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Community Prevalence of Ideal Cardiovascular Health, by the AHA Definition, and Relation to Cardiovascular Disease Incidence

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Abstract

Objectives—To estimate the prevalence of ideal cardiovascular health and its relation to incident cardiovascular disease (CVD).

Background—An American Heart Association committee recently set a goal to improve the cardiovascular heath of Americans by 20% by 2020. The committee developed definitions of “ideal,” “intermediate,” or “poor” cardiovascular health for adults and children based on seven CVD risk factors or health behaviors.

Methods—We used data from the Atherosclerosis Risk in Communities (ARIC) Study cohort, aged 45–64 years, to estimate the prevalence of ideal cardiovascular health in 1987–89 and the corresponding incidence rates of CVD. Incident CVD comprised stroke, heart failure, myocardial infarction, or fatal coronary disease.

Results—Among 12,744 participants initially free of CVD, only 0.1% had ideal cardiovascular health, 17.4% had intermediate cardiovascular health, and 82.5% had poor cardiovascular health. CVD incidence rates through 2007 showed a graded relation with the ideal, intermediate, and poor categories and with the number of ideal health metrics present: rates were one tenth as high in

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those with six ideal health metrics (3.9 per 1,000 person-years) compared with zero ideal health metrics (37.1 per 1,000 person-years).

Conclusions—In this community-based sample, few adults in 1987–9 had ideal cardiovascular health by the new AHA definition. Those who had the best levels of cardiovascular health nevertheless sustained relatively few events. Clearly, to achieve the AHA goal of improving cardiovascular health by 20% by 2020, we will need to redouble nationwide primordial prevention efforts at the population and individual levels.

Keywords

epidemiology; risk factors; cardiovascular disease; stroke; coronary disease

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Considerable epidemiologic evidence indicates that populations and individuals with optimal cardiovascular disease (CVD) risk factors and health behaviors experience very low rates of CVD events (1–8). This observation provides a foundation for population-wide approaches to encourage avoidance of CVD risk factor development in the first place (i.e., “maintenance of low risk” or “primordial prevention”). Avoidance of risk factors by youths and adults would eliminate much -- probably 70% or more -- of the epidemic of CVD in the United States (1–9). However, in U.S. population-based cohorts, disappointingly only about 5% of middle-aged and older adults have ideal risk factor levels (9).

Recently, the American Heart Association (AHA) Strategic Planning Task Force & Statistics Committee set a goal of “By 2020, to improve the cardiovascular health of all Americans by 20% while reducing deaths from cardiovascular diseases and stroke by 20%” (9). The committee developed definitions of “ideal,” “intermediate,” or “poor” cardiovascular health for adults and children based on seven CVD risk factors or health behaviors. To serve as a baseline, the committee reported the estimated current prevalence of each targeted risk factor or health behavior in the U.S. population. The percentages of adults meeting ideal cardiovascular health metrics were cited as: smoking (73%), body mass index (33%), physical activity (45%), healthy diet (<0.5%), total cholesterol (45%), blood pressure (42%), and fasting plasma glucose (58%). However, the AHA committee could not report what percent of US adults had actually achieved their definition of ideal cardiovascular health (i.e., ideal levels of all seven factors). The committee also did not provide data on the actual CVD incidence rates of adults meeting their ideal, intermediate, or poor cardiovascular health definitions.

We report here the prevalence of ideal cardiovascular health by the AHA definition in the Atherosclerosis Risk in Communities (ARIC) Study cohort in 1987–89 and the corresponding 20-year incidence rates of CVD.

Methods

Study design and subjects

The ARIC Study is a prospective cohort study of atherosclerotic diseases in four U.S. communities: Forsyth County, North Carolina; Jackson, Mississippi; Washington County, Maryland; and the northwest suburbs of Minneapolis, Minnesota (10). The cohort comprised, at baseline in 1987–89, 15,792 men and women aged 45 to 64 years who were selected by list or area probability sampling. Only African Americans were recruited in the Jackson study center. The baseline home interview and clinic examination measured various risk factors, health behaviors, and cardiovascular conditions. The ARIC Study protocol was approved by the institutional review board of each participating university.

Baseline examination

ARIC protocols have been described elsewhere (7,8,10). Diet was assessed by a slightly modified, 66-item Harvard food frequency questionnaire (11). We first excluded persons with extreme energy intake of <600 or >4200 kcal/d for men or <500 or >3600 kcal/d for women (approximate lower and upper 1 percentiles). We then categorized achievement of the five AHA ideal cardiovascular health items: ≥4.5 cups/d of fruits and vegetables (approximated as ≥4.5 servings/d in ARIC); ≥3.5 oz servings/wk of fish (approximated as ≥two 3–5 oz. servings/wk); ≥three 1 oz servings/d of whole grains (approximated as ≥three servings/d); sodium (<1,500 mg/d); and ≤36 oz/wk of sugar sweetened beverages (approximated as ≤4 glasses/wk). The Baecke questionnaire (12) asked participants to report the frequency of participation in up to four sports and in walking in the previous year; this was converted to minutes per week of moderate or vigorous exercise (13). Smoking status (current, former, or never smokers) was derived from interviews. Use of antihypertensive, cholesterol-lowering, and glucose-lowering medications within the past two weeks of baseline interview were self-reported or taken from prescription bottles. Fasting plasma total cholesterol was measured by enzymatic methods. Serum glucose was measured by a hexokinase/glucose-6-phosphate dehydrogenase method. Sitting BP was measured three times using a random-zero sphygmomanometer after five minutes rest. The mean of the last two measurements was used for analysis. Body mass index (kg/m^2) was computed from weight in a scrub suit and standing height. Using the AHA definitions of cardiovascular health (9), we classified each cardiovascular health metric at baseline into ideal, intermediate, or poor categories, as shown in Table 1.

Pre-existing heart failure at baseline was defined as the following: (1) an affirmative response to “Were any of the medications you took during the last 2 weeks for heart failure?” or (2) Stage 3 or “manifest heart failure” by Gothenburg criteria (14,15). Pre-existing coronary heart disease (CHD) at baseline was defined by self-reported prior physician diagnosis of myocardial infarction (MI) or coronary revascularization, or by prevalent MI by 12 lead ECG. Pre-existing stroke was defined by any self-reported prior physician diagnosis of stroke.

Incident CVD events

Incident CVD events comprised heart failure; definite or probable MI; definite fatal CHD; and definite or probable stroke. We followed all participants from the baseline examination in 1987 to 1989 to the date of CVD event, death, loss to follow-up, or otherwise through December 31, 2007. CVD events in ARIC were ascertained by contacting participants annually, identifying hospitalizations and deaths during the prior year, and by surveying discharge lists from local hospitals and death certificates from state vital statistics offices for potential CVD events (15–17). Incident heart failure in ARIC was defined as the first occurrence of either a hospitalization that included an *International Classification of Diseases, 9th Revision* (ICD-9) discharge code of 428 (428.0 to 428.9) among the primary or secondary diagnoses or else a death certificate with an ICD-9 code of 428 or an ICD-10 code of I50 among the listed or underlying causes of death (15). ARIC did not further validate ICD-9 code 428 for heart failure; validation studies using physician review of ARIC hospital records beginning in 2005 indicated the positive predictive value of ICD-9 428 to be 93% for acute decompensated heart failure and 97% for chronic heart failure.

For patients hospitalized with a potential MI, trained abstractors recorded the presenting symptoms and related clinical information, including cardiac biomarkers, and photocopied up to three 12-lead ECGs for Minnesota coding (18). Out-of-hospital deaths were investigated by means of death certificates and, in most cases, by an interview with one or more next of kin and a questionnaire filled out by the patient’s physician. Coroner reports or autopsy reports, when available, were abstracted for use in validation. A CHD event was defined as a validated definite or probable hospitalized MI or a definite CHD death. The criteria for definite or probable MI were based on combinations of chest pain symptoms, ECG changes, and cardiac enzyme levels (16). The criteria for definite fatal CHD were based on chest pain symptoms, history of CHD, underlying cause of death from the death certificate, and any other associated hospital information or medical history, including that from an ARIC clinic visit (16).

The diagnostic classification of stroke was described previously (17). In brief, for potential hospitalized strokes, the abstractors recorded signs and symptoms and photocopied neuroimaging (CT or MRI) and other diagnostic reports. Using criteria adopted from the National Survey of Stroke (19), definite or probable strokes were classified by computer algorithm and separate review by a physician, with disagreements resolved by a second physician.

Statistical analyses

Of 15,792 ARIC participants at baseline, we excluded, due to small numbers, participants who were neither white nor African American subjects (*n*=48). We further excluded 1,969 who at baseline had a history of heart failure, CHD or stroke, or could not be classified on history; 417 who were not fasting eight hours or more; 271 with extreme energy intake; and 299 who did not have complete information on risk factors or health behaviors, leaving 12,744.

Prevalences of each cardiovascular health metric at baseline, or combinations of them, were computed. Cumulative incidence of CVD was calculated via a life-table approach. Age, sex, and/or race-adjusted incidence rates of CVD were calculated according to cardiovascular health groups using Poisson regression. The hazard ratios (HR) of incident CVD in relation to cardiovascular health groups were estimated from Cox proportional hazard models adjusted for age, sex, and sometimes race. The proportional hazards assumption was confirmed by examining whether the ln(-ln) survival curves for the cardiovascular health groups were parallel.

The authors had full access to the data and take responsibility for its integrity. All authors have read and agree to the manuscript as written.

Results

Prevalence of ideal cardiovascular health

The ARIC cohort free of CVD in 1987–1989 had a mean age of 54 years. As shown in Table 1, the proportions of participants in the total ARIC sample who had ideal levels of individual cardiovascular health metrics were: smoking -72.2%, body mass index - 34.5%, physical activity - 37.7%, healthy diet - 5.3%, total cholesterol - 37.5%, blood pressure - 43.8%, and fasting plasma glucose - 53.2%. Except for total cholesterol, more whites than African Americans met ideal levels of each metric. The healthy diet components were poorly met, but were met more often for sugar sweetened beverages (69%) and sodium (58%), than for fruits and vegetables (30%), fish (28%), and whole grains (9%).

As shown in Table 2, only 0.1% of ARIC participants (*n*=17) had all seven cardiovascular health metrics in the ideal range and, thus, almost no one had “ideal cardiovascular health.” Approximately 12.2% of participants had 5 to 7 ideal health metrics, and this percentage varied by age, race, and sex: 15.2% for ages 45–54 and 8.8% for ages 55–64; 3.6% for African American men, 4.2% for African American women, 10.5% for white men, and 18.7% for white women.

The prevalence of having "intermediate" cardiovascular health (at least one intermediate metrics and no poor metrics) was also low: 17.4% (Table 3). In contrast, 82.5% of participants had "poor" cardiovascular health (at least one poor health metric). In fact, 27.9% had 3 or more poor health metrics.

Incidence rates of CVD

The median duration of follow-up was 18.7 years (maximum 21.1 years), during which 3,063 incident CVD events occurred. The first CVD event was CHD in 49%, heart failure in 30%, stroke in 16%, and multiple outcomes simultaneously in 5%. The 17 participants with all 7 factors rated ideal had no CVD events. In contrast, the CVD incidence rate was 7.5 per 1000 person years (95% CI 6.4–8.4) for those with intermediate cardiovascular health and was 14.6 (95% CI 14.0–15.2) for those with poor cardiovascular health.

There was a strong gradient of cumulative CVD incidence during follow-up according to the number of ideal health metrics met (Figure 1). The 2.8% of the ARIC cohort with 6 ideal factors had a relatively low cumulative CVD incidence of approximately 6%. In contrast, the 2.5% of the ARIC cohort with no ideal health factors had approximately a 50% cumulative incidence.

After adjustment for age, race, and sex (Table 4), the overall CVD incidence rate in ARIC was 13.3 per 1000 person-years. The rate was relatively low for those with 5–7 ideal health metrics (<7 per 1000 person-years) and less than one-fifth that of those with no ideal health metrics (32.1 per 1000 person-years). Table 4 also shows an overall higher incidence rate of CVD in African Americans (16.5 per 1000 person-years) than whites (12.2 per 1000 person-years). However, within each stratum of ideal cardiovascular health counts, CVD rates were relatively similar between African Americans and whites.

As shown in Figure 2, both ideal health behaviors (nonsmoking, body mass index, physical activity, healthy diet score) and ideal health factors (total cholesterol, blood pressure, glucose) contributed to lower CVD risk.

Discussion

The two main findings of applying the AHA 2020 cardiovascular health goal metrics to this long-term prospective study of cardiovascular health in middle-aged adults were that (1) the AHA metrics indeed reflect well subsequent risk of CVD, as reflected by a graded CVD incidence rate in relation to the number of ideal health metrics, and (2) virtually no one had ideal cardiovascular health in this community-based study in 1987–89. Previous studies documenting that CVD incidence rates are low in those with optimal cardiovascular health metrics1–8 studied fewer metrics and usually employed narrower CVD incidence definitions, such as CHD alone. In ARIC, for example, we estimated previously that 70% of CHD and stroke events and 77% of heart failure might be eliminated through avoidance of just four factors -- high blood pressure, high cholesterol, diabetes, and smoking (7,8). We extended previous findings to the new AHA definition of cardiovascular health in relation to a combined CVD endpoint that included CHD, heart failure, and stroke. The data further demonstrate that much of CVD might be eliminated through primordial prevention whereby people avoid CVD risk factors and risk behaviors in the first place.

The AHA goal to improve cardiovascular health by 20% by 2020 (9) is bold and forward-thinking, but achievement of the 2020 goal will be challenging. What is clear from our data and previous studies is that most US middle-aged adults have poor cardiovascular health, and few have ideal cardiovascular health. In fact, by the new AHA definition, only 0.1% of ARIC participants in 1987–89 had ideal cardiovascular health. There clearly also is some incongruency that almost no one in middle-age has ideal cardiovascular health, yet the lifetime probabilities of staying free of CHD were nearly 50% for Framingham men and nearly 70% for women (20), 79% and 80% respectively for heart failure (21), and 83% and 80% respectively for stroke (22). Yet, certainly, metrics like AHA's are needed to monitor the cardiovascular health of the population, even if the US population is currently a long way from ideal. Indeed, formulating a definition of cardiovascular health and establishing specific goal levels, even if challenging to achieve, provides an expanded view of CVD prevention.

A point that ARIC Study investigators made previously (7,8) is worth re-emphasizing. Although African Americans have higher rates of CVD than white Americans, this is mainly due to their lower frequency of ideal cardiovascular health metrics (Table 2). At similar levels of health metrics, African Americans and whites actually had similar CVD incidence rates in ARIC (Table 4). Yet, none of the 3,107 African Americans studied here had ideal cardiovascular health. Other factors, such as socioeconomic disadvantages, stress, or genetics, may contribute additionally to high CVD rates in African Americans, but clearly their low prevalence of "traditional" ideal cardiovascular health metrics is alarming.

We chose to focus on ARIC participants free of CVD at baseline, because we wanted to calculate subsequent CVD incidence rates. Although we excluded participants with self-reported physician diagnosed stroke, MI, or coronary revascularization, as well as MI by ECG or symptoms or treatment for heart failure, we did not have valid measures to exclude some other prevalent cardiovascular diseases (e.g., medically-treated angina), and we did not try to exclude subclinical CVD. Nevertheless, in middle-aged adults our baseline exclusion criteria likely eliminated most clinically important CVD from the cohort. Had we not excluded people with prevalent CVD, the percent prevalence of ideal cardiovascular health in the ARIC sample would be even lower than the observed 0.13%, because CVD patients can only achieve intermediate cardiovascular health, not ideal (9).

Drawbacks of our study warrant consideration. First, the ARIC sample is community-based but not nationally-representative. Most of the African Americans were from one center, so their lower prevalence of ideal cardiovascular health than ARIC whites, while consistent with national patterns (23), might be due to geographic or socioeconomic differences and should not be attributed to race, per se. Furthermore, ARIC has no cardiovascular health information on other minority groups. Such information needs to be documented in minority cohort studies and national surveys. Second, while measurement of major risk factors is well standardized and therefore they are quite generalizable from study to study, measurement of diet and physical activity are not. The instruments we employed were validated (11,12) but brief. For example, "fish" included deep fried and other types of fish that probably have widely varying health effects. In addition, sodium intake was likely quite underestimated by this brief food frequency questionnaire. Of course, if ARIC had asked about additional food items or activities, the prevalences of adults meeting ideal diet metrics might have been different. Nevertheless, our estimates for healthy diet and physical activity were close to national estimates (9). Third, we used a single measure of cardiovascular health. Changes in risk factor levels undoubtedly occurred over two decades of follow-up and would have typically led to underestimation of the true biological associations between cardiovascular health metrics and CVD incidence. This underestimation tends to be larger for behavioral factors than for biological risk factors. Fourth, we studied risk factors in from 1987–89. Yet, the 1987–89 prevalence estimates for ARIC are not greatly different from those for the U.S., currently (9). Using a more recent value, for example at ARIC Visit 4 in 1996–98, may have given different estimates of the prevalence of ideal health. Because the cohort would have been 9 years older then, likely the prevalence of ideal cardiovascular health would have been even lower. Finally, using the later ARIC exam data also would have shortened the follow-up time for CVD events, resulting in poorer precision of incidence rates.

Conclusions

In conclusion, in this community-based sample, few adults had ideal cardiovascular health by the new AHA definition. Those who had the best levels of cardiovascular health nevertheless sustained relatively few events. Clearly, to achieve the AHA goal of improving cardiovascular health by 20% by 2020, we will need to redouble our primordial prevention efforts at the population and individual levels. Such efforts must be targeted to youths and young adults, because by middle-age most Americans already have poor cardiovascular health.

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Selected Abbreviations

AHA	American Heart Association
ARIC	Atherosclerosis Risk in Communities
CHD	Coronary Heart Disease
CVD	Cardiovascular Disease
HR	Hazards Ratio
MI	Myocardial Infarction

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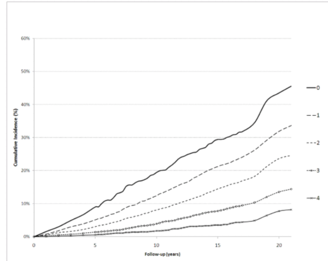

Figure 1. Cumulative incidence of cardiovascular disease according to number of ideal cardiovascular health metrics

Cumulative incidence of cardiovascular disease according to the number of ideal cardiovascular health metrics, ARIC, 1987–2007

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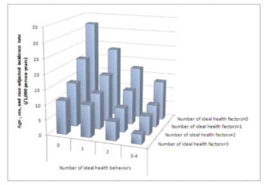

Figure 2. Incidence rate of cardiovascular disease according to the number of ideal health behaviors and factors

Age, sex, and race-adjusted incidence rate of cardiovascular disease according to the number of ideal cardiovascular health behaviors (nonsmoking, body mass index, physical activity, healthy diet score) and health factors (total cholesterol, blood pressure, glucose), ARIC, 1987–2007

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Table 1

Distribution of Individual Baseline Cardiovascular Health Metrics in AKIC Study Participants Free of Cardiovascular Disease, 1987–1989

Health Metric	Definition*	Total Sample, % (n = 12,744)	African Americans, % (n = 3,107)	Whites, % (n = 9,637)
Smoking				
Ideal	Never or quit > 12 months	72.2	68.5	73.4
Intermediate	Former ≤12 months	2.7	2.4	2.8
Poor	Current	25.1	29.1	23.9
Body Mass Index				
Ideal	<25 kg/m^2	34.5	22.7	38.3
Intermediate	25–29.99 kg/m^2	39.7	38.2	40.2
Poor	≥30 kg/m-	25.7	39.1	21.5
Physical Activity				
Ideal	≥150 min/wk moderate or ≥75 min/wk vigorous or ≥150 min/wk moderate + vigorous	37.7	22.0	42.8
Intermediate	1–149 min/wk moderate or 1–74 min/wk vigorous or 1–149 min/wk moderate + vigorous	25.8	21.5	27.2
Poor	None	36.5	56.6	30.1
Healthy Diet Score				
Ideal	4–5 components	5.3	4.4	5.6
Intermediate	2–3 components	63.5	59.2	64.8
Poor	0–1 components	31.3	36.5	29.6
Total Cholesterol				
Ideal	<200 mg/dL, without rx	37.5	40.5	36.6
Intermediate	200–239 mg/dL, or treated to <2(K) mg/dL	37.2	33.0	38.6
Poor	≥240 mg/dL	25.:	26.6	24.8
Blood Pressure				
Ideal	<120/<8() mmHg, without rx	43.8	23.8	50.2
Intermediate	SBP 120–139 or DBP 80–89 mmHg, or treated to <120/<80 mmHg	30.7	32.2	30.2
Poor	SBP≥l40or DBP≥90mmHg	25.5	44.0	19.6
Fasting Serum Glucose				
Ideal	<100 mg/dL, without rx	53.2	48.5	54.8

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Health Metric	Definition*	Total Sample, % (n = 12,744)	African Americans, % (n = 3,107)	Whites, % (n = 9,637)
Intermediate	100–125 mg/dL, or treated to <100 mg/dL	38.7	38.3	38.8
Poor	≥ 126 mg/dL	8.1	13.2	6.4

SBP = systolic blood pressure; DBP = diastolic blood pressure.

*Per reference (9).

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Table 2

Distribution (Prevalence, %) of Ideal Cardiovascular Health Metrics in Various Subgroups of ARIC Participants Free of Cardiovascular Disease, 1987–89

		Age group (y)		Men		Women	
Number of Ideal Health Metrics Present	**Total Sample, % (*n*=12,744)**	**45–54, % (*n*=6,899)**	**55–64, % (*n*=5,845)**	**African-American, % (*n*=1,191)**	**White, % (*n*=4,398)**	**African-American, % (*n*=1,916)**	**White, % (*n*=5,239)**
7	0.1	0.1	0.1	0	0.1	0.1	0.2
6	2.8	3.6	1.9	1.1	2.3	0.5	4.5
5	9.3	11.5	6.8	2.5	8.1	3.6	14.0
4	18.6	20.7	16.2	12.4	17.8	11.3	23.4
3	26.7	26.0	27.6	25.9	28.9	24.7	25.8
2	25.3	22.8	28.4	33.2	26.7	31.9	20.0
1	14.5	13.1	16.2	21.1	13.6	23.4	10.6
0	2.5	2.3	2.8	3.8	2.4	4.5	1.6
All	100	100	100	100	100	100	100.0

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Table 3

Prevalence of Baseline Cardiovascular Health Categories in ARIC Study Participants Free of Cardiovascular Disease, 1987–1989

				Prevalence		
Cardiovascular Health Category	**No. of Poor Health Metrics**	**No. of Intermediate Health Metrics**	**No. of Ideal Health Metrics**	**Total, % (n = 12,744)**	**African Americans,% (n = 3,107)**	**Whites, % (n = 9,637)**
Ideal Health*	0	0	7	0.1	0.0	0.2
Intermediate Health†	0	1–7	0–6	17.4	6.5	20.9
Poor Health‡	1–7	Any	Any	82.5	93.5	78.9
	(1)			(28.3)	(17–7)	(31.7)
	(2)			(26,3)	(27.6)	(25.8)
	(3)			(17.9)	(27.3)	(14.9)
	(4–7)			(10.0)	(20.9)	(6.5)

*Ideal Health = all seven health metrics at ideal levels

†Intermediate Health = at least one of seven health metrics at intermediate levels, but no poor health metrics

‡Poor Health = at least one of seven health metric at a poor level. Subgroups of poor health are shown in parentheses.

Table 4

Incidence Rate and Hazard Ratios of Cardiovascular Disease According to the Number of Ideal Cardiovascular Health Metrics, ARIC, 1987–2007

	Total Sample					African Americans			Whites		
Number of Ideal Metrics	No. of CVD Cases	Incidence Rate*†	(95% CI)	Hazard Ratio†	(95% CI)	No. of CVD Cases	Incidence Rate*†	(95% CI)	No. of CVD Cases	Incidence Rate*†	(95% CI)
7	0	0	--	--.	--	0	0	NA	0	0	NA
6	23	3.9	(2.6–5.9)	0.11	(0.07–0.17)	1	3.3‡	(1.5–7.4)	22	4.3	(2.8–6.5)
5	127	6.4	(5.4–7.6)	0.18	(0.14–0.23)	5			122	7.1	(5.9–8.4)
4	354	8.6	(7.8–9.6)	0.24	(0.20–0.29)	49	8.7	(6.6–11.5)	305	9.3	(8.3–10.4)
3	755	12.0	(11.2–12,9)	0.34	(0.28–0.40)	173	14.2	(12.2–16.5)	582	12.4	(11.4–13.5)
2	946	16.0	(15.0–17.1)	0.46	(0.39–0.54)	270	16.9	(15.0–19.1)	676	17.2	(15.9–18.6)
1	699	21.9	(20.3–23.6)	0.65	(0.55–0.77)	265	25.3	(22.4–28.6)	434	22.4	(20.4–24.7)
0	159	32.1	(37.5–3,5)	1.0	(reference)	72	40.4	(32.0–51.1)	87	30.4	(24.7–37.6)
Overall	3,063	13.3	(12.8–13.8)			835	16.5	(15.4–17.7)	2,228	12.2	(11.7–12.8)

*Incidence rate per 1.000 person-years

†Adjusted for age, sex. and race (except where race stratified)

‡Incidence rate and 95% CI was calculated by collapsing 5 and 6 ideal metrics categories