

Predictive Values of the Ideal Cardiovascular Health and the Fuster-BEWAT Scores for Detecting Subclinical Atherosclerosis in Healthy Individuals

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Background

The Ideal Cardiovascular Health Score (ICHS) has been validated for predicting CV event risk. The Fuster-BEWAT Score (FBS) is simpler as it does not use laboratory parameters (cholesterol and fasting glucose). The predictive value of these scores to detect the extent of subclinical atherosclerosis (SA) in healthy individuals has not been validated or compared.

Methods

Population.

ICHS and FBS were calculated in 4047 healthy workers (45.8 years, 36.9% women) participating in the CNIC-PESA (Progression of Early Subclinical Atherosclerosis) study.

Predictive values of scores.

The 7 ICHS components (exercise, body mass index, diet, smoking status, blood pressure, serum cholesterol and fasting glucose) were classified according to the AHA definitions¹ as poor, intermediate or ideal. The 5 FBS components (blood pressure, exercise, weight, alimentation and tobacco) were classified as poor, intermediate or ideal based on previous description². Imaging studies included 2D vascular ultrasound of carotid arteries, infra-renal aorta and ilio-femoral arteries and coronary artery calcium (CAC) by computed tomography scan. Subclinical atherosclerosis (SA) in each vascular site was defined as the presence of any plaque or having CAC score ≥ 1 . The number of vascular sites affected was used for defining the multi-territorial extent of SA and classified as disease free (no vascular sites affected), focal (1 site), intermediate (2-3 sites) or generalized (4-6 sites).

Statistical Analysis.

Association and diagnostic accuracy of both scores were evaluated for presence of plaques, of calcium and SA extension. Regressions were adjusted for age, gender, family cardiovascular disease history and education.

CONCLUSIONS

The use of scores assessing CV health behaviors and risk factors is useful to predict the presence of subclinical atherosclerosis in healthy adults at low short-term CV risk. While the ICHS and the FBS show a similar predictive value for detecting subclinical disease, the FBS is simpler and does not need laboratory results. Therefore, it may be considered as a first option in settings where access to laboratory analysis is limited.

Results

Distribution of the Ideal Cardiovascular Health Score components in the PESA study

	Total sample (n=4047)	Men (n=2551)	Women (n=1496)	P value
Age, yr, mean (SD)	45.8 (4.3)	46.3 (4.4)	44.9 (3.9)	<0.001
Female, %	36.9			
ICH score metrics				
Blood pressure, %				
Poor (SBP ≥ 140 or DBP ≥ 90 mm Hg)	257 (6.4)	220 (8.6)	37 (2.5)	<0.001
Intermediate (SBP 120-139 or DBP 80-89 mm Hg or treated to goal)	1322 (32.4)	1100 (43.1)	212 (14.2)	
Ideal (<120/<80 mm Hg)	2478 (61.2)	1231 (48.3)	1247 (83.4)	
Physical activity, %				
Poor (No moderate and vigorous activity)	0 (0.0)	0 (0.0)	0 (0.0)	<0.001
Intermediate (1-74 min/wk vigorous, 1-149 min/wk moderate, or equivalent combination)	262 (6.5)	110 (4.3)	152 (10.1)	
Ideal (≥ 75 min/wk vigorous, ≥ 150 min/wk moderate, or equivalent combination)	3785 (93.5)	2441 (95.7)	1344 (89.9)	
Body Mass Index, %				
Poor (≥ 30 kg/m ²)	593 (14.7)	489 (19.2)	104 (7.0)	<0.001
Intermediate (25-30 kg/m ²)	1794 (44.3)	1416 (55.5)	378 (25.3)	
Ideal (<25 kg/m ²)	1660 (41.0)	646 (25.3)	1014 (67.7)	
Diet, %				
Poor (0-1 components)	624 (15.4)	429 (16.8)	195 (13.0)	<0.001
Intermediate (2-3 components)	2616 (64.6)	1718 (67.4)	898 (60.1)	
Ideal (4-5 components)	805 (19.8)	404 (15.8)	403 (26.9)	
Smoking %				
Poor (current)	1144 (28.3)	694 (27.2)	450 (30.1)	0.164
Intermediate (quit < 1 y)	135 (3.3)	87 (3.4)	48 (3.3)	
Ideal (never or quit > 1 y)	2768 (68.4)	1770 (69.4)	998 (66.6)	
Total cholesterol, %				
Poor (≥ 240 mg/dL)	471 (11.6)	341 (13.4)	130 (8.6)	<0.001
Intermediate (180-239 mg/dL)	1503 (37.2)	989 (38.8)	514 (34.4)	
Ideal (<200 mg/dL)	2073 (51.2)	1221 (47.8)	852 (57.0)	
Plasma glucose, %				
Poor (≥ 126 mg/dL)	53 (1.3)	47 (1.8)	6 (0.4)	<0.001
Intermediate (100-125 mg/dL or treated to goal)	494 (12.2)	439 (17.2)	55 (3.7)	
Ideal (<100 mg/dL)	3500 (86.5)	2065 (80.9)	1435 (95.9)	
Number ideal metrics; n, %				
0	0 (0.0)	0 (0.0)	0 (0.0)	<0.001
1	58 (1.4)	48 (1.9)	10 (0.7)	
2	276 (6.8)	237 (9.3)	39 (2.6)	
3	778 (19.2)	643 (25.2)	135 (9.0)	
4	1047 (25.9)	759 (29.8)	288 (19.3)	
5	1073 (26.5)	593 (23.2)	480 (32.1)	
6	667 (16.5)	238 (9.3)	429 (28.7)	
7	148 (3.7)	33 (1.3)	115 (7.7)	

Distribution of the Fuster BEWAT Score components in the PESA study

	Total sample (n=4047)	Men (n=2551)	Women (n=1496)	P value
Fuster-BEWAT score metrics				
Blood pressure, %				
0 (SBP ≥ 140 and/or DBP ≥ 90 mm Hg)	257 (6.4)	220 (8.6)	37 (2.5)	<0.001
1 (SBP 130-139 and/or DBP 85-89 mm Hg)	402 (9.9)	340 (13.3)	62 (4.1)	
2 (SBP 120-129 and/or DBP 80-84 mm Hg)	910 (22.5)	760 (29.8)	150 (10.0)	
3 (SBP <120 and DBP <80 mm Hg)	2478 (61.2)	1231 (48.3)	1247 (83.4)	
Exercise, %				
0 (<10 moderate to vigorous activity min/week)	0 (0.0)	0 (0.0)	0 (0.0)	<0.001
1 (<75 moderate to vigorous activity min/week)	10 (0.2)	4 (0.2)	6 (0.4)	
2 (75-149 moderate to vigorous activity min/week)	252 (6.2)	106 (4.2)	146 (9.8)	
3 (≥ 150 moderate to vigorous activity min/week)	3785 (93.5)	2441 (95.7)	1344 (89.8)	
Weight, %				
0 (≥ 30 kg/m ²)	593 (14.7)	489 (19.2)	104 (7.0)	<0.001
1 (25-30 kg/m ²)	1794 (44.3)	1416 (55.5)	378 (25.3)	
2 (NA)	-	-	-	
3 (<25 kg/m ²)	1660 (41.0)	646 (25.3)	1014 (67.7)	
Alimentation, %				
0 (<1 fruit/vegetables servings daily)	180 (4.4)	111 (4.4)	69 (4.6)	0.073
1 (1-2 fruit/vegetables servings daily)	1875 (46.3)	1145 (44.9)	730 (48.8)	
2 (3-4 fruit/vegetables servings daily)	953 (23.5)	613 (24.0)	340 (22.7)	
3 (>4 fruit/vegetables servings daily)	1039 (25.7)	682 (26.7)	357 (23.9)	
Tobacco, %				
0 (>1 pack of tobacco per day)	193 (4.8)	135 (5.3)	58 (3.9)	0.002
1 (<1 pack of tobacco per day)	951 (23.5)	559 (21.9)	392 (26.2)	
2 (NA)	-	-	-	
3 (Non smoker)	2903 (71.7)	1857 (72.8)	1046 (69.9)	
Number ideal metrics; n, %				
0	26 (0.6)	18 (0.7)	8 (0.5)	<0.001
1	304 (7.5)	250 (9.8)	54 (3.6)	
2	1141 (28.2)	891 (34.9)	250 (16.7)	
3	1338 (33.1)	867 (34.0)	471 (31.5)	
4	976 (24.1)	431 (16.9)	545 (36.4)	
5	262 (6.5)	94 (3.7)	168 (11.2)	

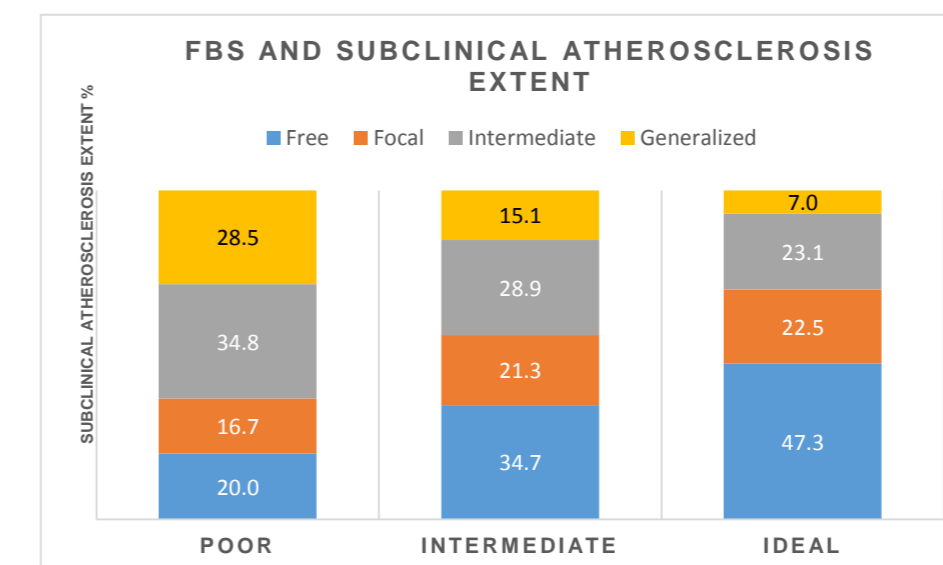
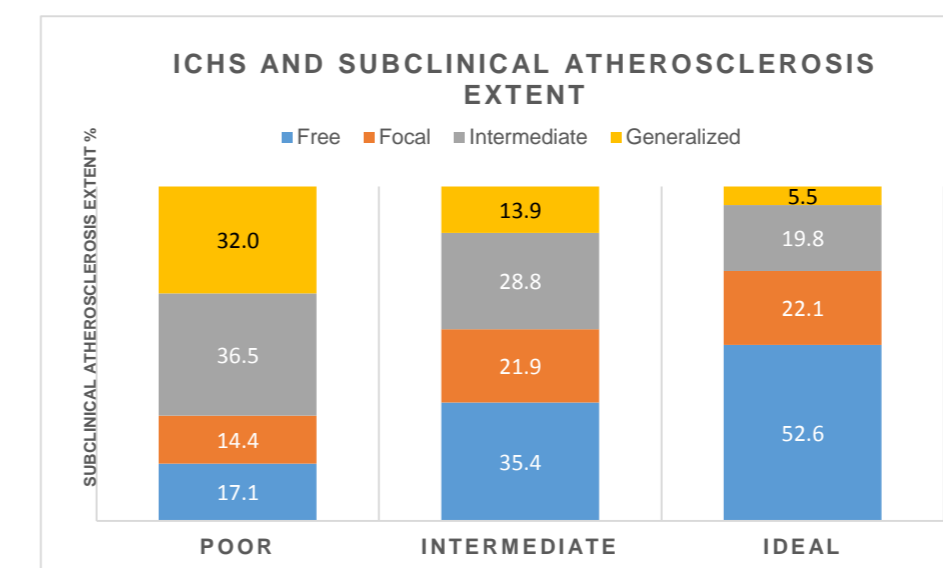
Association between ICHS and FBS and subclinical atherosclerosis measured as plaque presence and CACS ≥ 1

ICH score	Plaque presence*			
	N	OR	95% CI	p-value
Poor	334	ref		
Intermediate	2898	0.546	0.409, 0.729	<0.001
Ideal	815	0.394	0.285, 0.544	<0.001
C statistic (95% CI)		0.697 (0.681, 0.713)		
BEWAT score	Plaque presence*			
	N	OR	95% CI	p-value
Poor	269	ref		
Intermediate	2449	0.566	0.415, 0.772	<0.001
Ideal	1329	0.436	0.316, 0.603	<0.001
C statistic (95% CI)		0.694 (0.677, 0.710)		
ICH score	CAC ≥ 1			
	N	OR	95% CI	p-value
Poor	334	ref		
Intermediate	2898	0.655	0.504, 0.852	0.002
Ideal	815	0.555	0.385, 0.800	0.001
C statistic (95% CI)		0.780 (0.762, 0.797)		
BEWAT score	CAC ≥ 1			
	N	OR	95% CI	p-value
Poor	269	ref		
Intermediate	2449	0.715	0.530, 0.966	0.029
Ideal	1329	0.480	0.369, 0.734	<0.001
C statistic (95% CI)		0.780 (0.763, 0.798)		

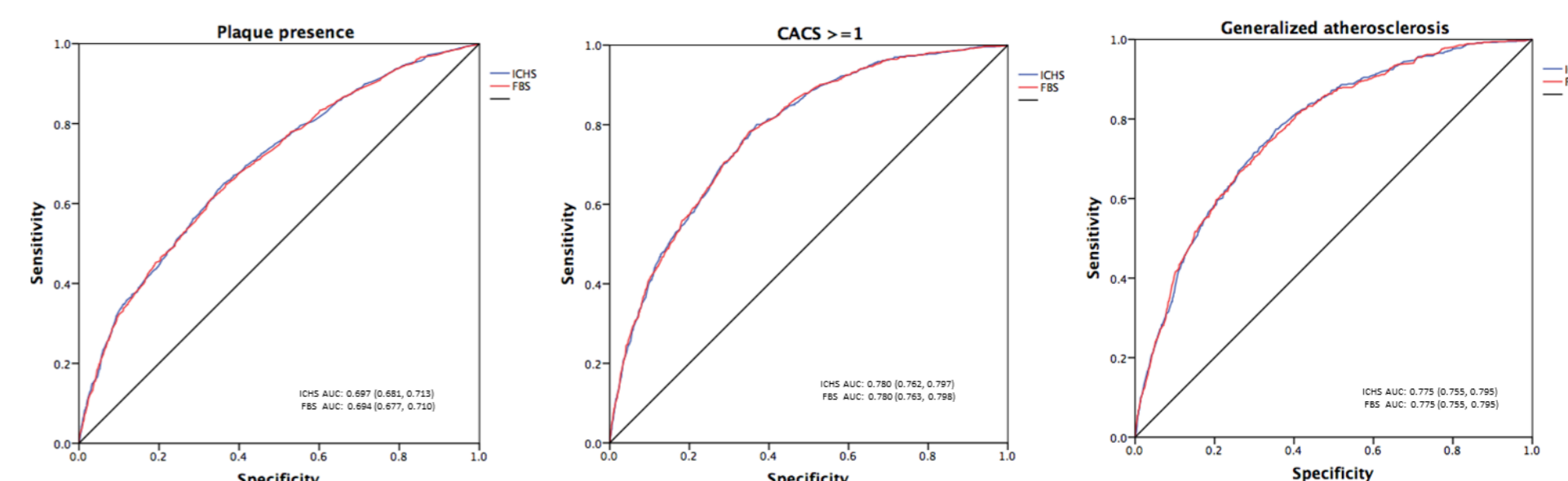
Prevalence of subclinical atherosclerosis by territories and extension

	Total (n=4047)	Men (n=2551)	Women (n=1496)	p-value
Presence of any plaque	2436 (60.2)	1727 (67.7)	709 (47.4)	<0.001
Carotid artery plaque	1266 (31.3)	919 (36.0)	347 (23.2)	<0.001
Iliofemoral artery plaque	1755 (43.4)	1328 (52.9)	427 (28.8)	<0.001
Infra-renal aorta plaque	980 (24.2)	650 (25.6)	330 (22.1)	<0.001
CACS				
mean	14.7 (85.3)	22.5 (106.3)	1.32 (10.4)	<0.001
0-1	3320 (82.0)	1894 (74.2)	1426 (95.3)	<0.001
1-100	586 (14.5)	521 (20.4)	65 (4.3)	
100-400	111 (2.7)	106 (4.2)	5 (0.3)	
≥ 400	30 (0.7)	30 (1.2)	0 (0.0)	
Multiterritorial extension				
None (0 sites)	1512 (37.4)	743 (29.1)	769 (51.4)	<0.001
Focal (1 site)	863 (21.3)	534 (20.9)	329 (22.0)	
Intermediate (2-3 sites)	1117 (27.6)	813 (31.9)	94 (6.3)	
Generalized (4-6 sites)	555 (13.7)	461 (18.1)	94 (6.3)	

ICHS and FBS distribution and multiterritorial extent of subclinical atherosclerosis



Discriminating accuracy for ICHS and FBS respect to plaque presence, CACS ≥ 1 and the presence of generalized atherosclerosis



1 Lloyd-Jones DM, Hong Y, Labarthe D, et al. Defining and setting national goals for cardiovascular health promotion and disease reduction: the American Heart Association's strategic Impact Goal through 2020 and beyond. *Circulation*. 2010;121(4):586-613.
2 Gomez-Pardo E, Fernandez-Alvira JM, Vilanova M, et al. A Comprehensive Lifestyle Peer Group-Based Intervention on Cardiovascular Risk Factors: The Randomized Controlled Fifty-Fifty Program. *J Am Coll Cardiol*. 2016;67(5):476-485.

Disclosures

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