, marital status, income and education.
†Indicates statistically significant.
CVD, cardiovascular disease.

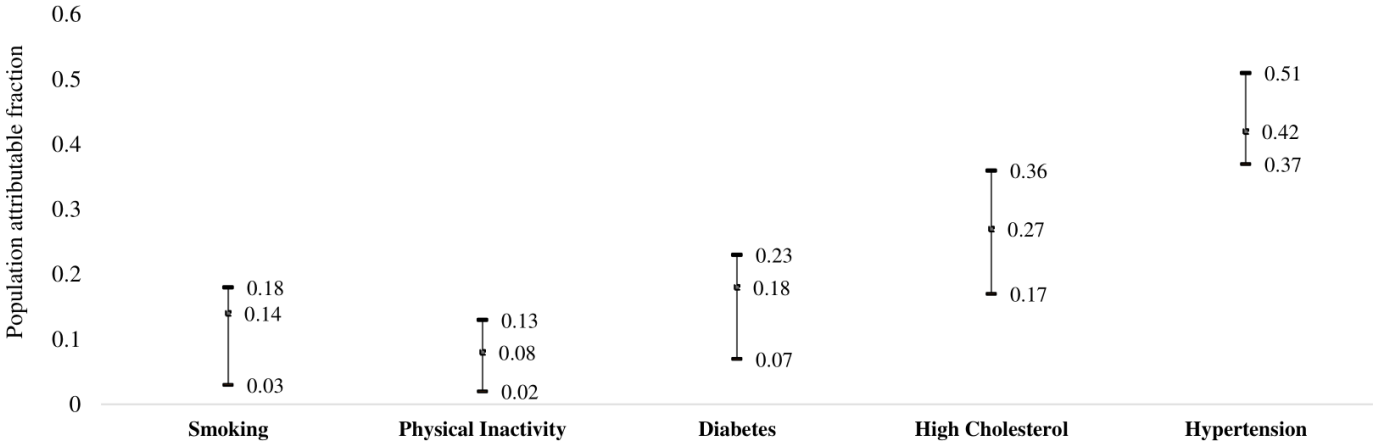

Figure 2 Population attributable factions of Life's Simple 7 components to cardiovascular disease outcomes.

risk factors in the target population. Smoking cessation programmes, in particular, seem to require culturally adapted public health approaches in order to be successful in the AI/AN population. For centuries, cultural practices among AI/ANs celebrated tobacco for religious, ceremonial and therapeutic purposes.[21] Today, some AIs still use tobacco as part of cultural practices, including burial offerings, for spiritual protection or as a gift, particularly among tribes native to the eastern seaboard and the Great Plains, for example, Six Nations of the Iroquois, Delaware, Nanticoke and Lakota.[21] More recently, excessive marketing of cigarettes and tobacco products targeted to AI/ANs and the establishment of smoke shops in some AI communities have promoted smoking.[22] Smoking-cessation programmes tailored towards AI/ANs have been introduced, but unlike in other populations in the USA, smoking rates have not declined in AI/ANs.[23] With tobacco's deep roots in native culture, social acceptance and pervasiveness of cigarette smoking in ceremonies, and many AIs living on rural reservations or trust lands make it hard for the smoking cessation programmes to succeed.

Interestingly, diet and BMI were not significantly associated with CVD outcomes in the current study. Although 85.2% of AI/ANs in our study reported consumption of an 'ideal' diet, as defined by the consumption of at least one fruit and/or vegetable per day, this measure is not sufficient to fully capture the consumption of a heart-healthy dietary pattern in our population. In fact, consumption of one fruit and/or vegetable per day does not meet the dietary recommendations.[24] It is, therefore, plausible to assume that dietary intake among AI/ANs is not ideal and may still infer a level of CVD risk. In addition, study participants may have overreported fruit and vegetable intake, resulting in reporting errors and bias, and potentially leading to insignificant associations with CVD.[25] Despite 74.5% of AI/ANs being overweight or obese in our study, BMI was not significantly associated with CVD outcomes. This finding stands in contrast to previous research that has found BMI to be positively associated with CVD risk.[26] As BMI was a self-reported measure in our study, and weight is often underreported by study participants,[27] our findings of an existing relationship may have been diluted. More studies are warranted to test the relationships between BMI and CVD among AI/ANs.

In addition to LS7 factors, SDH were associated with CVD outcomes among AI/ANs. Having health insurance and a regular healthcare provider (HCP) were significantly associated with increased odds of diabetes, high cholesterol levels, hypertension and CVD outcomes. Avoidance of medical care due to cost was inversely associated with CVD outcomes. These findings are contrary to current knowledge in other populations that finds individuals with poor healthcare access to utilise CVD preventative healthcare services less often and showed lower rates of optimal blood pressure[28] and glycaemic control,[29] compared with individuals with access to care and healthcare insurance coverage. One explanation might be that better access to healthcare helps in identifying risk factors and timely diagnoses of CVDs,[30] while individuals who delay medical care due to cost are not aware of their underlying conditions. In addition, the asymptomatic nature of hypertension and high cholesterol levels has been shown to contribute to a delay in screening and medical care.[31 32] Furthermore, many states with large AI/ANs populations have elected not to expand Medicaid under the 2010 Affordable Care Act; therefore, potentially leaving AI/ANs with high-deductible health insurance plans that do not adequately cover preventative CVD services.[33] As in other populations, comprehensively addressing existing CVD risk factors and SDH is an important strategy for improving CVH.[10] However, unique characteristics and culturally sensitive and adapted practices need to be employed to address lifestyle-related CVD risk factors in the AI/AN population.

Our study is not without limitations. First, due to the cross-sectional study design, we are unable to examine the temporality between influencing factors and CVD presence. Second, all the dependent and independent variables in BRFSS were self-reported and may be subject to socially desirable estimates and recall bias, and thus

may have brought about misclassifications. Third, AI/AN households without telephone or cell phones were excluded. Thus, findings can only be generalised to AI/ANs living in households with telephones or cellphones. Nevertheless, this study fills an important gap in the knowledge by characterising a vulnerable and understudied population that is not often described in the literature and by identifying this population's unique healthcare needs.

CONCLUSIONS

Our study identified modifiable lifestyle-related risk factors (hypertension, increased total cholesterol, diabetes, smoking and physical activity) and SDH associated with CVD outcomes among AI/ANs. Hypertension was the largest contributor to CVD outcomes among this population. These findings have intervention and policy implications. Culturally adapted interventions and appropriate policy and legislative support, that tackle the root issues of CVD outcomes while attending to SDH, are needed. Community-based programmes could promote heart-healthy lifestyle behaviours, while policy interventions might be aimed at increased funding for the IHS, state Medicaid expansions and subsidies to help with out-of-pocket costs for indigent AI/AN patients. Future research should focus on large-scale longitudinal studies that oversample for AI/ANs, examine CVD risk factors and evaluate community-based and clinical interventions in this population.

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