Evidence-Based ACC/AHA Guidelines for Cardiovascular Risk Assessment

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Faculty Disclosure Information

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Research support through University of California, Irvine from Amgen, Bristol Myers-Squibb, Gilead, and Regeneron,

Consultant / Advisory Board for Amgen, Re-Engineering Healthcare
Outline

• Review the role and limitations of global risk assessment
• Review the latest evidence recommendations for the assessment of screening tests for atherosclerosis in CVD risk assessment
• Review the evidence and recommendations for subclinical disease evaluation / imaging in CVD risk assessment
FIGURE 1. Risk of CHD according to elevated blood pressure (BP), elevated cholesterol, and left ventricular hypertrophy: Framingham cohort 6-year follow-up. Elevated BP = ≥160/95; elevated cholesterol = ≥260 mg/dl.

Framingham Heart Study: Kannel et al., 1961
Why Use Risk Scores?

1) Framingham director Dr. William Kannel had noted risk functions provide an “economic and efficient method of identifying persons at high cardiovascular risk who need preventive treatment”, (AJC 1976)

2) The ACC Bethesda Conf. noted intensity of treatment should match a person’s risk (Califf RM, JACC 1996).

3) A physician’s estimate is only accurate 24% of the time (Pignone et al, BMC health Serv Res 2003).

4) Routine use of global risk scores leads to greater use of guideline-based therapy and modest improvements in intermediate outcomes with no harm identified (Sheridan et al. BMC Health Serv Res 2008).
Recommendation to begin with a global risk assessment using the Pooled Cohort Equations to estimate 10-year ASCVD Risk (other risk assessment algorithms include the European SCORE, PROCAM, or Framingham scores)
What are the Pooled Cohort Equations and how do they differ from the Framingham Risk Scores used before?

1) The new equations now predict 10-year risk of both CHD and stroke (ASCVD) together rather than just CHD which was the focus of the 2001 ATP III Framingham Risk Score recommended.

2) They predict nonfatal MI, CHD death, or nonfatal or fatal stroke ONLY and do not include other CVD (PCI, CABG, unstable angina requiring hospitalization, PAD, etc.). Risk will be up to 2X higher for total CVD.
How well do the new risk scores predict future CHD risk and how should they be used?

1) The new equations are more precise in incorporating 4 cohorts: Framingham (original and offspring), ARIC, CARDIA, and CHS, but are limited to the risk factors common to these studies.

2) They have been validated in several cohorts; in very healthy cohorts including persons on statin therapy there may be some overprediction of risk.

3) They should be used as a starting point to help identify those most likely to benefit from a statin; other tests may help refine the treatment decision if uncertain.

4) They should be an impetus for a “risk discussion” between the clinician and patient, BUT not a prescription for a statin or other therapy.
Recommendations for Assessment of 10-Year Risk of a First Hard ASCVD Event

The race- and sex-specific Pooled Cohort Equations* to predict 10-year risk of a first hard ASCVD event should be used in non-Hispanic African Americans and non-Hispanic whites, 40 to 79 years of age.

Use of the sex-specific Pooled Cohort Equations for non-Hispanic whites may be considered for estimation of risk in patients from populations other than African Americans and non-Hispanic whites.

*Derived from the ARIC study, CHS, CARDIA study, Framingham original and offspring cohorts.
Recommendations for Long-Term Risk Assessment

It is reasonable to assess traditional ASCVD risk factors‡ every 4 to 6 years in adults 20 to 79 years of age who are free from ASCVD and to estimate 10-year ASCVD risk every 4 to 6 years in adults 40 to 79 years of age who are free from ASCVD.

Assessment of 30-year or lifetime ASCVD risk on the basis of traditional risk factors‡ may be considered in adults 20 to 59 years of age who are free from ASCVD and who are not at high short-term risk.

‡Age, sex, total cholesterol, high-density lipoprotein cholesterol, systolic BP, use of antihypertensive therapy, diabetes, and current smoking.
The ACC and the American Heart Association (AHA), in collaboration with the National Heart, Lung, and Blood Institute and other specialty societies, have released four guidelines focused on the assessment of cardiovascular risk, lifestyle modifications to reduce cardiovascular risk and management of elevated blood cholesterol and body weight in adults.

In order to support the implementation of these guidelines the ACC and AHA have jointly published a new mobile application (app).

The ASCVD Risk Estimator application helps health care providers and patients estimate 10-year and lifetime risks for atherosclerotic cardiovascular disease (ASCVD) using the Pooled Cohort Equations and lifetime risk prediction tools. The ASCVD Risk Estimator provides easy access to recommendations specific to calculated risk estimates. Additionally, the app includes readily accessible guideline reference information for both providers and patients related to therapy, monitoring, and lifestyle.

The app is available on both iTunes (iPhones, iPads) and Google Play (Galaxy, Nexus, other Android devices). Use the links below from your mobile device to download the app.

Available at www.cardiosource.com or www.clincalc.com
### ASCVD Risk Calculator: Pooled Cohort Equations (cont.)

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Units</th>
<th>Value</th>
<th>Acceptable range of values</th>
<th>Optimal values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>M or F</td>
<td>F</td>
<td>M or F</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>years</td>
<td>55</td>
<td>20-79</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>AA or WH</td>
<td>AA</td>
<td>AA or WH</td>
<td></td>
</tr>
<tr>
<td>Total Cholesterol</td>
<td>mg/dL</td>
<td>210</td>
<td>130-320</td>
<td>170</td>
</tr>
<tr>
<td>HDL-Cholesterol</td>
<td>mg/dL</td>
<td>56</td>
<td>20-100</td>
<td>50</td>
</tr>
<tr>
<td>Systolic BP</td>
<td>mm Hg</td>
<td>145</td>
<td>90-200</td>
<td>110</td>
</tr>
<tr>
<td>Treatment for High BP</td>
<td>Y or N</td>
<td>Y</td>
<td>Y or N</td>
<td>N</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Y or N</td>
<td>N</td>
<td>Y or N</td>
<td>N</td>
</tr>
<tr>
<td>Smoker</td>
<td>Y or N</td>
<td>N</td>
<td>Y or N</td>
<td>N</td>
</tr>
</tbody>
</table>
ASCVD Risk Calculator: 55 Year Old African-American and White Women

African American Women

- Your 10-Year ASCVD Risk (%): 7.7
- Optimal (%): 1.8

White Women

- Your 10-Year ASCVD Risk (%): 3.6
- Optimal (%): 1.4
SCORE 10-Year Fatal CVD Risk Algorithm: High Risk Countries

<1% low
1-%5% moderate
5-<10% high
>=10% very high
SCORE 10-Year CVD Risk
Algorithm: Low Risk Countries

<1% low
1-%<5% moderate
5-%<10% high
>=10% very high

Figure 4: SCORE chart: 10-year risk of fatal cardiovascular disease (CVD) in countries at low CVD risk based on the following risk factors: age, sex, smoking, systolic blood pressure, and total cholesterol. Note that the risk of total (fatal + non-fatal) CVD events will be approximately three times higher than the figures given.
Illustration of the Risk Age Concept From the European SCORE Algorithms

The risk of this 40 year old male smoker with risk factors is the same (3%) as that of a 60 year old man with ideal risk factor levels—therefore his risk age is 60 years.

Figure 6 Illustration of the risk—age concept.
The Detection Gap in CHD

“Despite many available risk assessment approaches, a substantial gap remains in the detection of asymptomatic individuals who ultimately develop CHD”

“The Framingham and European risk scores… emphasize the classic CHD risk factors…. is only moderately accurate for the prediction of short- and long-term risk of manifesting a major coronary artery event….”
Criteria required for a good screening test

- Provides an accurate determination of the likelihood that an asymptomatic person has the condition (accuracy)
- Reproducible results (reliability)
- Detect individuals where early intervention is likely to have a beneficial impact
- Should provide incremental value to risk predicted by office-based risk assessment

Redberg and Vogel et al., 34th Bethesda Conf. JACC 2003; 41: 1855-1917
Screening for Atherosclerosis
Risk Factors vs Disease

Numerous Risk Factors

- High LDL
- Low HDL
- High BP
- Diabetes
- Smoking
- CRP
- Metabolic Syn
- Lp(a)
- Homocysteine
- Dense LDL
- Lp-PLA2
- ApoB/ApoA
- Family History
- Sedentary Life
- Obesity
- Stress
- ...
- Over 200 risk factors have been reported.

Examples of Arterial Structure Tests

- Carotid IMT and Plaque Measured by Ultrasound
- Aortic and Carotid Plaque Detected by MRI
- Coronary Calcium Score Measured by CT
- Ankle Brachial Index
- Brachial Vasoreactivity Measured by Ultrasound
- Vascular Compliance Measured by Radial Tonometry
- Microvascular Reactivity Measured by Fingertip Tonometry
• CQ1: “What is the evidence with regard to reclassification or contribution to risk assessment when the following are considered in addition to the variables that are in the traditional risk scores?”
  • High-sensitivity C-reactive protein
    • Apolipoprotein B
    • Glomerular filtration rate
      • Microalbuminuria
    • Family history
  • Cardiorespiratory fitness
    • Ankle-brachial index
  • Carotid intima-media thickness
  • Coronary artery calcium score
Recommendations for Use of Newer Risk Markers After Quantitative Risk Assessment

If, after quantitative risk assessment, a risk-based treatment decision is uncertain, assessment of ≥1 of the following—family history, hs-CRP, CAC score, or ABI—may be considered to inform treatment decision making.†

Routine measurement of carotid intima-media thickness is not recommended in clinical practice for risk assessment for a first ASCVD event.†

†Based on new evidence reviewed during ACC/AHA update of evidence.
Table 6. Expert Opinion Thresholds for use of Optional Screening Tests When Risk-Based Decisions Regarding Initiation of Pharmacological Therapy are Uncertain Following Quantitative Risk Assessment

<table>
<thead>
<tr>
<th>Measure</th>
<th>Support Revising Risk Assessment Upward</th>
<th>Do Not Support Revising Risk Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family history of premature CVD</td>
<td>Male &lt;55 years of age</td>
<td>Occurrences at older ages only (if any)</td>
</tr>
<tr>
<td></td>
<td>Female &lt;65 years of age (1&lt;sup&gt;st&lt;/sup&gt; degree relative)</td>
<td></td>
</tr>
<tr>
<td>hs-CRP</td>
<td>≥2 mg/L</td>
<td>&lt;2 mg/L</td>
</tr>
<tr>
<td>CAC score</td>
<td>≥300 Agatston units or ≥75&lt;sup&gt;th&lt;/sup&gt; percentile for age, sex, and ethnicity*</td>
<td>&lt;300 Agatston units and &lt;75 percentile for age, sex, and ethnicity*</td>
</tr>
<tr>
<td>ABI</td>
<td>&lt;0.9</td>
<td>≥0.9</td>
</tr>
</tbody>
</table>

*For additional information, see http://www.mesa-nhlbi.org/CACReference.aspx.

ABI indicates ankle-brachial index; CAC, coronary artery calcium; CVD, cardiovascular disease; and hs-CRP, high-sensitivity C-reactive protein.
# ESC European CVD Prevention 2012 Guidelines: Recommendations Regarding Imaging Methods

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
<th>GRADE</th>
<th>Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement of carotid intima-media thickness and/or screening for atherosclerotic plaques by carotid artery scanning should be considered for cardiovascular risk assessment in asymptomatic adults at moderate risk.</td>
<td>IIa</td>
<td>B</td>
<td>Strong</td>
<td>130–132</td>
</tr>
<tr>
<td>Measurement of ankle–brachial index should be considered for cardiovascular risk assessment in asymptomatic adults at moderate risk.</td>
<td>IIa</td>
<td>B</td>
<td>Strong</td>
<td>133–135</td>
</tr>
<tr>
<td>Computed tomography for coronary calcium should be considered for cardiovascular risk assessment in asymptomatic adults at moderate risk.</td>
<td>IIa</td>
<td>B</td>
<td>Weak</td>
<td>136–138</td>
</tr>
<tr>
<td>Exercise electrocardiography may be considered for cardiovascular risk assessment in moderate-risk asymptomatic adults (including sedentary adults considering starting a vigorous exercise programme), particularly when attention is paid to non-electrocardiogram markers such as exercise capacity.</td>
<td>IIb</td>
<td>B</td>
<td>Strong</td>
<td>46, 139, 140</td>
</tr>
</tbody>
</table>
Carotid B-Mode Ultrasonography

- Measurement of intimal medial thickness
- Non-invasive, inexpensive, no radiation
- Well-established as an indicator of cardiovascular risk from epidemiologic studies
- Published clinical trials on utility of carotid IMT as measure of atherosclerosis and effects of therapy
- Accuracy of assessments depends on experience of those interpreting scans
- ACCF/AHA 2010 and ESC 2012 Guideline: CIMT measurement may be reasonable for CV risk assessment in asymptomatic adults at intermediate risk (Class IIa-B)
- **However, the 2013 ACC/AHA guideline does not recommend is measurement for risk assessment.**
A, Individuals without and with events classified according to their 10-year absolute risk to develop a myocardial infarction or stroke predicted with the Framingham Risk Score variables or classified according to their 10-year absolute risk to develop a first-time myocardial infarction or stroke predicted with the Framingham Risk Score and a common carotid intima-media thickness (CIMT) measurement. B, Observed Kaplan-Meier absolute risk estimates for all individuals (with and without events). The observed risk in reclassified individuals is significantly different from the observed risk of the individuals in the gray cells.
CIMT w/w/o Plaque and CHD Incidence: ARIC Study (Nambi et al., JACC 2010)

**Figure 1** Adjusted Coronary Heart Disease Incidence Rate per 1,000 Person-Years Adjusted by CIMT Categories With and Without Plaque

For every carotid intima-media thickness (CIMT) category (i.e., <25th percentile, 25th to 75th percentile, and >75th percentile), for the overall group (green bars), men (yellow bars), or women (orange bars), having carotid artery plaque is associated with a higher incidence of coronary heart disease.
23% of 13,145 eligible subjects were reclassified by adding CIMT and plaque information over traditional risk factors (Nambi et al., JACC 2010)

<table>
<thead>
<tr>
<th>CHD Risk by TRF Only</th>
<th>CHD Risk by TRF + CIMT + Plaque</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;5%</td>
</tr>
<tr>
<td>≤5%, low risk</td>
<td>5,585 (91.4)</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td>5%-10%, low-intermediate risk</td>
<td>839 (22.4)</td>
</tr>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td>10%-20%, high-intermediate risk</td>
<td>0 (0.00)</td>
</tr>
<tr>
<td></td>
<td>—</td>
</tr>
<tr>
<td>&gt;20%, high risk</td>
<td>0 (0.00)</td>
</tr>
<tr>
<td></td>
<td>—</td>
</tr>
<tr>
<td>All</td>
<td>6,264 (48.9)</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Values are n (%) and Kaplan-Meier 10-year risk (%). *All observed risks have been interpolated to 10-year event rates by Kaplan-Meier risk estimates using the actual observed events over a mean follow-up of 15.1 years.
Ankle-brachial blood pressure (ABI)

- Simple noninvasive test to confirm lower extremity peripheral arterial disease (PAD)
- Uses Doppler probe to measure SBP in brachial, posterior tibial, and dorsalis pedis arteries
  - The higher of the SBP measures taken in each arm is the denominator for the ABI calculation for each leg.
  - The higher of the two pressures in each ankle (from posterior tibial and dorsalis pedis arteries) forms the numerator for the left and right ABI, respectively.
- ABI <0.9 in either leg is diagnostic of PAD
- Test most useful in those over 50 who have other risk factors
- ACCF/AHA 2010 Guideline: Measurement reasonable for CV risk assessment in asymptomatic adults at intermediate risk (IIa-B); ALSO recommended by 2013 ACC/AHA Guideline (Iib-B)
Figure 2. Hazard Ratios for Total Mortality in Men and Women by Ankle Brachial Index at Baseline for All Studies Combined in the ABI Collaboration

Hazard ratios are not adjusted for age or cardiovascular risk factors.
Reclassification of Risk Category from ABI (ABI Collaboration, JAMA 2008)

19% of men and 38% of women would be reclassified in their risk category from addition of ABI.

<table>
<thead>
<tr>
<th>FRS Category&lt;sup&gt;b&lt;/sup&gt;</th>
<th>No. in FRS Category</th>
<th>CHD, %&lt;sup&gt;c&lt;/sup&gt;</th>
<th>No. in FRS Category</th>
<th>CHD, %&lt;sup&gt;c&lt;/sup&gt;</th>
<th>No. in FRS Category</th>
<th>CHD, %&lt;sup&gt;c&lt;/sup&gt;</th>
<th>No. in FRS Category</th>
<th>CHD, %&lt;sup&gt;c&lt;/sup&gt;</th>
<th>No. in FRS Category</th>
<th>CHD, %&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (&lt;10%)</td>
<td>5643</td>
<td>5</td>
<td>76</td>
<td>8</td>
<td>1076</td>
<td>5</td>
<td>4255</td>
<td>4</td>
<td>236</td>
<td>5</td>
</tr>
<tr>
<td>Intermediate (10%-19%)</td>
<td>7392</td>
<td>13</td>
<td>245</td>
<td>16</td>
<td>2069</td>
<td>12</td>
<td>4815</td>
<td>12</td>
<td>263</td>
<td>8</td>
</tr>
<tr>
<td>High (≥20%)</td>
<td>8398</td>
<td>23</td>
<td>1149</td>
<td>40</td>
<td>3406</td>
<td>21</td>
<td>3668</td>
<td>18</td>
<td>175</td>
<td>14</td>
</tr>
<tr>
<td><strong>Women</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (&lt;10%)</td>
<td>15 505</td>
<td>11</td>
<td>1083</td>
<td>21</td>
<td>6192</td>
<td>10</td>
<td>7909</td>
<td>9</td>
<td>321</td>
<td>11</td>
</tr>
<tr>
<td>Intermediate (10%-19%)</td>
<td>5563</td>
<td>13</td>
<td>558</td>
<td>25</td>
<td>2429</td>
<td>12</td>
<td>2433</td>
<td>11</td>
<td>143</td>
<td>13</td>
</tr>
<tr>
<td>High (≥20%)</td>
<td>1418</td>
<td>27</td>
<td>200</td>
<td>44</td>
<td>598</td>
<td>21</td>
<td>577</td>
<td>22</td>
<td>43</td>
<td>34</td>
</tr>
</tbody>
</table>
Coronary Calcium and Atherosclerosis: Pathology Evidence

- Coronary calcium invariably indicates the presence of atherosclerosis, but atherosclerotic lesions do not always contain calcium (1-3).
- Calcium deposition may occur early in life, as early as the second decade, and in lesions that are not advanced (4-5).
- Correlates with plaque burden; highly sensitive for angiographic disease

Cumulative Incidence of Any Coronary Event: MESA Study (Detrano et al., NEJM 2008)
Risk Factor-Adjusted Hazard Ratios by Coronary Calcium Score: MESA Study (Detrano et al., NEJM 2008)

<table>
<thead>
<tr>
<th>Coronary-Artery Calcium Score</th>
<th>Major Coronary Event</th>
<th>Any Coronary Event</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No./No. at Risk</td>
<td>Hazard Ratio (95% CI)</td>
</tr>
<tr>
<td>0</td>
<td>8/3409</td>
<td>1.00</td>
</tr>
<tr>
<td>1–100</td>
<td>25/1728</td>
<td>3.89 (1.72–8.79)</td>
</tr>
<tr>
<td>101–300</td>
<td>24/752</td>
<td>7.08 (3.05–16.47)</td>
</tr>
<tr>
<td>&gt;300</td>
<td>32/833</td>
<td>6.84 (2.93–15.99)</td>
</tr>
<tr>
<td>Log₂(CAC+1)†</td>
<td>1.20 (1.12–1.29)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*CAC denotes coronary-artery calcium score, and CI confidence interval.
†Major coronary events were myocardial infarction and death from coronary heart disease.
‡Each unit increase in log₂(CAC+1) represents a doubling of the coronary-artery calcium score.
Area Under Curve for Risk Factors Alone and Risk Factors Plus CAC by Ethnic Group: MESA Study (Detrano et al., NEJM 2008)

<table>
<thead>
<tr>
<th>Racial or Ethnic Group</th>
<th>Major Coronary Event</th>
<th>Any Coronary Event</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AUC for Risk Factors Alone</td>
<td>AUC for Risk Factors plus Coronary-Artery Calcium Score</td>
</tr>
<tr>
<td>White</td>
<td>0.76</td>
<td>0.79</td>
</tr>
<tr>
<td>Chinese</td>
<td>0.83</td>
<td>0.88</td>
</tr>
<tr>
<td>Black</td>
<td>0.79</td>
<td>0.87</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.84</td>
<td>0.86</td>
</tr>
<tr>
<td>Total</td>
<td>0.79</td>
<td>0.83</td>
</tr>
</tbody>
</table>

* Separate models are fitted for each racial or ethnic group. AUC denotes area under the receiver-operating-characteristic curve. P values are for the comparison between AUC without and AUC with the coronary-artery calcium score.

† Major coronary events were myocardial infarction and death from coronary heart disease.
The addition of CAC to models with age, gender, ethnicity and risk factors alone resulted in net reclassification of 0.25 (p<0.001); 23% of those with events were reclassified as high risk and 13% without events were reclassified as low risk.
What is the value of CAC =0? Warranty against CVD events for >=5 Years

<table>
<thead>
<tr>
<th>Study Type</th>
<th>Population (n)</th>
<th>CAC=0 (%)</th>
<th>FU (Years)</th>
<th>Number of events (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meta-Analysis</td>
<td>71,595</td>
<td>29,312 (41%)</td>
<td>4.3</td>
<td>154 (0.47%) CVD events</td>
</tr>
<tr>
<td>Retrospective</td>
<td>44,052</td>
<td>19,898 (45%)</td>
<td>5.6</td>
<td>104 (0.52%) Deaths</td>
</tr>
<tr>
<td>Prospective</td>
<td>6,809</td>
<td>3,414 (50%)</td>
<td>4.1</td>
<td>17 (0.52%) CHD events</td>
</tr>
</tbody>
</table>


Annual CHD Event Rates (in %) by Calcium Score Events by CAC Categories in Subjects with DM, MetS, or Neither Disease (Malik and Wong et al., Diabetes Care 2011)

Coronary Heart Disease

Coronary Artery Calcium Score

ACCF/AHA 2010 Guideline: CAC Scoring for CV risk assessment in asymptomatic adults aged 40 and over with diabetes (Class IIa-B)
Acc/AHA 2013 Guideline: IIb-B

“...Assessing CAC is likely to be the most useful of the current approaches to improving risk assessment among individuals found to be at intermediate risk after formal risk assessment.”
Does coronary artery screening by electron beam computed tomography motivate potentially beneficial lifestyle behaviors?

In 703 men and women aged 28-84 who received scanning for coronary calcium by EBCT, calcium score remained independently associated with:

- new aspirin usage
- new cholesterol medication
- consulting with a physician
- losing weight
- decreasing dietary fat
  
  ...but also increased worry

......potentially important risk-reducing behaviors may be reinforced by the knowledge of a positive coronary artery scan, independent of preexisting coronary risk factor status.

Wong ND et al. Am J Cardiol. 1996 Dec 1;78(11):1220-3
Impact of Coronary Artery Calcium Scanning on Coronary Risk Factors and Downstream Testing (Rozanski A et al. JACC 2011)

• We compared the clinical impact of conventional risk factor modification to that associated with the addition of coronary artery calcium (CAC) scanning.

• 2,137 volunteers underwent CAC scanning or did not undergo CAC scanning before risk factor counseling.

• Primary end point was 4-year change in coronary artery disease risk factors and Framingham Risk Score; also examined medical resource utilization
Eisner Study Results

– Compared with the no-scan group, the scan group showed improvement in systolic blood pressure ($p = 0.02$) and LDL-C ($p = 0.04$), and waist circum in those with increased abdominal girth ($p = 0.01$).

– Increase in Framingham Risk Score (FRS) in the no-scan group, but no change in the scan group ($0.7 \pm 5.1$ vs. $0.002 \pm 4.9$, $p = 0.003$).

– Within the scan group, increasing baseline CAC score was associated with an improvement in risk factors and FRS ($p<0.01$).

– Downstream medical testing and costs in the scan group were similar to the no-scan group.
Radiation dose

- “dose [EBT dose 0.7 mSv, MDCT dose 1.5 mSv]”
  - AHA Scientific Statement Circulation 2005
- CAC Dose = 1 mSv (Gerber AHA Scient Statement on Ionizing Radiation 2009)
  - Similar to Mammogram
  - Similar to long distance air flight
  - 1/3 annual background radiation
Can Screening for Atherosclerosis Identify Those Most Likely to Benefit from Lipid-Lowering Therapy?

Associations between C-reactive protein, coronary artery calcium, and cardiovascular events: implications for the JUPITER population from MESA, a population-based cohort study

Lancet 2011; 378: 684–92

Michael J Blaha, Matthew J Budoff, Andrew P DeFilippis, Ron Blankstein, Juan J Rivera, Arthur Agatston, Daniel H O’Leary, Joao Lima, Roger S Blumenthal, Khurram Nasir

75% of all events occurred in 25% with CAC>100

Number needed to treat:
CAC 0 549
CAC 1-100 94
CAC > 100 24
Intermediate Risk MESA Subjects (n=1330)

C-statistics:

- FRS alone 0.623
- FRS+CAC 0.784 (p<0.001)
- FRS+CIMT 0.652 (p=0.01)
- FRS+FMD 0.639 (p=0.06)
- FRS+CRP 0.640 (p=0.03)
- FRS+FamHx 0.675 (p=0.001)
- FRS+ABI 0.650 (p=0.01)

Yeboah J et al, JAMA 2012
Predicting ASCVD Risk: Global Risk Assessment and Beyond

- Arterial imaging/function
- Biomarkers
- Metabolic syndrome
- Family history
- Pooled 10 yr ASCVD Risk Equation

Summary

• Global risk assessment is the foundation for CVD risk evaluation in asymptomatic individuals.

• Screening tests for subclinical atherosclerosis can be recommended for further refinement of CVD risk prediction over global risk assessment.

• Guidelines suggest intermediate risk subjects may be suitable for such screening to identify those needing more aggressive risk factor intervention.

• New 2013 ACC/AHA guidelines recommend assessment of family history, hs-CRP, CAC, or ABI when the treatment decision based on global risk scoring is uncertain.

• However, it is not known whether screening for subclinical atherosclerosis will ultimately lead to long-term clinical benefit and save lives.
Thank You!