Distribution of 10-Year and Lifetime Predicted Risks for Cardiovascular Disease in US Adults

Findings From the National Health and Nutrition Examination Survey 2003 to 2006

Amanda K. Marma, MD; Jarett D. Berry, MD, MS; Hongyan Ning, MD, MS; Stephen D. Persell, MD, MPH; Donald M. Lloyd-Jones, MD, ScM

Background—National guidelines for primary prevention suggest consideration of lifetime risk for cardiovascular disease in addition to 10-year risk, but it is currently unknown how many US adults would be identified as having low short-term but high lifetime predicted risk if stepwise stratification were used.

Methods and Results—We included 6329 cardiovascular disease–free and nonpregnant individuals ages 20 to 79 years, representing approximately 156 million US adults, from the National Health and Nutrition Examination Survey 2003 to 2004 and 2005 to 2006. We assigned 10-year and lifetime predicted risks to stratify participants into 3 groups: low 10-year (<10%)/low lifetime (<39%) predicted risk, low 10-year (<10%)/high lifetime (≥39%) predicted risk, and high 10-year (≥10%) predicted risk or diagnosed diabetes. The majority of US adults (56%, or 87 million individuals) are at low short-term but high lifetime predicted risk for cardiovascular disease. Twenty-six percent (41 million adults) are at low short-term and low lifetime predicted risk, and only 18% (28 million individuals) are at high short-term predicted risk. The addition of lifetime risk estimation to 10-year risk estimation identifies higher-risk women and younger men in particular.

Conclusions—Whereas 82% of US adults are at low short-term risk, two thirds of this group, or 87 million people, are at high lifetime predicted risk for cardiovascular disease. These results provide support for use of a stepwise stratification system aimed at improving risk communication, and they provide a baseline for public health efforts aimed at increasing the proportion of Americans with low short-term and low lifetime risk for cardiovascular disease. (Circ Cardiovasc Qual Outcomes. 2010;3:00-00.)

Key Words: cardiovascular diseases • coronary disease • epidemiology
Table 1. Risk Factor Definitions and Lifetime Risk Stratification

<table>
<thead>
<tr>
<th>CVD RFs</th>
<th>Optimal RF</th>
<th>Not Optimal RF</th>
<th>Elevated RF</th>
<th>Major RF*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP and DBP, mm Hg</td>
<td>SBP &lt;120 and DBP &lt;80</td>
<td>AND</td>
<td>OR</td>
<td>AND</td>
</tr>
<tr>
<td>Total cholesterol, mg/dL</td>
<td>&lt;180</td>
<td>180–199</td>
<td>200–239</td>
<td>≥240 or treated</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Current smoking</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Lifetime Risk Stratification

Low Predicted Lifetime Risk

- All Optimal RF
- ≥1 RF Not Optimal

High Predicted Lifetime Risk

- ≥1 Elevated RF
- 1 Major RF
- ≥2 Major RF

Definitions of Risk Strata

We determined the distribution of 3 risk strata in the US population: low 10-year/low lifetime, low 10-year/high lifetime, and high 10-year predicted risk, as defined below. For the main analysis, we calculated 10-year predicted risk for hard CHD (myocardial infarction or coronary death) for all participants using the ATP III risk assessment tool, and we defined a calculated risk of ≥10% or diagnosed diabetes as “high 10-year predicted risk” because individuals with this level of predicted risk would potentially be eligible for intensive preventive measures, including drug therapy. Among the participants with low (<10%) 10-year predicted risk (and no diabetes), we assigned lifetime predicted risk for CVD (myocardial infarction, coronary insufficiency, angina, atherothrombotic stroke, intermittent claudication, or CVD death) using our previously published algorithm, as shown in Table 1. We defined “low lifetime predicted risk” as the 2 lower risk strata (“all optimal” or “≥1 not optimal” risk factors), which, according to our prior work, have predicted lifetime risk <39%, and “high lifetime predicted risk” as the 3 higher risk strata (“≥1 elevated,” “1 major” or “≥2 major” risk factors), which have predicted lifetime risk ≥39%. This stratification was chosen a priori based on the previously observed apparent natural separation in lifetime risks of these 2 groups in the Framingham cohorts as well as in a large pooled sample of US multi-ethnic cohorts. It has been further justified with recent work demonstrating differential burden and progression of subclinical atherosclerosis in younger adults using the identical stratification algorithm.

In further analyses, we also included obesity (body mass index ≥30 kg/m²) and low HDL cholesterol (<40 mg/dL for men or <50 mg/dL for women) as major risk factors. To examine whether a more stringent definition of low short-term risk would weaken the distinction of different lifetime predicted risk groups among those at low report of currently smoking every day or on some days and having smoked ≥100 cigarettes in their lifetime, and antihypertensive and lipid-lowering medication use was also defined by self-report. Blood pressure measures were performed by trained and certified physicians using previously described procedures and a mercury manometer; the average of the last 2 measurements were used whenever available, although single measurements were used if they were the only available measurements. Total and high-density lipoprotein (HDL) cholesterol were measured as described previously. Obesity was defined as body mass index ≥30 kg/m².

Methods

Study Participants

We included CVD-free, nonpregnant participants ages 20 to 79 years who completed a mobile examination in the 2003 to 2004 or 2005 to 2006 NHANES (n=7396), which provided representative samples of the noninstitutionalized US population targeted by the NCEP/ATP III for cardiovascular risk prediction. We defined participants as having CVD if they answered “yes” when asked if a doctor or health professional ever told them they had CHD, heart attack, stroke, or congestive heart failure. We excluded participants with missing values for blood pressure (n=698), cholesterol (n=306), or height or weight (n=63) to obtain our final study sample (n=6529) (Supplemental Figure 1). For self-reported data, answers other than “yes” were assumed to be “no.”

Risk Factor Ascertainment

We defined CVD risk factors as follows. Diabetes mellitus was defined by self-reported health professional–diagnosed diabetes (but not “borderline” diabetes); cigarette smoking was defined by self-
short-term predicted risk, we also repeated the primary stratification described above using 2 additional definitions of short-term risk. For the first, we defined low short-term risk as ≤10% predicted 10-year risk for hard CHD (and absence of diabetes) using the ATP III risk assessment tool. For the second, we defined low short-term risk as ≤20% predicted 10-year risk for total CVD (coronary death, myocardial infarction, coronary insufficiency, angina, ischemic stroke, hemorrhagic stroke, transient ischemic attack, intermittent claudication, or heart failure) (and absence of diabetes) using the risk functions published by D’Agostino et al.

Statistical Analysis
We used survey procedures in SAS version 9.1 (SAS Institute, Cary, NC) to generate accurate frequencies and variances accounting for the complex, multistage design of the NHANES. We used the survey weights to estimate the number of noninstitutionalized, CVD-free and nonpregnant US adults ages 20 to 79 years in each group. Analyses were performed for all eligible adults and were stratified by age, sex, and race subgroups. For some subgroup analyses, we split the population into fewer categories to avoid presenting data from cells with fewer than 30 subjects, as recommended by the NHANES Analytic Guidelines. When results from fewer subjects are provided, this is noted in the tables. Differences between groups in the distribution of risk strata were assessed using the \( \chi^2 \) test, and a 2-tailed probability value \( \leq 0.05 \) was considered statistically significant.

Results
Participant Characteristics
A total of 6329 individuals (representing approximately 156 million US adults) met inclusion criteria and had complete...
information to determine their short-term and lifetime risk strata (Supplemental Figure 1). Exclusion on the basis of missing variables was somewhat more likely for blacks (19.4%) compared with whites (12.1%). The final study sample was representative of 86.4% of the noninstitutionalized, nonpregnant, CVD-free US population ages 20 to 79 years. Specific participant characteristics, weighted to reflect the US population, are shown in Supplemental Tables 1 and 2.

Distribution of Risk Strata
Among the overwhelming majority (82.0%) of US adults with low short-term predicted risk (Table 2), two thirds are at high lifetime predicted risk, whereas only one third are at low lifetime predicted risk (see Table 1). Of note, the proportion of US adults with very low lifetime risk due to all optimal risk factors is small, at 11.4%; the proportion is smaller in men than in women and is dramatically smaller in older compared with younger age groups (Table 2). The estimated size of the US population in each risk stratum is shown in Figure 1.

Effect of Demographic Variables on Risk Strata
At the youngest ages, almost all men and women are at low short-term predicted risk, and further stratification by lifetime predicted risk produces 2 groups of substantial sizes in both sexes (Table 2). For example, as shown in Figure 2, the majority of men younger than 60 years and women younger than 80 years are at low 10-year predicted risk, and among this large group the majority have low 10-year but high lifetime predicted risk. However, at older ages the proportion at high short-term predicted risk is markedly higher in men than in women, such that in the oldest age group (60 to 79 years) only 10.4% of men but 70.2% of women are at low-short-term predicted risk. Thus, at older ages, lifetime risk stratification identifies a much larger group of women (63.7% of women ages 60 to 79 years) with low short-term/high lifetime risk compared with men (7.4% of

men ages 60 to 79 years) (Table 2 and Figure 2). Patterns of predicted risks are similar among races; although Mexican-Americans had lower predicted risk compared with other racial groups (Table 2), this is probably the result of their younger age distribution (Supplemental Table 1).

Effect of Including Low HDL Cholesterol and Obesity as Major Risk Factors
When low HDL cholesterol and obesity are also counted as major risk factors, the proportion with high lifetime predicted risk is larger, though modestly so (Table 3). For example, including both risk factors causes ≈10.3% of adults to move from the low short-term/low lifetime predicted risk group to the low short-term/high lifetime predicted risk group.

Distribution of Major Risk Factors
Table 4 gives the proportion and absolute numbers of US adults affected with each of the elevated and major risk factors. The wide distribution of isolated risk factors indicates that no single risk factor is responsible for determining the lifetime risk stratification. For example, despite its high prevalence (especially among younger adults), smoking as the sole risk factor results in high lifetime predicted risk status in only 9.4% of individuals who have low short-term predicted risk.

Effect of Altering Low Short-Term Risk Definitions
When low short-term risk is defined either as <6% predicted 10-year risk for hard CHD (and absence of diabetes) using the ATP III risk assessment tool or as <20% predicted 10-year risk for total CVD (and absence of diabetes) using the risk functions published by D’Agostino et al., the distribution of lifetime predicted risk among those at low short-term predicted risk does not change meaningfully (data not shown).

Discussion
Principal Findings
The present report represents the first analysis of the distribution of lifetime CVD risk strata in the US population, and it has 2 major findings. First, the overwhelming majority (82%) of US adults are at low (<10%) short-term predicted risk for CVD-free US adults ages 20 to 79 years. Low short-term risk is defined as <10% 10-year predicted risk for hard CHD (myocardial infarction or coronary death) and absence of diabetes using the ATP III algorithm. Low lifetime predicted risk is defined as <39% lifetime risk for CVD (myocardial infarction, coronary insufficiency, angina, atherothrombotic stroke, intermittent claudication, or CVD death), using our previously published algorithm. See Table 1 for lifetime risk strata definitions.

Figure 1. Population estimates of risk strata among CVD-free, nonpregnant US adults ages 20 to 79 years. Low short-term risk is defined as <10% 10-year predicted risk for hard CHD (myocardial infarction or coronary death) and absence of diabetes using the ATP III algorithm. Low lifetime predicted risk is defined as <39% lifetime risk for CVD (myocardial infarction, coronary insufficiency, angina, atherothrombotic stroke, intermittent claudication, or CVD death), using our previously published algorithm. See Table 1 for lifetime risk strata definitions.

Figure 2. Sex- and age-specific population estimates of risk strata distribution among CVD-free, nonpregnant US adults ages 20 to 79 years. See Figure 1 for definitions.

Table 4 gives the proportion and absolute numbers of US adults affected with each of the elevated and major risk factors. The wide distribution of isolated risk factors indicates that no single risk factor is responsible for determining the lifetime risk stratification. For example, despite its high prevalence (especially among younger adults), smoking as the sole risk factor results in high lifetime predicted risk status in only 9.4% of individuals who have low short-term predicted risk.

Effect of Altering Low Short-Term Risk Definitions
When low short-term risk is defined either as <6% predicted 10-year risk for hard CHD (and absence of diabetes) using the ATP III risk assessment tool or as <20% predicted 10-year risk for total CVD (and absence of diabetes) using the risk functions published by D’Agostino et al., the distribution of lifetime predicted risk among those at low short-term predicted risk does not change meaningfully (data not shown).

Discussion
Principal Findings
The present report represents the first analysis of the distribution of lifetime CVD risk strata in the US population, and it has 2 major findings. First, the overwhelming majority (82%) of US adults are at low (<10%) short-term predicted risk for CVD-free US adults ages 20 to 79 years. Low short-term...
risk for a coronary event, but this majority comprises 2
groups: one third in the low short-term CHD/low lifetime
CVD predicted risk group and two thirds (ie, 87 million
individuals) in the low short-term CHD/high lifetime CVD
predicted risk group. Among those 40 to 59 years of age, a
group that may be of particular interest for clinical preven-
tion, 80% have low short-term predicted risk, but three
fourths of these have high lifetime predicted risk. Second,
the size of the low short-term/high lifetime predicted risk
group is substantial in women and younger men, precisely
the populations for which the ATP III risk assessment tool
has been shown to discriminate risk poorly.1–3

Current Study in Context
Prior studies have reported the distribution of lifetime CVD
risk strata in selected cohorts.4–6 Using the same lifetime risk
algorithm used in the present study, these prior studies
demonstrated that the low short-term risk group comprises 2
strata in the United States.

Table 3. Distribution of Combined 10-Year CHD and Lifetime CVD Predicted Risk Strata in the CVD-Free, Nondiabetic, Nonpregnant, 20- to 79-Year-Old US Population, With Obesity and Low HDL Cholesterol Included as Major Risk Factors

<table>
<thead>
<tr>
<th>Stratum</th>
<th>n</th>
<th>Weighted, n</th>
<th>Low 10-Year CHD/Low Lifetime CVD Predicted Risk</th>
<th>Low 10-Year CHD/High Lifetime CVD Predicted Risk</th>
<th>High 10-Year CHD Predicted Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>All Optimal</td>
<td>≥1 Elevated</td>
<td></td>
</tr>
<tr>
<td>Neither included</td>
<td>6329</td>
<td>156 100 000</td>
<td>11.4 (0.4)</td>
<td>15.1 (0.7)</td>
<td>17.5 (0.7)</td>
</tr>
<tr>
<td>Both included</td>
<td>6329</td>
<td>156 100 000</td>
<td>7.5 (0.4)</td>
<td>8.7 (0.6)</td>
<td>10.1 (0.7)</td>
</tr>
<tr>
<td>Obesity only</td>
<td>6329</td>
<td>156 100 000</td>
<td>9.2 (0.4)</td>
<td>10.4 (0.7)</td>
<td>11.8 (0.7)</td>
</tr>
<tr>
<td>Low HDL-C only</td>
<td>6329</td>
<td>156 100 000</td>
<td>8.6 (0.4)</td>
<td>11.4 (0.6)</td>
<td>13.8 (0.7)</td>
</tr>
</tbody>
</table>

Ten-year hard CHD risk calculated based on D’Agostino et al,10 with “low” defined as <10% 10-year predicted CHD risk and absence of diabetes. Obesity is defined as body mass index ≥30 kg/m². Low HDL-C is defined as <40 mg/dL for men and <50 mg/dL for women.

P is for the comparison to the stratification without HDL-C and obesity included.

Clinical and Public Health Implications
We therefore believe that our results provide support for
adoption of this stratification system by healthcare profes-
ionals to aid risk communication for a large segment of
CVD risk was a more motivating 50%.4 Additionally, individ-
uals with low short-term/high lifetime predicted risk could be
informed that at present, even at young ages, they probably
have significantly greater subclinical disease burden com-
pared with those with low short-term/low lifetime predicted
risk due to a more favorable risk factor profile.8 Such facts may be
useful for motivating lifestyle changes or adherence to

therapeutic absolute risk, it has well-recognized limitations,
particularly in women and younger men.1–3 The stepwise
stratification system used in the present analysis identifies
a low short-term/high predicted risk group that is
highly prevalent in the US population, particularly in women
and younger men. This is because the lifetime risk
algorithm comprising the “second step” in our stratification is
not dependent on sex or age and stratifies observed lifetime risk
similarly for both sexes and all adult age groups studied to
date, whereas the Framingham Risk Score (and the related
ATP III tool) is overwhelmingly dependent on the weighting
of the sex and age variables. In fact, we showed in the present
analysis that the lifetime risk algorithm is not driven by any
single risk factor and that it identifies a substantial low
short-term/high lifetime risk group even when stringent
definitions of low short-term risk are applied.

Significance of Demographic Variables and Risk
Factor Definitions
Although the Framingham Risk Score for 10-year predicted
risk of CHD represents an important advance in primary
prevention that has allowed clinicians to match intensity of
therapy to absolute risk, it has well-recognized limitations,
particularly in women and younger men.1–3 The stepwise
stratification system used in the present analysis identifies
a low short-term/high predicted risk group that is
highly prevalent in the US population, particularly in women
and younger men. This is because the lifetime risk
algorithm comprising the “second step” in our stratification is
not dependent on sex or age and stratifies observed lifetime risk
similarly for both sexes and all adult age groups studied to
date, whereas the Framingham Risk Score (and the related
ATP III tool) is overwhelmingly dependent on the weighting
of the sex and age variables. In fact, we showed in the present
analysis that the lifetime risk algorithm is not driven by any
single risk factor and that it identifies a substantial low
short-term/high lifetime risk group even when stringent
definitions of low short-term risk are applied.

Clinical and Public Health Implications
We therefore believe that our results provide support for
adoption of this stratification system by healthcare profes-
ionals to aid risk communication for a large segment of
the US population. Assigning a lifetime predicted risk status to
US adults presenting for primary prevention would change
the message to those 87 million individuals with low short-
term but high lifetime predicted risk. As an example of what
these individuals may be counseled to expect in terms of

pharmaceutical therapy in the 56% of the population with low short-term predicted risk but significant risk factor burden.

As noted above and strikingly apparent in Figure 2, this may be particularly true for women and younger men. The more intensive focus on total atherosclerotic CVD as the end point for lifetime risk makes the estimate more relevant for women, whose majority of first events are stroke rather than CHD, and who have considerable morbidity and mortality from other non-CHD outcomes such as heart failure. Furthermore, the extended time frame of lifetime risk avoids false reassurance for women and younger men with unhealthy lifestyle habits who are nonetheless “low risk” for a coronary event in the short term. Given that more women than men die of CVD each year in the United States and that younger adults are beginning to see a reversal in declines in CHD mortality (probably caused by increases in obesity, diabetes, hypertension, and metabolic syndrome in this age group), relevant and motivating risk messages are urgently needed for these segments of the population. The addition of a second step to risk assessment with lifetime risk estimates shows promise in this regard.

We believe that our results may also prove useful on a public health level. Our data might assist in the estimation of costs associated with any new guidelines regarding long-term risk, and they also provide a current baseline for population health. Thus, programs that focus on primordial prevention, in combination with clinical practice that stresses the maintenance of a healthy lifestyle and monitors rates of adverse change in risk factor levels even before they become “treatable,” are likely to have the best long-term success in reducing the burden of CVD in the United States.

### Potential Limitations

Because fasting glucose levels were not available for the majority of participants, we relied on self-report to identify diabetes; therefore, a small proportion of individuals with undiagnosed diabetes may have been misclassified as lower risk. Additionally, the applicability of our risk stratification algorithms to all races is not ensured; both the 10-year and lifetime risk function algorithms were developed in the exclusively white Framingham cohorts. However, the 10-year risk functions for hard CHD have since been shown to be transportable to other races, and the lifetime risk stratification algorithm has been validated in the multi-ethnic (black and white) US cohorts of the Chicago Heart Association Detection Project in Industry and the Cardiovascular Lifetime Risk Pooling Project as well as in CARDIA and MESA, with data on subclinical disease. Finally, our short-term and lifetime predicted risks were for different end points; whereas the short-term outcome for our main analysis is hard CHD, as recommended by current guidelines, the lifetime outcome is total atherosclerotic CVD. However, we did compare short-term CVD with lifetime CVD predicted risk in a secondary analysis.

### Table 4. Estimated Prevalence of Major or Elevated Risk Factors in the CVD-Free, Nonpregnant, 20- to 79-Year-Old US Population

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Major Risk Factors</th>
<th>Elevated or Major Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>No. Individuals (%)†</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>Present</td>
<td>8 770 000 (5.6)</td>
</tr>
<tr>
<td>Smoking</td>
<td>Present</td>
<td>40 510 000 (25.9)</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>≥240 mg/dL</td>
<td>25 300 000 (16.2)</td>
</tr>
<tr>
<td>Lipid-lowering treatment</td>
<td>Present</td>
<td>16 500 000 (10.6)</td>
</tr>
<tr>
<td>Systolic blood pressure</td>
<td>≥160 mm Hg</td>
<td>4 680 000 (3.0)</td>
</tr>
<tr>
<td>Diastolic blood pressure</td>
<td>≥100 mm Hg</td>
<td>1 600 000 (1.0)</td>
</tr>
<tr>
<td>Antihypertensive therapy</td>
<td>Present</td>
<td>25 720 000 (16.5)</td>
</tr>
<tr>
<td>Obesity</td>
<td>Present</td>
<td>50 800 000 (32.5)</td>
</tr>
<tr>
<td>Low HDL-C</td>
<td>Present</td>
<td>41 350 000 (26.5)</td>
</tr>
</tbody>
</table>

*Estimate unstable because of subsample size <30.
†Total individuals with major risk factor.
‡Individuals at low 10-year CHD risk with this as the only elevated or major risk factor resulting in high lifetime CVD risk status.
analysis, and although ATP III focuses on hard CHD as the outcome of interest, the more inclusive outcome of total CVD may be more clinically relevant. We believe that despite the potential limitations, our delineation of short-term and lifetime risk strata among US adults represents valuable information for policy makers and clinicians looking to confront the substantial burden of CVD in the United States.

Sources of Funding
Dr Lloyd-Jones and this work are supported in part by grant R21 HL085375 from the National Heart, Lung, and Blood Institute. Dr Berry is the Dedman Family Scholar in Clinical Care, UT Southwestern Medical Center.

Disclosures
None.

References
Distribution of 10-Year and Lifetime Predicted Risks for Cardiovascular Disease in US Adults: Findings From the National Health and Nutrition Examination Survey 2003 to 2006
Amanda K. Marma, Jarett D. Berry, Hongyan Ning, Stephen D. Persell and Donald M. Lloyd-Jones

Circ Cardiovasc Qual Outcomes. published online November 16, 2009; Circulation: Cardiovascular Quality and Outcomes is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2009 American Heart Association, Inc. All rights reserved.
Print ISSN: 1941-7705. Online ISSN: 1941-7713

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circoutcomes.ahajournals.org/content/early/2009/11/16/CIRCOUTCOMES.109.869727

Data Supplement (unedited) at:
http://circoutcomes.ahajournals.org/content/suppl/2009/11/16/CIRCOUTCOMES.109.869727.DC1

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation: Cardiovascular Quality and Outcomes can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation: Cardiovascular Quality and Outcomes is online at:
http://circoutcomes.ahajournals.org/subscriptions/
Supplemental Material
### Supplemental Table 1. Characteristics of 6,329 Eligible NHANES 2003 to 2006 Participants, Weighted to Reflect the CVD-free, Nonpregnant, 20- to 79-Year Old U.S. Population - by Demographic Stratum

<table>
<thead>
<tr>
<th>Mean (SD) of Risk Factor Level</th>
<th>Percentage (SE) with Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>TC (mg/dL)</td>
</tr>
<tr>
<td>Total</td>
<td>44.0 (0.4)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>43.0 (0.4)</td>
</tr>
<tr>
<td>Women</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>45.0 (0.4)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td>24.3 (0.1)</td>
</tr>
<tr>
<td>30-39</td>
<td>34.5 (0.2)</td>
</tr>
<tr>
<td>40-49</td>
<td>44.5 (0.2)</td>
</tr>
<tr>
<td>50-59</td>
<td>53.7 (0.1)</td>
</tr>
<tr>
<td>60-69</td>
<td>64.1 (0.1)</td>
</tr>
<tr>
<td>70-79</td>
<td>74.0 (0.2)</td>
</tr>
<tr>
<td>Women</td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td>24.4 (0.2)</td>
</tr>
<tr>
<td>30-39</td>
<td>34.5 (0.1)</td>
</tr>
<tr>
<td>40-49</td>
<td>44.3 (0.2)</td>
</tr>
<tr>
<td>50-59</td>
<td>54.0 (0.1)</td>
</tr>
<tr>
<td>Race</td>
<td>Men</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>White</td>
</tr>
<tr>
<td></td>
<td>60-69</td>
</tr>
<tr>
<td>SD=standard deviation, SE=standard error, TC=total cholesterol, HDL-C=high-density lipoprotein cholesterol, SBP=systolic blood pressure, DBP=diastolic blood pressure, BMI=body mass index, DM=diabetes mellitus, HTN=hypertension, Tx=treatment.</td>
<td></td>
</tr>
</tbody>
</table>
Supplemental Table 2. Characteristics of 6,329 Eligible NHANES 2003 to 2006 Participants, Weighted to Reflect the CVD-free, Nonpregnant, 20- to 79-Year Old U.S. Population - by Risk Stratum

<table>
<thead>
<tr>
<th>Mean (SD) of Risk Factor Level</th>
<th>Percentage (SE) with Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>TC (mg/dL)</td>
</tr>
<tr>
<td>SBP (mm Hg)</td>
<td>DBP (mm Hg)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>DM (%)</td>
</tr>
<tr>
<td>Smoking (%)</td>
<td>Anti-HTN tx (%)</td>
</tr>
<tr>
<td>Lipid-lowering Tx (%)</td>
<td></td>
</tr>
<tr>
<td>Overall 44.0 (0.4)</td>
<td>200.6 (0.7)</td>
</tr>
<tr>
<td>Low 10-yr CHD risk* 40.6 (0.3)</td>
<td>198.4 (0.7)</td>
</tr>
<tr>
<td>All Optimal 32.6 (0.6)</td>
<td>156.5 (1.0)</td>
</tr>
<tr>
<td>≥1 Not Optimal 38.0 (0.5)</td>
<td>179.7 (0.9)</td>
</tr>
<tr>
<td>≥1 Elevated 42.7 (0.5)</td>
<td>213.4 (0.5)</td>
</tr>
<tr>
<td>1 Major 41.4 (0.4)</td>
<td>206.2 (1.3)</td>
</tr>
<tr>
<td>≥2 Major 49.0 (0.7)</td>
<td>230.2 (2.4)</td>
</tr>
<tr>
<td>High 10-yr CHD risk* 59.7 (0.4)</td>
<td>210.8 (1.8)</td>
</tr>
</tbody>
</table>

*10-year hard coronary heart disease risk calculated based on D’Agostino et al 2001, with “low” defined as <10% 10-year predicted CHD risk and absence of diabetes.

SD=standard deviation, SE=standard error, TC=total cholesterol, HDL-C=high-density lipoprotein cholesterol, SBP=systolic blood pressure, DBP=diastolic blood pressure, BMI=body mass index, DM=diabetes mellitus, HTN=hypertension, Tx=treatment, CHD=coronary heart disease.
Supplemental Figure 1. Selection of study sample. CVD=cardiovascular disease, HDL=high-density lipoprotein.

All NHANES 2003-2004 and 2005-2006 participants (n=20,470)

- Did not meet inclusion criteria (n=13,074)
  - Did not complete interview and exam (n=877)
  - Currently pregnant (n=647)
  - Age <20 or >79 years (n=10,782)
  - Answered “yes” to whether a doctor or health professional ever said they had coronary heart disease, a heart attack, a stroke, or congestive heart failure (n=768)

Target sample:
Interview and exam participants aged 20 to 79 years, nonpregnant, and free of CVD (n=7,396)

- Excluded due to missing variables (n=1,067)
  - Blood pressure (n=698)
  - Total and/or HDL Cholesterol (n=306)
  - Height or weight (n=63)

Final study sample:
Participants with necessary data available to estimate risk (n=6,329)