SUPPLEMENTAL MATERIAL

Supplementary method

Appendix 1: Methods for evaluating each individual CVH metric

CVH metric	Method of measurement	Quantification of CVH metric	
DASH diet score*		Points	Metrics: DASH diet score
	Using dietary data collected from 2 nonconsecutive 24-hour recalls. The mean values of each dietary component were used in this study	100	95th percentile (top/ideal diet)
		80	75th–94th percentile
		50	50th–74th percentile
		25	25th–49th percentile
		0	1st–24th percentile (bottom/ least ideal quartile)
Physical activity score		Points	Metrics: minutes of moderate- (or greater) intensity activity per week
	Self-reported minutes of moderate or vigorous physical activity per week	100	≥150 minutes
		90	120-149 minutes
		80	90-119 minutes
		60	60-89 minutes
		40	30-59 minutes
		20	1-29 minutes
		0	0 minutes
Tobacco/nicotine exposure score		Points	Metrics: Combustible tobacco use or secondhand smoke exposure
	Self-reported tobacco use or secondhand smoke exposure	100	Never smoker
		75	Former smoker, quit ≥ 5 years
		50	Former smoker, quit 1–<5 years
		25	Former smoker, quit <1 years
		0	Current smoker
		Subtract 20 points (unless score is 0) for living with active indoor smoker in home	
Sleep health score		Points	Metrics: Sleep hours
	Self-reported average hours of sleep per night	100	7-9 hours
		90	9-<10 hours
		70	6–<7 hours
		40	5–<6 or ≥10 hours
		20	4–<5 hours
		0	< 4 hours
Body mass index score		Points	Metrics: BMI
	Body mass index (BMI) was calculated as weight in kilograms divided by standing height in meters squared. Weight and standing height were	100	<25 kg/m^2
		70	25.0-29.9 kg/m^2
		30	30.0-34.9 kg/m^2
		15	35.0-39.9 kg/m^2
		0	≥ 40.0 kg/m^2

	measured in mobile examination centers with standard protocols.		
Blood lipid score		Points	Metrics: Non-HDL cholesterol
	Non-HDL cholesterol was calculated by total cholesterol minus HDL cholesterol. Serum cholesterol was measured enzymatically	100	<130 mg/dL
		60	130-159 mg/dL
		40	160-189 mg/dL
		20	190-219 mg/dL
		0	≥ 220 mg/dL
		If drug-treated level, subtract 20 points	
Glucose score		Points	Metrics: FPG or HbA1c
	HbA1c was measured by high-performance liquid chromatography methods. Fasting plasma glucose (FPG) was measured by standard methods.	100	No history of diabetes and FPG <100 mg/dL (or HbA1c <5.7 %)
		60	No diabetes and FPG 100–125 100 mg/dL (or HbA1c 5.7–6.4%)
		40	Diabetes with HbA1c <7.0 %
		30	Diabetes with HbA1c 7.0–7.9 %
		20	Diabetes with HbA1c 8.0–8.9 %
		10	Diabetes with Hb A1c 9.0–9.9 %
		0	Diabetes with HbA1c ≥10.0 %
Blood pressure score		Points	Metrics: Systolic and diastolic BPs
	The average of all available BP measurements was used to calculate systolic and diastolic BP. BPs were measured in mobile examination centers with standard protocols.	100	<120/<80 mm Hg
		75	120-129/<80 mm Hg
		50	130-139 or 80-89 mm Hg
		25	140-159 or 90-99 mm Hg
		0	≥ 160 or ≥ 100 mm Hg
		Subtract 20 points (unless score is 0) if treated level	

* The scoring system of DASH diet score is based on quintiles with the lowest intake receiving one point and the top quintile receiving 5 points for healthy components (vegetables, fruits, nuts and legumes, whole grains, and low-fat dairy products); The scoring for unhealthy components is reversely coded so that quintile 1 receives 5 points and quintile 5 receives one point (sugar-sweetened drinks, red and processed meats and sodium intake). The total score ranged from 8 to 40 points. Higher scores are related to greater adherence to the DASH diet pattern.

Appendix 2: Statistical method used for estimating the difference in life expectancy.

We integrated information from three sources to estimate differences in life expectancies between CVH levels (henceforth "exposure groups"):

(1) Age-specific population all-cause mortality rate derived from National Vital Statistics System of National Center for Health Statistics (NCHS) (2019, from 0 to 100 years).

(2) The adjusted HRs of all-cause mortality in each exposure group (levels of CVH) versus the reference, derived from NHANES.

(3) The age-specific population prevalence (categorized in 10-year age groups) of each exposure groups, derived from NHANES.

Population all-cause mortality rates were obtained from the national vital statistics reports (2019, from 0 to 100 years). Age- and sex- specific population mortality rate was used when we assessed the association of CVH with life expectancy in men and women; Age- and race/ethnicity-specific population mortality rate was used when we assessed the association of CVH with life expectancy in White, Black and Mexican participants (Since the population mortality rate for Mexican were not provided, we use the Hispanic population mortality rates instead).

We used Cox regression models to evaluate the associations between levels of CVH and risk of all-cause mortality, and/or by sex (sex-specific model) or by race (race-specific model). Several covariates were adjusted in these models, including age (20-34, 35-49, 50-64 and ≥ 65 years old), levels of educational attainment, family income, health insurance, and/or sex or race/ethnicity in the corresponding model. Nationally representative prevalence of each CVH groups were calculated to create lifetables.

The lifetables for each of the 3 exposure groups (CVH levels) were built based on the

estimated group- and age-specific death rate (IR_{aj}), which was calculated by weighting (1) the population mortality rate by the corresponding (2) adjusted HR and (3) prevalence. We inferred the age-specific mortality rates appropriate for our reference group IR_{a0} as[28]:

$$IR_{a0} = \frac{IR_a}{(P_{a0} + \sum_{j=1}^{2} P_{aj} \times HR_{aj})}$$

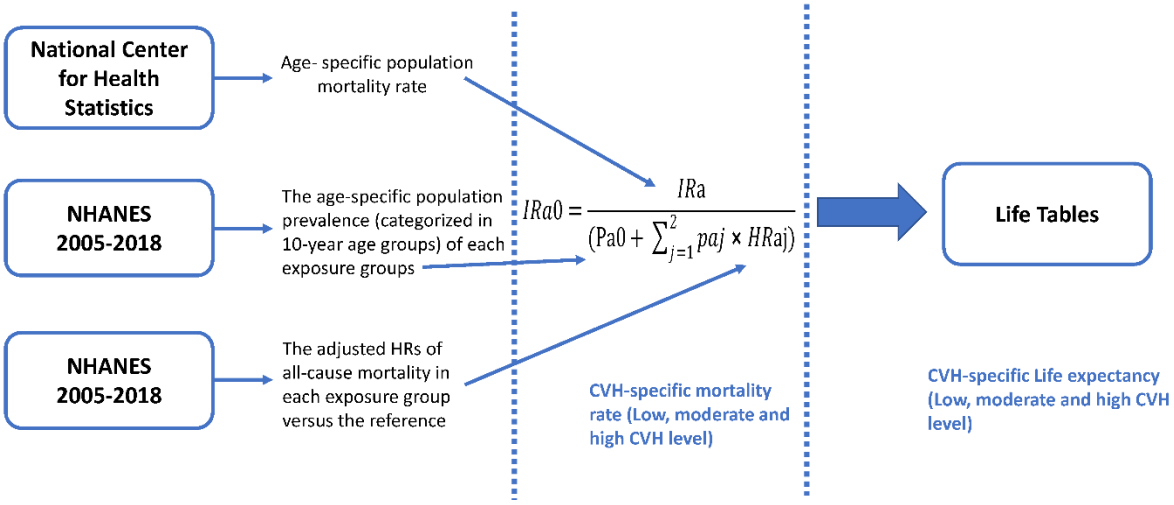
Where IR_a is the population mortality rate for age group a, P_{aj} is the prevalence of exposure group j, and HR_{aj} is the adjusted hazard ratio in comparison of exposure group j versus reference group (j = 0). The age-specific mortality rates in each of the non-reference exposure groups were then inferred in turn by multiplying the age-specific mortality rate for the reference group IR_{a0} by the hazard ratios HR_{aj}.

$$IR_{aj} = IR_{a0} \times HR_{aj} \text{ (j} > 0)$$

We built the life table starting at age 50 years and ending at 100 years by single-year age intervals. Survival probability was set of 1 at age 50 years; probability of survival between ages x and x + 1 was calculated based on probability of dying (mortality rate) between ages x and x + 1 assuming that survivor function declines linearly between ages x and x + 1.[18,29] The life expectancy at any given age was derived by dividing the total person-years that would be lived beyond age x by the number of persons who survived to that age interval.

Finally, the estimated higher survival time (years) due to higher CVH was calculated as the difference in the life expectancy at any given age between the reference group and each of the exposure group.

Overview of Data Source and Method



Supplementary Table 2. Characteristics of participants at baseline by sex.

Characteristic	Men	Women
Prevalence, % (weighted N)	48.2 (71.7 million)	51.8 (77.1 million)
Number of participants (Sample)	11,079	11,924
Age, years (SE)	44.6 (0.26)	46.6 (0.26)
Educational level, % (weighted N)		
Less than high school	14.2 (10.2 million)	12.8 (9.9 million)
High school	23.7 (17.0 million)	21.8 (16.8 million)
Some college or above	62.1 (44.5 million)	65.4 (50.4 million)
Family Income, % (weighted N)		
Low	16.5 (11.8 million)	19.0 (14.6 million)
Intermediate	32.3 (23.2 million)	33.0 (25.4 million)
High	45.2 (32.4 million)	42.0 (32.4 million)
Insurance, % (weighted N)		
No insurance	20.1 (14.4 million)	15.5 (12.0 million)
Government insurance	13.8 (9.9 million)	17.0 (13.1 million)
Private insurance	66.0 (47.3 million)	67.2 (51.8 million)
AHA Life's Essential 8 Scores, (Mean, SE)		
Mean Total CVH Score (SE)	65.7 (0.30)	68.9 (0.32)
Mean DASH diet score (SE)	40.4 (0.51)	51.8 (0.51)
Mean physical activity score (SE)	55.5 (0.83)	50.9 (0.89)
Mean tobacco/nicotine exposure score (SE)	66.6 (0.62)	73.8 (0.53)
Mean sleep health score (SE)	83.4 (0.34)	84.3 (0.34)
Mean body mass index score (SE)	60.9 (0.50)	60.9 (0.56)
Mean blood lipid score (SE)	62.0 (0.43)	66.8 (0.46)
Mean blood glucose score (SE)	87.1 (0.31)	87.8 (0.28)
Mean blood pressure score (SE)	69.7 (0.46)	74.8 (0.37)

Data are mean (SE) or percentages (weight N). SE, standard error; DASH diet, the Dietary Approaches to Stop Hypertension (DASH) diet score

Supplementary Table 3. Characteristics of participants at baseline by race groups.

Characteristic	White	Black	Mexican	Other Hispanic	Others
Prevalence, % (weighted N)	68.8 (102 million)	10.4 (15.5 million)	8.3 (12.4 million)	5.5 (8.2 million)	6.9 (10.3 million)
Number of participants (Sample)	9,697	4,881	3,729	2,273	2,423
Age, years (SE)	47.4 (0.28)	43.4 (0.33)	39.9 (0.30)	41.7 (0.40)	42.0 (0.40)
Educational level, % (weighted N)					
Less than high school	8.6 (8.8 million)	17.2 (2.7 million)	43.7 (5.4 million)	29.0 (2.4 million)	8.5 (0.9 million)
High school	22.8 (23.4 million)	26.8 (4.2 million)	22.9 (2.8 million)	22.0 (1.8 million)	15.5 (1.6 million)
Some college or above	68.6 (70.3 million)	56.0 (8.7 million)	33.3 (4.1 million)	48.9 (4.0 million)	75.9 (7.8 million)
Family Income, % (weighted N)					
Low	12.7 (13.0 million)	28.8 (4.5 million)	37.7 (4.7 million)	30.7 (2.5 million)	17.8 (1.8 million)
Intermediate	31.1 (31.9 million)	37.7 (5.8 million)	36.4 (4.5 million)	35.7 (2.9 million)	34.1 (3.5 million)
High	51.6 (52.9 million)	24.8 (3.9 million)	16.7 (2.1 million)	22.5 (1.8 million)	41.1 (4.2 million)
Insurance, % (weighted N)					
No insurance	12.2 (12.5 million)	24.4 (3.8 million)	46.3 (5.7 million)	31.6 (2.6 million)	16.5 (1.7 million)
Government insurance	13.3 (13.7 million)	25.0 (3.9 million)	14.5 (1.8 million)	21.5 (1.8 million)	18.6 (1.9 million)
Private insurance	74.3 (76.1 million)	50.2 (7.8 million)	38.6 (4.8 million)	46.5 (3.8 million)	64.5 (6.7 million)
AHA Life's Essential 8 Scores, (Mean, SE)					
Mean Total CVH Score (SE)	68.0 (0.4)	62.4 (0.3)	66.1 (0.3)	66.9 (0.5)	70.5 (0.5)
Mean DASH diet score (SE)	47.3 (0.6)	37.6 (0.8)	46.3 (0.8)	45.7 (1.0)	50.5 (1.0)
Mean physical activity score (SE)	55.7 (1.0)	47.6 (1.0)	41.8 (1.0)	46.8 (1.4)	54.8 (1.3)
Mean tobacco/nicotine exposure score (SE)	69.1 (0.7)	68.7 (0.8)	75.4 (0.8)	75.6 (1.0)	75.4 (1.3)
Mean sleep health score (SE)	85.5 (0.4)	74.2 (0.5)	83.8 (0.5)	80.6 (0.7)	84.3 (0.6)
Mean body mass index score (SE)	61.9 (0.5)	52.3 (0.6)	55.0 (0.8)	60.3 (0.8)	71.1 (1.1)
Mean blood lipid score (SE)	63.5 (0.4)	71.3 (0.5)	64.1 (0.7)	63.5 (0.9)	66.2 (0.9)
Mean blood glucose score (SE)	88.9 (0.3)	81.6 (0.5)	85.1 (0.6)	86.0 (0.5)	86.1 (0.7)
Mean blood pressure score (SE)	72.1 (0.4)	65.7 (0.6)	77.6 (0.5)	76.4 (0.8)	76.0 (0.7)

Data are mean (SE) or percentages (weight N). SE, standard error; DASH diet, the Dietary Approaches to Stop Hypertension (DASH) diet score.

Supplementary Table 4. Hazard ratios and 95% confidence interval for category of LE8 with the hazard of mortality (multiple imputation was used to impute data for missing covariates)

	All-cause		CVD mortality		Non-CVD mortality	
	Cases/Total*	**HRs (95% CI) †**	**Cases/Total***	**HRs (95% CI) †**	**Cases/Total***	**HRs (95% CI) †**
CVH score						
Low (LE8<50)	422/3,704	1 (reference)	120/3704	1 (reference)	302/3704	1 (reference)
Moderate (50-79)	834/14,977	0.55 (0.46-0.66)	192/14977	0.41 (0.30-0.55)	642/14977	0.62 (0.50-0.75)
High (≥80)	103/4,322	0.38 (0.28-0.52)	16/4322	0.23 (0.11-0.46)	87/4322	0.44 (0.33-0.60)

Results adjusted for sex, age, race/ethnicity, education, family income and health insurance. *: unweighted number of participants; †: sampling weights were considered in analyses;

Supplementary Table 5. Hazard ratios and 95% confidence interval for category of LE8 with the hazard of mortality in men and women

	All-cause		CVD mortality		Non-CVD mortality	
	Cases/Total *	**HRs (95% CI) †**	**Cases/Total ***	**HRs (95% CI) †**	**Cases/Total ***	**HRs (95% CI) †**
Men						
Low (LE8<50)	231/1,932	1 (reference)	63/1932	1 (reference)	168/1932	1 (reference)
Moderate (50-79)	488/7,463	0.54 (0.42-0.69)	112/7463	0.38 (0.25-0.58)	376/7463	0.61 (0.45-0.81)
High (⩾80)	53/1,684	0.43 (0.29-0.63)	13/1684	0.36 (0.17-0.79)	41/1684	0.46 (0.30-0.71)
Women						
Low (LE8<50)	191/1,772	1 (reference)	57/1772	1 (reference)	134/1772	1 (reference)
Moderate (50-79)	346/7,514	0.58 (0.46-0.75)	80/7514	0.47 (0.32-0.68)	266/7514	0.63 (0.47-0.85)
High (⩾80)	50/2,638	0.35 (0.20-0.61)	4/2638	0.11 (0.04-0.33)	46/2638	0.43 (0.25-0.75)
***P*-interaction (Men vs. women)**		0.62		0.09		0.94

Results adjusted for age, race/ethnicity, education, family income and health insurance. *: unweighted number of participants; †: sampling weights were considered in analyses.

Supplementary Table 6. Hazard ratios and 95% confidence interval for category of LE8 with the hazard of all-cause mortality race/ethnicity groups

	All-cause mortality	
	Cases/Total*	**HRs (95% CI) †**
White		
Low (LE8<50)	205/1,492	1 (reference)
Moderate (50-79)	478/6,141	0.55 (0.44-0.69)
High (⩾80)	64/2,064	0.36 (0.25-0.52)
Black		
Low (LE8<50)	143/1,097	1 (reference)
Moderate (50-79)	183/3,251	0.68 (0.55-0.85)
High (⩾80)	11/5,33	0.38 (0.20-0.71)
Mexican		
Low (LE8<50)	37/563	1 (reference)
Moderate (50-79)	87/2,583	0.65 (0.40-1.07)
High (⩾80)	15/583	1.53 (0.68-3.44)

Results adjusted for sex, age, education, family income and health insurance. *: unweighted number of participants; †: sampling weights were considered in analyses.

P-interaction (White vs. Black) =0.46; *P*-interaction (White vs. Mexican) =0.005; *P*-interaction (Black vs. Mexican) =0.026.

Supplementary Table 7. The estimates of cumulative survival time at the of 50 among participants with different levels of LE8 score

	Total Population		
	HRs (95% CI)	**LE at age 50 (95% CI)**	***Years of life gain* between adjacent groups (95% CI)**
LE8 Score			
Low (<50)	1 (reference)	27.1 (25.9, 28.2)	
50-<60	0.74 (0.62, 0.89)	29.9 (28.8, 30.9)	2.8 (1.0, 4.6)
60-<70	0.50 (0.40, 0.62)	33.7 (32.4, 34.9)	3.8 (1.8, 5.7)
70-<80	0.39 (0.30, 0.50)	36.1 (34.4, 37.6)	2.4 (0.2, 4.6)
80-<90	0.39 (0.28, 0.54)	35.9 (33.6, 38.1)	-0.2 (-3.0, 2.7)
90-100	0.31 (0.17, 0.56)	38.0 (32.4, 42.7)	2.1 (3.4, 6.9)
Mean increase in LE per 10-point increase compared to poor CVH			**2.2 (1.0, 3.2)**

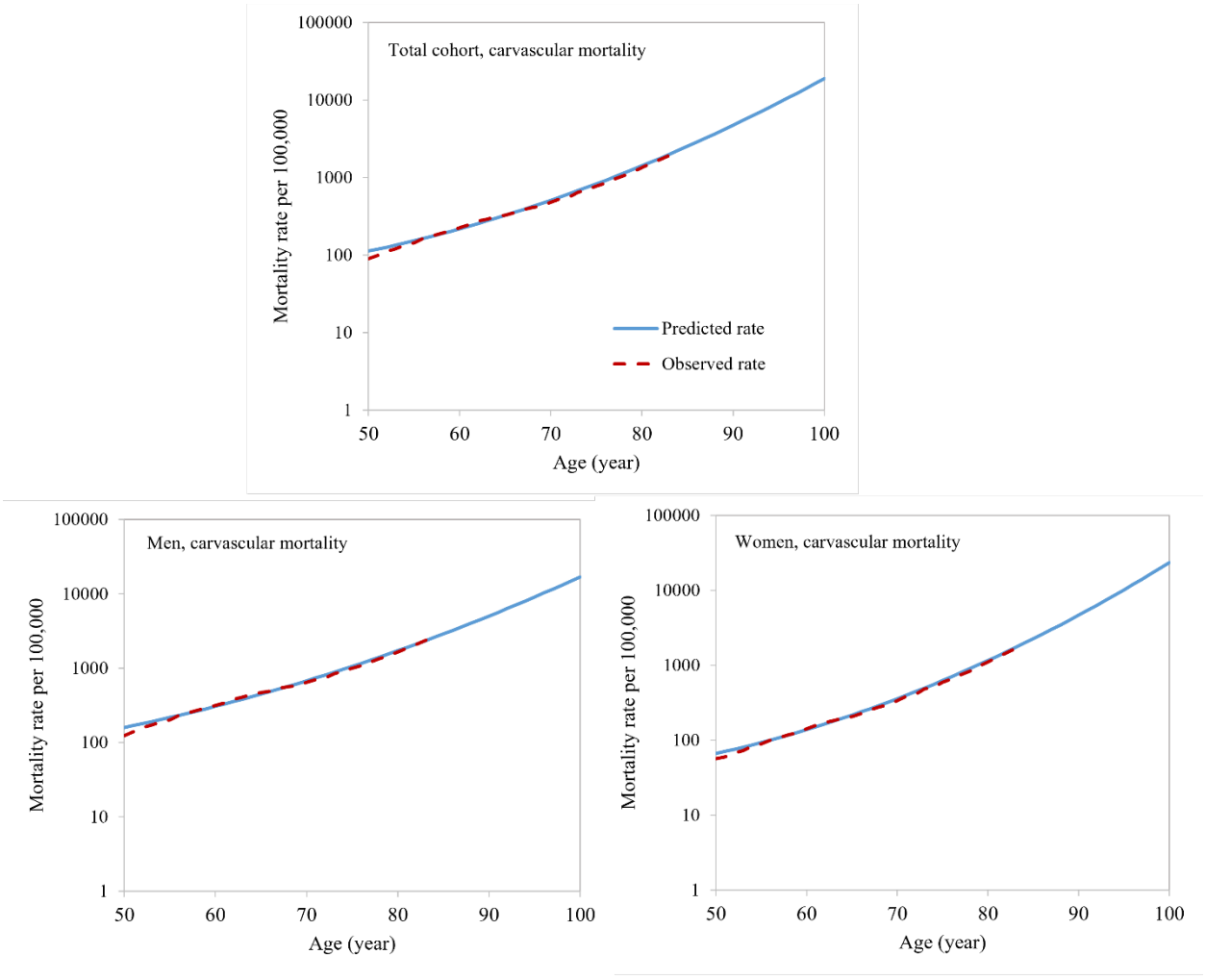
HRs were adjusted for sex, race/ethnicity, age, education, health insurance, family income.

Supplementary Table 8. The estimates of cumulative survival time at the of 50 among participants with different levels of individual CVH metrics

	Total population		
	HRs (95% CI)	**LE at age 50 (95% CI)**	***Years of life gain* (95% CI)**
DASH diet score			
Poor (<50)	1 (reference)	30.5 (29.5, 31.4)	reference
Intermediate (50-79)	0.90 (0.76-1.07)	31.5 (30.5, 32.4)	0.9 (-0.7, 2.7)
Ideal (≥80)	0.70 (0.58-0.85)	33.8 (32.8, 34.9)	3.3 (1.6, 5.1)
Physical activity score			
Poor (<50)	1 (reference)	30.2 (29.7, 30.7)	reference
Intermediate (50-79)	0.60 (0.43, 0.83)	35.0 (31.6, 37.8)	4.8 (1.3, 7.7)
Ideal (≥80)	0.61 (0.51, 0.74)	34.8 (33.8, 35.8)	4.6 (3.1, 6.1)
Tobacco/nicotine exposure score			
Poor (<50)	1 (reference)	26.8 (25.5, 27.9)	reference
Intermediate (50-79)	0.59 (0.49, 0.72)	31.7 (30.8, 32.6)	4.9 (3.2, 6.8)
Ideal (≥80)	0.45 (0.38, 0.54)	34.2 (33.3, 35.0)	7.4 (5.7, 9.1)
Sleep health score			
Poor (<50)	1 (reference)	28.1 (26.8, 29.4)	reference
Intermediate (50-79)	0.68 (0.56, 0.84)	31.6 (30.3, 32.9)	3.5 (1.6, 5.5)
Ideal (≥80)	0.59 (0.48, 0.72)	33.0 (32.5, 33.5)	5.0 (3.2, 6.7)
Body mass index score			
Poor (<50)	1 (reference)	31.2 (30.4, 32.1)	reference
Intermediate (50-79)	0.78 (0.65, 0.93)	33.6 (32.5, 34.5)	2.3 (0.6, 3.8)
Ideal (≥80)	1.00 (0.85, 1.18)	31.3 (30.2, 32.3)	0.0 (-1.1, 1.1)
Blood lipid score			
Poor (<50)	1 (reference)	32.7 (31.8, 33.6)	reference
Intermediate (50-79)	0.89 (0.72, 1.10)	33.9 (32.4, 35.0)	1.2 (-0.6, 2.7)
Ideal (≥80)	1.24 (1.06, 1.45)	30.6 (29.9, 31.4)	-2.0 (-3.6, -0.5)
Glucose score			
Poor (<50)	1 (reference)	28.1 (26.8, 29.3)	reference
Intermediate (50-79)	0.60 (0.48, 0.75)	33.0 (31.8, 34.1)	4.8 (2.9, 6.9)
Ideal (≥80)	0.60 (0.50, 0.71)	33.1 (32.3, 33.8)	4.9 (3.2, 6.8)
Blood pressure score			
Poor (<50)	1 (reference)	30.2 (29.4, 31.1)	reference
Intermediate (50-79)	0.73 (0.64, 0.84)	33.2 (32.3, 34.2)	3.0 (1.3, 4.6)
Ideal (≥80)	0.72 (0.61, 0.85)	33.4 (32.1, 34.4)	3.1 (1.3, 4.7)

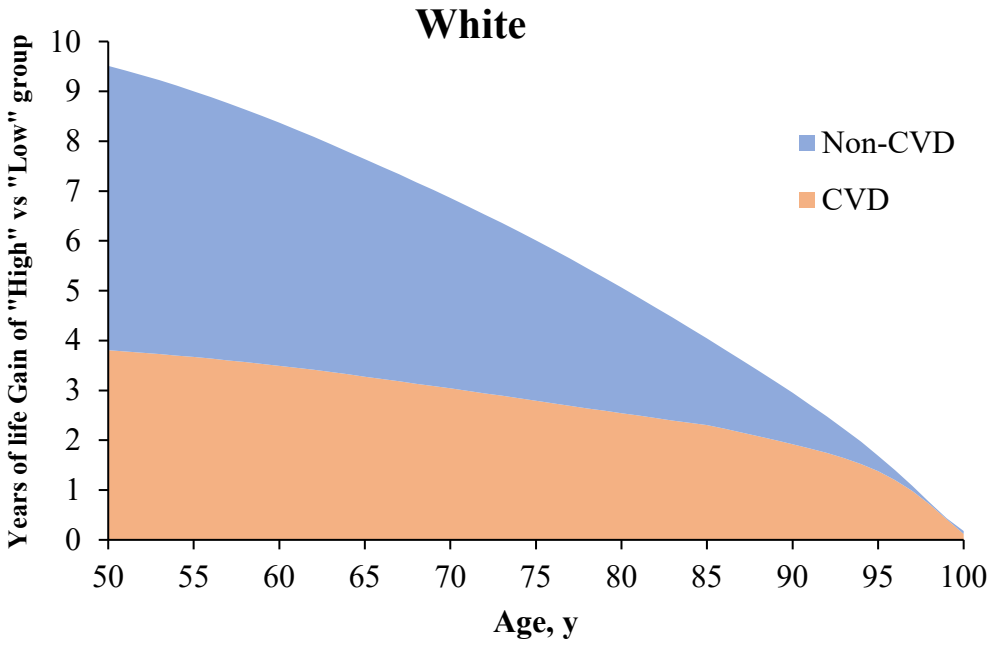
Results were adjusted for sex, race/ethnicity, age, education, health insurance, family income.

Supplementary Figure 1. Observed and predicted rate of US population mortality rates of 2019.



Rate was predicted by Poisson model log-linear age + age^2.

Supplementary Figure 2. Estimated years of life gained from high versus low CVH attributable to reduced death from cardiovascular disease and other causes in White participants.



CVH, cardiovascular health; CVD, cardiovascular disease

Supplementary Figure 3. The estimates of cumulative survival time from 50 years of age onward among participants with different levels of CVH, estimated by the LE8 score, in Mexican participants.

Supplementary Figure 3