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ORIGINAL RESEARCH

Estimated Impact of Achieving Optimal Cardiovascular Health Among US Adults on Cardiovascular Disease Events

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BACKGROUND: Better cardiovascular health (CVH) scores are associated with lower risk of cardiovascular disease (CVD). However, estimates of the potential population-level impact of improving CVH on US CVD event rates are not currently available.

METHODS AND RESULTS: Using data from the National Health and Nutrition Examination Survey 2011 to 2016 (n=11 696), we estimated the proportions of US adults in CVH groups. Levels of 7 American Heart Association CVH metrics were scored as ideal (2 points), intermediate (1 point), or poor (0 points), and summed to define overall CVH (low, 0–8 points; moderate, 9–11 points; or high, 12–14 points). Using individual-level data from 7 US community-based cohort studies (n=30 447), we estimated annual incidence rates of major CVD events by levels of CVH. Using the combined data sources, we estimated population attributable fractions of CVD and the number of CVD events that could be prevented annually if all US adults achieved high CVH. High CVH was identified in 7.3% (95% CI, 6.3%–8.3%) of US adults. We estimated that 70.0% (95% CI, 56.5%–79.9%) of CVD events were attributable to low and moderate CVH. If all US adults attained high CVH, we estimated that 2.0 (95% CI, 1.6–2.3) million CVD events could be prevented annually. If all US adults with low CVH attained moderate CVH, we estimated that 1.2 (95% CI, 1.0–1.4) million CVD events could be prevented annually.

CONCLUSIONS: The potential benefits of achieving high CVH in all US adults are considerable, and even a partial improvement in CVH scores would be highly beneficial.

Key Words: cardiovascular disease ■ epidemiology ■ health status disparities ■ prevention ■ risk factors

Cardiovascular disease (CVD) is a major cause of morbidity and the leading cause of death in the United States and globally.[1,2] Epidemiologic and clinical trial evidence has established the causal associations of high blood pressure (BP), dyslipidemia, diabetes mellitus, and cigarette smoking with increased risk of CVD.[3] However, despite the availability of effective interventions targeting these risk factors for primary prevention, previously declining CVD death rates are plateauing.[4] In an effort to shift attention toward the preservation of ideal levels of risk factors (ie, primordial prevention), the American Heart Association (AHA) developed the cardiovascular health (CVH) concept, which integrates 7 modifiable factors: smoking status, body mass index (BMI), physical activity, diet quality, total cholesterol, BP, and fasting glucose.[5]

Several studies have documented the associations of CVH with various CVD outcomes[6–14] and have described the US population prevalence of CVH over time.[7,15,16] In 2012, Yang et al reported the associations

See Editorial by Michos and Khan

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CLINICAL PERSPECTIVE

What Is New?

- This is the first analysis to estimate the potential impact of improving population-level cardiovascular health (CVH) on reductions in cardiovascular disease (CVD) events.
- We estimated that only 7.3% of US adults had a high CVH score, and 70.0% of CVD events in the Unites States were attributable to low and moderate CVH.
- If all US adults attained high CVH, we estimated that 2.0 million CVD events could be prevented annually in the United States; even partial improvements would be beneficial; if all US adults with low CVH attained moderate CVH, we estimated that 1.2 million CVD events could be prevented annually.

What Are the Clinical Implications?

- The American Heart Association CVH score integrates 7 of the most important metrics for CVD prevention: smoking status, body mass index, physical activity, diet quality, total cholesterol, blood pressure, and fasting glucose.
- Higher CVH scores are associated with lower risk of CVD, and discussions with individuals about improving their CVH score may contribute to population-level reductions in CVD burden.
- Future research should identify multipronged approaches and policy initiatives targeting CVH in conjunction with the social determinants of health throughout the life course to improve CVH in the United States.

Nonstandard Abbreviations and Acronyms

AHA	American Heart Association
CVH	cardiovascular health
NHANES	National Health and Nutrition Examination Survey
PAF	population attributable fraction
PIF	potential impact fraction

of CVH metrics with population health indicators, including population attributable fractions (PAFs) of mortality.[7] However, PAFs for incident nonfatal as well as fatal CVD events have not been estimated for individual CVH metrics or by level of the total CVH score. Furthermore, the potential impact of achieving high CVH among all US adults on CVD events is unknown. This information could aid researchers, clinicians, and policy makers in developing and implementing strategies to reduce the overall burden of CVD in US adults.

Using a comprehensive analytic framework and nationally representative data, the objectives of this study were 2-fold: to quantify the prevalence and PAFs of CVH levels in US adults overall and in subgroups defined by age, sex, and race/ethnicity; and to estimate the number of CVD events that could be prevented annually if US adults had improved CVH levels.

METHODS

The data and materials that support the findings of this study can be requested from the corresponding author and the National Heart, Lung, and Blood Institute BioLINCC.

Estimating the Proportions of US Adults in 3 CVH Score Groups

The National Health and Nutrition Examination Survey (NHANES) uses a complex, stratified, multistage probability cluster sampling design to select representative samples of the US civilian, noninstitutionalized population.[17] We combined 3 survey cycles, conducted between 2011 and 2016, which included 17 048 participants aged ≥20 years. The analysis was limited to nonpregnant, nonlactating participants with complete information for characterization of all 7 CVH metrics, yielding a final analysis sample size of 11 696 adults. Smoking status and the frequency, duration, and intensity of leisure-time physical activities in a typical week were ascertained via questionnaires. BMI was calculated as the weight in kilograms divided by height in meters squared. Dietary intake was assessed via 2 interviewer-administered 24-hour recalls, and the average was used in analyses, yielding a healthy diet score ranging from 0 to 5 based on AHA criteria.[5] Total cholesterol and BP were measured according to standard NHANES protocols. Because fasting plasma glucose values were only available for a subsample of NHANES participants, we used glycated hemoglobin values as a proxy for fasting glucose levels, as suggested by the American Diabetes Association.[7,18]

On the basis of AHA definitions (Table 1), CVH was scored for each individual metric as ideal (2 points), intermediate (1 point), or poor (0 points).[5] A composite CVH score (range, 0–14 points), based on the sum of individual CVH metrics, was calculated for each participant. We stratified participants, a priori, into high (12–14 points), moderate (9–11 points), and low (0–8 points) CVH groups, which is supported by prior reports[10,13,19] and hazard ratios (HRs) of CVD events for CVH scores in the current study (Figure S1).

We used survey analysis procedures to estimate the proportion of US adults in CVH score groups by

Table 1. Proportions of US Adults Meeting Recommended Levels of CVH Metrics: NHANES 2011 to 2016

Health Metric	Definition		Proportion of US Adults in CVH Categories, % (95% CI)				
				Sex		Race	
			All Adults	Men	Women	White/Other[§]	Black
Smoking	Ideal	Never or quit >12 mo	78.6 (77.2–80.0)	76.3 (74.3–78.3)	80.8 (79.0–82.6)	79.2 (77.7–80.8)	73.9 (71.0–76.8)
	Intermediate	Former, quit ≤12 mo	2.8 (2.3–3.4)	3.4 (2.6–4.3)	2.2 (1.5–2.9)	2.9 (2.3–3.5)	2.3 (1.5–3.1)
	Poor	Current	18.6 (17.2–19.9)	20.2 (18.3–22.1)	17.0 (15.4–18.6)	17.9 (16.4–19.4)	23.8 (21.2–26.4)
Body mass index, kg/m^2	Ideal	<25	29.3 (27.7–31.0)	26.0 (24.3–27.6)	32.4 (30.1–34.7)	30.1 (28.3–31.9)	23.0 (21.0–25.0)
	Intermediate	25–29.99	33.0 (31.4–34.6)	38.4 (36.3–40.4)	27.9 (25.8–30.1)	33.9 (32.2–35.7)	25.3 (22.9–27.7)
	Poor	≥30	37.7 (35.9–39.5)	35.7 (33.1–38.2)	39.6 (37.7–41.5)	36.0 (34.0–37.9)	51.7 (48.9–54.5)
Physical activity	Ideal	≥150 min/wk moderate or ≥75 min/wk vigorous or ≥150 combination	39.3 (37.3–41.3)	42.1 (40.0–44.2)	36.7 (33.7–39.6)	39.7 (37.5–42.0)	35.7 (32.9–38.5)
	Intermediate	1–149 min/wk moderate or 1–74 min/wk vigorous or 1–149 min/wk combination	16.9 (15.6–18.2)	15.6 (13.9–17.3)	18.2 (16.6–19.8)	17.1 (15.6–18.5)	15.9 (14.2–17.6)
	Poor	None	43.8 (41.3–46.3)	42.3 (39.4–45.2)	45.1 (42.0–48.2)	43.2 (40.4–45.9)	48.4 (45.5–51.3)
Healthy diet score*	Ideal	4–5 Components	0.7 (0.5–0.9)	0.3 (0.2–0.5)	1.0 (0.6–1.3)	0.6 (0.4–0.8)	1.1 (0.6–1.5)
	Intermediate	2–3 Components	24.7 (22.8–26.7)	20.4 (18.5–22.3)	28.8 (26.1–31.5)	25.5 (23.3–27.7)	18.9 (16.2–21.5)
	Poor	0–1 Component	74.6 (72.6–76.6)	79.2 (77.3–81.1)	70.2 (67.6–72.9)	73.9 (71.7–76.1)	80.1 (77.3–82.9)
Total cholesterol, mg/dL	Ideal	<200 (untreated)	46.3 (44.3–48.3)	46.8 (44.3–49.2)	45.8 (43.2–48.4)	45.1 (43.1–47.2)	55.3 (52.7–57.8)
	Intermediate	200–239 or treated to goal	41.5 (39.5–43.5)	41.9 (39.4–44.3)	41.1 (38.7–43.6)	42.3 (40.1–44.4)	35.2 (32.7–37.8)
	Poor	≥240	12.2 (11.1–13.4)	11.4 (10.0–12.7)	13.1 (11.4–14.7)	12.6 (11.4–13.8)	9.5 (7.9–11.2)
Blood pressure, mm Hg	Ideal	<120/<80 (untreated)	41.2 (39.6–42.7)	35.4 (33.2–37.7)	46.5 (44.6–48.4)	42.2 (40.4–44.0)	32.9 (30.4–35.3)
	Intermediate	120–139/80–89 or treated to goal	43.8 (42.3–45.3)	48.5 (46.5–50.5)	39.4 (37.7–41.1)	43.4 (41.9–45.0)	46.4 (44.3–48.5)
	Poor	≥140/90	15.1 (13.8–16.3)	16.1 (14.2–17.9)	14.1 (12.9–15.4)	14.4 (12.9–15.8)	20.7 (18.7–22.8)
HbA1c, %[†]	Ideal	<5.7 (Untreated)	66.8 (65.3–68.3)	66.4 (64.4–68.3)	67.2 (65.6–68.8)	68.7 (67.1–70.3)	51.8 (49.0–54.5)
	Intermediate	5.7–6.5 or treated to goal	25.0 (23.8–26.3)	24.5 (22.9–26.1)	25.5 (24.0–27.1)	23.7 (22.3–25.0)	35.8 (33.3–38.3)
	Poor	≥6.5	8.2 (7.4–9.0)	9.2 (7.9–10.4)	7.3 (6.5–8.0)	7.6 (6.7–8.6)	12.4 (11.0–13.8)
Total CVH score[‡]	High	12–14 Points	7.3 (6.3–8.3)	6.1 (5.1–7.1)	8.4 (6.7–10.1)	7.8 (6.6–8.9)	3.5 (2.3–4.8)
	Moderate	9–11 Points	34.2 (32.4–36.0)	33.6 (31.3–35.9)	34.7 (32.4–37.0)	35.0 (33.1–37.0)	27.5 (24.8–30.1)
	Low	0–8 Points	58.5 (56.1–60.9)	60.3 (57.7–62.9)	56.9 (54.0–59.8)	57.2 (54.6–59.8)	69.0 (66.0–71.9)

CVH indicates cardiovascular health; HbA1c, glycated hemoglobin; and NHANES, National Health and Nutrition Examination Survey.

*The 5 dietary score components include ≥4.5 cups/day of fruits/vegetables, ≥2 servings of fish per week (3.5 oz), ≥3 servings of whole grains per day (1 oz), <1500 mg/d of sodium, and <450 kcal/wk of sugar-sweetened beverages. Dietary values are scaled to a 2000-kcal/d diet.

[†]Given that fasting plasma glucose values were only available for a subsample of NHANES participants, we used HbA1c values as a proxy for fasting glucose levels (fasting plasma glucose ≥126 mg/dL=HbA1c ≥6.5%; fasting plasma glucose 100–125 mg/dL=HbA1c 5.7%–6.4%; fasting plasma glucose <100 mg/dL untreated=HbA1c <5.7% untreated), as suggested by the American Diabetes Association.

[‡]The total CVH score represents the sum of individual metric point values and ranges from 0 to 14. Each individual metric was scored as ideal (2 points), intermediate (1 point), or poor (0 points). We defined overall CVH as high (12–14 points), moderate (9–11 points), or low (0–8 points).

[§]Includes Mexican American, other Hispanic, non-Hispanic Asian, and other races.

subgroups of age (20–39, 40–59, and ≥60 years), sex, and race/ethnicity (White/other [including Mexican American, other Hispanic, non-Hispanic Asian, and other races] and Black race/ethnicity). Original NHANES sampling weights were recalibrated on the basis of the proportion of participants excluded because of missing CVH data by age, sex, and race/ethnicity within each NHANES cycle, yielding US nationally representative estimates.[20]

Estimating the Incidence and HRs of Major CVD Events

We pooled individual-level data from 30 447 participants free of CVD at baseline and with complete information for characterization of all 7 CVH metrics, from 7 US cohort studies included in the Lifetime Risk Pooling Project[19,21]: the ARIC (Atherosclerosis Risk in Communities) Study,[22] CARDIA (Coronary Artery Risk Development in Young Adults Study),[23] CHS (Cardiovascular Health Study),[24] MESA (Multi-Ethnic Study of Atherosclerosis),[25] FHS (Framingham Heart Study),[26] Framingham Offspring Study,[27] and the WHI (Women's Health Initiative) Observational Study.[28] Detailed data ascertainment methods are available in the original design publications from each study, and the data were harmonized for comparability.[19,21,29] Because individual studies used different instruments for assessing physical activity and diet, we used modified definitions for data harmonization (Table S1), which have been detailed previously.[14,19,29,30]

We used Poisson regression models to estimate incidence of major CVD events (composite of nonfatal myocardial infarction, stroke, heart failure, or CVD death), which were adjudicated using similar methods in each cohort.[19,21] The estimates were calibrated to reflect an annual occurrence of 2.85 million major CVD events (795 000 stroke, 1 055 000 coronary heart disease, and 1 000 000 heart failure) in the US adult population in 2019, as reported by the AHA.[31] We used Cox proportional hazards regression to estimate HRs of CVD events for the overall CVH score and its individual components, stratified by age group and sex. HRs were not further stratified by race/ethnicity because few CVD events occurred among Black participants with a high CVH score. However, there was no evidence of a CVH-by-race/ethnicity interaction (P=0.82), which is supported by prior reports.[6,13] The earliest initial data collection was March 25, 1985, and follow-up time was censored at the time of a first CVD event, death from non-CVD causes, or end of follow-up through August 31, 2016.

Estimating the PAFs and Number of Events Prevented

A more detailed description of the PAF methods is available in Data S1. We calculated PAFs to estimate the proportion of CVD events that could hypothetically be prevented (or postponed), assuming a causal relationship, if the entire US adult population (or subgroups) had high CVH.[32] Within each age-, sex-, and race/ethnicity-specific stratum, we multiplied the PAFs by the expected number of annual CVD events to estimate the absolute number of events that could be prevented, which were summed to produce adjusted estimates overall and by subgroup.[33,34] We calculated PAFs in 2 separate analyses based on different assumptions: (1) all adults with a low or moderate CVH score would achieve a high CVH score; and (2) all adults with a low CVH score would achieve a moderate CVH score, while all adults with a moderate or high CVH score would remain in these groups. We repeated this general approach for each individual component of CVH.

Two sensitivity analyses were conducted. First, we estimated the number of CVD events prevented assuming only fractions of US adults achieved a high or moderate CVH score. Second, we assessed continuous CVH scores by estimating potential impact fractions (PIFs).[32] Specifically, we estimated the number of CVD events prevented assuming the mean CVH score in the US population increased by 1, 2, or 3 points. We additionally estimated the PIFs and number of CVD events prevented assuming all US adults achieved the maximum CVH score.

We accounted for uncertainty in our estimation of the proportions of CVH score groups, incidence rates, and HRs of CVD using Monte Carlo simulation.[35,36] For each age-, sex-, and race/ethnicity-specific PAF and PIF calculation, 10 000 simulations were conducted, with the 2.5th and 97.5th percentiles forming 95% CIs. All analyses were conducted using SAS version 9.4 and R version 3.6.2. This study was approved by the institutional review board at Northwestern University. Written informed consent was obtained from all participants for initial data collection in each original cohort and NHANES.

RESULTS

The mean CVH score among US adults from NHANES was 7.9 (95% CI, 7.8–8.0), and scores were approximately normally distributed (Figure S2). High CVH was identified in 7.3% (95% CI, 6.3%–8.3%), moderate CVH in 34.2% (95% CI, 32.4%–36.0%), and low CVH in 58.5% (95% CI, 56.1%–60.9%) of US adults (Table 1). The prevalence of high CVH was greater among younger compared with older adults, women compared with men, and White/other [including Mexican American, other Hispanic, non-Hispanic Asian, and other races] compared with Black adults (Table 1 and Table S2). More detailed characteristics of US adults in NHANES are presented in Table S3.

A total of 30 447 participants were included from the pooled cohorts (mean [SD] age at baseline, 55.0 [13.9] years; 60.6% women; 31.8% Black race), and CVH scores were approximately normally distributed (Figure S2). High CVH was identified in 7.5%, moderate CVH in 35.9%, and low CVH in 56.6% of participants (Table S1). More detailed baseline characteristics of the participants are presented in Table S4.

A total of 6546 incident CVD events (1430 stroke, 2764 coronary heart disease, and 2352 heart failure) occurred in the pooled cohort participants over 538 477 person-years of follow-up (mean [SD] follow-up, 16.2 [7.2] years). Incidence rates were higher among older compared with younger participants, men compared with women, and Black compared with White/other [including Mexican American, other Hispanic, non-Hispanic Asian, and other races] participants (Table 2). Among men aged 40 to 59 years, compared with low CVH, HRs (95% CIs) were 0.38 (0.33–0.44) for moderate CVH and 0.19 (0.11–0.33) for high CVH. Corresponding HRs (95% CIs) among women aged 40 to 59 years were 0.37 (0.31–0.43) and 0.12 (0.07–0.20). Patterns were similar among participants aged 20 to 39 years and ≥60 years. HRs for individual CVH metrics are presented in Table S5.

An estimated 2.85 million CVD events occurred among US adults in 2019 (Table S6).[31] We estimated that 70.0% (95% CI, 56.5%–79.9%) of CVD events were attributable to low and moderate levels of CVH, and 2.0 (95% CI, 1.6–2.3) million CVD events could potentially be prevented annually if all US adults attained a high CVH score (Table 3). We estimated that 42.0% (95% CI, 35.3%–48.2%) of all CVD events could be attributed to low levels of CVH alone, and that 1.2 (95% CI, 1.0–1.4) million CVD events could be prevented annually if these individuals attained moderate CVH. PAFs for CVD events were higher among younger compared with older adults, women compared with men, and Black compared with White/other [including Mexican American, other Hispanic, non-Hispanic Asian, and other races] adults.

We estimated that 42.4% (95% CI, 33.3%–50.1%) of CVD events were attributable to poor and intermediate levels of diet, whereas 4.8% (95% CI, 2.4%–7.1%) were attributable to poor and intermediate levels of total cholesterol. Thus, if all US adults achieved ideal levels of diet or total cholesterol, 42.4% or 4.8% of CVD events, respectively, could be prevented annually (Figure 1, blue bars). Corresponding PAFs for other metrics ranged from 12.8% (smoking) to 39.7% (BP). This pattern was similar when evaluating the proportion of CVD events attributable to poor levels alone (Figure 1, orange bars). However, the PAFs for smoking, BMI, physical activity, BP, and glycated hemoglobin were similar in magnitude (range, 9.1%–10.7%). Compared with older adults, PAFs among younger adults were higher for BMI, diet, and total cholesterol; and lower for BP (Table S7). Compared with women, PAFs among men were higher for total cholesterol and lower for BMI (Table S8). Compared with White/other [including Mexican American, other Hispanic, non-Hispanic Asian, and other races] adults, PAFs among Black adults were higher for all metrics, except physical activity and diet (Table S9).

The estimated numbers of CVD events prevented for fractions of US adults achieving high or moderate CVH are presented in Figure 2. For example, if the proportion of US adults with high CVH increased from 7.3% to 30.0%, an estimated 489 000 (95% CI, 394 000–558 000) CVD events could be prevented annually. A similar number of CVD events could be prevented if the proportion of US adults with moderate or high CVH increased from 41.5% to 65.4%.

The estimated PIF for a 1-point greater mean CVH score among US adults was 19.7% (95% CI, 17.4%–21.9%), which could prevent an estimated 559 000 (95% CI, 497 000–618 000) CVD events annually (Table S10). If all US adults achieved a maximum CVH score of 14, the corresponding PIF and number of CVD events prevented annually were 76.2% (95% CI, 71.5%–80.0%) and 2.2 (95% CI, 2.0–2.3) million, respectively.

DISCUSSION

In this analysis, which combined US nationally representative survey data and CVD incidence data from >30 000 adults from 7 community-based US cohort studies, we found that a high CVH score was uncommon among US adults but associated with a substantially lower risk of CVD compared with a low or moderate CVH score. If all individuals with either a low or moderate CVH score achieved a high CVH score, we estimated that nearly 2 million CVD events could be prevented annually, or ≈70% of all CVD events among US adults in 2019. Even if only a small fraction of the US population had higher CVH, we estimated that there would still be a large number of CVD events prevented. The current findings revealed a low prevalence of high CVH among US adults and highlight the potential impact of preventive efforts targeting future achievement of high CVH among all US adults.

Higher CVH scores are associated with lower risks of various CVD (and non-CVD) outcomes.[6–14] In 2012, Yang et al examined time trends of CVH metrics among US adults and estimated associated PAFs in relation to all-cause and CVD mortality.[7] However, PAFs for incident CVD events, including those that are not fatal, were not estimated because of a lack of CVD incidence data in NHANES. Fatal and nonfatal CVD events cost the United States an estimated

Table 2. Associations Between CVH Score Categories and Incident CVD Events: The Lifetime Risk Pooling Project

Subgroups	Low CVH			Moderate CVH			High CVH			Per 1-Unit Higher CVH
	Events/ Participants	Events per 1000 PYs	HR (95% CI)*	Events/ Participants	Events per 1000 PYs	HR (95% CI)*	Events/ Participants	Events per 1000 PYs	HR (95% CI)*	HR (95% CI)*
Aged 20–39 y										
White/other† men	26/207	4.93	1 (Reference)	29/578	1.82	0.41 (0.28–0.59)	2/297	0.23	0.07 (0.03–0.20)	0.69 (0.63–0.76)
Black men	29/211	5.28		28/463	2.15		2/93	0.77		
White/other† women	10/164	2.23	1 (Reference)	13/588	0.78	0.43 (0.28–0.68)	7/481	0.51	0.24 (0.11–0.51)	0.75 (0.68–0.84)
Black women	28/361	2.77		25/672	1.28		2/121	0.57		
Aged 40–59 y										
White/other† men	721/2772	16.1	1 (Reference)	174/1622	6.13	0.38 (0.33–0.44)	12/227	2.99	0.19 (0.11–0.33)	0.77 (0.75–0.79)
Black men	293/870	22.2		32/278	7.37		1/30	2.10		
White/other† women	489/2607	10.8	1 (Reference)	161/2396	3.71	0.37 (0.31–0.43)	13/565	1.29	0.12 (0.07–0.20)	0.75 (0.73–0.77)
Black women	398/2123	12.7		53/842	4.28		0/100	0.00		
Aged ≥60 y										
White/other† men	1155/2373	42.0	1 (Reference)	382/1169	24.6	0.55 (0.49–0.61)	20/100	14.6	0.34 (0.22–0.51)	0.83 (0.81–0.85)
Black men	183/536	29.8		34/166	18.4		3/16	16.0		
White/other† women	1269/2987	31.3	1 (Reference)	390/1437	18.4	0.58 (0.52–0.64)	25/183	9.22	0.29 (0.20–0.42)	0.83 (0.81–0.84)
Black women	449/2029	19.4		86/726	10.2		2/57	2.77		

CVD indicates cardiovascular disease; CVH, cardiovascular health; HR, hazard ratio; and PY, person-year.
*HRs for CVD events are adjusted for age (continuous) and race/ethnicity. HRs for moderate and high CVH were estimated using low CVH as the reference category.
†Includes Mexican American, other Hispanic, non-Hispanic Asian, and other races.

Table 3. CVH Category Prevalence and Potential Impact of Improving CVH Among US Adults

Subgroups	Proportion of US Adults in CVH Categories, % (95% CI)			Achievement of Moderate CVH Among US Adults With Low CVH		Achievement of High CVH Among All US Adults	
	Low	Moderate	High	Population Attributable Fraction, % (95% CI)	CVD Events Prevented, No. in Thousands (95% CI)*	Population Attributable Fraction, % (95% CI)	CVD Events Prevented, No. in Thousands (95% CI)†
Aged 20–39 y							
White/other‡ men	41.7 (37.7–45.7)	46.8 (43.6–50.0)	11.5 (9.2–13.7)	37.7 (21.9–51.9)	30 (17–41)	88.2 (76.1–94.9)	70 (60–75)
Black men	46.5 (39.9–53.2)	45.1 (39.8–50.4)	8.4 (4.0–12.7)	40.3 (23.8–54.8)	6 (4–8)	88.9 (77.3–95.4)	13 (12–14)
White/other‡ women	32.4 (28.7–36.1)	50.0 (46.7–53.2)	17.6 (14.2–21.1)	29.7 (12.8–46.0)	10 (4–16)	59.4 (33.7–77.0)	21 (12–27)
Black women	54.7 (47.7–61.7)	40.0 (33.6–46.3)	5.3 (2.6–8.1)	41.7 (20.0–59.6)	4 (2–6)	67.8 (42.9–83.2)	7 (5–9)
Total	38.9 (36.0–41.7)	47.6 (45.3–49.9)	13.5 (11.7–15.4)	36.7 (19.9–51.9)	51 (28–72)	80.4 (63.8–90.6)	112 (89–126)
Aged 40–59 y							
White/other‡ men	65.9 (61.2–70.6)	29.8 (25.1–34.5)	4.3 (2.7–5.9)	51.7 (45.0–57.7)	232 (202–259)	75.5 (61.7–85.2)	340 (277–383)
Black men	81.8 (77.0–86.7)	17.3 (12.5–22.1)	0.8 (0.0–1.8)	57.0 (50.4–62.7)	45 (40–50)	78.4 (64.2–87.1)	62 (51–69)
White/other‡ women	60.4 (56.4–64.3)	32.7 (29.3–36.2)	6.9 (4.9–8.9)	51.2 (44.7–57.0)	146 (128–163)	84.2 (75.5–90.3)	241 (216–258)
Black women	76.6 (70.7–82.4)	21.3 (15.7–26.9)	2.1 (0.8–3.4)	57.1 (50.5–62.9)	35 (31–39)	86.3 (77.9–91.9)	53 (48–56)
Total	64.9 (61.7–68.1)	30.0 (27.0–32.9)	5.2 (3.9–6.4)	53.1 (46.4–59.1)	459 (401–511)	80.4 (68.5–88.7)	696 (592–767)
Aged ≥60 y							
White/other‡ men	75.7 (72.0–79.5)	22.3 (18.9–25.8)	1.9 (0.9–3.0)	38.8 (32.5–44.5)	355 (298–408)	62.1 (46.2–73.8)	569 (424–676)
Black men	81.9 (76.6–87.2)	17.0 (12.0–21.9)	1.1 (0.0–2.3)	40.6 (34.2–46.5)	25 (21–29)	63.3 (47.2–75.1)	39 (29–46)
White/other‡ women	75.0 (70.5–79.5)	23.1 (18.6–27.5)	1.9 (0.9–3.0)	35.7 (29.8–41.2)	285 (238–330)	67.9 (55.8–77.1)	543 (446–617)
Black women	89.8 (87.0–92.7)	9.5 (6.6–12.4)	0.7 (0.0–1.3)	39.9 (34.0–45.5)	22 (19–25)	70.1 (57.5–79.3)	39 (32–44)
Total	76.3 (73.1–79.4)	21.9 (18.9–24.8)	1.8 (1.2–2.5)	37.2 (31.2–42.9)	688 (577–791)	64.4 (50.4–74.9)	1189 (931–1383)
Men	60.3 (57.7–62.9)	33.6 (31.3–35.9)	6.1 (5.1–7.1)	43.8 (36.8–50.2)	694 (583–795)	69.0 (53.9–79.9)	1093 (854–1265)
Women	56.9 (54.0–59.8)	34.7 (32.4–37.0)	8.4 (6.7–10.1)	39.8 (33.4–45.7)	504 (423–579)	71.3 (59.9–79.9)	903 (758–1011)
White/other‡ adults	57.2 (54.6–59.8)	35.0 (33.1–37.0)	7.8 (6.6–8.9)	41.4 (34.7–47.6)	1060 (889–1217)	69.7 (56.1–79.6)	1783 (1436–2037)
Black adults	69.0 (66.0–71.9)	27.5 (24.8–30.1)	3.5 (2.3–4.8)	47.4 (40.0–53.8)	138 (117–157)	73.4 (60.4–82.0)	214 (176–239)
All adults	58.5 (56.1–60.9)	34.2 (32.4–36.0)	7.3 (6.3–8.3)	42.0 (35.3–48.2)	1198 (1005–1374)	70.0 (56.5–79.9)	1996 (1611–2276)

CVD indicates cardiovascular disease; and CVH, cardiovascular health.

* Number of CVD events prevented annually if (1) all adults with low CVH had moderate CVH; and (2) all adults with moderate CVH or high CVH remained in these groups.

† Number of CVD events prevented annually if all adults with low CVH or moderate CVH had high CVH.

‡Includes Mexican American, other Hispanic, non-Hispanic Asian, and other races.

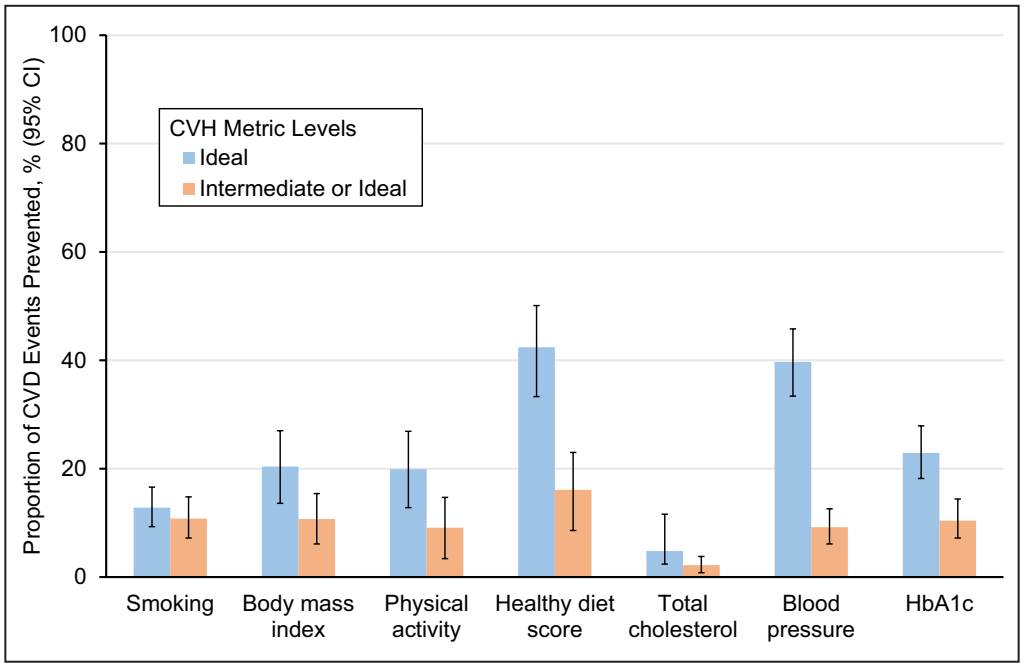

Figure 1. Population attributable fractions of cardiovascular disease (CVD) events for individual cardiovascular health (CVH) score metrics.
The blue bars represent the estimated population attributable fractions if adults with a poor or intermediate level of a given CVH metric achieved an ideal level. The orange bars represent the estimated population attributable fractions if (1) adults with a poor level of a given CVH metric achieved an intermediate level; and (2) all adults with an intermediate or ideal level of a given CVH metric remained in the same score groups. Error bars indicate 95% CIs. HbA1c indicates glycated hemoglobin.

$351.2 billion annually[31] and are leading causes of disability-adjusted life years.[1] The current study estimated PAFs for incident CVD events by combining nationally representative CVH prevalence estimates with incidence data from a large, diverse pooled cohort of US adults. In addition, the current study estimated the potential impact of population-level achievement of high CVH on the number of CVD events prevented. On the basis of our analyses, only 7.3% of US adults had a high CVH score. We estimated that among all US adults, 70.0% of CVD events were attributable to a low or moderate CVH score, with 41.3% attributable to a low CVH score alone. Our estimate of 2 million CVD events prevented by achievement of a high CVH score in all US adults represents a theoretical limit for event reduction, assuming a causal relationship between the CVH score and CVD events. In addition, it may not be realistic to fully achieve this goal in the short-term, as interventions to improve and maintain high CVH may not have an immediate effect on reducing the burden of CVD.[37] However, the estimated benefits of even a partial improvement in CVH scores were considerable. Therefore, CVH is a potential target for comprehensive prevention policy initiatives to reduce the future burden of CVD.[38,39]

Persistent sex differences and racial disparities in CVH are well documented.[15,16] Men typically have higher rates of CVD mortality compared with women throughout the life course, until old age.[40] The current findings suggest that, on average, women had better CVH scores, although low levels of CVH became more common in older age, contributing to a higher PAF for CVD among women compared with men. Black adults had higher PAFs for CVD compared with White/other [including Mexican American, other Hispanic, non-Hispanic Asian, and other races] adults in all age groups, reflecting persistently worse CVH scores, which have been identified in previous analyses among US adults.[15,16] Consequently, improvement of CVH specifically in Black adults could prevent a relatively large number of CVD events. Overall, our estimates suggest that targeting improvement of CVH in the US population may contribute to reducing sex- and race/ethnicity-associated differences in CVD burden. Multilevel interventions that can be effectively translated, disseminated, and implemented should be developed to address the maintenance of high CVH as early as possible in all adults,[41,42] which could have a greater theoretical impact on CVD prevention compared with treating existing risk factors.

The current quantitative estimates of potential population-level improvements may simultaneously aid individuals, clinicians, policy makers, and

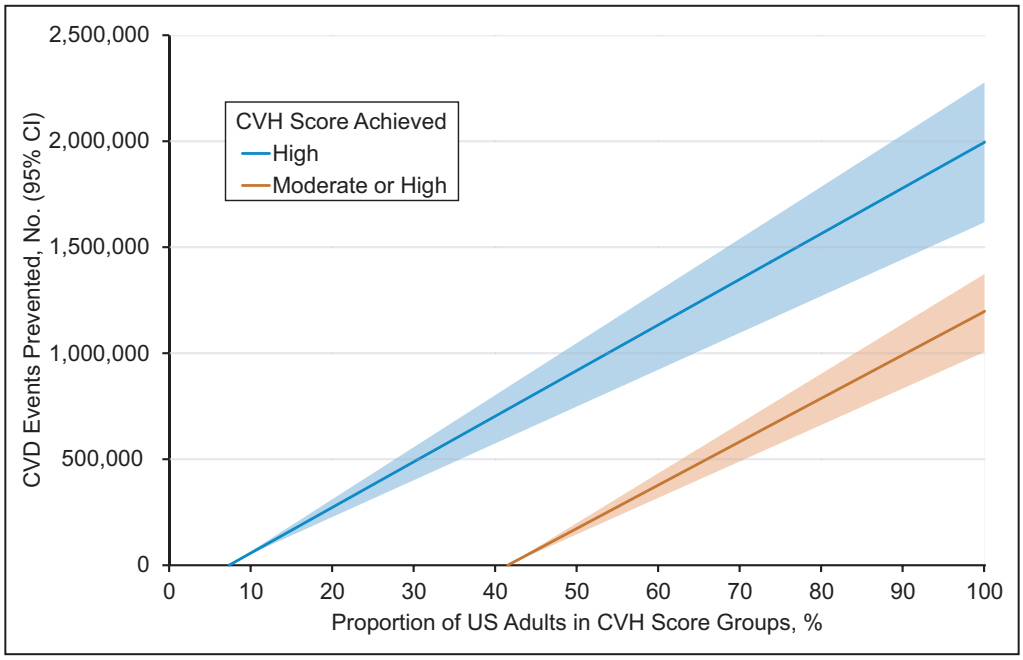

Figure 2. Estimated numbers of cardiovascular disease (CVD) events prevented annually with US population improvement of cardiovascular health (CVH) scores.
The blue line represents the estimated number of CVD events prevented annually if adults with a low or moderate CVH score achieved a high CVH score. The orange line represents the estimated number of CVD events prevented annually if (1) adults with a low CVH score achieved a moderate CVH score; and (2) all adults with a moderate or high CVH score remained in the same score groups. Tinted regions indicate 95% CIs.

researchers as they work to address plateaus in the declining burden of CVD.[4] The CVH score provides a simple and useful composite measure of an individual's health status, which can be tracked over time and targeted for preservation across the life course.[37] Discussions with individuals about their CVH score may be beneficial, and primordial prevention is explicitly endorsed by the 2019 American College of Cardiology/AHA Guideline on the Primary Prevention of Cardiovascular Disease.[43] Among younger adults in our study, PAFs were greater for BMI, healthy diet, and total cholesterol, whereas the PAFs for BP were greater among older adults. Maintaining ideal levels of upstream risk factors, like healthy body weight, physical activity, and diet, could translate to future CVD risk reductions. Lifestyle modifications are effective for supporting weight loss or maintenance and improving levels of primary cardiovascular risk factors and CVD events.[44,45] Ultimately, achievement of high CVH among all US adults will require multipronged approaches and policy initiatives targeting CVH in conjunction with social determinants of health throughout the life course.[43,46,47] Recent US nationally representative data from the Medical Expenditure Panel Survey 2006 to 2015 suggested CVH levels in the United States are worsening.[48] Therefore, it is imperative that clinicians, policy makers, researchers, and individuals work together in making primordial prevention of CVD a priority so that the estimated benefits reported herein can be realized.

Limitations

First, HRs and PAFs were derived from pooled observational cohort data. Thus, our data cannot predict event reductions based on individual therapeutic targeting of CVH, although prior analyses suggest improving CVH among individuals is associated with more favorable subclinical and clinical CVD outcomes.[14,39] Second, we were unable to adjust our estimates for covariables other than age, sex, and race because of insufficient sample size for further stratification in the PAF weighting approach.[33,34] Thus, residual confounding is possible, attributable to factors like socioeconomic status or health insurance status, which are associated with both CVH and CVD.[47] Furthermore, our estimates assume a causal relationship between CVH and CVD, and it is possible that factors beyond the 7 CVH metrics could be contributing to estimated associations between CVH and CVD. Third, although our pooled data were harmonized,[19,21,29] different measurement methods were used in individual cohorts, which may have resulted in reduced precision for quantification of CVD risk

among different total CVH score and individual metric levels, particularly for self-reported lifestyle components of CVH, like diet and physical activity. Fourth, data from studies included in the pooled cohorts were collected over a period of >30 years. Thus, the potential for secular trends in CVD event rates and risk factor associations is unavoidable, and the estimated HRs of CVD may not be representative of all contemporary US adults. However, both the distribution of CVH scores and participant characteristics in the 2 included data sources were comparable, and magnitudes of association for the components of the CVH score have been consistent in many different populations over time.[21,49] Finally, data presented in this study are solely from the United States, and we were able to report estimates only for White/other [including Mexican American, other Hispanic, non-Hispanic Asian, and other races] and Black adults because of insufficient data for disaggregation of other race/ethnicity groups.

CONCLUSIONS

The potential impact of achieving a high CVH score in all US adults is considerable, and even a partial improvement in CVH scores would be highly beneficial. Population- and individual-level strategies to maintain or restore high CVH are urgently needed to reduce the prevailing high burden of CVD in US adults.

ARTICLE INFORMATION

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Disclosures

None.

Supplementary Material

Data S1
Tables S1–S10
Figures S1–S2

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SUPPLEMENTAL MATERIAL

Data S1.

Expanded Methods. Description of Population Attributable Fraction Methodology

Population Attributable Fractions and Events Prevented

We calculated age-, sex-, and race/ethnicity-specific population attributable fractions (PAFs) to estimate the proportion of CVD events that could hypothetically be prevented (or postponed), assuming a causal relationship, if the entire US adult population (or subgroups) had high CVH, using the following formula:

$$PAF = \frac{\sum_{i=1}^{k} p_i(HR_i - 1)}{1 + \sum_{i=1}^{k} p_i(HR_i - 1)}$$

where p_i is the proportion of CVH level i, HR_i is the age- and race-adjusted hazard ratio of CVD comparing CVH level i to the reference high CVH level, and k is the total number of CVH levels. For example, to calculate the estimated PAF for black women aged 40-59 years:

$$PAF = \frac{0.213(3.16 - 1) + 0.766(8.64 - 1)}{1 + 0.213(3.16 - 1) + 0.766(8.64 - 1)} = 86.3\%$$

We then multiplied the age-, sex-, and race/ethnicity-specific PAFs by the corresponding number of annual CVD events to estimate the absolute number of annual events that could be prevented. This process was conducted for each age, sex, and race/ethnicity, and aggregated. For example, to calculate the estimated number of annual CVD events prevented for black women aged 40-59 years:

$$Events\ Prevented = PAF * No.of\ Expected\ Events = 0.863 * 61424 = 53009$$

In a sensitivity analysis, we calculated potential impact fractions (PIFs) for the continuous CVH score with a similar overall approach, but using the following formula:

$$PIF = \frac{\int_{x=0}^{m} HR(x)P(x)dx - \int_{x=0}^{m} HR(x)P'(x)dx}{\int_{x=0}^{m} HR(x)P(x)dx}$$

where *HR(x)* is the hazard ratio for a 1-unit increase in CVH score, *P(x)* is the population distribution of the CVH score, *P'(x)* is the counterfactual distribution of the CVH score (e.g., the mean CVH score is increased 1 point in the US population), and *m* is the maximum CVH score (14; i.e., the theoretical minimum risk level).

Uncertainty Estimation

We accounted for uncertainty in our estimation of the proportions of CVH score categories, incidence rates, and hazard ratios of CVD using Monte Carlo simulation. For each age-, sex-, and race/ethnicity-specific PAF calculation, numbers were randomly generated from assumed distributions for the prevalence of CVH level *i* (normal distribution with mean p_i and standard error SE_{pi}; calculated using SAS PROC SURVEYFREQ) and the HR comparing CVH level *i* to high CVH (log-normal distribution with mean HR_i and SE_{HRi}; calculated using Cox proportional hazards regression). Next, the incidence rate (*IR*) of CVD was calculated using Poisson regression and the point estimate multiplied by the respective US population number to estimate the total number of annual CVD events, overall and by subgroup. Numbers of expected CVD events were assumed to be fixed. Finally, the PAF was multiplied by the total number of events to estimate the number of events prevented. For each age-, sex-, and race/ethnicity-specific calculation, 10,000 simulations were conducted for the PAF and events prevented. The 2.5th and 97.5th percentile estimates of the simulated distributions were used to form 95% confidence intervals. The same general approach was used for calculation of PAFs for the individual CVH metrics, and for calculation of PIFs.

Table S1. Proportions of US Adults Meeting Recommended Levels of Cardiovascular Health Metrics by Age Group, Sex, and Race: The Lifetime Risk Pooling Project.

Health Metric	Definition		Participants in CVH Categories, No. (%)							
			All Participants	Sex		Race		Age Group		
				Men	Women	White/other	Black	Aged 20-39 y	Aged 40-59 y	Aged ≥60 y
Smoking	Ideal	Never or quit >12 months	14278 (46.9)	4476 (37.3)	9802 (53.2)	9505 (45.8)	4773 (49.2)	2369 (55.9)	6347 (44.0)	5562 (47.2)
	Intermediate	Former, quit ≤12 months	9847 (32.3)	4831 (40.2)	5016 (27.2)	7076 (34.1)	2771 (28.6)	619 (14.6)	4594 (31.8)	4634 (39.3)
	Poor	Current	6322 (20.8)	2701 (22.5)	3621 (19.6)	4172 (20.1)	2150 (22.2)	1248 (29.5)	3491 (24.2)	1583 (13.4)
Body mass index, kg/m^2	Ideal	<25	11154 (36.6)	3889 (32.4)	7265 (39.4)	8443 (40.7)	2711 (28.0)	2697 (63.7)	4666 (32.3)	3791 (32.2)
	Intermediate	25-29.99	11407 (37.5)	5567 (46.4)	5840 (31.7)	8038 (38.7)	3369 (34.8)	1019 (24.1)	5568 (38.6)	4820 (40.9)
	Poor	≥30	7886 (25.9)	2552 (21.3)	5334 (28.9)	4272 (20.6)	3614 (37.3)	520 (12.3)	4198 (29.1)	3168 (26.9)
Physical activity *	Ideal	Fourth quartile	7767 (25.5)	3917 (32.6)	3850 (20.9)	5786 (27.9)	1981 (20.4)	1058 (25.0)	3732 (25.9)	2977 (25.3)
	Intermediate	Third and second quartiles	15122 (49.7)	5849 (48.7)	9273 (50.3)	10463 (50.4)	4659 (48.1)	2119 (50.0)	7116 (49.3)	5887 (50.0)
	Poor	First quartile	7558 (24.8)	2242 (18.7)	5316 (28.8)	4504 (21.7)	3054 (31.5)	1059 (25.0)	3584 (24.8)	2915 (24.7)
Healthy diet score †	Ideal	Fifth and fourth quintiles	5450 (17.9)	1568 (13.1)	3882 (21.1)	3546 (17.1)	1904 (19.6)	847 (20.0)	2539 (17.6)	2064 (17.5)
	Intermediate	Third and second quintiles	11898 (39.1)	4337 (36.1)	7561 (41.0)	8063 (38.9)	3835 (39.6)	1695 (40.0)	5686 (39.4)	4517 (38.3)
	Poor	First quintile	13099 (43.0)	6103 (50.8)	6996 (37.9)	9144 (44.1)	3955 (40.8)	1694 (40.0)	6207 (43.0)	5198 (44.1)
Total cholesterol, mg/dL	Ideal	<200 (untreated)	13013 (42.7)	5874 (48.9)	7139 (38.7)	8768 (42.2)	4245 (43.8)	3226 (76.2)	5887 (40.8)	3900 (33.1)
	Intermediate	200-239 or treated to goal	11410 (37.5)	4373 (36.4)	7037 (38.2)	8006 (38.6)	3404 (35.1)	826 (19.5)	5532 (38.3)	5052 (42.9)
	Poor	≥240	6024 (19.8)	1761 (14.7)	4263 (23.1)	3979 (19.2)	2045 (21.1)	184 (4.3)	3013 (20.9)	2827 (24.0)
Blood pressure, mm Hg	Ideal	<120/<80 (untreated)	11668 (38.3)	4417 (36.8)	7251 (39.3)	8796 (42.4)	2872 (29.6)	3171 (74.9)	6250 (43.3)	2247 (19.1)
	Intermediate	120-139/80-89 or treated to goal	12477 (41.0)	5236 (43.6)	7241 (39.3)	8219 (39.6)	4258 (43.9)	963 (22.7)	5952 (41.2)	5562 (47.2)
	Poor	≥140/90	6302 (20.7)	2355 (19.6)	3947 (21.4)	3738 (18.0)	2564 (26.4)	102 (2.4)	2230 (15.5)	3970 (33.7)
Fasting glucose, mg/dL	Ideal	<100 (untreated)	19625 (64.5)	6961 (58.0)	12664 (68.7)	13094 (63.1)	6531 (67.4)	4099 (96.8)	8924 (61.8)	6602 (56.0)
	Intermediate	100-125 or treated to goal	8549 (28.1)	4139 (34.5)	4410 (23.9)	6355 (30.6)	2194 (22.6)	109 (2.6)	4522 (31.3)	3918 (33.3)
	Poor	≥126	2273 (7.5)	908 (7.6)	1365 (7.4)	1304 (6.3)	969 (10.0)	28 (0.7)	986 (6.8)	1259 (10.7)
Total CVH Score ‡	High	12-14 points	2270 (7.5)	763 (6.4)	1507 (8.2)	1853 (8.9)	417 (4.3)	992 (23.4)	922 (6.4)	356 (3.0)
	Moderate	9-11 points	10937 (35.9)	4276 (35.6)	6661 (36.1)	7790 (37.5)	3147 (32.5)	2301 (54.3)	5138 (35.6)	3498 (29.7)
	Low	0-8 points	17240 (56.6)	6969 (58.0)	10271 (55.7)	11110 (53.5)	6130 (63.2)	943 (22.3)	8372 (58.0)	7925 (67.3)

CVH, cardiovascular health; LRPP, Cardiovascular Disease Lifetime Risk Pooling Project

* In the LRPP, Z-scores were calculated from the distribution of physical activity scores in each individual cohort, measured using different metrics, and quartiles were computed. Ideal: 4th quartile; intermediate: 3rd and 2nd quartiles; poor: 1st quartile.

† In the LRPP, the Alternate Healthy Eating Index (AHEI-2010) was calculated in each individual cohort and quintiles were computed. Ideal: 5th and 4th quintiles; intermediate: 3rd and 2nd quintiles; poor: 1st quintile

‡ The total CVH score represents the sum of individual metric point values and ranges from 0 to 14. Each individual metric was scored as ideal (2 points), intermediate (1 point), or poor (0 points). We defined overall CVH as high (12-14 points), moderate (9-11 points), or low (0-8 points).

Table S2. Proportions of US Adults Meeting Cardiovascular Health Metrics by Age Group: NHANES 2011-2016.

Health Metric	Definition		Proportion of US Adults, % (95% CI)		
			Aged 20-39 y	Aged 40-59 y	Aged ≥60 y
Smoking	Ideal	Never or quit >12 months	74.5 (72.1-77.0)	75.7 (73.5-77.9)	88.2 (86.8-89.6)
	Intermediate	Former, quit ≤12 months	4.3 (3.2-5.5)	2.5 (1.6-3.4)	1.1 (0.7-1.6)
	Poor	Current	21.2 (19.1-23.2)	21.8 (19.4-24.1)	10.6 (9.4-11.9)
Body mass index, kg/m^2	Ideal	<25	35.9 (33.0-38.7)	25.9 (23.8-28.0)	25.1 (22.6-27.7)
	Intermediate	25-29.99	30.2 (27.9-32.4)	33.7 (31.2-36.2)	35.8 (33.5-38.0)
	Poor	≥30	33.9 (31.5-36.4)	40.4 (37.5-43.3)	39.1 (36.3-41.9)
Physical activity	Ideal	≥150 min/week moderate or ≥75 min/week vigorous or ≥150 combination	48.9 (46.0-51.8)	36.7 (33.7-39.8)	29.9 (27.2-32.6)
	Intermediate	1 to 149 min/week moderate or 1 to 74 min/week vigorous or 1 to 149 min/week combination	15.5 (14.1-16.9)	18.7 (16.0-21.5)	16.4 (14.5-18.3)
	Poor	None	35.6 (32.4-38.8)	44.5 (41.0-48.1)	53.7 (50.6-56.8)
Healthy diet score [a]	Ideal	4-5 components	0.2 (0.1-0.3)	0.6 (0.3-0.8)	1.4 (1.0-1.8)
	Intermediate	2-3 components	19.6 (17.3-21.8)	24.6 (21.9-27.4)	32.0 (29.1-34.8)
	Poor	0-1 components	80.2 (77.9-82.5)	74.8 (72.1-77.6)	66.6 (63.7-69.6)
Total cholesterol, mg/dL	Ideal	<200 (untreated)	71.5 (68.9-74.1)	36.4 (33.7-39.1)	25.8 (23.7-28.0)
	Intermediate	200-239 or treated to goal	22.0 (19.6-24.3)	45.6 (42.6-48.7)	62.1 (59.7-64.6)
	Poor	≥240	6.5 (5.4-7.6)	18.0 (16.1-19.9)	12.0 (10.6-13.5)
Blood pressure, mm Hg	Ideal	<120/<80 (untreated)	64.9 (62.8-67.0)	36.5 (34.0-39.1)	15.5 (13.0-18.0)
	Intermediate	120-139/80-89 or treated to goal	30.1 (28.1-32.2)	49.3 (46.5-52.0)	54.7 (51.7-57.6)
	Poor	≥140/90	5.0 (4.1-5.8)	14.2 (12.5-15.9)	29.9 (27.4-32.3)
HbA1c, % [†]	Ideal	<5.7 (untreated)	87.5 (85.8-89.1)	64.3 (61.7-66.9)	42.4 (39.6-45.1)
	Intermediate	5.7-6.5 or treated to goal	10.4 (9.1-11.8)	26.3 (23.9-28.8)	42.9 (40.3-45.5)
	Poor	≥6.5	2.1 (1.5-2.7)	9.4 (7.8-10.9)	14.7 (13.2-16.2)
Total CVH Score [‡]	High	12-14 points	13.5 (11.7-15.4)	5.2 (3.9-6.4)	1.8 (1.2-2.5)
	Moderate	9-11 points	47.6 (45.3-49.9)	30.0 (27.0-32.9)	21.9 (18.9-24.8)
	Low	0-8 points	38.9 (36.0-41.7)	64.9 (61.7-68.1)	76.3 (73.1-79.4)

CI, confidence interval; CVH, cardiovascular health; HbA1c, glycated hemoglobin; NHANES, National Health and Nutrition Examination Survey

* The 5 dietary score components include ≥4.5 cups/day of fruits/vegetables, ≥2 servings of fish per week (3.5 oz), ≥3 servings of whole grains per day (1 oz), <1500 mg/day of sodium, and <450 kcal/week of sugar-sweetened beverages. Dietary values are scaled to a 2000 kcal/day diet.

† Given that fasting plasma glucose values were only available for a subsample of NHANES participants, we used HbA1c values as a proxy for fasting glucose levels (fasting plasma glucose ≥126 mg/dL = HbA1c ≥6.5%; fasting plasma glucose 100-125 mg/dL = HbA1c 5.7-6.4%; fasting plasma glucose <100 mg/dL untreated = HbA1c <5.7% untreated), as suggested by the American Diabetes Association.

‡ The total CVH score represents the sum of individual metric point values and ranges from 0 to 14. Each individual metric was scored as ideal (2 points), intermediate (1 point), or poor (0 points). We defined overall CVH as high (12-14 points), moderate (9-11 points), or low (0-8 points).

Table S3. Characteristics of US Adults in CVH Groups by Age Group, Sex, Race, and Cardiovascular Health: NHANES 2011-2016.

Characteristics *	White/other Men, CVH			Black Men, CVH			White/other Women, CVH			Black Women, CVH		
	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
Aged 20-39 years												
Age, years	31.0 (0.3)	28.5 (0.4)	27.4 (0.5)	30.3 (0.5)	26.9 (0.6)	24.9 (0.6)	30.0 (0.3)	29.3 (0.3)	28.6 (0.8)	30.4 (0.4)	27.2 (0.7)	27.9 (1.8)
Current smoking, %	66.6 (3.3)	37.4 (4.5)	0.0 (0.0)	77.7 (5.2)	56.1 (7.5)	0.0 (0.0)	84.1 (2.6)	40.1 (5.8)	0.0 (0.0)	82.3 (4.8)	52.2 (12.4)	0.0 (0.0)
Antihypertensive med. use, %	5.9 (1.1)	1.3 (0.7)	0.0 (0.0)	10.4 (2.6)	1.2 (0.7)	0.0 (0.0)	6.2 (1.4)	0.9 (0.3)	0.0 (0.0)	14.5 (2.8)	0.8 (0.8)	0.0 (0.0)
Lipid-lowering med. use, %	4.2 (1.0)	1.1 (0.7)	0.0 (0.0)	3.7 (1.7)	0.3 (0.3)	0.0 (0.0)	2.2 (0.9)	0.6 (0.4)	0.0 (0.0)	2.8 (0.8)	0.0 (0.0)	0.0 (0.0)
History of diabetes, %	3.4 (1.0)	0.4 (0.2)	0.0 (0.0)	7.5 (2.4)	0.0 (0.0)	0.0 (0.0)	4.4 (1.3)	0.9 (0.5)	0.7 (0.6)	8.1 (2.4)	0.0 (0.0)	0.0 (0.0)
Body mass index, kg/m^2	31.9 (0.4)	26.5 (0.3)	23.4 (0.3)	32.3 (0.6)	25.8 (0.6)	22.9 (0.4)	33.8 (0.6)	26.6 (0.3)	22.3 (0.3)	35.1 (0.5)	28.9 (0.5)	23.7 (1.0)
Leisure physical activity, min/wk	163 (17)	456 (26)	596 (41)	342 (52)	633 (64)	1227 (271)	96 (20)	266 (22)	610 (67)	81 (13)	374 (82)	697 (147)
AHA healthy diet score	0.5 (0.0)	0.7 (0.0)	1.4 (0.1)	0.6 (0.1)	0.5 (0.1)	0.9 (0.2)	0.6 (0.0)	1.0 (0.1)	1.5 (0.1)	0.6 (0.1)	0.7 (0.1)	1.6 (0.3)
Total cholesterol, mg/dL	202.2 (1.9)	177.1 (1.8)	162.7 (2.2)	192.7 (4.1)	165.0 (2.1)	151.0 (4.7)	189.9 (2.0)	176.8 (1.5)	170.6 (2.1)	180.1 (2.3)	171.1 (2.5)	160.6 (4.5)
Systolic blood pressure, mmHg	122.9 (0.7)	117.2 (0.5)	110.7 (0.8)	128.4 (1.2)	119.3 (1.3)	112.0 (0.9)	115.3 (0.7)	109.3 (0.7)	105.7 (0.7)	117.9 (1.1)	111.1 (1.1)	107.0 (2.1)
Diastolic blood pressure, mmHg	74.0 (0.7)	68.9 (0.5)	65.1 (1.1)	72.3 (1.3)	65.7 (1.0)	65.7 (1.1)	70.2 (0.6)	66.6 (0.6)	65.8 (0.8)	71.3 (0.9)	66.0 (0.9)	64.5 (1.3)
Hemoglobin A1c, %	5.5 (0.0)	5.2 (0.0)	5.1 (0.0)	5.8 (0.1)	5.3 (0.0)	5.2 (0.1)	5.4 (0.1)	5.1 (0.0)	5.1 (0.0)	5.7 (0.1)	5.3 (0.0)	5.2 (0.1)
Aged 40-59 years												
Age, years	50.4 (0.2)	49.0 (0.5)	47.8 (1.1)	50.2 (0.4)	49.1 (0.7)	42.4 (0.4)	50.7 (0.3)	48.9 (0.4)	48.1 (0.7)	50.2 (0.5)	46.8 (0.6)	46.8 (1.3)
Current smoking, %	51.4 (3.4)	11.0 (3.2)	0.0 (0.0)	72.4 (4.7)	35.7 (12.7)	0.0 (0.0)	58.3 (3.9)	21.7 (4.6)	0.0 (0.0)	65.7 (5.3)	27.0 (13.6)	0.0 (0.0)
Antihypertensive med. use, %	26.2 (1.8)	8.2 (2.1)	1.9 (1.2)	42.6 (3.2)	13.0 (4.8)	0.0 (0.0)	28.8 (2.3)	12.3 (2.2)	0.6 (0.6)	49.1 (3.0)	11.3 (3.6)	11.1 (11.1)
Lipid-lowering med. use, %	21.5 (1.7)	10.2 (2.4)	7.6 (4.8)	26.8 (3.4)	3.8 (1.8)	0.0 (0.0)	21.8 (1.6)	7.5 (2.4)	0.2 (0.2)	19.1 (2.8)	4.2 (2.2)	0.0 (0.0)
History of diabetes, %	13.9 (1.7)	2.2 (0.7)	0.0 (0.0)	18.2 (2.4)	6.1 (3.2)	0.0 (0.0)	15.0 (1.3)	2.7 (1.4)	0.0 (0.0)	15.5 (2.1)	4.1 (2.3)	0.0 (0.0)
Body mass index, kg/m^2	30.5 (0.3)	27.1 (0.2)	24.1 (0.4)	31.2 (0.4)	27.0 (0.6)	21.4 (0.6)	32.4 (0.3)	25.4 (0.3)	22.4 (0.2)	35.3 (0.5)	28.1 (0.6)	22.9 (0.4)
Leisure physical activity, min/wk	118 (15)	392 (40)	653 (123)	193 (31)	632 (140)	528 (129)	82 (8)	278 (17)	655 (156)	160 (26)	300 (56)	518 (81)
AHA healthy diet score	0.7 (0.0)	1.1 (0.1)	1.8 (0.1)	0.7 (0.0)	1.2 (0.1)	0.9 (0.7)	0.9 (0.0)	1.4 (0.1)	1.8 (0.1)	0.8 (0.1)	1.3 (0.1)	2.2 (0.5)
Total cholesterol, mg/dL	209.3 (2.1)	193.2 (2.2)	181.5 (2.9)	193.6 (2.7)	180.3 (4.2)	163.7 (22.1)	213.6 (1.9)	203.0 (2.7)	179.7 (3.3)	201.8 (2.9)	184.1 (3.4)	174.6 (5.1)
Systolic blood pressure, mmHg	126.6 (0.9)	117.0 (0.9)	113.9 (1.8)	130.3 (1.2)	122.0 (1.6)	114.8 (3.1)	123.9 (0.8)	115.0 (1.0)	108.6 (1.2)	130.8 (1.1)	115.9 (1.1)	113.1 (4.8)
Diastolic blood pressure, mmHg	77.1 (0.5)	73.2 (0.5)	69.7 (0.9)	78.6 (0.8)	73.2 (0.9)	72.7 (4.3)	73.5 (0.4)	71.5 (0.6)	67.8 (0.9)	75.3 (0.7)	70.4 (0.8)	69.8 (2.1)
Hemoglobin A1c, %	5.9 (0.1)	5.3 (0.0)	5.3 (0.1)	6.3 (0.1)	5.5 (0.1)	5.5 (0.1)	5.9 (0.0)	5.3 (0.0)	5.2 (0.0)	6.2 (0.1)	5.4 (0.1)	5.1 (0.1)
Aged ≥60 years												
Age, years	69.1 (0.3)	69.8 (0.5)	66.9 (1.1)	68.1 (0.5)	70.3 (1.0)	71.7 (2.2)	70.1 (0.3)	69.4 (0.7)	69.0 (1.5)	68.3 (0.4)	69.2 (1.3)	71.4 (2.7)
Current smoking, %	25.6 (1.9)	0.5 (0.4)	0.0 (0.0)	42.7 (3.9)	5.6 (4.2)	0.0 (0.0)	25.7 (2.5)	4.7 (2.2)	0.0 (0.0)	32.0 (4.2)	2.2 (2.3)	0.0 (0.0)
Antihypertensive med. use, %	52.6 (2.3)	28.5 (3.8)	6.3 (5.5)	68.9 (2.5)	34.3 (5.4)	33.5 (22.2)	59.6 (1.9)	39.1 (4.8)	15.7 (8.8)	72.4 (2.1)	42.6 (9.2)	52.4 (25.4)
Lipid-lowering med. use, %	52.8 (2.7)	32.1 (4.1)	18.2 (13.0)	45.1 (3.0)	18.6 (5.0)	0.0 (0.0)	43.1 (1.9)	33.3 (4.8)	15.6 (7.2)	47.6 (3.7)	17.1 (6.9)	0.0 (0.0)
History of diabetes, %	29.1 (2.0)	5.3 (1.5)	0.0 (0.0)	33.1 (3.1)	13.5 (4.5)	0.0 (0.0)	18.0 (1.5)	3.7 (1.1)	1.8 (1.8)	33.4 (2.7)	3.9 (3.0)	0.0 (0.0)
Body mass index, kg/m^2	30.5 (0.3)	25.4 (0.3)	21.7 (0.7)	29.4 (0.4)	26.2 (0.5)	22.2 (1.1)	30.3 (0.3)	25.5 (0.5)	22.1 (0.6)	33.2 (0.5)	27.3 (0.7)	23.3 (1.2)
Leisure physical activity, min/wk	110 (10)	427 (41)	431 (47)	65 (8)	508 (84)	592 (179)	69 (5)	327 (50)	594 (99)	67 (10)	328 (36)	248 (63)
AHA healthy diet score	1.0 (0.0)	1.4 (0.1)	2.2 (0.1)	0.9 (0.0)	1.6 (0.1)	2.1 (0.9)	1.2 (0.0)	1.9 (0.1)	2.0 (0.2)	1.1 (0.1)	1.7 (0.2)	3.3 (0.4)
Total cholesterol, mg/dL	180.5 (2.1)	180.6 (2.8)	167.0 (6.4)	185.0 (3.3)	172.9 (3.6)	157.7 (10.6)	205.3 (1.6)	199.7 (3.4)	189.9 (4.6)	201.9 (2.4)	190.7 (5.2)	182.2 (9.0)
Systolic blood pressure, mmHg	132.5 (0.7)	123.8 (1.3)	113.5 (3.6)	137.6 (1.4)	130.7 (2.2)	116.2 (3.0)	134.6 (0.8)	123.1 (1.5)	115.5 (2.1)	137.9 (1.4)	128.7 (3.1)	126.5 (3.7)
Diastolic blood pressure, mmHg	68.7 (0.5)	68.3 (0.7)	62.5 (2.2)	71.4 (1.2)	69.2 (1.3)	63.3 (0.7)	67.9 (0.6)	67.4 (1.0)	64.4 (1.9)	67.3 (0.9)	68.5 (1.9)	69.7 (3.9)
Hemoglobin A1c, %	6.1 (0.0)	5.5 (0.0)	5.3 (0.1)	6.3 (0.1)	5.7 (0.1)	5.5 (0.2)	5.9 (0.0)	5.5 (0.0)	5.4 (0.0)	6.3 (0.1)	5.6 (0.1)	5.1 (0.1)

AHA, American Heart Association; CVH, cardiovascular health; DBP, diastolic blood pressure; HDL, high-density lipoprotein; SBP, systolic blood pressure

* Values are expressed as mean (standard error) or % (standard error) taking into consideration the complex survey design of the National Health and Nutrition Examination Survey 2011-2016

Table S4. Characteristics of US Adults in CVH Groups by Age Group, Sex, Race, and Cardiovascular Health: The Lifetime Risk Pooling Project.

Characteristics *	White/other Men, CVH			Black Men, CVH			White/other Women, CVH			Black Women, CVH		
	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
Aged 20-39 years												
Age, years	27.8 (4.6)	26.4 (4.0)	26.6 (3.5)	26.1 (3.3)	25.0 (3.1)	24.8 (3.1)	26.6 (4.2)	26.8 (4.0)	26.8 (3.8)	26.0 (3.3)	25.1 (3.3)	25.1 (3.3)
Current smoking, %	58.0	25.6	2.4	64.9	29.4	1.1	76.8	31.6	3.1	59.3	23.1	2.5
Antihypertensive med. use, %	5.8	1.6	0.3	6.2	1.5	0.0	2.4	1.9	0.2	8.6	2.5	0.0
Lipid-lowering med. use, %	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
History of diabetes, %	0.5	0.2	0.0	1.0	0.0	0.0	2.4	0.3	0.0	0.8	0.3	0.0
Body mass index, kg/m^2	27.5 (4.7)	24.5 (3.4)	22.9 (2.0)	27.0 (5.0)	24.1 (3.6)	22.9 (2.2)	28.1 (6.7)	23.2 (4.1)	21.7 (2.3)	29.7 (7.4)	24.9 (5.8)	22.4 (2.5)
Physical activity, z-score	-0.13 (1.02)	0.21 (0.92)	0.77 (1.03)	-0.27 (0.85)	0.36 (1.08)	1.03 (1.12)	-0.63 (0.58)	-0.24 (0.73)	0.39 (0.89)	-0.82 (0.51)	-0.48 (0.69)	0.27 (0.82)
aHEI diet score	39.7 (8.8)	46.4 (10.8)	58.0 (11.5)	36.9 (8.6)	42.3 (10.1)	51.8 (15.2)	41.5 (9.9)	51.0 (10.5)	61.4 (9.5)	40.5 (8.1)	44.6 (10.1)	56.0 (11.2)
Total cholesterol, mg/dL	201.7 (37.7)	176.7 (32.0)	164.2 (23.8)	192.3 (40.7)	175.8 (31.7)	164.9 (24.8)	191.4 (34.0)	178.9 (31.2)	168.6 (24.8)	189.8 (38.8)	174.9 (30.2)	168.1 (24.8)
Systolic blood pressure, mmHg	120.3 (11.9)	114.7 (9.9)	111.2 (8.3)	121.3 (11.0)	115.6 (9.8)	110.5 (8.8)	109.4 (11.0)	105.1 (9.8)	103.1 (7.8)	112.1 (11.1)	106.9 (9.0)	104.8 (8.1)
Diastolic blood pressure, mmHg	75.1 (11.3)	70.9 (9.1)	69.6 (7.6)	75.0 (10.7)	70.8 (9.5)	69.7 (7.7)	68.0 (9.4)	66.6 (8.6)	65.2 (7.1)	70.2 (10.5)	66.6 (8.6)	66.0 (7.5)
Fasting glucose, mg/dL	88.3 (16.5)	85.8 (10.3)	84.1 (7.3)	85.9 (14.9)	83.4 (8.0)	81.2 (6.8)	86.6 (27.8)	81.5 (12.0)	81.0 (6.6)	85.4 (31.2)	79.2 (15.2)	77.8 (7.8)
Aged 40-59 years												
Age, years	52.2 (4.5)	51.6 (4.5)	50.6 (4.5)	52.0 (4.3)	51.1 (4.3)	49.7 (4.3)	52.2 (4.5)	51.0 (4.5)	50.2 (4.4)	52.9 (4.1)	52.7 (4.1)	52.7 (4.0)
Current smoking, %	33.5	11.3	0.4	43.1	18.7	6.7	37.1	15.4	2.1	25.0	8.1	1.0
Antihypertensive med. use, %	21.3	10.1	2.2	36.2	17.6	6.7	28.2	11.2	3.0	46.5	23.3	10.0
Lipid-lowering med. use, %	5.3	3.8	3.1	3.3	2.9	3.3	5.0	2.5	1.1	7.4	4.8	3.0
History of diabetes, %	3.8	0.7	0.5	11.1	3.8	0.0	4.4	0.5	0.0	13.0	1.5	0.0
Body mass index, kg/m^2	28.8 (4.1)	26.2 (3.1)	24.0 (2.0)	28.7 (4.9)	26.7 (4.0)	23.8 (2.2)	29.0 (6.1)	24.8 (4.0)	22.5 (2.3)	32.4 (6.6)	27.9 (5.3)	24.4 (3.3)
Physical activity, z-score	0.00 (0.97)	0.59 (1.05)	1.04 (1.09)	-0.27 (1.03)	0.43 (1.42)	1.69 (2.84)	-0.40 (0.79)	0.14 (0.91)	0.76 (1.05)	-0.36 (0.86)	0.16 (0.99)	0.59 (0.92)
aHEI diet score	41.7 (10.2)	48.4 (11.4)	56.9 (10.8)	41.8 (9.8)	50.1 (11.8)	62.9 (10.5)	44.9 (9.6)	51.1 (10.1)	59.1 (8.6)	46.2 (10.6)	55.5 (11.0)	63.1 (9.5)
Total cholesterol, mg/dL	215.9 (38.0)	195.9 (32.5)	179.0 (25.8)	210.7 (45.8)	187.7 (34.7)	169.5 (20.7)	226.8 (42.9)	201.1 (33.6)	182.8 (27.5)	221.8 (43.7)	197.7 (36.8)	181.5 (29.8)
Systolic blood pressure, mmHg	123.2 (15.5)	114.5 (12.2)	108.7 (10.2)	131.6 (20.3)	117.5 (14.0)	110.1 (9.3)	121.4 (18.1)	111.1 (14.0)	104.6 (10.1)	131.1 (19.1)	119.0 (15.0)	112.9 (12.1)
Diastolic blood pressure, mmHg	76.4 (10.1)	71.8 (8.1)	68.4 (7.0)	83.9 (12.2)	76.1 (9.8)	72.3 (7.7)	72.3 (10.0)	68.2 (8.9)	65.2 (7.2)	80.0 (10.6)	74.7 (9.2)	71.0 (7.4)
Fasting glucose, mg/dL	107.8 (28.1)	96.0 (10.5)	91.6 (7.1)	112.1 (42.7)	92.5 (12.4)	86.9 (7.2)	106.4 (35.0)	92.4 (12.7)	88.8 (7.9)	114.3 (51.7)	89.9 (13.4)	84.6 (7.5)
Aged ≥60 years												
Age, years	67.3 (5.4)	67.8 (5.6)	68.1 (5.8)	66.1 (5.2)	67.8 (5.6)	68.1 (5.6)	68.1 (5.4)	67.6 (5.5)	67.4 (5.6)	66.5 (5.0)	66.9 (5.3)	65.8 (4.6)
Current smoking, %	16.4	5.1	0.0	25.2	15.1	0.0	19.2	5.9	0.0	14.2	3.9	0.0
Antihypertensive med. use, %	40.3	26.1	9.0	54.9	46.4	18.8	45.9	25.5	10.4	58.9	39.7	14.0
Lipid-lowering med. use, %	8.3	7.6	3.0	12.6	8.4	0.0	9.1	7.1	6.0	18.4	14.7	8.8
History of diabetes, %	5.3	1.7	0.0	19.1	5.1	6.7	4.1	0.5	0.0	16.2	3.2	0.0
Body mass index, kg/m^2	28.0 (3.7)	25.7 (3.0)	24.0 (2.4)	28.3 (4.7)	25.7 (3.9)	24.1 (2.7)	28.0 (4.9)	24.3 (3.4)	22.6 (2.3)	31.2 (6.1)	26.8 (4.7)	23.6 (3.3)
Physical activity, z-score	0.08 (1.05)	0.61 (1.11)	1.01 (0.99)	-0.22 (0.88)	0.25 (1.22)	1.21 (2.15)	-0.25 (0.77)	0.24 (0.95)	0.92 (1.27)	-0.20 (0.97)	0.26 (0.96)	0.80 (1.27)
aHEI diet score	44.9 (10.1)	52.6 (11.8)	62.6 (9.8)	46.4 (11.1)	55.1 (12.3)	65.0 (8.2)	45.1 (11.1)	53.6 (12.8)	63.3 (10.9)	51.8 (11.1)	61.3 (10.7)	65.5 (8.6)
Total cholesterol, mg/dL	208.9 (38.8)	190.5 (30.9)	175.9 (23.9)	200.2 (40.1)	176.0 (33.6)	180.9 (24.9)	229.4 (38.9)	209.2 (32.0)	190.8 (24.7)	227.1 (44.3)	207.6 (36.1)	193.8 (29.3)
Systolic blood pressure, mmHg	136.1 (19.7)	123.9 (17.9)	114.8 (11.2)	137.9 (19.8)	126.3 (18.4)	115.3 (11.7)	136.2 (20.5)	124.5 (18.8)	114.9 (14.0)	137.7 (20.1)	126.7 (16.9)	116.3 (9.7)
Diastolic blood pressure, mmHg	74.8 (10.3)	70.9 (9.4)	67.7 (7.9)	79.5 (11.7)	74.8 (8.4)	72.8 (7.7)	71.0 (10.5)	67.5 (9.6)	64.8 (7.9)	76.9 (10.3)	73.6 (9.2)	70.0 (7.3)
Fasting glucose, mg/dL	114.6 (37.6)	96.0 (14.6)	89.3 (8.0)	114.8 (42.5)	92.4 (20.2)	87.8 (8.6)	108.0 (32.6)	92.1 (11.5)	88.0 (7.9)	110.5 (42.6)	90.7 (13.9)	88.3 (8.2)

aHEI, adjusted Healthy Eating Index 2010; CVH, cardiovascular health; DBP, diastolic blood pressure; HDL, high-density lipoprotein; SBP, systolic blood pressure

* Values are expressed as mean (standard deviation) or %.

Table S5. Associations Between Individual Cardiovascular Health Metrics and Incident Cardiovascular Disease Events: The Lifetime Risk Pooling Project.

Subgroups	Men, Hazard Ratios (95% CIs) *			Women, Hazard Ratios (95% CIs) *		
	Poor	Intermediate	Ideal	Poor	Intermediate	Ideal
Aged 20-39						
Smoking	1 [Reference]	0.30 (0.14-0.63)	0.43 (0.29-0.63)	1 [Reference]	0.95 (0.50-1.80)	0.69 (0.43-1.11)
Body mass index	1 [Reference]	0.62 (0.36-1.07)	0.45 (0.27-0.76)	1 [Reference]	0.55 (0.30-1.01)	0.44 (0.26-0.73)
Physical activity	1 [Reference]	0.70 (0.44-1.13)	0.59 (0.35-0.99)	1 [Reference]	0.71 (0.45-1.13)	0.57 (0.27-1.20)
Healthy diet score	1 [Reference]	0.63 (0.42-0.94)	0.31 (0.15-0.65)	1 [Reference]	0.81 (0.50-1.31)	0.77 (0.41-1.45)
Total cholesterol	1 [Reference]	0.75 (0.41-1.38)	0.31 (0.17-0.56)	1 [Reference]	0.80 (0.30-2.15)	0.71 (0.28-1.77)
Blood pressure	1 [Reference]	0.58 (0.28-1.18)	0.39 (0.19-0.80)	1 [Reference]	0.27 (0.12-0.60)	0.10 (0.05-0.21)
Fasting glucose	1 [Reference]	0.87 (0.11-7.25)	0.50 (0.07-3.57)	1 [Reference]	0.20 (0.06-0.70)	0.07 (0.03-0.15)
Aged 40-59 y						
Smoking	1 [Reference]	0.54 (0.47-0.61)	0.44 (0.38-0.51)	1 [Reference]	0.37 (0.32-0.44)	0.40 (0.35-0.46)
Body mass index	1 [Reference]	0.69 (0.60-0.78)	0.56 (0.48-0.66)	1 [Reference]	0.68 (0.60-0.79)	0.51 (0.43-0.59)
Physical activity	1 [Reference]	0.81 (0.71-0.93)	0.67 (0.57-0.78)	1 [Reference]	0.81 (0.71-0.93)	0.75 (0.63-0.89)
Healthy diet score	1 [Reference]	0.77 (0.68-0.87)	0.57 (0.46-0.70)	1 [Reference]	0.81 (0.71-0.92)	0.48 (0.39-0.59)
Total cholesterol	1 [Reference]	0.77 (0.67-0.89)	0.68 (0.59-0.79)	1 [Reference]	0.74 (0.64-0.86)	0.68 (0.59-0.79)
Blood pressure	1 [Reference]	0.62 (0.53-0.71)	0.37 (0.31-0.43)	1 [Reference]	0.64 (0.56-0.74)	0.34 (0.29-0.41)
Fasting glucose	1 [Reference]	0.45 (0.37-0.53)	0.35 (0.30-0.42)	1 [Reference]	0.34 (0.29-0.41)	0.24 (0.20-0.28)
Aged ≥60 y						
Smoking	1 [Reference]	0.66 (0.58-0.76)	0.57 (0.49-0.66)	1 [Reference]	0.65 (0.57-0.74)	0.58 (0.51-0.65)
Body mass index	1 [Reference]	0.87 (0.77-0.98)	0.84 (0.74-0.96)	1 [Reference]	0.72 (0.65-0.80)	0.62 (0.56-0.69)
Physical activity	1 [Reference]	0.83 (0.73-0.94)	0.71 (0.62-0.82)	1 [Reference]	0.84 (0.76-0.92)	0.68 (0.60-0.77)
Healthy diet score	1 [Reference]	0.79 (0.72-0.87)	0.55 (0.47-0.66)	1 [Reference]	0.80 (0.73-0.87)	0.53 (0.46-0.61)
Total cholesterol	1 [Reference]	0.88 (0.76-1.01)	0.81 (0.71-0.93)	1 [Reference]	0.89 (0.81-0.98)	1.04 (0.93-1.16)
Blood pressure	1 [Reference]	0.73 (0.66-0.81)	0.47 (0.40-0.54)	1 [Reference]	0.72 (0.66-0.79)	0.43 (0.38-0.50)
Fasting glucose	1 [Reference]	0.58 (0.51-0.67)	0.46 (0.40-0.53)	1 [Reference]	0.56 (0.49-0.64)	0.42 (0.37-0.48)

CI, confidence interval; CVH, cardiovascular health

* Hazard ratios are adjusted for age (continuous) and race

Table S6. Expected Number of Annual Cardiovascular Disease Events and Rates in US Adults by Age, Sex, and Race Groups.

Subgroups	US Adults Aged ≥20 y, No. *	Events (95% CI) per 1000 Person-Years †	Expected CVD Events, No. per Year †
Aged 20-39 y			
White/other men	36,805,000	2.16 (1.60-2.72)	80,000
Black men	4,801,000	3.15 (2.34-3.95)	15,000
White/other women	35,689,000	0.98 (0.63-1.33)	35,000
Black women	5,732,000	1.87 (1.38-2.37)	11,000
Aged 40-59 y			
White/other men	36,008,000	12.49 (11.68-13.31)	450,000
Black men	4,201,000	18.94 (16.88-21.00)	80,000
White/other women	38,695,000	7.39 (6.82-7.95)	286,000
Black women	5,655,000	10.86 (9.86-11.86)	61,000
Aged ≥60 y			
White/other men	26,554,000	34.51 (32.80-36.23)	916,000
Black men	2,210,000	27.82 (24.14-31.49)	61,000
White/other women	29,774,000	26.87 (25.59-28.15)	800,000
Black women	3,083,000	17.89 (16.38-19.41)	55,000
Total	229,209,000	12.43	2,850,000

CVD, cardiovascular disease; NHANES, National Health and Nutrition Examination Survey

* US population numbers were estimated from NHANES 2011-2016 and are representative of the US non-institutionalized population.

† Expected CVD event numbers were estimated using Poisson regression models calibrated to reflect an annual 2.85 million incident major CVD events in the US adult population per year, as reported by the American Heart Association.

Table S7. Cardiovascular Health Metrics and Potential Impact of Improving Cardiovascular Health Among US Adults by Age Group.

Subgroups	Proportion of US Adults in CVH Metric Categories, % (95% CI)			Achievement of Intermediate or Ideal Levels		Achievement of Ideal Levels	
	Poor	Intermediate	Ideal	PAF, % (95% CI)	Events Prevented (95% CI), Thousands *	PAF, % (95% CI)	Events Prevented (95% CI), Thousands †
Aged 20-39 y							
CVH Behaviors							
Smoking	21.2 (19.1-23.2)	4.3 (3.2-5.5)	74.5 (72.1-77.0)	23.8 (7.7, 39.6) ‡	33 (11, 55)	16.1 (8.0, 24.7) ‡	22 (11, 34)
Body mass index	33.9 (31.5-36.4)	30.2 (27.9-32.4)	35.9 (33.0-38.7)	NA §	NA §	35.2 (15.7, 53.5)	49 (22, 74)
Physical activity	35.6 (32.4-38.8)	15.5 (14.1-16.9)	48.9 (46.0-51.8)	NA §	NA §	13.9 (1.6, 26.8)	19 (2, 37)
Healthy diet score	80.2 (77.9-82.5)	19.6 (17.3-21.8)	0.2 (0.1-0.3)	22.6 (3.6, 36.4)	31 (5, 51)	45.8 (26.0, 57.0)	64 (36, 79)
CVH Factors							
Total cholesterol	6.5 (5.4-7.6)	22.0 (19.6-24.3)	71.5 (68.9-74.1)	NA §	NA §	23.3 (15.0, 32.0)	32 (21, 44)
Blood pressure	5.0 (4.1-5.8)	30.1 (28.1-32.2)	64.9 (62.8-67.0)	2.9 (0.7, 7.0)	4 (1, 10)	28.5 (13.3, 44.2)	40 (18, 61)
HbA1c	2.1 (1.5-2.7)	10.4 (9.1-11.8)	87.5 (85.8-89.1)	2.8 (0.3, 9.6)	4 (0, 13)	11.1 (5.5, 17.9)	15 (8, 25)
Aged 40-59 y							
CVH Behaviors							
Smoking	21.8 (19.4-24.1)	2.5 (1.6-3.4)	75.7 (73.5-77.9)	20.6 (15.5, 26.0)	178 (134, 225)	23.6 (18.5, 29.1)	204 (160, 251)
Body mass index	40.4 (37.5-43.3)	33.7 (31.2-36.2)	25.9 (23.8-28.0)	15.9 (10.2, 21.9)	138 (88, 189)	30.8 (23.7, 37.5)	266 (205, 325)
Physical activity	44.5 (41.0-48.1)	18.7 (16.0-21.5)	36.7 (33.7-39.8)	9.5 (3.2, 15.7)	82 (28, 136)	18.7 (11.2, 26.1)	161 (97, 225)
Healthy diet score	74.8 (72.1-77.6)	24.6 (21.9-27.4)	0.6 (0.3-0.8)	17.6 (8.8, 25.7)	152 (76, 222)	44.4 (33.8, 53.5)	384 (292, 463)
CVH Factors							
Total cholesterol	18.0 (16.1-19.9)	45.6 (42.6-48.7)	36.4 (33.7-39.1)	5.3 (2.4, 8.7)	46 (20, 75)	11.9 (5.6, 18.3)	103 (49, 158)
Blood pressure	14.2 (12.5-15.9)	49.3 (46.5-52.0)	36.5 (34.0-39.1)	8.5 (5.4, 12.0)	73 (46, 103)	39.6 (33.8, 45.3)	343 (293, 392)
HbA1c	9.4 (7.8-10.9)	26.3 (23.9-28.8)	64.3 (61.7-66.9)	12.9 (8.9, 17.5)	112 (77, 152)	24.3 (19.1, 29.8)	210 (165, 258)
Aged ≥60 y							
CVH Behaviors							
Smoking	10.6 (9.4-11.9)	1.1 (0.7-1.6)	88.2 (86.8-89.6)	5.3 (3.2, 7.6)	97 (60, 141)	7.5 (5.1, 10.2)	139 (95, 188)
Body mass index	39.1 (36.3-41.9)	35.8 (33.5-38.0)	25.1 (22.6-27.7)	9.1 (4.6, 13.6)	167 (86, 250)	14.4 (8.7, 20.1)	266 (161, 370)
Physical activity	53.7 (50.6-56.8)	16.4 (14.5-18.3)	29.9 (27.2-32.6)	9.6 (3.8, 15.4)	177 (71, 284)	20.9 (14.4, 27.4)	386 (266, 505)
Healthy diet score	66.6 (63.7-69.6)	32.0 (29.1-34.8)	1.4 (1.0-1.8)	14.9 (8.9, 20.8)	274 (165, 383)	41.2 (33.6, 48.0)	760 (621, 886)
CVH Factors							
Total cholesterol	12.0 (10.6-13.5)	62.1 (59.7-64.6)	25.8 (23.7-28.0)	0.9 (0.1, 1.8) ‡	17 (3, 33)	NA §	NA §
Blood pressure	29.9 (27.4-32.3)	54.7 (51.7-57.6)	15.5 (13.0-18.0)	10.0 (6.8, 13.4)	185 (126, 247)	40.6 (34.8, 46.1)	750 (642, 851)
HbA1c	14.7 (13.2-16.2)	42.9 (40.3-45.5)	42.4 (39.6-45.1)	9.9 (6.9, 13.2)	182 (128, 244)	23.2 (18.8, 27.7)	428 (347, 511)

CI, confidence interval; CVH, cardiovascular health; HbA1c, glycated hemoglobin; NA, not available; PAF, population attributable fraction

* Number of CVD events prevented annually if (1) all adults with poor levels had intermediate levels; and (2) all adults with intermediate levels or ideal levels remained in these levels

† Number of CVD events prevented annually if all adults with poor levels or moderate levels had ideal levels

‡ The PAFs for achievement of intermediate or ideal CVH metric levels can be larger than the corresponding PAFs for achievement of high CVH if the magnitude of association comparing poor and intermediate levels is larger than the magnitude of association comparing poor and ideal levels.

§ The PAFs cannot be calculated for the CVH metrics with hazard ratios of 1 or greater

Table S8. Cardiovascular Health Metrics and Potential Impact of Improving Cardiovascular Health Among US Adults by Sex.

Subgroups	Proportion of US Adults in CVH Metric Categories, % (95% CI)			Achievement of Intermediate or Ideal Levels		Achievement of Ideal Levels	
	Poor	Intermediate	Ideal	PAF, % (95% CI)	Events Prevented (95% CI), Thousands *	PAF, % (95% CI)	Events Prevented (95% CI), Thousands †
Men							
CVH Behaviors							
Smoking	20.2 (18.3-22.1)	3.4 (2.6-4.3)	76.3 (74.3-78.3)	11.4 (7.1, 16.1)	181 (113, 255)	14.6 (10.4, 19.2)	232 (165, 305)
Body mass index	35.7 (33.1-38.2)	38.4 (36.3-40.4)	26.0 (24.3-27.6)	8.3 (3.7, 13.0)	131 (59, 206)	16.0 (8.5, 23.3)	254 (135, 369)
Physical activity	42.3 (39.4-45.2)	15.6 (13.9-17.3)	42.1 (40.0-44.2)	9.2 (3.1, 15.3)	146 (49, 243)	20.0 (12.4, 27.6)	316 (196, 437)
Healthy diet score	79.2 (77.3-81.1)	20.4 (18.5-22.3)	0.3 (0.2-0.5)	18.4 (9.8, 26.4)	292 (155, 418)	42.9 (31.9, 52.1)	680 (506, 825)
CVH Factors							
Total cholesterol	11.4 (10.0-12.7)	41.9 (39.4-44.3)	46.8 (44.3-49.2)	1.6 (.7, 2.7)	26 (10, 43)	6.1 (3.4, 8.9)	97 (54, 141)
Blood pressure	16.1 (14.2-17.9)	48.5 (46.5-50.5)	35.4 (33.2-37.7)	9.1 (5.9, 12.5)	144 (94, 198)	38.5 (31.9, 45.0)	610 (505, 712)
HbA1c	9.2 (7.9-10.4)	24.5 (22.9-26.1)	66.4 (64.4-68.3)	10.9 (7.5, 14.8)	172 (119, 234)	21.7 (17.1, 26.5)	344 (271, 420)
Women							
CVH Behaviors							
Smoking	17.0 (15.4-18.6)	2.2 (1.5-2.9)	80.8 (79.0-82.6)	10.0 (7.3, 13.1)	127 (92, 165)	10.5 (7.9, 13.4)	133 (101, 169)
Body mass index	39.6 (37.7-41.5)	27.9 (25.8-30.1)	32.4 (30.1-34.7)	13.7 (9.1, 18.4)	174 (115, 233)	25.8 (20.0, 31.6)	327 (253, 400)
Physical activity	45.1 (42.0-48.2)	18.2 (16.6-19.8)	36.7 (33.7-39.6)	8.9 (3.9, 14.0)	113 (50, 177)	19.8 (13.3, 26.1)	251 (169, 330)
Healthy diet score	70.2 (67.6-72.9)	28.8 (26.1-31.5)	1.0 (0.6-1.3)	13.1 (7.2, 18.8)	166 (91, 238)	41.7 (35.1, 47.7)	527 (444, 603)
CVH Factors							
Total cholesterol	13.1 (11.4-14.7)	41.1 (38.7-43.6)	45.8 (43.2-48.4)	3.0 (1.0, 5.2)	38 (13, 65)	3.1 (1.2, 4.9)	39 (16, 62)
Blood pressure	14.1 (12.9-15.4)	39.4 (37.7-41.1)	46.5 (44.6-48.4)	9.3 (6.3, 12.8)	118 (80, 162)	41.2 (35.4, 46.8)	522 (448, 592)
HbA1c	7.3 (6.5-8.0)	25.5 (24.0-27.1)	67.2 (65.6-68.8)	9.9 (6.8, 13.8)	125 (86, 175)	24.4 (19.7, 29.5)	309 (249, 374)

CI, confidence interval; CVH, cardiovascular health; HbA1c, glycated hemoglobin; PAF, population attributable fraction

* Number of CVD events prevented annually if (1) all adults with poor levels had intermediate levels; and (2) all adults with intermediate levels or ideal levels remained in these levels

† Number of CVD events prevented annually if all adults with poor levels or moderate levels had ideal levels

Table S9. Cardiovascular Health Metrics and Potential Impact of Improving Cardiovascular Health Among US Adults by Race.

Subgroups	Proportion of US Adults in CVH Metric Categories, % (95% CI)			Achievement of Intermediate or Ideal Levels		Achievement of Ideal Levels	
	Poor	Intermediate	Ideal	PAF, % (95% CI)	Events Prevented (95% CI), Thousands *	PAF, % (95% CI)	Events Prevented (95% CI), Thousands †
White/other							
CVH Behaviors							
Smoking	17.9 (16.4-19.4)	2.9 (2.3-3.5)	79.2 (77.7-80.8)	10.1 (6.7, 13.8)	258 (171, 354)	12.1 (8.8, 15.7)	309 (224, 401)
Body mass index	36.0 (34.0-37.9)	33.9 (32.2-35.7)	30.1 (28.3-31.9)	10.2 (5.8, 14.9)	262 (147, 381)	19.6 (12.9, 26.1)	500 (330, 667)
Physical activity	43.2 (40.4-45.9)	17.1 (15.6-18.5)	39.7 (37.5-42.0)	9.1 (3.4, 14.7)	232 (88, 376)	19.9 (12.9, 26.9)	510 (330, 689)
Healthy diet score	73.9 (71.7-76.1)	25.5 (23.3-27.7)	0.6 (0.4-0.8)	16.0 (8.7, 22.9)	409 (221, 586)	42.4 (33.5, 50.1)	1086 (856, 1283)
CVH Factors							
Total cholesterol	12.6 (11.4-13.8)	42.3 (40.1-44.4)	45.1 (43.1-47.2)	2.2 (0.8, 3.8)	57 (21, 97)	4.6 (2.4, 6.8)	118 (62, 174)
Blood pressure	14.4 (12.9-15.8)	43.4 (41.9-45.0)	42.2 (40.4-44.0)	8.9 (5.9, 12.2)	227 (152, 311)	39.3 (33.1, 45.3)	1006 (846, 1159)
HbA1c	7.6 (6.7-8.6)	23.7 (22.3-25.0)	68.7 (67.1-70.3)	9.8 (6.8, 13.5)	251 (174, 346)	22.1 (17.6, 26.9)	564 (449, 687)
Black							
CVH Behaviors							
Smoking	23.8 (21.2-26.4)	2.3 (1.5-3.1)	73.9 (71.0-76.8)	17.2 (11.5, 22.9)	50 (33, 67)	19.5 (14.3, 25.0)	57 (42, 73)
Body mass index	51.7 (48.9-54.5)	25.3 (22.9-27.7)	23.0 (21.0-25.0)	14.7 (9.2, 20.2)	43 (27, 59)	27.6 (19.7, 35.2)	80 (57, 103)
Physical activity	48.4 (45.5-51.3)	15.9 (14.2-17.6)	35.7 (32.9-38.5)	9.3 (3.4, 15.1)	27 (10, 44)	19.6 (12.0, 27.1)	57 (35, 79)
Healthy diet score	80.1 (77.3-82.9)	18.9 (16.2-21.5)	1.1 (0.6-1.5)	16.6 (8.4, 24.1)	48 (25, 70)	41.8 (32.0, 49.9)	122 (93, 145)
CVH Factors							
Total cholesterol	9.5 (7.9-11.2)	35.2 (32.7-37.8)	55.3 (52.7-57.8)	2.2 (0.8, 3.9)	6 (2, 11)	6.1 (2.6, 9.7)	18 (8, 28)
Blood pressure	20.7 (18.7-22.8)	46.4 (44.3-48.5)	32.9 (30.4-35.3)	11.9 (7.6, 16.8)	35 (22, 49)	43.4 (36.5, 49.9)	126 (106, 145)
HbA1c	12.4 (11.0-13.8)	35.8 (33.3-38.3)	51.8 (49.0-54.5)	15.9 (10.9, 21.9)	46 (32, 64)	30.6 (24.3, 36.6)	89 (71, 107)

CI, confidence interval; CVH, cardiovascular health; HbA1c, glycated hemoglobin; PAF, population attributable fraction

* Number of CVD events prevented annually if (1) all adults with poor levels had intermediate levels; and (2) all adults with intermediate levels or ideal levels remained in these levels

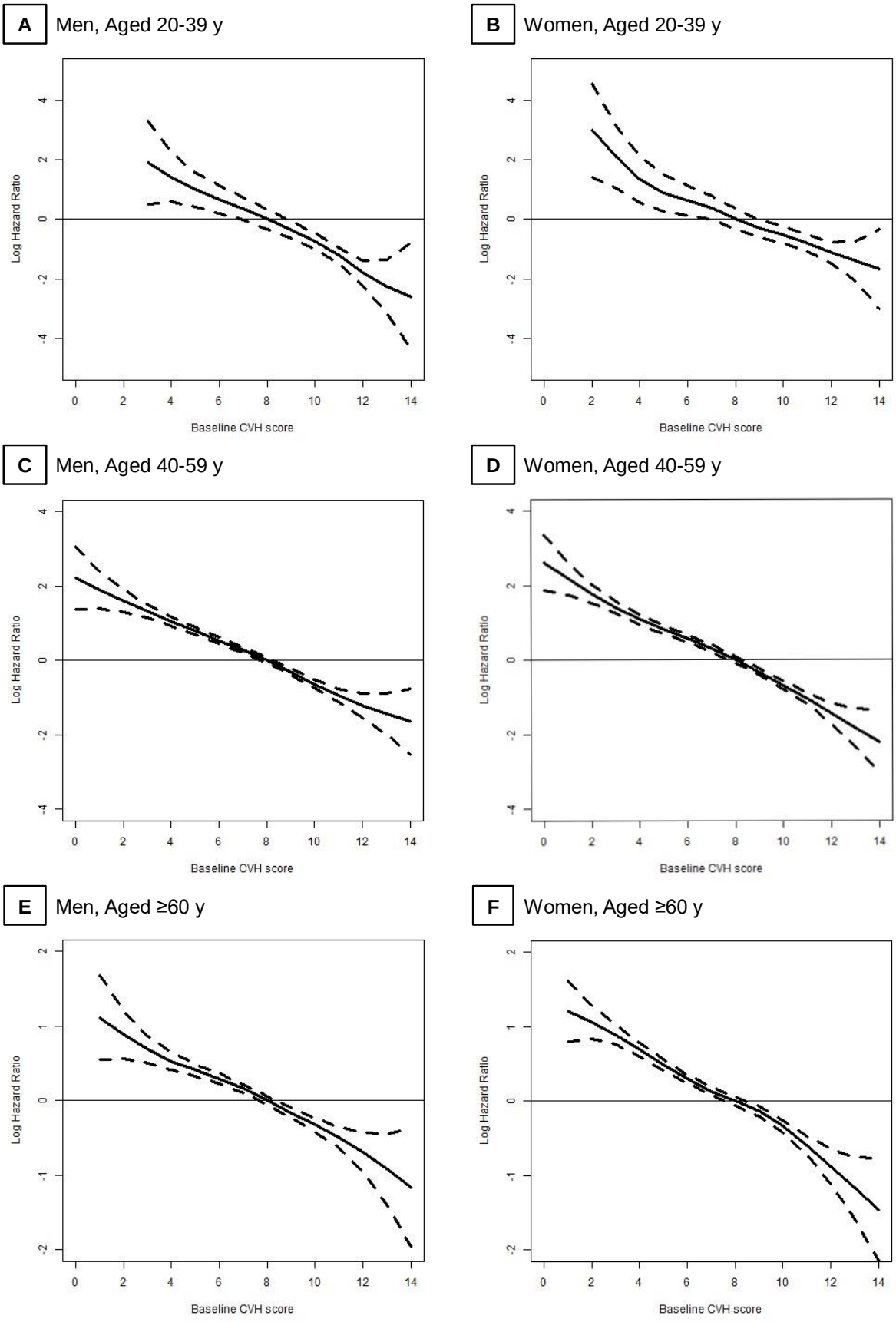
† Number of CVD events prevented annually if all adults with poor levels or moderate levels had ideal levels

Table S10. Mean Cardiovascular Health Scores and Potential Impact of Improving the Continuous Cardiovascular Health Score Among US Adults.

Subgroups	CVH Score, Mean (95% CI)	Per Increase of Mean CVH Score						Achievement of Maximum CVH Score (14)	
		1 Point		2 Points		3 Points			
		PIF, % (95% CI)	Events Prevented, No. (95% CI), Thousands	PIF, % (95% CI)	Events Prevented, No. (95% CI), Thousands	PIF, % (95% CI)	Events Prevented, No. (95% CI), Thousands	PIF, % (95% CI)	Events Prevented, No. (95% CI), Thousands
Aged 20-39 y									
White/other men	8.77 (8.58-8.97)	30.8 (24.3-37.0)	25 (19-29)	52.2 (42.7-60.3)	41 (34-48)	66.9 (56.6-75.0)	53 (45-60)	85.4 (76.6-91.1)	68 (61-72)
Black men	8.54 (8.24-8.84)	30.8 (24.1-36.7)	5 (4-6)	52.2 (42.4-59.9)	8 (6-9)	66.9 (56.3-74.6)	10 (9-11)	86.6 (77.7-91.9)	13 (12-14)
White/other women	9.39 (9.22-9.56)	24.6 (16.3-32.0)	9 (6-11)	43.2 (30.0-53.8)	15 (10-19)	57.2 (41.5-68.6)	20 (14-24)	72.8 (56.0-83.2)	25 (20-29)
Black women	8.25 (8.02-8.47)	24.6 (16.4-32.1)	3 (2-3)	43.2 (30.1-53.8)	5 (3-6)	57.2 (41.5-68.6)	6 (4-7)	80.4 (64.2-89.3)	9 (7-10)
Total	8.99 (8.85-9.13)	28.8 (21.7-35.3)	40 (30-50)	49.3 (38.5-58.1)	69 (54-82)	63.8 (51.7-72.9)	89 (72-102)	82.1 (70.7-89.1)	115 (99-125)
Aged 40-59 y									
White/other men	7.49 (7.27-7.71)	23.1 (21.0-25.2)	104 (94-113)	40.9 (37.6-44.0)	184 (169-198)	54.5 (50.7-58.1)	245 (228-261)	81.9 (78.3-85.0)	369 (352-382)
Black men	6.53 (6.28-6.79)	23.1 (21.0-25.2)	18 (17-20)	40.9 (37.6-44.0)	33 (30-35)	54.5 (50.7-58.1)	43 (40-46)	85.9 (82.6-88.7)	68 (66-71)
White/other women	7.78 (7.58-7.99)	24.6 (22.5-26.6)	70 (64-76)	43.2 (40.0-46.1)	123 (114-132)	57.2 (53.5-60.4)	163 (153-173)	82.7 (79.4-85.5)	236 (227-244)
Black women	6.80 (6.53-7.08)	24.6 (22.6-26.6)	15 (14-16)	43.2 (40.1-46.2)	27 (25-28)	57.2 (53.6-60.5)	35 (33-37)	86.9 (84.0-89.4)	53 (52-55)
Total	7.53 (7.38-7.68)	23.7 (21.6-25.7)	208 (189-226)	41.8 (38.5-44.8)	366 (338-393)	55.6 (51.8-59.0)	487 (454-517)	82.9 (79.4-85.8)	727 (696-752)
Aged ≥60 y									
White/other men	7.04 (6.85-7.23)	16.7 (14.8-18.6)	153 (135-171)	30.7 (27.3-33.8)	281 (251-310)	42.3 (38.1-46.1)	387 (349-423)	72.0 (67.0-76.3)	660 (614-700)
Black men	6.31 (5.99-6.63)	16.7 (14.7-18.6)	10 (9-11)	30.7 (27.3-33.8)	19 (17-21)	42.3 (38.0-46.1)	26 (23-28)	75.5 (70.4-79.7)	46 (43-49)
White/other women	7.15 (6.96-7.35)	17.2 (15.5-18.8)	137 (124-150)	31.4 (28.6-34.1)	251 (229-272)	43.2 (39.7-46.4)	346 (317-372)	72.5 (68.3-76.1)	580 (546-609)
Black women	6.01 (5.79-6.24)	17.2 (15.5-18.8)	9 (9-10)	31.4 (28.6-34.1)	17 (16-19)	43.2 (39.7-46.5)	24 (22-26)	77.8 (73.8-81.2)	43 (41-45)
Total	7.02 (6.87-7.17)	16.9 (15.1-18.7)	311 (277-343)	31.0 (27.9-33.9)	568 (512-622)	42.7 (38.8-46.3)	783 (711-848)	72.5 (67.9-76.5)	1330 (1244-1402)
Men	7.79 (7.66-7.93)	19.7 (17.4-21.9)	315 (278-350)	35.3 (31.6-38.7)	566 (507-621)	47.8 (43.3-51.8)	765 (694-830)	76.4 (71.6-80.4)	1225 (1147-1288)
Women	8.04 (7.90-8.18)	19.5 (17.5-21.4)	244 (218-268)	35.1 (31.8-38.1)	438 (397-476)	47.6 (43.6-51.2)	594 (544-638)	75.9 (71.5-79.4)	947 (892-991)
White/other Adults	8.00 (7.87-8.13)	19.4 (17.3-21.5)	498 (443-551)	34.9 (31.4-38.1)	896 (807-979)	47.3 (43.1-51.1)	1215 (1107-1312)	75.5 (70.9-79.4)	1939 (1819-2037)
Black Adults	7.27 (7.14-7.40)	21.4 (18.9-23.7)	61 (54-67)	38.0 (34.1-41.6)	108 (97-118)	51.0 (46.4-55.1)	145 (131-156)	82.1 (77.6-85.6)	233 (220-243)
All Adults	7.92 (7.80-8.04)	19.6 (17.4-21.7)	559 (497-618)	35.2 (31.7-38.5)	1004 (904-1096)	47.7 (43.4-51.5)	1359 (1238-1468)	76.2 (71.5-80.0)	2171 (2039-2279)

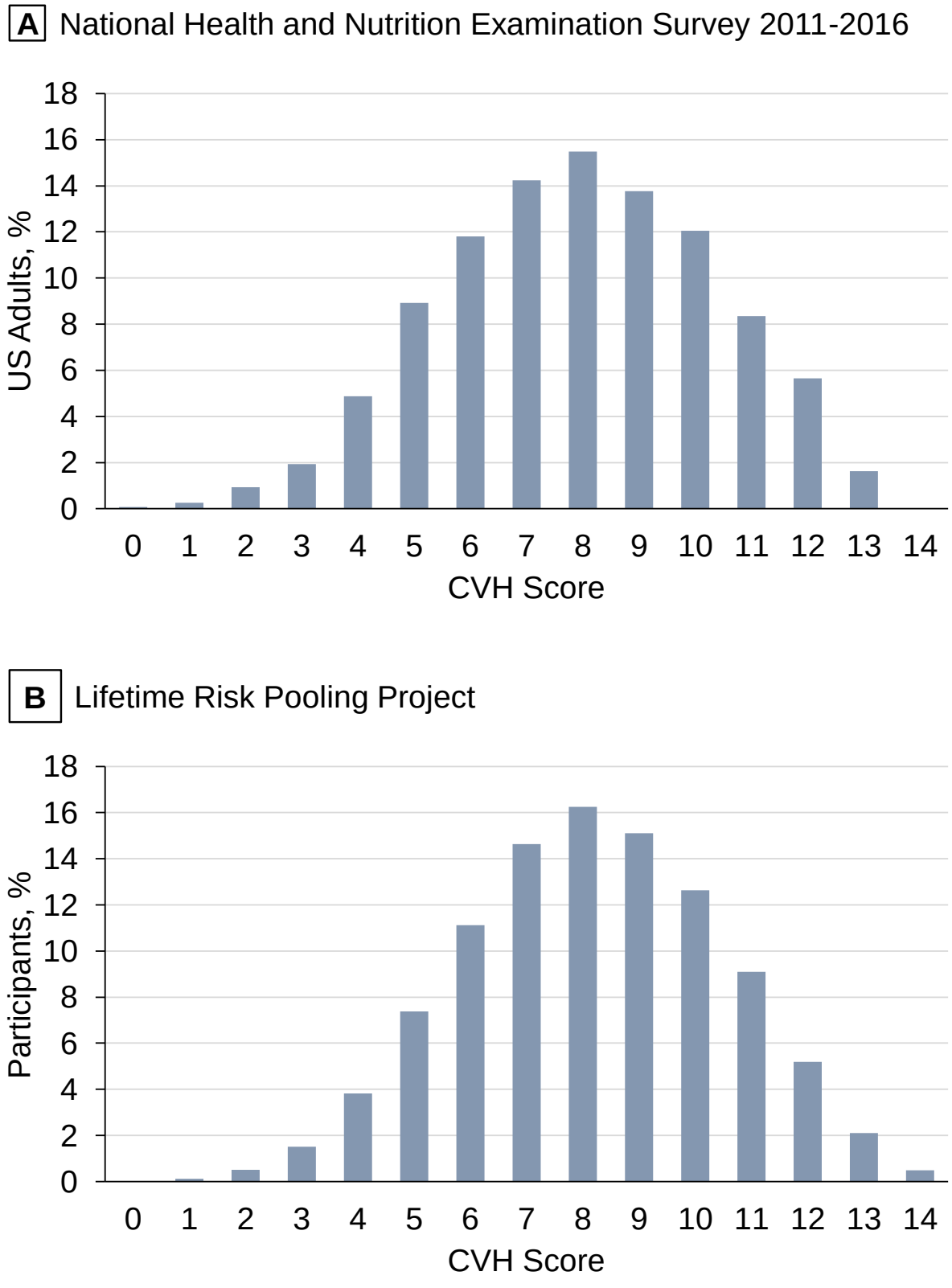
CI, confidence interval; CVH, cardiovascular health; PAF, population attributable fraction; PIF, potential impact fraction

Figure S1. Associations Between Cardiovascular Health Score and Incident Cardiovascular Disease Events by Age Group and Sex: The Lifetime Risk Pooling Project.



Dashed lines indicate 95% confidence intervals; CVH indicates cardiovascular health

Figure S2. Distribution of Cardiovascular Health Scores in US Adults: NHANES 2011-2016 and the LRPP.



CVH indicates cardiovascular health; LRPP, Lifetime Risk Pooling Project