Beyond Framingham

Prediction of cardiovascular risk

Niels van Pelt
Cardiologist, Middlemore Hospital
Niels Bohr (Danish Physicist) 1885-1962

“Prediction is very difficult, especially if it's about the future”
Introduction

• Why do we assess cardiovascular risk?
• How does Predict improve Framingham
• Additional to the classic risk factors
• 51 yr old man WB concerned about his CVD risk
• Well, non smoker
• mild untreated hypertension 140/90
• Family history-Father (smoker) had a MI 58
• Non fasting lipids. TC 6.1, HDL 1.2, LDL 3.7, chol/HDL 5.1
Your risk of heart attack or stroke within the next 5 years

Very High

High

Moderate

Mild

Your current CVD Risk is 11%. This is a moderate risk.
Your Heart Forecast

Your risk of heart attack or stroke within the next 5 years

**Key**
- Red: Your current risk
- Blue: Your ideal risk zone (Based on Non-smoker, TC/HDL ratio: 4, BP: 120/80)

**Level of Risk**
- Very High
- High
- Moderate
- Mild

- Your 'Heart Age' is 62 years old.

- Consider medications

- Medications

- 35 40 45 50 55 60 65 70 75 Years

- 50%
- 20%
- 15%
- 10%

About you  Your Health  Your Numbers  HEART AGE FORECAST  What if
• Why consider risk

• Measuring risk addresses the question ...can we reduce the risk of a cardiac death, heart attack, stroke

• Who is having cardiac events- how good are we at predicting the risk...WB’s risk 11%?
PREDICT: CVD events in 30-74 years during follow-up from 2002-2015, by clinical history (n = 432,211)

Most events occur in pts with prev IHD

Prof Rod Jackson University of Auckland (unpublished)
• Previous MI, stroke- consider (very) high risk

• High risk strategy….Attention life style (good diet, no smoking, regular aerobic exercise)

• Lifelong aspirin and statin

• Optimise BP and diabetes
• Secondary prevention is more effective when the overall risk is higher

• Before Framingham treatment decisions often based on a single risk factor
relative stroke risk and usual Blood Pressure

(45 prospective studies: 450,000 people 13,000 events)

- DBP > 80 mmHg
- DBP > 90 mmHg
- DBP > 95 mmHg
- DBP > 100 mmHg

5% of 60 year olds
50% of 60 year olds
CVD events prevented per 1000 treated by baseline combined risk and extent of systolic blood pressure-lowering.

![Bar chart showing CVD events avoided per 1000 treated vs. SBP reduction and 5 year CVD risk.](chart)

CVD events avoided/1000 treated with statins by baseline 5-year CVD risk & LDL reduction

Vascular events avoided per 1000 treated

LDL reduction (mmol/L)

5 year CVD risk (%)

CTTC. Lancet 2012; 380:581-90
• How does the Framingham risk score perform in NZ population?

Calibration plots: PREDICT vs Framingham
• Framingham overestimates the actual risk in most people by ~5%

• PREDICT - new prediction tools will be based on *actual* events in NZ’ers
• WB- Predict assess risk as 11%

• Do we consider a statin or aspirin… If persons are concerned about their risk then they may prefer to take statin irrespective of the predicted risk

<table>
<thead>
<tr>
<th>Table 7</th>
<th>Goals for people without known cardiovascular disease</th>
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<tbody>
<tr>
<td>CVD risk ≥15%</td>
<td>CVD risk &lt;15%</td>
</tr>
<tr>
<td>Reduce 5-year cardiovascular risk to &lt;15%</td>
<td>Reduce risk with lifestyle interventions</td>
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<tr>
<td>Recalculate risk at each review to determine current CVD risk</td>
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New Zealand Primary Care Handbook 2012
Beyond the traditional risk factors

Calcium scoring with CT
• CT calcium scoring identifies calcified coronary plaque

• safe- no contrast, minimal radiation exposure

• Calcium score reflects coronary plaque burden

• Many studies have strongly linked the calcium score with increased cardiovascular risk- *incremental benefit* when assessing risk

• Ideally suited to further evaluate intermediate risk patients (espec 40-70 yr of age)
Calcium Scoring - reclassify risk

Intermediate Risk

- Ca score - 0 (Arterial Age - 39 yrs, 30% Low Risk)
- Ca score - 25 (Arterial Age - 63 yrs, 48% Intermediate Risk)
- Ca score - 300 (Arterial Age - 80 yrs, 22% High Risk)
The value of CT cardiac angiography and CT calcium score testing in a modern cardiology service in New Zealand: A report of a single centre 8 year experience from 5237 outpatient procedures

CJ Ellis,1,2 G Gamble,3 C Edwards,1,4 N Van Pelt,1,5 R Gabriel,1,5 B Lowe,1,2 J Christiansen,4,6 A To,4,7 H Winch,1 M Osborne,8 JA Ormiston,1,2 ME Legget.1,2,3

22% patients with low framingham risk re assigned to a higher risk

![Graph showing frequency of Framingham CVS 5 Year Risk Estimate % with corresponding Ca Score categories.]
The value of CT cardiac angiography and CT calcium score testing in a modern cardiology service in New Zealand: A report of a single centre 8 year experience from 5237 outpatient procedures

CJ Ellis, G Gamble, C Edwards, N Van Pelt, R Gabriel, B Lowe, J Christiansen, A To, H Winch, M Osborne, JA Ormiston, ME Legget.
A 15-Year Warranty Period for Asymptomatic Individuals Without Coronary Artery Calcium

A Prospective Follow-Up of 9,715 Individuals

Valentina Valenti, MD,* Bráin ó Hartaigh, PhD,*† Ran Heo, MD,* Iksung Cho, MD,* Joshua Schulman-Marcus, MD,* Heidi Gransar, MS,* Quynh A. Truong, MD, MPH,* Leslee J. Shaw, PhD, Joseph Knapper, MD,* Anita A. Kelkar, MD,* Pratik Sandesara, MD,* Fay Y. Lin, MD,* Sebastiano Sciarretta, MD,*# Hyuk-Jae Chang, MD, PhD,†† Tracy Q. Callister, MD,‡‡ James K. Min, MD*
Use of Coronary Artery Calcium Testing to Guide Aspirin Utilization for Primary Prevention: Estimates From the Multi-Ethnic Study of Atherosclerosis

Michael D. Miedema, MD, MPH; Daniel A. Duprez, MD, PhD; Jeffrey R. M. Misialek, MPH; Michael J. Blaha, MD, MPH; Khurram Nasir, MD, MPH; Michael G. Silverman, MD; Ron Blankstein, MD; Matthew J. Budoff, MD; Philip Greenland, MD; Aaron R. Folsom, MD, MPH

Background—Aspirin for the primary prevention of coronary heart disease (CHD) is only recommended for individuals at high risk for CHD although the majority of CHD events occur in individuals who are at low to intermediate risk.

Methods and Results—To estimate the potential of coronary artery calcium (CAC) scoring to guide aspirin use for primary prevention of CHD, we studied 4229 participants from the Multi-Ethnic Study of Atherosclerosis who were not on aspirin at baseline and were free of diabetes mellitus. Using data from median 7.6-year follow-up, 5-year number-needed-to-treat estimations were calculated by applying an 18% relative CHD reduction to the observed event rates. This was contrasted to 5-year number-needed-to-harm estimations based on the risk of major bleeding reported in an aspirin meta-analysis. Results were stratified by a 10% 10-year CHD Framingham Risk Score (FRS). Individuals with CAC≥100 had an estimated net benefit with aspirin regardless of their traditional risk status (estimated 5-year number needed to treat of 173 for individuals <10% FRS and 92 for individuals ≥10% FRS, estimated 5-year number needed to harm of 442 for a major bleed). Conversely, individuals with zero CAC had unfavorable estimations (estimated 5-year number needed to treat of 2036 for individuals <10% FRS and 808 for individuals ≥10% FRS, estimated 5-year number needed to harm of 442 for a major bleed). Sex-specific and age-stratified analyses showed similar results.

Conclusions—For the primary prevention of CHD, Multi-Ethnic Study of Atherosclerosis participants with CAC≥100 had favorable risk/benefit estimations for aspirin use while participants with zero CAC were estimated to receive net harm from aspirin. (Circ Cardiovasc Qual Outcomes. 2014;7:453-460.)

Key Words: aspirin ■ coronary disease ■ prevention
CT Calcium Score
Guide primary prevention aspirin

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<th>Rx for 5 Years</th>
<th>Ca2+ &gt;100</th>
<th>Ca2+ = 0</th>
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<tr>
<td>NNT to Prevent CHD event</td>
<td>92 – 173</td>
<td>808 - 2063</td>
</tr>
<tr>
<td>NNT to Harm</td>
<td>442</td>
<td>442</td>
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Cardiac Society of Australia and New Zealand Position Statement: Coronary Artery Calcium Scoring

Christian Hamilton-Craig (chair), Clara Chow, Niels van Pelt, John Younger, Michael Jelinek Jonathan Chan, Gary Liew (co-chair).

CAC = 0. A zero score confers a near-zero risk of death, <1% at 10 years.
CAC = 1-100. <10% Low risk
CAC = 101-400. 10-20% intermediate risk
CAC = 101-400 and >75th centile. 15-20% moderately high risk
CAC > 400. >20% High risk.

Patients with moderately-high or high risk based on CAC score are recommended to receive secondary prevention-equivalent interventions such as aspirin and high potency statins, and attention to diet and lifestyle measures. Patients at intermediate risk CAC>100 will benefit from aspirin; statins are considered reasonable if they are above 75th centile. Patients with low CAC are encouraged to optimize diet and lifestyle as the evidence for pharmacotherapy is weak, and aspirin/statins are not generally recommended.
• WB chose to start atorvastatin however he developed aches in his legs with exercise and stopped after 3 months

• Calcium score recommend to guide therapy

• Calcium score 183
The estimated probability of a non-zero calcium score for a white male of age 51 is **44%**.

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<th>Percentiles and Calcium Scores for: white male of age 51</th>
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<tr>
<td>25th</td>
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<tr>
<td>0</td>
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The observed calcium score of **183** is at percentile **92** for subjects of the same age, gender, and race/ethnicity who are free of clinical cardiovascular disease and treated diabetes.

Chart 1: Percentiles
• Ca score reclassified WB cardiovascular risk from intermediate to high

• recommended aspirin and statin - WB restarted atorvastatin at low dose

• Ca score personalises risk assessment
some things are easier to predict than others......
Conclusions

- Risk factor modification most effective in high risk group
- Traditional Framingham risk models overestimate risk in NZers
- Calcium scoring reclassifies risk in approximately 50%- personalises risk assessment
Discussion points

• Would you have started on WB on a statin (or aspirin)

• Would you utilise calcium scoring in your practice

• What about CRP, carotid intimal thickness

• Risk reduction in the statin intolerant patient