

A photograph of a modern, multi-story glass skyscraper under a blue sky with white clouds. A glass-enclosed skybridge connects two parts of the building. The skybridge has text on it: "St. Michael's Hospital" and "LI KASHING KNOWLEDGE INSTITUTE".

St. Michael's

Inspired Care.
Inspiring Science.

Detection of ASCVD before symptoms

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Detection of ASCVD before symptoms

Relationships with financial sponsors:

- Grants/Research Support: N/A
- Speakers Bureau/Honoraria: CHRC
- Consulting Fees: Novo Nordisk
- Patents: N/A
- Other: N/A

HPI

51 M

Corporate lawyer; not very active

No CV symptoms

Twin brother recently had MI and
3VD; needed CABG

Past Medical History

Hypertension

Home Medications

Valsartan 80mg daily

Physical Exam

VS: BP 117/73 mmHg, HR 88 and
regular.

CV: S1, S2 with physiologic split, no
murmurs.

Chest: No crackles.

Extremities: No edema. Good equal
bilateral pulses.

Labs

Electrolytes: WNL

CBC: WNL

TC: 5.2 mmol/L

HDL: 1.1 mmol/L

TG: 1.5 mmol/L

LDL: 3.4 mmol/L



Predicting CV risk

FRAMINGHAM RISK SCORE (FRS)

Estimation of 10-year Cardiovascular Disease (CVD) Risk

Patient's Name: _____ Date: _____

Step 1¹

In the "points" column enter the appropriate value according to the patient's age, HDL-C, total cholesterol, systolic blood pressure, and if they smoke or have diabetes. Calculate the total points.

Risk Factor	Risk Points		Points	
	Men	Women		
Age				
30-34	0	0		
35-39	2	2		
40-44	5	4		
45-49	7	5		
50-54	8	7		
55-59	10	8		
60-64	11	9		
65-69	12	10		
70-74	14	11		
75+	15	12		
HDL-C (mmol/L)				
>1.6	-2	-2		
1.3-1.6	-1	-1		
1.2-1.29	0	0		
0.9-1.19	1	1		
<0.9	2	2		
Total Cholesterol				
<4.1	0	0		
4.1-5.19	1	1		
5.2-6.19	2	3		
6.2-7.2	3	4		
>7.2	4	5		
Systolic Blood Pressure (mmHg)	Not Treated	Treated	Not Treated	Treated
<120	-2	0	-3	-1
120-129	0	2	0	2
130-139	1	3	1	3
140-149	2	4	2	5
150-159	2	4	4	6
160+	3	5	5	7
Smoker	Yes	4	0	3
	No	0	0	0
Diabetes	Yes	statin-indicated condition		
	No	0	0	0
Total Points				

Step 2¹

Using the total points from Step 1, determine the 10-year CVD risk* (%).

Total Points	10-Year CVD Risk (%) [*]	
	Men	Women
-3 or less	<1	<1
-2	1.1	1.0
-1	1.4	1.2
0	1.6	1.5
1	1.9	1.7
2	2.3	2.0
3	2.8	2.4
4	3.3	2.8
5	3.9	3.3
6	4.7	3.9
7	5.6	4.5
8	6.7	5.3
9	8.0	6.3
10	9.6	7.3
11	11.3	8.5
12	13.3	10.0
13	15.6	11.7
14	18.4	13.7
15	21.6	15.9
16	25.3	18.5
17	29.4	21.5
18	>30	24.8
19	>30	27.5
20	>30	>30
21**	>30	>30

* Double cardiovascular disease risk percentage for individuals between the ages of 30 and 59 without diabetes if the presence of a positive history of premature cardiovascular disease is present in a first-degree relative before 55 years of age for men and before 65 years of age for women. This is known as the modified Framingham Risk Score.¹

Step 4^{2,3}

Using 10-year CVD risk from Step 2, determine if patient is Low, Moderate or High risk.¹ Indicate Lipid and/or Apo B targets

Risk Level ¹	Initiate Treatment If:	Primary Target (LDL-C)	Alternate Target
High FRS ≥20%	• Consider treatment in all (Strong, High)	• <2 mmol/L or ≥50% decrease in LDL-C (Strong, Moderate)	• Apo B ≤0.8 g/L or • Non-HDL-C ≤2.6 mmol/L (Strong, High)
Intermediate FRS 10-19%	• LDL-C ≥3.5 mmol/L (Strong, Moderate) • For LDL-C <3.5 mmol/L consider if: • Apo B ≥1.2 g/L • OR Non-HDL-C ≥4.3 mmol/L (Strong, Moderate) • Men ≥50 and women ≥60 with 1 risk factor: low HDL-C, impaired fasting glucose, high waist circumference, smoker, hypertension	• ≤2 mmol/L or ≥50% decrease in LDL-C (Strong, Moderate)	• Apo B ≤0.8 g/L or • Non-HDL-C ≤2.6 mmol/L (Strong, Moderate)
Low FRS <10%	• statins generally not indicated	• statins generally not indicated	• statins generally not indicated
Statin-indicated conditions**	• Clinical atherosclerosis* • Abdominal aortic aneurysm* • Diabetes mellitus Age ≥40 years 15-Year duration for age ≥30 years (DM1) Microvascular disease • Chronic kidney disease (age ≥50 years) eGFR <60 mL/min/1.73 m ² or ACR >3 mg/mmol		

Lipid targets LDL-C: _____ or Apo B: _____

10-yr CVD risk

18.8%

¹ Adapted from D'Agostino RB et al. (1998). General cardiovascular risk profile for use in primary care. The Framingham Heart Study. Circ 2008;117:743-53.

² Adapted from: Ganavaj J et al. (2009). Canadian Cardiovascular Society/Canadian guidelines for the diagnosis and treatment of dyslipidemia and prevention of cardiovascular disease in the adult. Can J Cardiol. 2009;25(10):567-579.

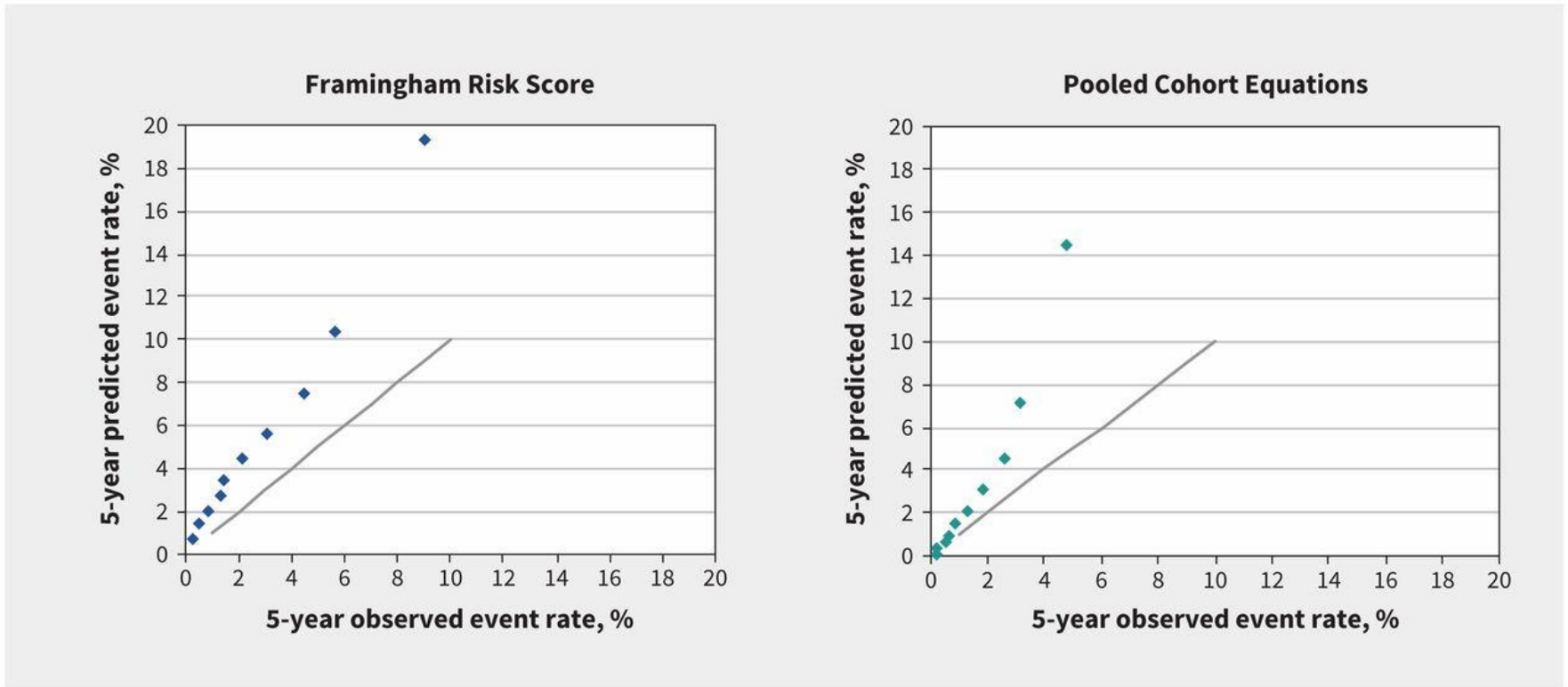
³ Adapted from: Anderson T et al. (2012). Update of the Canadian Cardiovascular Society guidelines for the diagnosis and treatment of dyslipidemia for the prevention of cardiovascular disease in the adult. Can J Cardiol. 2013;28(2):161-167.

* apoB: apolipoprotein B stat, CVD: cardiovascular disease, FRS: Framingham Risk Score, HDL-C: high-density lipoprotein cholesterol, LDL-C: low-density lipoprotein cholesterol

** Statins indicated as initial therapy

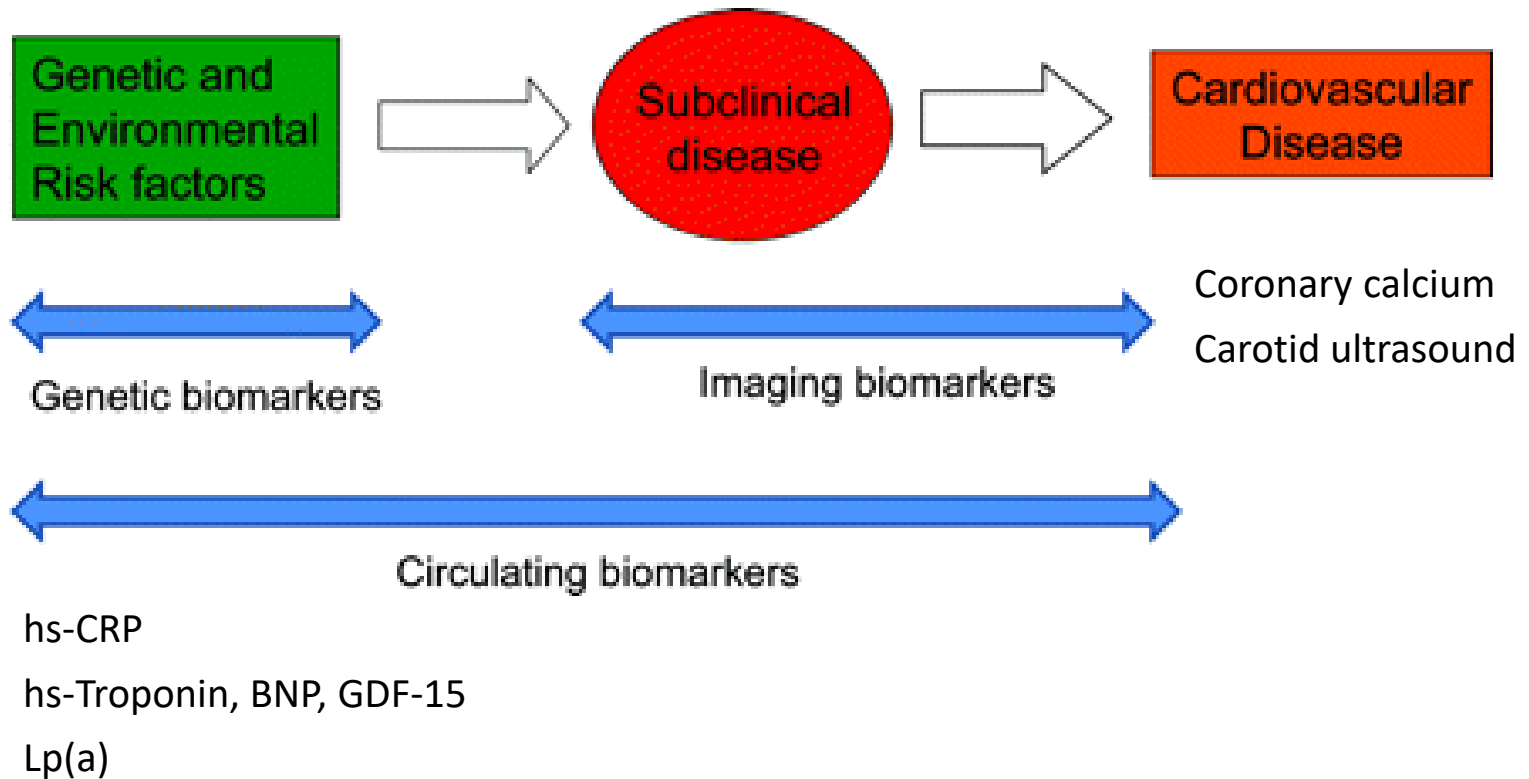
*** Consider LDL-C < 1.8 mmol/L for subjects with acute coronary syndrome (ACS) within past 3 months

Predicting CV risk



84 617 Ontario residents aged 40 to 79 years, without ASCVD

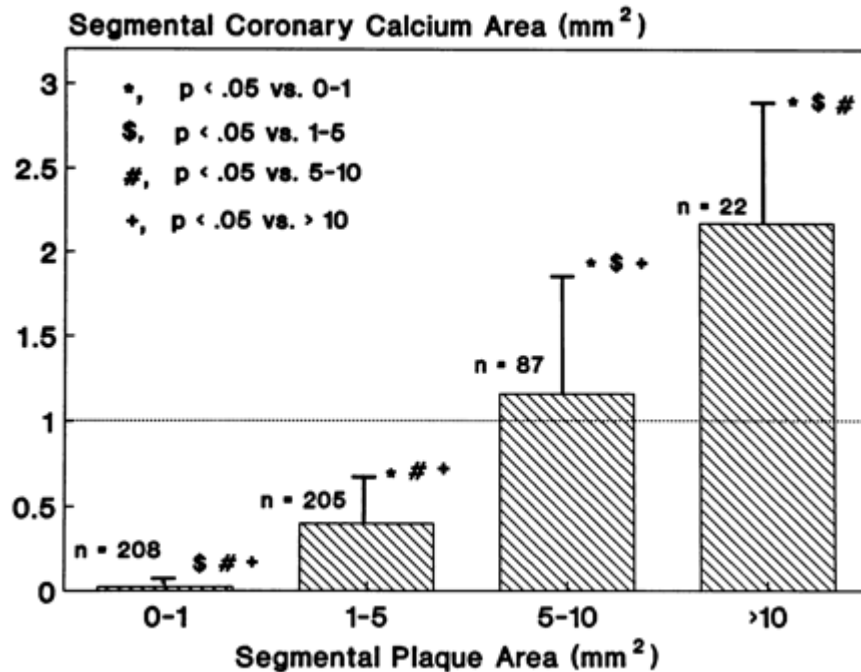
Imaging biomarkers



Imaging biomarkers

- Little data in the literature on the use of stress echocardiography or MPI in asymptomatic individuals for the purpose of cardiovascular risk assessment.
- Calcium score
- Carotid ultrasound (CIMT)

What is Coronary Calcium?

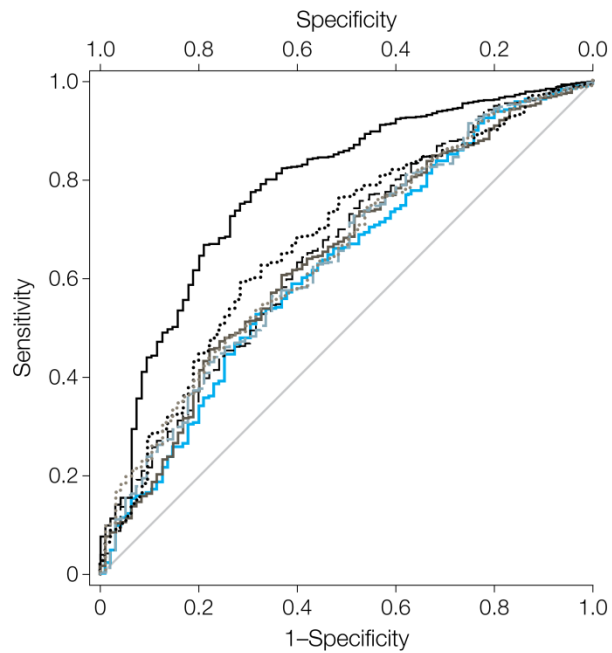


- Strong link between CAC and coronary plaque
- CAC score is derived based on the number, area, and radiodensity of calcific lesions

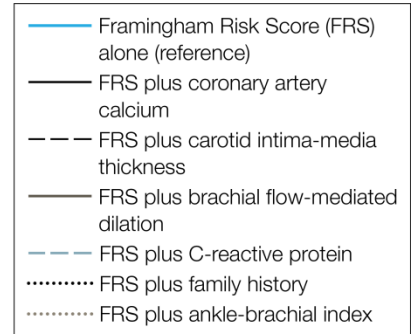
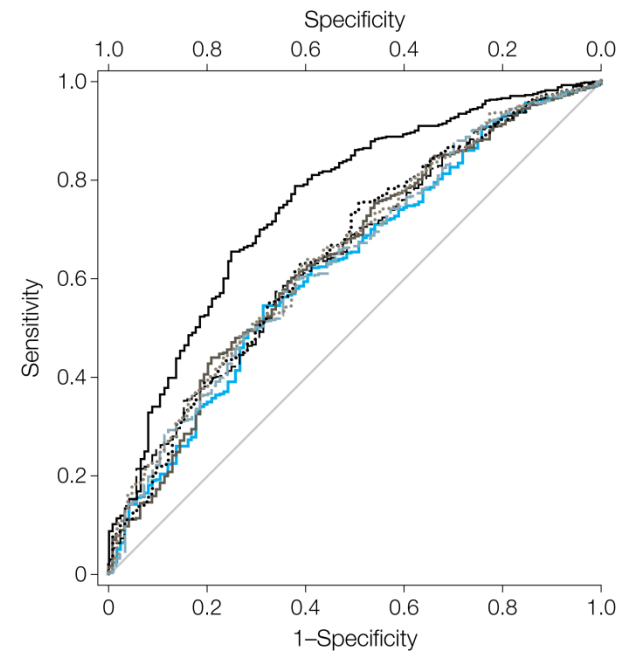
Rumberger et al. Circulation. 1995.

What is Coronary Calcium?

A Incident coronary heart disease



B Incident cardiovascular disease



Yeboah et al. JAMA. 2012.



[Back to MESA Tools](#)

Input your age, select your gender and race/ethnicity, input (optionally) your observed calcium score and click "Calculate".

Age (45-84):

Gender:

Race/Ethnicity:

Observed Agatston Calcium Score (optional):

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

Percentiles and Calcium Scores for: white male of age 51

25th	50th	75th	90th
0	0	29	132

MESA 10-Year CHD Risk with Coronary Artery Calcification

MESA 10-Year CHD Risk with Coronary Artery Calcification

1. Gender Male Female

2. Age (45-85 years) Years

3. Coronary Artery Calcification Agatston

4. Race/Ethnicity

5. Diabetes Yes No

6. Currently Smoke Yes No

7. Family History of Heart Attack (History in parents, siblings, or children) Yes No

8. Total Cholesterol mg/dL or mmol/L

9. HDL Cholesterol mg/dL or mmol/L

10. Systolic Blood Pressure mmHg or kPa

11. Lipid Lowering Medication Yes No

12. Hypertension Medication Yes No

[Calculate 10-year CHD risk](#)

1. Gender Male Female

2. Age (45-85 years) Years

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4. Race/Ethnicity

5. Diabetes Yes No

6. Currently Smoke Yes No

7. Family History of Heart Attack (History in parents, siblings, or children) Yes No

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9. HDL Cholesterol mg/dL or mmol/L

10. Systolic Blood Pressure mmHg or kPa

11. Lipid Lowering Medication Yes No

12. Hypertension Medication Yes No

[Calculate 10-year CHD risk](#)

Using the Coronary Artery Calcium Score		
10 Year risk of a CHD Event	Coronary Age	Difference from Chrono
3.3%	46	-5
Without Considering the Coronary Artery Calcium Score		
10 Year risk of a CHD Event	Coronary Age	Difference from Chrono
7.4%	64	+13

Using the Coronary Artery Calcium Score		
10 Year risk of a CHD Event	Coronary Age	Difference from Chronolog
11.2%	74	+23
Without Considering the Coronary Artery Calcium Score		
10 Year risk of a CHD Event	Coronary Age	Difference from Chronolog
7.4%	64	+13

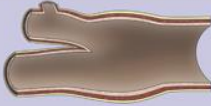

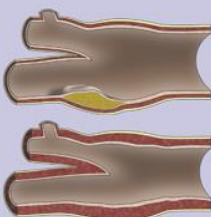
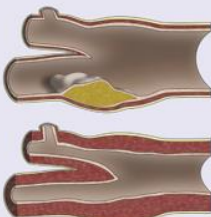
What is Coronary Calcium?

TABLE 4: Numbers of Subjects in Four Coronary Artery Calcification Agatston Score Ranks with Two CT Techniques by Observer 1

Regular-Dose ECG-Gated MDCT		Low-Dose Ungated MDCT				Total
		0	1–100	101–400	> 400	
0	'Zero'	257	5	0	0	262
1–100	'Mild'	5	122	5	0	132
101–400	'Moderate'	0	9	43	4	56
> 400	'Extensive'	0	0	5	28	33
Total		262	136	53	32	483

- Excellent correlation with non-gated chest CT
- Opportunity to identify patients who might benefit from aspirin

What about carotid ultrasound?

Grade	Plaque Type		Plaque Thickness
0		No plaque	IMT < 1.5 mm
I		Protuberant (Focal thickening of vessel wall)	< 1.5 mm
II		Protuberant or Diffuse (Vessel wall thickened throughout; CIMT \geq 1.5 mm)	1.5 – 2.4 mm
III		Protuberant or Diffuse (CIMT \geq 2.5 mm)	\geq 2.5 mm

- Good correlation between carotid and coronary plaque
- Smaller improvement in model performance
- AUC: \sim +0.02
- NRI: \sim 10-15%

Take home message

- Imaging of vascular bed to detect subclinical atherosclerosis
- Strongest data for coronary calcium
 - Coronary CTA reserved for *symptomatic* patients
- ‘Opportunistic’ look at atherosclerosis in non-CV dedicated imaging
- Ultrasound more accessible, less costly
 - Smaller incremental improvement to traditional CV risk factor models



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Thank you