Coronary Artery Calcification Testing
Is it Time to Abandon Risk Factors for CVD Risk Assessment?

Khurram Nasir, MD MPH

1900-1940: Infectious diseases was the leading cause of death in the United States, and the average life expectancy was only 47 in 1930

Sanitation, TB & Pneumonia Control, Penicillin significantly improved outcomes

1945: 1 out of every 3 men in the United States developed CVD in their 50’s with majority of dying in 60’s

1946: 44% of deaths in the US could be attributed to cardiovascular disease. That was an increase of about 20% since 1940

How Cardiovascular Disease Became Our Biggest Threat?
Franklin D. Roosevelt
32nd President of the United States
Born: January 30, 1882 Hyde Park, New York
Died: April 12, 1945 (aged 63) Warm Springs, Georgia
Cause of Death: Massive Cerebral Hemorrhage

Yalta Conference: February 4–11, 1945

FDR Blood Pressure Trends 1937-1945

Unfinished Portrait of FDR
1948: Events That Did Not Make Headlines…

- Congress created the National Heart Institute
- The Framingham Heart Study enrolled its first patient.

Concept of cardiovascular “risk factors”

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Hypertension</th>
<th>Hyperlipidemia</th>
<th>Smoking</th>
<th>Diabetes</th>
</tr>
</thead>
</table>

Kannel et al., Ann Intern Med 1961

Statins: Journey from Discovery to “Established” Role in Primary Prevention

- 1960: Block & Lynen establish reduction of HMG-CoA is the major point of regulation on the pathway to cholesterol
- 1971: Akira Endo, a Japanese biochemist began the search for cholesterol-lowering drug.
- 1984: Coronary Primary Prevention Trial demonstrated cholesterol lowering could significantly reduce the risk of heart attacks and angina.
2001-2003

Framingham Based Risk Scores is Incorporated in National Guidelines to Use for Assessing Risk of Developing CVD & Management with statins in Asymptomatic Individuals

How do we classify Asymptomatic Individuals Based on FRS?

- **<10%**: Low Risk
  - Reassurance
  - Avoid further risk assessments for 5 years.
- **>20%**: High Risk
  - Candidates for aggressive management with LDL goals of <100 mg/dl and aspirin
- **10-20%**: Intermediate Risk
  - Do not qualify for the most intensive risk factor interventions
  - Candidate for pharmacotherapy if LDL>160 mg/dl

2003: How Good are Traditional Strategies in Estimating CHD risk??

222 patients with 1st acute MI, no prior CAD
men <55 y/o (75%), women <65 (25%), no DM

10% 18% 72%

High Risk Intermediate Risk Low Risk

Akash R et al, JACC 2003;41:1475-9
2013 New “Atherosclerotic” CVD Risk & cholesterol guidelines: Worth the wait?

- **GROUP 1: PEOPLE WITH CLINICAL ASCVD**
- **GROUP 2: PEOPLE WITH LDL-C ≥ 190**
- **GROUP 3: DIABETES, AGE 40–75, LDL-C 70–189, NO CLINICAL ASCVD**
- **GROUP 4: AGE 40–75, LDL-C 70–189, NO ASCVD, BUT 10-YEAR RISK ≥ 7.5%**

Risk for Mass Medicalization?

- Based on preliminary results from MESA individuals meeting criteria
- NCEP: 25%
- New Guidelines: 55%

**OVERESTIMATED RISK**

Patients whose risk factors predicted between 7.5 and 10 percent chance of strokes or heart attacks had them far less frequently, according to an analysis of three studies.

- Actual rate of heart attack or stroke
- Average predicted rate

<table>
<thead>
<tr>
<th>Study 1</th>
<th>Study 2</th>
<th>Study 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>0%</td>
<td>3%</td>
<td>8%</td>
</tr>
<tr>
<td>0%</td>
<td>1%</td>
<td>6%</td>
</tr>
<tr>
<td>0%</td>
<td>3%</td>
<td>8%</td>
</tr>
</tbody>
</table>

SOURCE: Lassen

"If experts are having this debate over the new guidelines, then what are practitioners and patients sitting on the sidelines going to think?"

Peter Libby, chief of the division of cardiovascular medicine at Brigham and Women’s Hospital Boston

What Does it Mean for Stakeholder?

- PHYSICIAN
- HEALTH SYSTEM
- PATIENT
- ACCURATE RISK ASSESSMENT
Computed Tomography for Non-Invasive Imaging of Subclinical Coronary Atherosclerosis

Agatston AS, Janowitz WR et al. Quantification of coronary artery calcium using ultrafast computed tomography. JACC 1990

Coronary Artery Calcium Scanning Should be Used for Primary Prevention

Pros and Cons

<table>
<thead>
<tr>
<th>Study Type</th>
<th>Population</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>3,014 (50%)</td>
<td>4.1</td>
<td>17 (0.52%) CHD events</td>
</tr>
</tbody>
</table>

What is the value of CAC = 0?

<table>
<thead>
<tr>
<th>Study Type</th>
<th>Population</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>3,014 (50%)</td>
<td>4.1</td>
<td>17 (0.52%) CHD events</td>
</tr>
</tbody>
</table>


Appropriate Resource Allocation

“Can we use CAC testing to identify those who may and may not benefit from preventive therapy?”

Two major comments

Low likelihood of absence & presence of CAC among those at extreme spectrum of risk profile

CAC testing will not have a meaningful impact in predicting “clinical events” these groups
Impact of coronary artery calcium on coronary heart disease events in individuals at the extremes of traditional risk factor burden: the Multi-Ethnic Study of Atherosclerosis

Michael G. Silverman 1,2, Michael J. Blaha 1, Harlan M. Krumholz 3, Matthew J. Budoff 4, Ron Blasdtain 2, Christopher T. Sibley 5, Arthur Agatston 6, Roger S. Blumenthal 1, and Khurram Nasir 1,6,7,8*

European Heart Journal
doi:10.1093/eurheartj/eht508
doi: 10.1161/CIRCULATIONAHA.113.003625
2014;129:77-86; originally published online October 20, 2013; Circulation.

Are all Diabetics Equivalent?

CAC in 2014: The question to ask is “Why Not” rather than “Why”?

- Most precise measure for risk of clinical CVD event
- Widely available
- Inexpensive (75-100 $)
- Easy to perform (takes 2-3 minutes) and interpret
- Radiation equivalent to mammogram

Advantages to stakeholders

- **Health System**: Appropriately allocating healthcare resources to groups likely to receive net benefit from proven Interventions.
- **Clinician**: personalized assessment of risk on case by case situation
- **Patient**: Shared decision making

---

**EDITORIAL POINT OF VIEW**

Short and lifetime cardiovascular risk estimates: Same wine, different bottles. Do we have the COURAGE to abandon risk scores?

- **Catherine N. Swift, MD, MPH**, and **Michael J. Scanlon, MD, MPH**

- Center for Preventive and Chronic Care, Sydney Health Western Camp, Albany, N.Y.
- Department of Medicine, New York University College of Medicine, New York, N.Y.
- Department of Epidemiology, Kaiser Permanente Colorado Health, Denver International Airport, Arapahoe, N.Y.
- The Arizona Patient Care Center for the Prevention of Heart Disease, Scottsdale, AZ.