Ideal Cardiovascular Health and Mortality from All Causes and Diseases of the Circulatory System among Adults in the United States

Running title: Ford, et al.; Cardiovascular health and mortality

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Journal Subject Codes: [8] Epidemiology; [121] Primary prevention; [135] Risk Factors
Abstract:

**Background** - Recently, the American Heart Association (AHA) developed a set of seven ideal health metrics that will be used to measure progress towards their 2020 goals for cardiovascular health. The objective of the present study was to examine how well these metrics predicted mortality from all-causes and diseases of the circulatory system in a national sample of adults in the United States.

**Methods and Results** - We used data from 7622 adults aged ≥20 years who participated in the National Health and Nutrition Examination Survey from 1999 to 2002 and whose mortality through 2006 was determined via linkage to the National Death Index. For the dietary and glycemic metrics, we used alternative measures. During a median follow-up of 5.8 years, 532 deaths (186 deaths from diseases of the circulatory system) occurred. About 1.5% of participants met none of the seven ideal cardiovascular health metrics, and 1.1% of participants met all seven metrics. The number of ideal metrics was significantly and inversely related to mortality from all-causes and diseases of the circulatory system. Compared to participants who met none of the ideal metrics, those meeting five or more metrics had a reduction of 78% (adjusted hazard ratio [aHR]: 0.22; 95% confidence interval [CI]: 0.10, 0.50) in the risk for all-cause mortality and 88% (aHR: 0.12; 95% CI: 0.03, 0.57) in the risk for mortality from diseases of the circulatory system.

**Conclusions** - The number of ideal cardiovascular health metrics is a strong predictor of mortality from all-causes and diseases of the circulatory system.

**Key words:** cardiovascular disease risk factors, epidemiology, mortality, population, prevention
Despite an impressive decline in the mortality rate from coronary heart disease and stroke since the 1960s, preliminary estimates for 2008 show that 617,527 people died of diseases of the heart, which remains as the leading cause of death in the United States, and 133,750 from cerebrovascular diseases. Consequently, more progress in reducing the mortality rate remains to be achieved. Reducing the mortality rate can be realized by lowering the incidence of cardiovascular disease, lowering the case-fatality rate of cardiovascular disease, or a combination of the two.

In the recently released American Heart Association’s *Strategic Impact Goal Through 2020 and Beyond*, the American Heart Association (AHA) charted a new course by focusing on improving cardiovascular health in addition to decreasing cardiovascular disease mortality. The AHA developed seven metrics that address cardiovascular health and, for each metric, created three states that reflected poor, intermediate, and ideal health. These metrics draw upon the extensive body of epidemiological investigations that identified critical risk factors for cardiovascular disease and clinical trials that confirmed that lowering the level of some of these risk factors reduced the morbidity and mortality from cardiovascular disease. Furthermore, the AHA 2020 goals align more closely with the concept of primordial prevention and grew out of the investigations that championed primordial prevention.

Several studies have variably defined a low cardiovascular risk profile based on different risk factors and behaviors. However, at present, little is known about how well the new AHA 2020 goals predict the incidence and mortality from cardiovascular disease. Therefore, the objective of the present study was to examine the relationship between the AHA 2020 goals and mortality from all-causes and diseases of the circulatory system in a recent cohort of United States adults.
Methods

We used the public data files for the 2006 follow-up of participants of the 1999-2000 and 2001-2002 cycles of the National Health and Nutrition Examination Survey (NHANES). The samples in 1999-2000 and 2001-2002 were selected by using a multistage, stratified sampling design and constitute representative samples of the noninstitutionalized civilian US population. Participants were interviewed at home and invited for a clinical examination. Details about the NHANES and its methods have been published.\textsuperscript{12} The study received approval from the National Center for Health Statistics Research Ethics Review Board, and participants were asked to sign an informed consent form.

The mortality status of participants aged ≥20 years through 2006 was determined by using the National Death Index.\textsuperscript{13} Participants who were not deemed to have died as of December 31, 2006 were considered to be alive. The International Classification of Diseases, 10th Revision (ICD-10) codes I00-I99 were used to identify deaths from diseases of the circulatory system.

The AHA 2020 goals include the following seven behaviors and risk factors: smoking status, body mass index, physical activity, healthy dietary score, total cholesterol, blood pressure, and fasting plasma glucose.\textsuperscript{2} Participants who had smoked 100 cigarettes during their lifetime and were still currently smoking were defined as showing evidence of poor health. Former smokers who had quit within the previous 12 months were defined as showing evidence of intermediate health. Former smokers who had quit for more than 12 months or participants who had never smoked were defined as showing evidence of ideal health. Body mass index (kg/m\textsuperscript{2}) was calculated from measured weight and height. Participants with a body mass index of ≥30 kg/m\textsuperscript{2}, 25-<30 kg/m\textsuperscript{2}, and <25 kg/m\textsuperscript{2} had poor health, intermediate health, and ideal health,
respectively. Participants were asked about the frequency and duration of participation in moderate and vigorous physical activity during the past 30 days. The weekly frequency of bouts of physical activity was calculated by multiplying the number of such bouts during the 30-day period by a factor of 7/30. For each participant, the weekly number of minutes of moderate activity (weekly frequency multiplied by the average duration for each bout) and the weekly number of minutes of vigorous activity (weekly frequency multiplied by the average duration for each bout multiplied by 2) were summed.\textsuperscript{14} Ideal, intermediate, and poor health were defined as 150 or more minutes of moderate or vigorous activity per week, 1-149 minutes per week, and 0 minutes per week, respectively.

In lieu of the AHA’s specific dietary criteria, we used the Healthy Eating Index (HEI) score as our healthy dietary score.\textsuperscript{15} The HEI includes three of the five primary criteria included in the AHA’s healthy dietary score: fruits and vegetables, whole grains, and sodium. Not included are sugar-sweetened beverages and fish consumption. Participants with a HEI score <50 were assigned to poor health, those with a score of >50 to <81 were assigned to intermediate health, and those with a score of ≥81 were assigned to ideal health.\textsuperscript{16} The index was determined from dietary information collected by a single 24-hour recall administered in person to participants attending the medical examination.

Serum total cholesterol and high-density lipoprotein cholesterol were measured enzymatically on a Hitachi 717 Analyzer or a Hitachi 912 Analyzer (Roche Diagnostics, Indianapolis, IN). Ideal, intermediate, and poor health were defined as <200 mg/dl, 200-239 mg/dl or treated to goal, and ≥240 mg/dl, respectively. Up to four attempts were made to measure blood pressure. The average of the last two measurements of blood pressure for participants who had three or four measurements, the last measurement for participants with only
two measurements, and the only measurement for participants who had one measurement were used. Current use of antihypertensive medications was based on self-report. Ideal, intermediate, and poor health were defined as systolic blood pressure (SBP) <120 mm Hg and diastolic blood pressure (DBP) <80 mm Hg, SBP 120-139 mm Hg and DBP 80-89 mm Hg or treated to goal, and SBP ≥140 mm HG or DBP ≥90, respectively.

Although the AHA relied on fasting plasma glucose to determine hyperglycemia, we used HbA1c concentrations for two reasons. First, recent recommendations from the American Diabetes Association allow for the use of HbA1c to diagnose diabetes (ADA 2010). Second, a sizeable percentage of participants in NHANES who have an examination are not fasting. Therefore, to maximize our sample size, we opted for concentrations of HbA1c, which is not subject to fasting conditions. Participants with a HbA1c ≥6.5% had poor health, those with a concentration of 5.7 to <6.5% had intermediate health, and those with a concentrations <5.7% had ideal health. Participants who reported being treated with insulin or oral medications to lower blood glucose and had a concentration <6.5% were deemed to have intermediate health.

We included several covariates in our analyses: age, gender, race or ethnicity (white, African American, Mexican American, other), educational status (<high school, high school graduate/General Educational Development or equivalent, >high school), alcohol use, self-reported health status, health insurance, history of cardiovascular disease, and history of cancer. We calculated alcohol use from several questions regarding the use of alcohol during a participant’s lifetime, 12-month period, and recent use. Men who consumed an average of ≤2 drinks per day and women who consumed on average ≤1 drink per day were considered as moderate drinkers, and men who consumed an average of >2 drinks per day and women who consumed on average >1 drink per day were considered as excessive drinkers. Self-reported
health status was determined from the question “Would you say your health in general is excellent, very good, good, fair, or poor?”. Health insurance coverage (yes/no) was derived from the question “Are you covered by health insurance or some other kind of health care plan?”. Participants who reported ever being told by a doctor or other health professional that they had congestive heart failure, coronary heart disease, angina pectoris, heart attack, or stroke were considered as having a history of cardiovascular disease.

Our analyses were limited to participants who were aged ≥20 years. We calculated mortality rates per 1,000 person-years of follow-up. Adjustment for age or age and gender was performed using the direct method with the year 2000 US population. Differences in age-and gender adjusted proportions were examined with t-tests. Pearson correlations adjusted for age and gender between the ranks of continuous variables used to formulate the health metrics were calculated. Risk estimates for mortality were calculated using Cox proportional hazards regression analysis for the individual and number of 2020 cardiovascular health goals. In these analyses, we adjusted for age (continuous), gender, race or ethnicity (white, African American, Mexican American, other), educational attainment (<high school, high school graduate or equivalent, and beyond high school), alcohol use (excessive alcohol use yes/no), self-reported health status (fair or poor health; good, very good, or excellent health), health insurance coverage (yes/no), and histories of cardiovascular disease (yes/no) and cancer (yes/no). Proportionality assumptions were examined using Schoenfeld residuals and were found to be met. Estimates were calculated with SAS and SUDAAN, the latter to account for the complex sampling design of the survey.
Results

Of the 9471 participants aged ≥20 years who had an examination, 10 were ineligible for the follow-up study and 8005 had sufficient information for the cardiovascular health metrics. Additional exclusions for incomplete information of other study variables reduced the sample size to 7622. The sample included 3635 men, 3987 women, 3857 whites, 1329 African Americans, 1814 Mexican Americans, and 622 of another race or ethnicity. The median age was 43 years.

The age- and gender adjusted prevalence of ideal health for the individual health factors ranged from 10.9% for the HEI dietary score to 81.3% for HbA1c (Table 1). Without adjustment, 1.5% of participants had no ideal health criteria, 8.4% had 1, 19.9% had 2, 27.4% had 3, 22.1% had 4, 14.0% had 5, 5.5% had 6, and 1.1% had 7 (after adjustment for age and gender: 1.5%, 8.6%, 20.3%, 27.5%, 21.9%, 13.8%, 5.4%, and 1.0%, respectively). The interrelationships between the dichotomized health metrics and correlations for continuous variables are shown in Tables 2 and 3.

During a median follow-up of 5.8 years, 532 deaths (186 deaths from diseases of the circulatory system) were recorded among the 7622 participants. Smoking status, dietary score, HbA1c, physical activity, and blood pressure were significantly associated with all-cause mortality (Table 4). In the maximally-adjusted model, only smoking status, physical activity, Healthy Eating Index score, blood pressure, and HbA1c retained their statistical significance. Five metrics (smoking status, physical activity, Healthy Eating Index score, blood pressure and HbA1c) showed evidence of a graded response indicating that the intermediate health categories for these metrics were associated with reduced all-cause mortality. With the exception of blood
pressure, the hazard ratios for mortality from diseases of the circulatory system generally were aligned with those for all-cause mortality although the confidence limits included unity.

Four of the seven dichotomized cardiovascular health metrics (ideal health versus intermediate or poor) were significantly associated with all-cause mortality (Figure 1, Panel A). Ranked according to the magnitude of the hazard ratio for all-cause mortality were dietary score and HbA1c, ideal smoking status, and physical activity. For mortality from diseases of the circulatory system, ideal health for blood pressure proved to be a particularly strong determinant. Furthermore, dietary score and HbA1c were also significantly associated with this outcome. We also redid the above models after revising the outcome variable by comparing ideal and intermediate health to poor health (Figure 1, Panel B). The resulting magnitude and rank order of the hazard ratios showed some differences from those of the models in panel A of Figure 1.

When the dichotomized cardiovascular health metrics were summed, a strong inverse relationship was present between the number of ideal health metrics and mortality from all-causes or diseases of the circulatory system (Table 5). Because so few deaths occurred among participants with six or seven ideal health metrics, we grouped participants with 5, 6, or 7 ideal health metrics into one category. Compared to participants with no ideal health metrics, those with 5 or more had reduced all-cause mortality (adjusted hazard ratio [aHR] = 0.22; 95% confidence interval [CI] = 0.10, 0.50) and mortality from diseases of the circulatory system (aHR = 0.12; 95% CI = 0.03, 0.57). When participants who died during the first year of follow-up were excluded from the analyses (481 deaths, 7571 at risk), a strong reduction in risk with increasing number of ideal health metrics remained evident (adjusted hazard ratios for participants with 1, 2, 3, 4, and 5+ ideal health metrics are 0.68 [95% CI = 0.32, 1.45]; 0.69 [95% CI = 0.31, 1.52]; 0.58 [95% CI = 0.24, 1.38]; 0.49 [95% CI = 0.19, 1.27]; 0.22 [95% CI: 0.08, 0.62]).
Furthermore, after excluding participants with self-reported cardiovascular disease from the analyses, the hazard ratios for participants with 5 or more ideal health metrics were similar to the hazard ratios for the entire analytical sample of 7622 participants.

We also created a score out of the seven cardiovascular health metrics ranging from 0 to 14 by assigning a value of 0 for poor health, 1 for intermediate health, and 2 for ideal health for each metric. The maximally-adjusted hazard ratio per unit score was 0.86 (95% CI: 0.81, 0.91) for all-cause mortality and 0.83 (95% CI: 0.76, 0.91) for mortality from diseases of the circulatory system.

Discussion

Using a recent national sample of US adults, we show that the number of ideal cardiovascular health metrics was strongly and inversely related to mortality from all-causes and diseases of the circulatory system. These data, which are consistent with the results from a recent prospective study, suggest that attainment of the AHA 2020 goals could result in substantial reductions in mortality.

Since the 1960s, mortality from coronary heart disease has enjoyed a more or less sustained decrease. The early period of this drop was likely governed primarily by reductions in the prevalence of smoking, mean concentration of total cholesterol, and blood pressure. The introduction of the coronary care unit during the 1960s and its subsequent expansion also saved lives. The development of ever more sophisticated medical and surgical treatments in ensuing decades further contributed to reducing the mortality rate from coronary heart disease. Between 1980 and 2000, treatments accounted for approximately 47% and reductions in risk factors for approximately 44% of the deaths from coronary heart disease that were prevented or...
postponed in the United States.\textsuperscript{21} Models consistently show that enormous reductions in the mortality from coronary heart disease are achievable with meaningful reductions in risk factors.\textsuperscript{22} Thus, the development of the AHA 2020 goals that emphasize cardiovascular health represents an important evolution from disease management to health promotion.

Controlling for confounding constitutes a major challenge in observational studies. To examine the impact of various possible confounders on our risk estimates, we presented several proportional hazards models that contained different sets of covariates. We included self-reported health and prevalent chronic disease as possible confounders because these factors are related to mortality as well as to the AHA cardiovascular health metrics. Conceivably, these factors could also form part of the causal pathways between the AHA metrics and mortality in which case the model was overadjusted and the benefits attributable to the metrics were underestimated. However, a comparison of models with and without these factors shows that self-reported health and prevalent chronic disease did not materially affect the hazard ratios. Similar considerations apply to the model that adds all the AHA metrics.

Our analyses using the NHANES 1999-2002 data show that only a small percentage of US adults met ideal criteria for all seven cardiovascular health metrics, a result that is disappointing but perhaps not surprising. One consequence of the very small percentage of participants in the extremes of the distribution is that large cohorts with large numbers of deaths are needed to form stable and accurate estimates of the risk for mortality among those with six or seven ideal health metrics. Most adults met 2, 3, or 4 ideal health metrics, all of which are associated with substantial reduction in mortality compared to participants with no ideal health metric. The challenge for clinical and public health professionals is to keep moving the distribution of the number of health metrics in the desired direction. In this regard, a number of
major efforts are under way. An example of a clinical program is the AHA’s *The Guideline Advantage* jointly managed by the American Cancer Society, American Diabetes Association, and AHA. An example of a recent major public health initiative launched by the U.S. Department of Health and Human Services is the *Communities Putting Prevention to Work* initiative that funded 50 communities with the goal of reducing tobacco use, increasing physical activity, improving nutrition, and reducing obesity. In addition to continued efforts to promote healthy lifestyles, public health programs have put a greater focus on systems and environmental changes in order to effect changes and options for healthy lifestyle choices. Examples of such policy and systems level efforts include smoking bans and restrictions in public places and recent efforts to address the amount of sodium in foods.

In the AHA statement, the prevalence of an ideal healthy dietary score was <0.5%. In contrast, our use of the HEI score and the cut points we used yielded a prevalence of an ideal healthy dietary score of about 11%. How well the AHA’s healthy dietary score predicts mortality remains unknown. However, three of its five primary components are shared with the HEI score. Five of the seven metrics (current smoking, physical activity, healthy diet score, blood pressure, HbA1c) showed a gradient in risk suggesting that health gains are feasible when adults move from poor to intermediate health as well as when they move from intermediate to ideal health for most health metrics. Future studies comparing the gain in health benefits associated with a change from poor to intermediate health to the gain associated with a change from intermediate to ideal health for each metric may yield helpful insights that will be of value to clinicians in optimizing the cardiovascular health of their patients.

Not all of the individual metrics contributed to the reduction in risk; body mass index and total cholesterol status were not significantly related to mortality from all-causes. The reasons for
these findings are not clear. Of note is that a previous analysis of the mortality experience by NHANES III participants found a weak relationship between body mass index and all-cause mortality. The authors of that study postulated that treatment for some of downstream effects of obesity such as dyslipidemias and hypertension may have blunted some of the risk associated with being obese. Also, follow-up time may not have been long enough to discern the effects of BMI. An earlier study among men observed no associations for BMI or other measures of adiposity with coronary heart disease mortality during up to 14 years of follow-up, but positive associations after 14 years of follow-up, suggesting that the effects of adiposity may not become apparent for some time. A recent meta-analysis found that anthropometric measures such as body mass index did not improve risk prediction for cardiovascular disease once traditional cardiovascular risk factors were considered. From a public health perspective, the prevention and control of excess weight represents a valuable public health goal because, in addition to other considerations, excess weight causes dyslipidemia, high blood pressure, and hyperglycemia.

Hypercholesterolemia is considered one of the three cardinal risk factors for coronary heart disease and has also been shown to be a risk factor for all-cause mortality. Consequently, the poor prediction by this risk factor in the current study was unexpected. The use of cholesterol-lowering medications particularly in the form of statins has been increasing rapidly in the United States, and some of the non-cholesterol lowering effects of statin use may have played a role in our findings. Furthermore, the use of cholesterol-lowering medications among the participants with untreated hypercholesterolemia at baseline likely increased which may have negated some of the adverse effect suggested by elevated baseline concentrations. Alternatively,
the lack of a significant association may have represented a chance occurrence. It is also possible that a significant association may emerge with longer follow-up of the cohort.

Our results should be considered in light of several limitations. First, the follow-up of our cohort was of limited duration. Consequently, the number of deaths, even at over 500, posed a major challenge to estimate the risks in the extremes of the distribution of the number of ideal health metrics. Thus, collapsing some categories for some analyses was necessary. Furthermore, the limited number of deaths also led us not to undertake stratified analyses by various demographic or other factors. Second, we only had a single measurement for all the health metrics, and, thus, were unable to account for changes in these metrics that may have occurred during the course of the follow-up period. Finally, as noted before, we did not adhere perfectly to all of the AHA 2020 health metrics for practical reasons.

Other studies are needed to examine the relationships between the AHA 2020 goals and the incidence and mortality of cardiovascular disease. Examining these relationships in historical as well as in more current cohorts will provide important feedback about the choice of metrics as well as the selected definitions for poor, intermediate, and ideal health.

Acknowledgments: The findings and conclusions in this article are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Conflict of Interest Disclosures: None

References:


Table 1. Selected Age- and Gender-Adjusted Baseline Characteristics among Adults Aged ≥20 Years, by Mortality Status, National Health and Nutrition Examination Survey 1999-2002

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Deceased (N=532)</th>
<th>Survivors (N=7090)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean or % (95% CI)</td>
<td>Mean or % (95% CI)</td>
</tr>
<tr>
<td>Age (years)*</td>
<td>67.0 (64.7, 69.3)</td>
<td>44.2 (43.5, 44.9)</td>
</tr>
<tr>
<td>Men, %†</td>
<td>66.5 (54.2, 76.8)</td>
<td>47.7 (46.6, 48.9)</td>
</tr>
<tr>
<td>Whites, %</td>
<td>57.8 (50.7, 64.5)</td>
<td>73.3 (69.5, 76.8)</td>
</tr>
<tr>
<td>&gt;High school, %</td>
<td>34.2 (25.1, 44.5)</td>
<td>54.3 (51.3, 57.3)</td>
</tr>
<tr>
<td>Excessive alcohol use, %</td>
<td>8.7 (5.6, 13.3)</td>
<td>12.7 (9.6, 16.7)</td>
</tr>
<tr>
<td>Poor or fair health, %</td>
<td>44.7 (34.8, 55.1)</td>
<td>14.4 (12.8, 16.3)</td>
</tr>
<tr>
<td>Has health insurance, %</td>
<td>83.7 (70.4, 91.7)</td>
<td>82.8 (81.0, 84.5)</td>
</tr>
<tr>
<td>History of cardiovascular disease, %</td>
<td>34.0 (24.5, 45.0)</td>
<td>7.1 (6.3, 7.9)</td>
</tr>
<tr>
<td>History of cancer, %</td>
<td>13.4 (9.8, 17.9)</td>
<td>7.2 (6.4, 8.1)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>30.1 (28.2, 31.9)</td>
<td>28.0 (27.7, 28.3)</td>
</tr>
<tr>
<td>Physically active (min/week) ‡</td>
<td>7.3 (3.9, 13.0)</td>
<td>33.2 (27.7, 39.7)</td>
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<td>Healthy Eating Index score (%)</td>
<td>58.7 (56.2, 61.3)</td>
<td>63.9 (63.1, 64.7)</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>204.8 (192.2, 217.4)</td>
<td>203.5 (201.6, 205.4)</td>
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<tr>
<td>Systolic blood pressure (mm Hg)</td>
<td>122.5 (119.4, 125.5)</td>
<td>122.6 (121.9, 123.4)</td>
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<tr>
<td>Diastolic blood pressure (mm Hg)</td>
<td>70.2 (68.7, 72.5)</td>
<td>72.5 (71.9, 73.1)</td>
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<tr>
<td>HbA1c (%)</td>
<td>5.8 (5.5, 6.1)</td>
<td>5.4 (5.3, 5.5)</td>
</tr>
<tr>
<td>Not currently smoking, %</td>
<td>68.6 (55.3, 79.4)</td>
<td>73.2 (70.7, 75.5)</td>
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<tr>
<td>BMI &lt;25 kg/m2, %</td>
<td>27.4 (18.5, 38.6)</td>
<td>34.8 (33.1, 36.6)</td>
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<tr>
<td>Physically active, %</td>
<td>27.0 (18.7, 37.3)</td>
<td>42.6 (39.6, 45.7)</td>
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<tr>
<td>HEI &gt;80, %</td>
<td>4.3 (2.5, 7.3)</td>
<td>11.2 (9.6, 13.1)</td>
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<tr>
<td>Total cholesterol &lt;200 mg/dl, %</td>
<td>42.9 (36.5, 49.5)</td>
<td>45.1 (43.4, 46.7)</td>
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<tr>
<td>Optimal blood pressure, %</td>
<td>36.4 (28.9, 44.6)</td>
<td>40.7 (38.6, 42.9)</td>
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<td>HbA1c &lt;5.7%, %</td>
<td>66.0 (55.4, 75.1)</td>
<td>82.0 (79.9, 83.9)</td>
</tr>
<tr>
<td>Number of AHA 2020 metrics for ideal health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>4.7 (1.6, 12.8)</td>
<td>1.5 (1.1, 1.9)</td>
</tr>
<tr>
<td>1</td>
<td>9.6 (6.3, 14.3)</td>
<td>8.4 (7.3, 9.7)</td>
</tr>
<tr>
<td>2</td>
<td>28.6 (21.4, 37.1)</td>
<td>19.9 (18.5, 21.4)</td>
</tr>
<tr>
<td>3</td>
<td>28.0 (20.2, 37.4)</td>
<td>27.6 (26.0, 29.2)</td>
</tr>
<tr>
<td>4</td>
<td>24.0 (16.0, 34.4)</td>
<td>22.1 (20.9, 23.4)</td>
</tr>
<tr>
<td>≥5</td>
<td>5.2 (1.7, 14.6)</td>
<td>20.5 (18.5, 22.8)</td>
</tr>
</tbody>
</table>

*Unadjusted.
†Adjusted for age.
‡Means represent back-transformed means of Box-Cox transformation.
Table 2. Age-and Gender-Adjusted Percentages of Ideal Cardiovascular Health Metrics among Participants Aged ≥20 Years, by Ideal Cardiovascular Health Metric Status, National Health and Nutrition Examination Survey 1999-2002

<table>
<thead>
<tr>
<th>Ideal cardiovascular health metric status</th>
<th>Current smoking</th>
<th>Body mass index</th>
<th>Physical activity</th>
<th>Healthy diet score</th>
<th>Total cholesterol</th>
<th>Blood pressure</th>
<th>HbA1c</th>
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<tbody>
<tr>
<td>Current smoking</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Yes</td>
<td>—</td>
<td>68.3 (1.8)</td>
<td>79.5 (1.5)</td>
<td>86.6 (1.6)</td>
<td>73.3 (1.1)</td>
<td>70.8 (1.5)</td>
<td>73.2 (1.1)</td>
</tr>
<tr>
<td>No</td>
<td>—</td>
<td>74.6 (1.0)</td>
<td>67.6 (1.0)</td>
<td>71.1 (1.2)</td>
<td>72.3 (1.4)</td>
<td>72.9 (1.2)</td>
<td>70.4 (2.2)</td>
</tr>
<tr>
<td>p</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.450</td>
<td>0.152</td>
<td>0.203</td>
</tr>
<tr>
<td>Body mass index</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>33.3 (1.0)</td>
<td>—</td>
<td>39.5 (1.5)</td>
<td>41.0 (2.2)</td>
<td>40.5 (1.3)</td>
<td>43.3 (1.8)</td>
<td>38.8 (0.9)</td>
</tr>
<tr>
<td>No</td>
<td>40.8 (1.4)</td>
<td>—</td>
<td>32.4 (1.0)</td>
<td>34.0 (0.8)</td>
<td>29.2 (1.1)</td>
<td>28.8 (1.0)</td>
<td>16.0 (1.8)</td>
</tr>
<tr>
<td>p</td>
<td>&lt;0.001</td>
<td>—</td>
<td>&lt;0.001</td>
<td>0.002</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Physical activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>45.9 (1.7)</td>
<td>46.0 (2.4)</td>
<td>—</td>
<td>54.1 (3.3)</td>
<td>41.3 (1.5)</td>
<td>45.9 (1.8)</td>
<td>44.3 (1.7)</td>
</tr>
<tr>
<td>No</td>
<td>30.8 (1.2)</td>
<td>39.1 (1.2)</td>
<td>—</td>
<td>40.3 (1.3)</td>
<td>41.7 (1.7)</td>
<td>38.4 (1.3)</td>
<td>29.4 (2.0)</td>
</tr>
<tr>
<td>p</td>
<td>&lt;0.001</td>
<td>0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.794</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Healthy diet score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>12.9 (1.0)</td>
<td>13.7 (1.3)</td>
<td>14.4 (1.2)</td>
<td>—</td>
<td>11.7 (1.2)</td>
<td>12.8 (1.4)</td>
<td>12.0 (0.9)</td>
</tr>
<tr>
<td>No</td>
<td>4.7 (0.7)</td>
<td>9.6 (0.7)</td>
<td>8.6 (0.8)</td>
<td>—</td>
<td>10.4 (0.7)</td>
<td>9.7 (0.8)</td>
<td>7.5 (0.9)</td>
</tr>
<tr>
<td>p</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.177</td>
<td>0.037</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>45.4 (0.8)</td>
<td>52.2 (1.3)</td>
<td>45.0 (1.2)</td>
<td>48.8 (2.4)</td>
<td>—</td>
<td>50.6 (1.4)</td>
<td>45.9 (0.8)</td>
</tr>
<tr>
<td>No</td>
<td>43.9 (1.6)</td>
<td>41.0 (1.0)</td>
<td>45.3 (0.9)</td>
<td>44.8 (0.8)</td>
<td>—</td>
<td>41.1 (0.9)</td>
<td>39.6 (2.1)</td>
</tr>
<tr>
<td>p</td>
<td>0.308</td>
<td>&lt;0.001</td>
<td>0.852</td>
<td>0.117</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.008</td>
</tr>
<tr>
<td>Blood pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>40.0 (1.2)</td>
<td>48.7 (1.5)</td>
<td>44.2 (1.3)</td>
<td>45.3 (2.5)</td>
<td>44.8 (1.4)</td>
<td>—</td>
<td>42.9 (1.0)</td>
</tr>
<tr>
<td>No</td>
<td>42.0 (1.3)</td>
<td>35.9 (1.1)</td>
<td>37.7 (1.1)</td>
<td>39.9 (1.1)</td>
<td>36.4 (1.3)</td>
<td>—</td>
<td>24.1 (2.1)</td>
</tr>
<tr>
<td>p</td>
<td>0.155</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.055</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HbA1c</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>81.9 (1.0)</td>
<td>89.9 (0.9)</td>
<td>86.1 (1.3)</td>
<td>87.0 (1.6)</td>
<td>82.6 (0.9)</td>
<td>88.2 (1.1)</td>
<td>—</td>
</tr>
<tr>
<td>No</td>
<td>80.2 (1.5)</td>
<td>77.1 (1.0)</td>
<td>78.2 (0.8)</td>
<td>80.5 (0.9)</td>
<td>80.1 (1.2)</td>
<td>77.5 (1.1)</td>
<td>—</td>
</tr>
<tr>
<td>p</td>
<td>0.221</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.034</td>
<td>&lt;0.001</td>
<td>—</td>
</tr>
</tbody>
</table>

P-values represent the difference between proportions.
Table 3. Correlations Adjusted for Age and Gender between the Ranks of Continuous Variables Used to Define Cardiovascular Health Metrics among 7622 Participants Aged >=20 Years, National Health and Nutrition Examination Survey 1999-2002

<table>
<thead>
<tr>
<th>Variable</th>
<th>BMI (kg/m²)</th>
<th>Physically active (min/week)</th>
<th>Healthy Eating Index score (%)</th>
<th>Total cholesterol (mg/dl)</th>
<th>Systolic blood pressure (mm Hg)</th>
<th>Diastolic blood pressure (mm Hg)</th>
<th>HbA1c (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (kg/m²)</td>
<td>—</td>
<td>-0.10</td>
<td>-0.09</td>
<td>0.11</td>
<td>0.19</td>
<td>0.15</td>
<td>0.29</td>
</tr>
<tr>
<td>Physically active (min/week)</td>
<td>—</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Healthy Eating Index score (%)</td>
<td>—</td>
<td>0.15</td>
<td>-0.02</td>
<td>-0.06</td>
<td>-0.01</td>
<td>-0.12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>&lt;0.001</td>
<td>0.236</td>
<td>0.001</td>
<td>0.531</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>—</td>
<td>-0.06</td>
<td>-0.04</td>
<td>-0.07</td>
<td>-0.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>0.001</td>
<td>0.024</td>
<td>0.001</td>
<td>&lt;.0001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic blood pressure (mm Hg)</td>
<td>—</td>
<td>0.08</td>
<td>0.16</td>
<td>0.07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;.0001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diastolic blood pressure (mm Hg)</td>
<td>—</td>
<td>0.41</td>
<td>0.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>—</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HbA1c (%)</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 4. Hazard Ratios (95% Confidence Interval) for Mortality from All-Causes and Diseases of the Circulatory System among 7622 Participants Aged >=20 Years, National Health and Nutrition Examination Survey 1999-2002. The National Death Index was used to ascertain mortality through 2006

<table>
<thead>
<tr>
<th>Model 1: adjusted for age and gender</th>
<th>All-cause mortality</th>
<th>Diseases of the circulatory system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking status</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Body mass index</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Physically active</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Healthy Eating Index score</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>HbA1c</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model 2: as model 1 plus race or ethnicity, education, health insurance, and alcohol use</th>
<th>All-cause mortality</th>
<th>Diseases of the circulatory system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking status</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Body mass index</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Physically active</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Healthy Eating Index score</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>HbA1c</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model 3: as model 2 plus self-reported health status, history of cardiovascular disease, and history of cancer</th>
<th>All-cause mortality</th>
<th>Diseases of the circulatory system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking status</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Body mass index</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Physically active</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Metric</td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Healthy Eating Index score</td>
<td>1.00</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>(0.49, 1.01)</td>
<td>(0.27, 0.72)</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>1.00</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>(0.56, 1.09)</td>
<td>(0.62, 1.13)</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>1.00</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>(0.69, 0.96)</td>
<td>(0.54, 1.02)</td>
</tr>
<tr>
<td>HbA1c</td>
<td>1.00</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td>(0.65, 1.36)</td>
<td>(0.42, 0.94)</td>
</tr>
</tbody>
</table>

**Model 4: as model 3 plus other cardiovascular health metrics**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking status</td>
<td>1.00</td>
<td>0.71</td>
<td>0.55</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(0.26, 1.91)</td>
<td>(0.35, 0.87)</td>
<td>(0.00, 0.25)</td>
<td>(0.23, 1.02)</td>
</tr>
<tr>
<td>Body mass index</td>
<td>1.00</td>
<td>0.86</td>
<td>1.21</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(0.64, 1.15)</td>
<td>(0.85, 1.73)</td>
<td>(0.78, 2.32)</td>
<td>(0.88, 2.93)</td>
</tr>
<tr>
<td>Physically active</td>
<td>1.00</td>
<td>0.82</td>
<td>0.75</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(0.56, 1.21)</td>
<td>(0.61, 0.91)</td>
<td>(0.25, 0.98)</td>
<td>(0.37, 1.14)</td>
</tr>
<tr>
<td>Healthy Eating Index score</td>
<td>1.00</td>
<td>0.76</td>
<td>0.51</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(0.54, 1.09)</td>
<td>(0.30, 0.85)</td>
<td>(0.51, 3.06)</td>
<td>(0.25, 1.49)</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>1.00</td>
<td>0.83</td>
<td>0.88</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(0.60, 1.13)</td>
<td>(0.65, 1.19)</td>
<td>(0.53, 1.39)</td>
<td>(0.53, 1.45)</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>1.00</td>
<td>0.78</td>
<td>0.75</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(0.65, 0.93)</td>
<td>(0.54, 1.03)</td>
<td>(0.48, 1.21)</td>
<td>(0.05, 0.41)</td>
</tr>
<tr>
<td>HbA1c</td>
<td>1.00</td>
<td>0.87</td>
<td>0.58</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>(0.61, 1.24)</td>
<td>(0.39, 0.88)</td>
<td>(0.44, 1.25)</td>
<td>(0.33, 0.93)</td>
</tr>
</tbody>
</table>
Table 5. Sample Sizes, Rates, and Hazard Ratios for Mortality from All-Causes and Diseases of the Circulatory System among Participants Aged >=20 Years, National Health and Nutrition Examination Survey 1999-2002. The National Death Index was used to ascertain mortality through 2006

<table>
<thead>
<tr>
<th>Number of ideal cardiovascular health metrics</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5+</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All participants</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>All-causes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. deaths / no. at risk</td>
<td>16</td>
<td>99</td>
<td>170</td>
<td>156</td>
<td>71</td>
<td>20</td>
</tr>
<tr>
<td>Age and gender adjusted rate /1,000 PY (95% CI)</td>
<td>17.3 (7.0, 27.6)</td>
<td>10.4 (7.6, 13.2)</td>
<td>10.9 (8.4, 13.4)</td>
<td>8.1(5.9, 10.4)</td>
<td>6.3 (4.5, 8.2)</td>
<td>3.5 (1.1, 5.9)</td>
</tr>
<tr>
<td>Age and gender adjusted hazard ratios (95% CI)</td>
<td>1.00</td>
<td>0.53 (0.28, 1.01)</td>
<td>0.48 (0.25, 0.94)</td>
<td>0.36 (0.17, 0.76)</td>
<td>0.29 (0.13, 0.64)</td>
<td>0.13 (0.06, 0.30)</td>
</tr>
<tr>
<td>Adjusted hazard ratios (95% CI)*</td>
<td>1.00</td>
<td>0.55 (0.29, 1.06)</td>
<td>0.52 (0.26, 1.01)</td>
<td>0.41 (0.19, 0.87)</td>
<td>0.34 (0.15, 0.77)</td>
<td>0.17 (0.07, 0.39)</td>
</tr>
<tr>
<td>Adjusted hazard ratios (95% CI)†</td>
<td>1.00</td>
<td>0.59 (0.31, 1.11)</td>
<td>0.63 (0.33, 1.21)</td>
<td>0.50 (0.24, 1.04)</td>
<td>0.44 (0.20, 0.96)</td>
<td>0.22 (0.10, 0.50)</td>
</tr>
<tr>
<td><strong>Diseases of the circulatory system</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. deaths / no. at risk</td>
<td>8</td>
<td>35</td>
<td>66</td>
<td>49</td>
<td>24</td>
<td>4</td>
</tr>
<tr>
<td>Age and gender adjusted rate /1,000 PY (95% CI)</td>
<td>6.1 (1.2, 11.0)</td>
<td>3.6 (2.1, 5.1)</td>
<td>3.8 (2.7, 4.9)</td>
<td>2.1 (1.4, 2.8)</td>
<td>1.8 (1.0, 2.6)</td>
<td>0.6 (0.0, 1.2)</td>
</tr>
<tr>
<td>Age and gender adjusted hazard ratios (95% CI)</td>
<td>1.00</td>
<td>0.41 (0.16, 1.02)</td>
<td>0.34 (0.13, 0.90)</td>
<td>0.19 (0.07, 0.49)</td>
<td>0.17 (0.07, 0.44)</td>
<td>0.08 (0.02, 0.32)</td>
</tr>
<tr>
<td>Adjusted hazard ratios (95% CI)*</td>
<td>1.00</td>
<td>0.41 (0.15, 1.09)</td>
<td>0.36 (0.13, 1.02)</td>
<td>0.20 (0.07, 0.58)</td>
<td>0.19 (0.07, 0.54)</td>
<td>0.09 (0.02, 0.40)</td>
</tr>
<tr>
<td>Adjusted hazard ratios (95% CI)†</td>
<td>1.00</td>
<td>0.40 (0.15, 1.09)</td>
<td>0.46 (0.17, 1.22)</td>
<td>0.25 (0.09, 0.67)</td>
<td>0.27 (0.10, 0.72)</td>
<td>0.12 (0.03, 0.57)</td>
</tr>
<tr>
<td><strong>Limited to participants without CVD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>All-causes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. deaths / no. at risk</td>
<td>10</td>
<td>57</td>
<td>104</td>
<td>104</td>
<td>49</td>
<td>15</td>
</tr>
<tr>
<td>Age and gender adjusted rate /1,000 PY (95% CI)</td>
<td>13.6 (2.4, 24.7)</td>
<td>7.8 (4.7, 11.0)</td>
<td>8.5 (6.0, 11.0)</td>
<td>6.9 (4.6, 9.1)</td>
<td>5.1 (3.3, 6.9)</td>
<td>2.5 (0.8, 4.1)</td>
</tr>
<tr>
<td>Age and gender adjusted hazard ratios (95% CI)</td>
<td>1.00</td>
<td>0.50 (0.20, 1.21)</td>
<td>0.47 (0.20, 1.15)</td>
<td>0.39 (0.15, 1.01)</td>
<td>0.27 (0.10, 0.71)</td>
<td>0.13 (0.05, 0.35)</td>
</tr>
<tr>
<td>Adjusted hazard ratios (95% CI)*</td>
<td>1.00</td>
<td>0.52 (0.20, 1.33)</td>
<td>0.52 (0.21, 1.30)</td>
<td>0.45 (0.16, 1.21)</td>
<td>0.32 (0.12, 0.89)</td>
<td>0.17 (0.06, 0.48)</td>
</tr>
<tr>
<td>Adjusted hazard ratios (95% CI)†</td>
<td>1.00</td>
<td>0.59 (0.23, 1.51)</td>
<td>0.61 (0.24, 1.55)</td>
<td>0.54 (0.21, 1.44)</td>
<td>0.39 (0.14, 1.09)</td>
<td>0.21 (0.07, 0.59)</td>
</tr>
</tbody>
</table>
### Diseases of the circulatory system

<table>
<thead>
<tr>
<th>No. deaths / no. at risk</th>
<th>7 / 111</th>
<th>13 / 675</th>
<th>26 / 1468</th>
<th>27 / 1900</th>
<th>13 / 1497</th>
<th>4 / 1204</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age and gender adjusted rate /1,000 PY (95% CI)</td>
<td>7.0 (1.5, 12.6)</td>
<td>1.4 (0.5, 2.2)</td>
<td>1.5 (0.7, 2.2)</td>
<td>1.5 (0.8, 2.3)</td>
<td>0.9 (0.4, 1.5)</td>
<td>0.7 (0.0, 1.4)</td>
</tr>
<tr>
<td>Age and gender adjusted hazard ratios (95% CI)</td>
<td>1.00</td>
<td>0.13 (0.04, 0.36)</td>
<td>0.09 (0.03, 0.26)</td>
<td>0.09 (0.03, 0.26)</td>
<td>0.06 (0.02, 0.16)</td>
<td>0.07 (0.02, 0.30)</td>
</tr>
<tr>
<td>Adjusted hazard ratios (95% CI)*</td>
<td>1.00</td>
<td>0.12 (0.04, 0.41)</td>
<td>0.10 (0.03, 0.32)</td>
<td>0.10 (0.03, 0.35)</td>
<td>0.07 (0.02, 0.22)</td>
<td>0.09 (0.02, 0.41)</td>
</tr>
<tr>
<td>Adjusted hazard ratios (95% CI)†</td>
<td>1.00</td>
<td>0.13 (0.04, 0.43)</td>
<td>0.12 (0.04, 0.35)</td>
<td>0.12 (0.04, 0.36)</td>
<td>0.09 (0.03, 0.25)</td>
<td>0.10 (0.02, 0.47)</td>
</tr>
</tbody>
</table>

CI = confidence interval; PY = person-years.
*Adjusted for age, gender, race or ethnicity, education, health insurance, and alcohol use.
†Adjusted for age, gender, race or ethnicity, education, self-reported health status, health insurance, alcohol use, history of cardiovascular disease (for models involving all participants only), and history of cancer.
**Figure Legend:**

**Figure 1.** Adjusted Hazard Ratios (95% confidence interval) for Mortality from All-Causes and Diseases of the Circulatory System among 7622 Participants Aged ≥20 Years, National Health and Nutrition Examination Survey 1999-2002. The National Death Index was used to ascertain mortality through 2006. Panel A shows hazard ratios for ideal versus intermediate and poor health for each cardiovascular health metric. Panel B shows hazard ratios for ideal and intermediate health versus poor health for each cardiovascular health metric.
A. Ideal versus intermediate and poor health

Adjusted for age, gender, race or ethnicity, education, self-reported health status, health insurance, alcohol use, history of cardiovascular disease, history of cancer, and other cardiovascular health metrics.

B. Ideal and intermediate health versus poor health
Ideal Cardiovascular Health and Mortality from All Causes and Diseases of the Circulatory System among Adults in the United States
Earl S. Ford, Kurt J. Greenlund and Yuling Hong

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