

# Non-invasive detection of coronary inflammation by computed tomography analysis of pericoronary fat enhances cardiovascular risk prediction in 3912 individuals

## The CRISP-CT study



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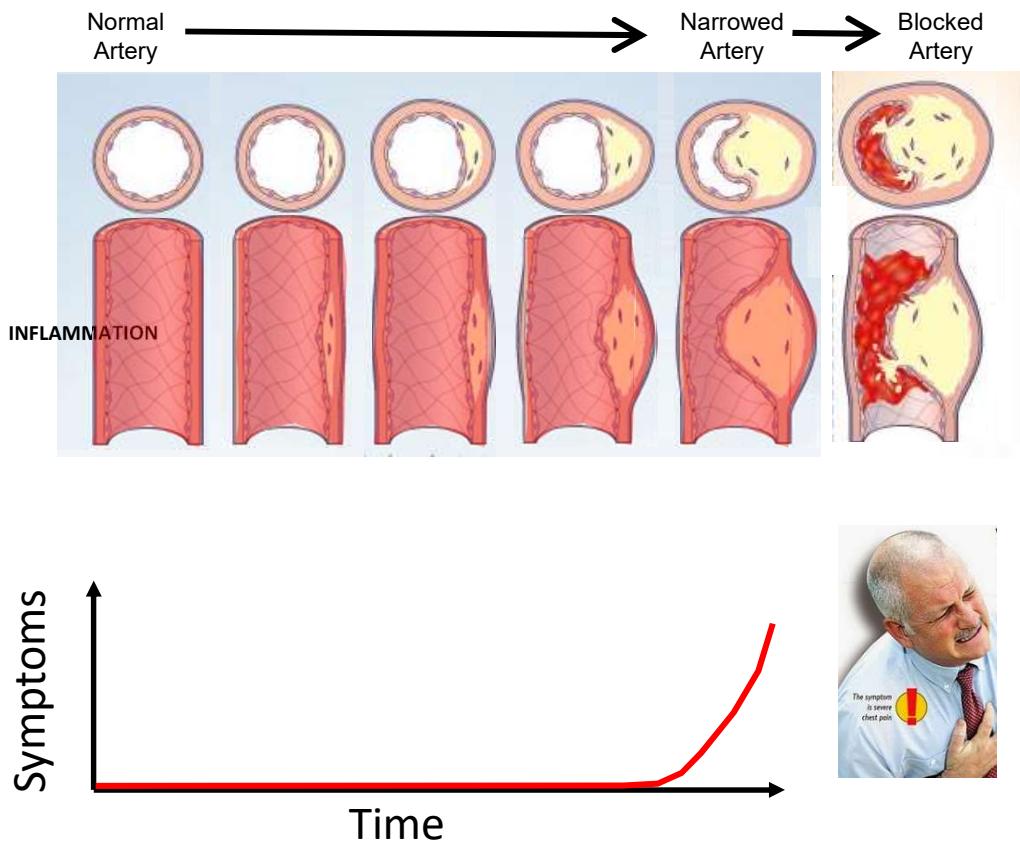
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<sup>5</sup>Oxford University Hospitals NHS Foundation Trust, Oxford, U.K.

<sup>6</sup>UCL Institute of Cardiovascular Science, London, UK.

## Residual cardiovascular risk: the unmet need

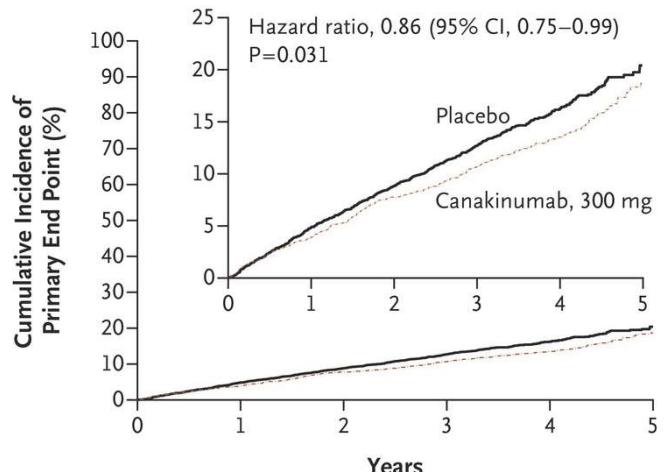


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### Antiinflammatory Therapy with Canakinumab for Atherosclerotic Disease

#### Primary End Point with Canakinumab, 300 mg, vs. Placebo

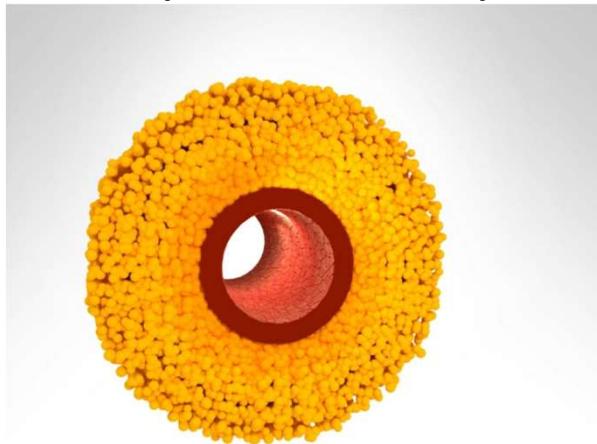


#### No. at Risk

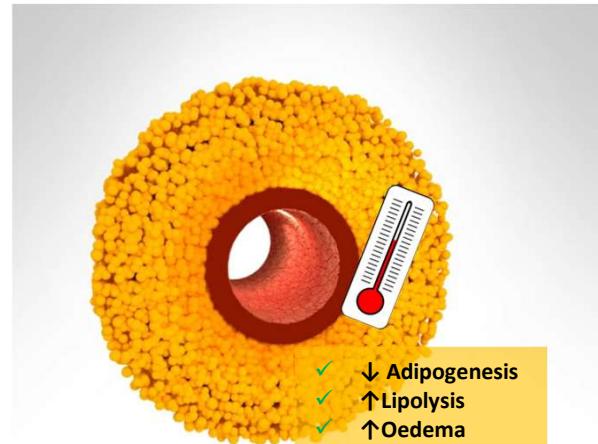
	Placebo	3344	3141	2973	2632	1266	210
	Canakinumab	2263	2149	2038	1819	938	199

## Perivascular Fat Attenuation Index (FAI): Technology detecting coronary inflammation on CCTA

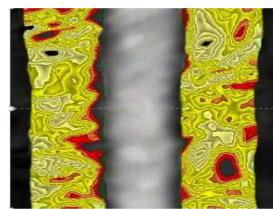
Healthy, non-inflamed artery



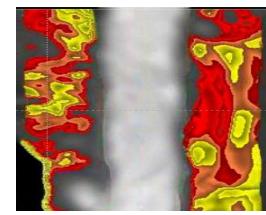
“Healthy,” inflamed artery



Low FAI



High FAI



# Can FAI predict cardiovascular risk?



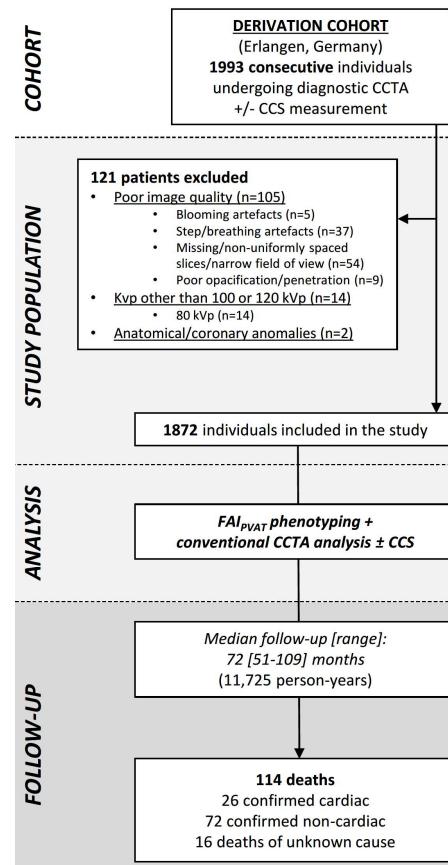
## The CRISP-CT study



S Achenbach

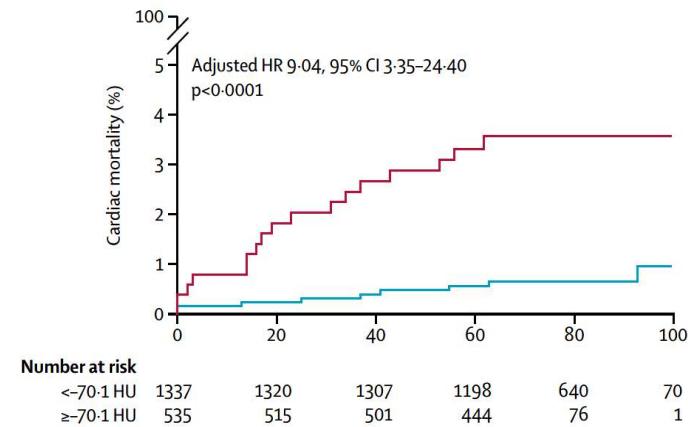
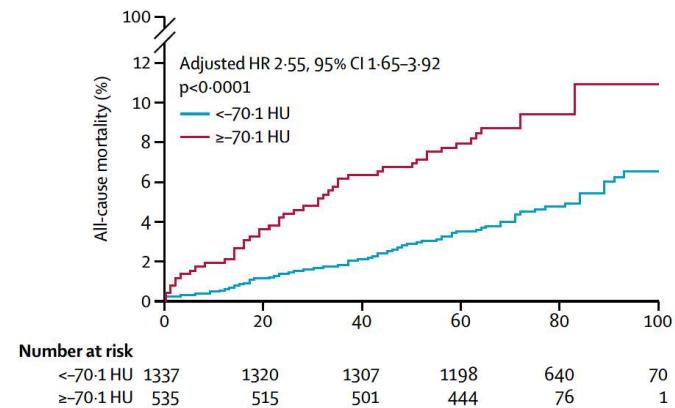
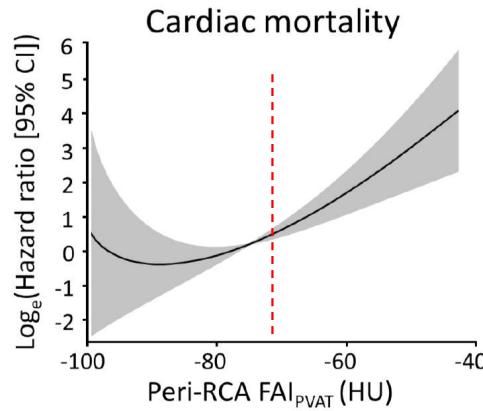
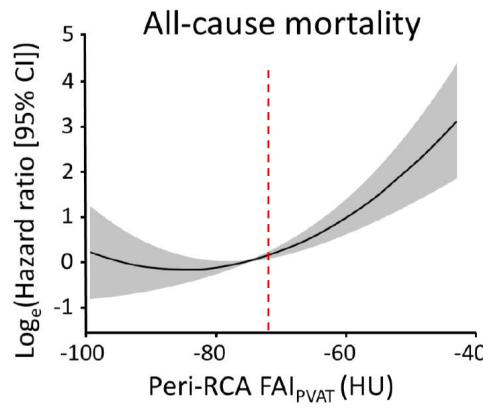


M Desai



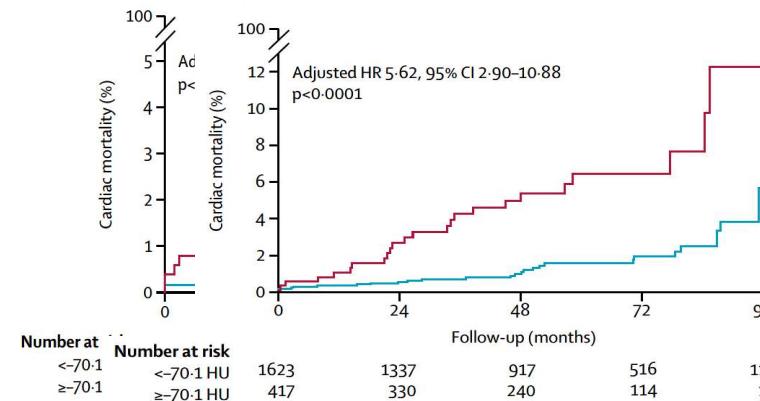
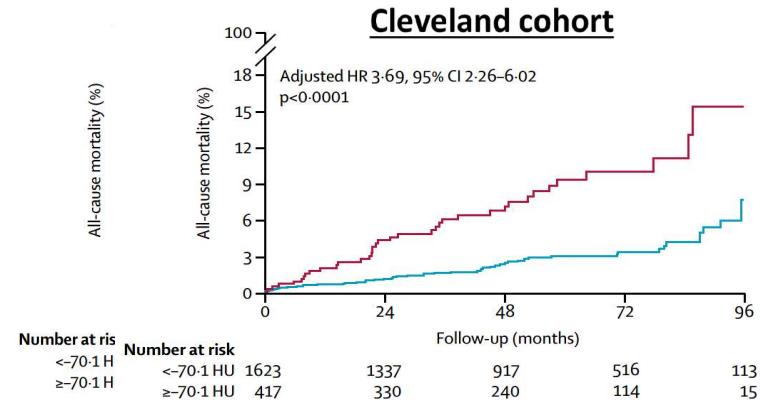
## FAI has prognostic value in predicting cardiac death

### Erlangen cohort

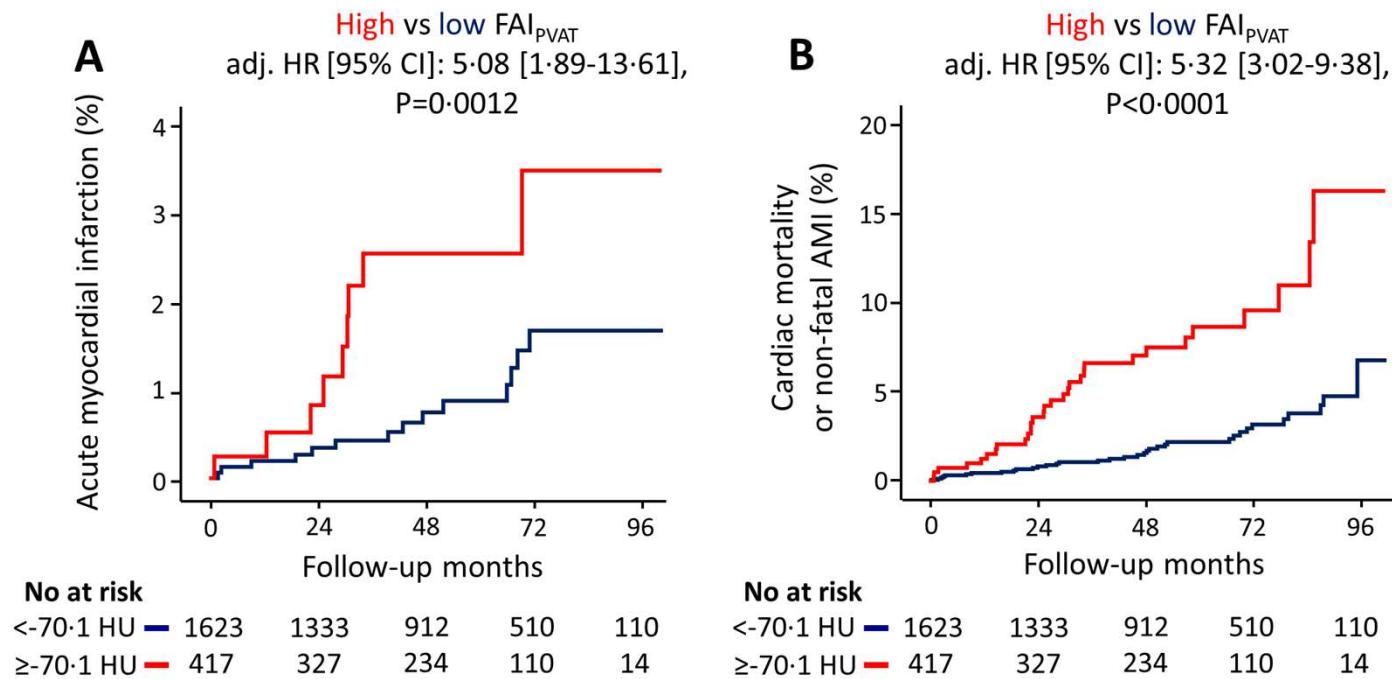


## FAI has prognostic value in predicting cardiac death

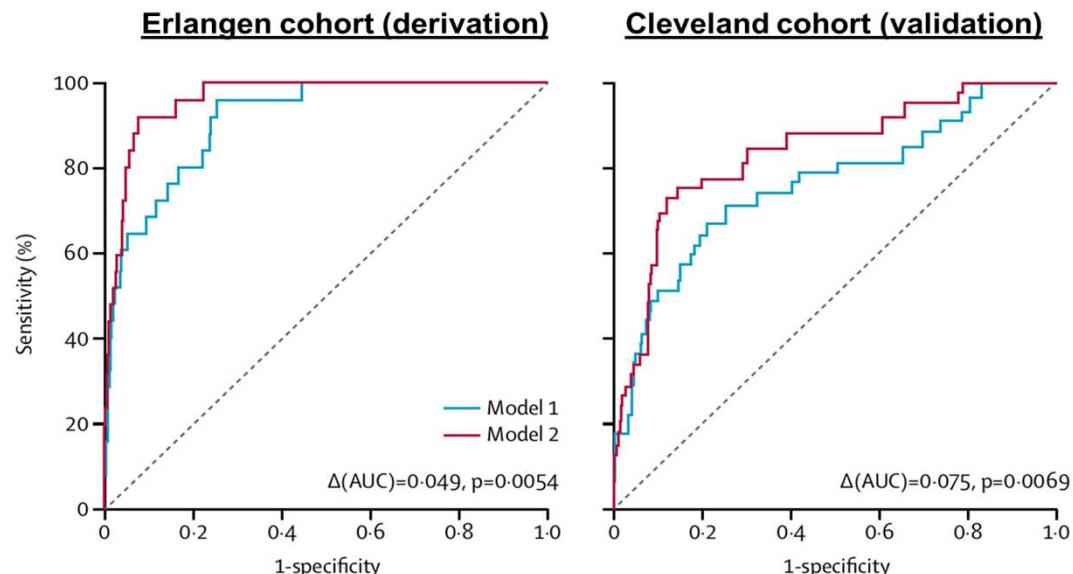
### Erlangen cohort



## FAI predicts non-fatal myocardial infarction



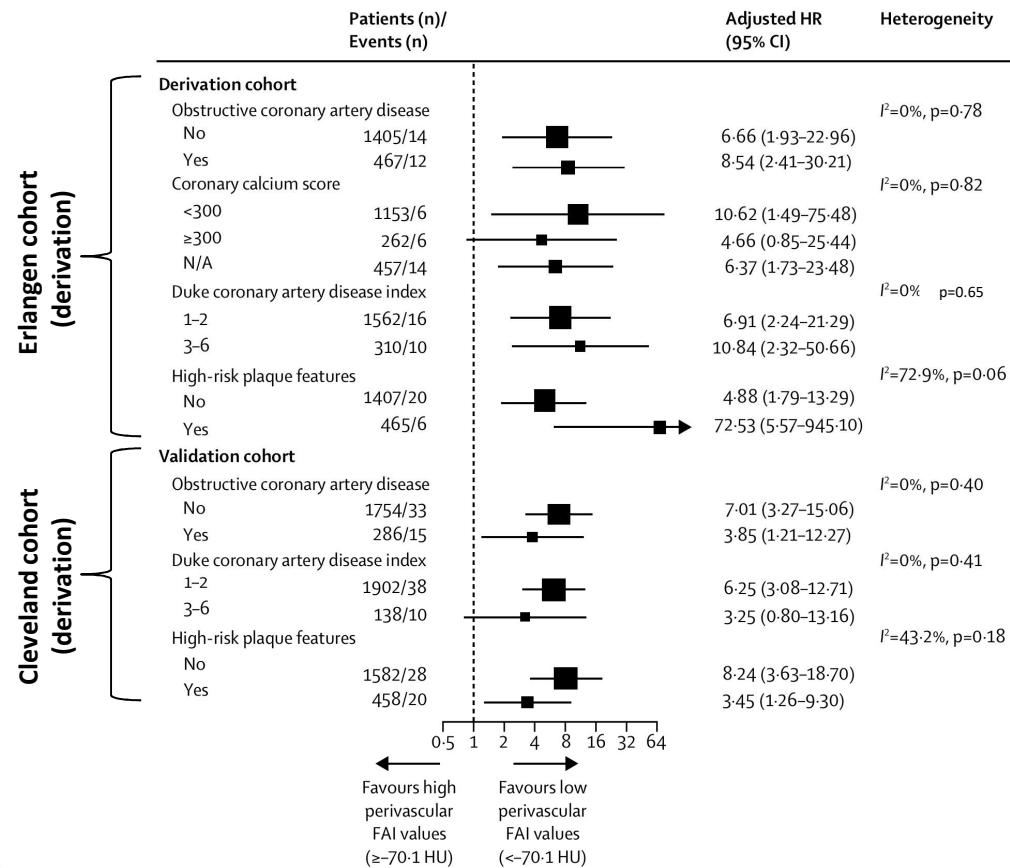
## FAI improves prediction of cardiac death over and above current state-of-the-art



- **Model 1:** age, sex, hypertension, hypercholesterolaemia, diabetes mellitus, smoker status, epicardial fat volume, modified Duke CAD index and number of high-risk plaque features on CCTA.
- **Model 2:** Model 1 + FAI

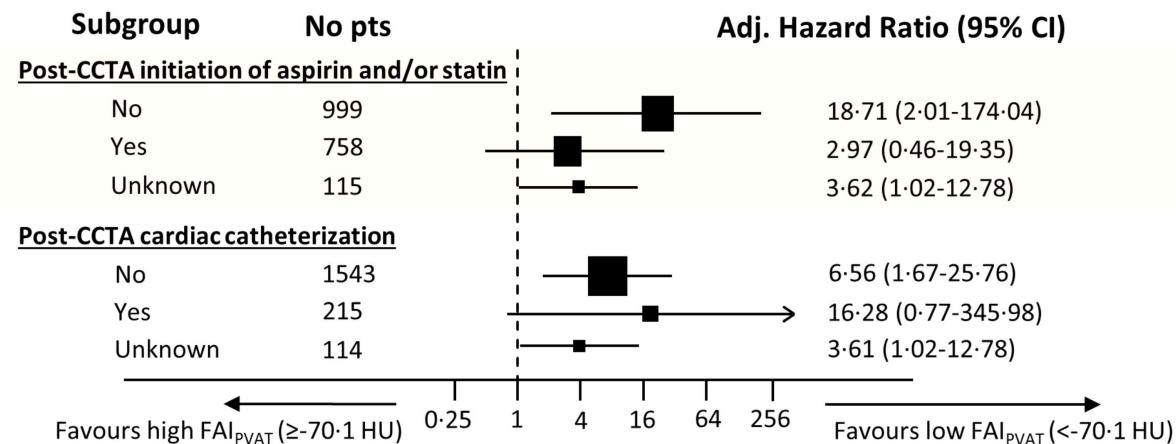
**Areas under the curve:**  
Derivation: 0.913 (95% CI 0.867–0.958) to 0.962 (0.940–0.983),  $P=0.0054$   
Validation: 0.763 (95% CI 0.669–0.858) to 0.838 (0.764–0.912),  $P=0.0069$

## FAI predicts cardiac mortality across all risk groups



## FAI may predict benefit from primary prevention in “low risk” individuals

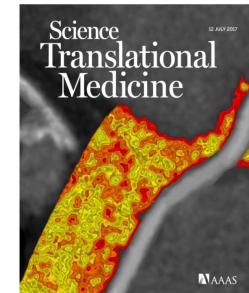
### Cardiac mortality prediction in Erlangen cohort, after treatment initiation



Risk for both groups together: Adjusted HR 9.04[3.35-24.4]

## FAI: A powerful, novel technology for CV risk stratification

- ✓ Biology/Science: FAI is a novel index of coronary inflammation based on perivascular fat phenotyping
- ✓ Clinical value: FAI has a striking prognostic value for cardiac death and non-fatal AMI, over and above current risk scores and state-of-the-art interpretation of CCTA (risk modifiable?)
- ✓ Potential to use in clinical practice: The FAI technology is applicable to any standard CCTA, from any scanner and with any scan settings (with appropriate weighting)
- ✓ Pitfalls: FAI needs appropriate corrections for obesity, scanner type, scan settings and other technical factors, so crude measurement of “perivascular attenuation” is of limited value in clinical practice. Consistent and validated image analysis tools will allow quality-assured delivery of FAI technology for patient benefit.



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Advanced Solutions for Cardiovascular Risk Prediction

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## Non-invasive detection of coronary inflammation using computed tomography and prediction of residual cardiovascular risk (the CRISP-CT study): a post-hoc analysis of prospective outcome data

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## FAI leads to significant risk reclassification

	Model performance		Discrimination (IDI [95% CI])	Risk reclassification						
	Change in $\chi^2$	p value*		Events		Non-events		NRI (95% CI)		
				Risk up	Risk down	Risk up	Risk down			
<b>Cardiac mortality</b>										
Derivation	20.29	<0.0001	0.038 (0.000-0.174)	0.64	0.36	0.17	0.83	0.94 (0.07-1.34)		
Validation	25.30	<0.0001	0.032 (0.001-0.090)	0.56	0.44	0.20	0.80	0.72 (0.34-1.07)		
<b>All-cause mortality</b>										
Derivation	16.54	<0.0001	0.017 (0.003-0.052)	0.48	0.52	0.19	0.81	0.58 (0.35-0.77)		
Validation	25.60	<0.0001	0.030 (0.008-0.068)	0.51	0.49	0.21	0.79	0.60 (0.30-0.86)		

Perivascular FAI comparison was  $\geq-70.1$  HU vs  $<-70.1$  HU. IDI and NRI were calculated at 6 years. Baseline model (current state-of-the-art or model 1): age, sex, hypertension, hypercholesterolaemia, diabetes mellitus, active smoker status, epicardial adipose tissue volume, modified Duke coronary artery disease index (reference: group 1, mild or no disease), and number of high-risk plaque features. New model (model 2): model 1 plus high perivascular FAI values. FAI=fat attenuation index. IDI=integrated discrimination improvement. NRI=net reclassification improvement index.

\*Likelihood ratio test.