

How to Identify Young People at Risk to Change their Lifestyle

Cómo identificar a los jóvenes con riesgo para cambiar su modo de vida

“Health is the state in which necessary functions are achieved imperceptibly or with pleasure.”

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INTRODUCTION

In regular clinical practice, we have experienced that most patients with cardiovascular events are, on average, in their mid-60s for men, and 8 more years for women (i.e. in their 70s), and that only 10% of all individuals are under 50 years of age. However, this late onset of symptoms hides the drama of structural damage in the arterial system that began many decades earlier, probably in youth.

As Sniderman and Furberg expressively put it, “The natural history of coronary disease can be likened to a three-act tragedy. The first act introduces and develops the main characters—namely, atherogenic dyslipoproteinaemia, hypertension, and smoking—that appear as we mature and unless something is done, persist during our lifetime. During the second act, which also takes place over decades, these villains incessantly attack and progressively deform the innocent arterial wall. Finally, the third act, which can be tragically brief: in an instant the plaque ruptures, the artery thromboses, and the hero or heroine dies, all too frequently unaware of the drama that was enacted within their arteries. What is the difference, you ask? In the drama of coronary disease, the ending is not fixed; if some of the characters are edited out of the play as soon as they appear, the third act need never take place.” (1)

However, damage in young patients cannot be detected since “Cardiovascular risk prediction in this population is particularly tricky because the atherosclerotic cardiovascular disease risk score, the main tool to determine statin eligibility, weighs age as the single most powerful predictor of risk. For the overall population, this is probably appropriate, but for younger patients the atherosclerotic cardiovascular disease (ASCVD) score likely underestimates it.” (2)

The drama why this poor tool **does not** predict patient risk is due -as we wrote in another letter- to the fact that: “A *risk factor* (which may or may not be causal) must be strongly associated with the disease to be seriously considered as a possible *screening test*.”

For example, the risk ratio (relative risk or odds ratio) between 20% of the population with the highest and lowest risk needs to be 50 times or greater.

There is practically no single risk factor with an odds ratio sufficiently high to qualify as cardiovascular disease predictor to be used as screening test; however, this real fact is not widely acknowledged.

The paradox that relevant causal risk factors are poor predictors of the disease they engender is because they are usually disseminated in our society, so that nearly everybody is exposed to its causes, though not everyone yields to the clinical effect of the exposure.

Since a risk factor with extremely high RR (or OR) is not found in clinical practice, multiple independent risk factors must be combined, as used in the Framingham risk score or other similar ones.” (3)

However, from those scores, only the age variable remains practically as a predictive variable. In the Women’s Health Study, age presents a C statistic discrimination (ROC curve) of 0.70, and the remaining risk factors, as systolic blood pressure, smoking, and LDL cholesterol levels, add little; they only bring the ROC curve to 0.77. (4)

The recent YOUNG-MI registry of patients who experienced a myocardial infarction at ≤50 years of age (5) reconfirms it. Median age was 45 years (17% were <30 years), 80% were men and the majority (83%) had at least one conventional risk factor. Despite these risk factors, the median 10-year atherosclerotic cardiovascular disease risk score of the cohort before myocardial infarction was surprisingly low, 4.8%, which meant that only 49% and 29% would have met the criteria for statin eligibility of the 2013 American College of Cardiology/American Heart Association guidelines and the 2016 U.S. Preventive Services Task Force recommendations, respectively.

For Mehta and Anand, it implies that “... the fact that most patients in the registry (83%) had at least one conventional risk factor (dyslipidemia, smoking, hypertension, or diabetes) prior to their myocardial infarction suggests that aggressive treatment of these risk factors is probably as important in young patients as in older patients.” (6)

Therefore, how do we solve this dilemma? We need to identify the patients at risk, but we do not have the tools.

THE IDEAL CARDIOVASCULAR HEALTH SCORE

In primary prevention, it may be necessary to reverse the focus and change the paradigm we have been using. Instead of detecting the likelihood of developing the disease with a score -a situation we now know is impossible-, we should focus on people’s lifestyle, even that of young people, with the national goal of improving cardiovascular health status. (7)

In 2010, the American Heart Association announced its Strategic Impact Goals, proposing a new paradigm to improve cardiovascular health by measuring the *ideal cardiovascular health* (ICVH) score.

The AHA stated 7 concepts: 4 health behaviors and 3 physiological risk factors to define cardiovascular health: smoking status, body mass index, dietary content, participation in physical activity, and levels of blood pressure, blood glucose, and total cholesterol. To encompass the entire spectrum of cardiovascular health (from optimal to uncontrolled levels), each metric has 3 clinically based strata defined as ideal

(2), intermediate (1), and poor (0). (Table 1) (8)

There are two meta-analyses on the association between ideal cardiovascular health (ICVH) metrics and risk of cardiovascular events or mortality; the first is less complete, (9) and the second is more updated. (10)

The latest meta-analysis by Guo L and Zhang reviewed 13 prospective cohorts (published between 2011 and 2017), with a total of 193,126 persons, a sample size ranging from 2,981 to 95,429 and follow-up duration from 4.0 to 18.7 years. Overall, the methodological quality of the included studies was generally high.

The highest vs. lowest category of ICVH metrics was compared. Classification was heterogeneous according to the 7 metrics (the highest had basically a score of 6-7, others had 5-7, and the lowest was between 0, 0-1 and 0-2).

All-cause mortality resulted in a substantial reduction of about 50%, RR 0.54 (95% CI 0.41-0.69).

Cardiovascular mortality reduction was greater, RR 0.30 (0.18-0.51).

AHA 7 ideal cardiovascular health metrics			Lloyd-Jones score
1. Current smoking	Ideal	Never smoked or quit >12 months	2
	Intermediate	Former smoker ≤12 months	1
2. Body Mass Index (BMI)	Poor	Current smoker	0
	Ideal	<25 kg / m ²	2
3. Physical Activity	Intermediate	25-29.9 kg / m ²	1
	Poor	>30 kg / m ²	0
	Ideal	Moderate ≥2.5 h/week or vigorous ≥1¼	2
4. Healthy diet	Intermediate	Moderate 1 to <2.5.h/week or vigorous 1 to <1¼	1
	Poor	None	0
	Ideal	4 to 5 components	2
5. Total cholesterol	Intermediate	2 to 3 components	1
	Poor	0 to 1 components	0
	Ideal	<200 mg/dL (no treatment)	2
6. Blood pressure	Intermediate	<200 mg/dL (treated) or 200-239 mg/dL	1
	Poor	≥240 mg/dL	0
	Ideal	<120/<80 mmHg. (no treatment)	2
7. Fasting glucose	Intermediate	<120/80 mmHg. (treated) or 120-139 or 80-89 mmHg	1
	Poor	≥140. or diastolic pressure ≥90 mmHg	0
	Ideal	<100 m/dL (no treatment)	2
	Intermediate	<100 mg/dL (treated) or 100 to 125 mg/dL	1
	Poor	≥126 mg/dL	0
APPENDIX			
The Healthy Diet Score (range 0 - 5)		assigning 1 point per each component	1
Fruits and vegetables		≥4.5 cups/day	1
Fish		≥2 100-gram servings/week	1
Whole grains rich in fiber		≥3 30-gram servings/day	1
Sodium		<1,500 mg/day	1
Sugar-sweetened beverages		≤1 liter/week	1

Table 1. AHA 7 ideal cardiovascular health metrics

Cardiovascular events reduction was even greater, RR 0.22 (0.11-0.42).

Stroke was reduced to one third, RR 0.33 (0.20-0.55).

The different forms of mortality presented certain heterogeneity (I^2 66%, $p=0.01$), but it is interesting that heterogeneity was due to baseline admission age for cardiovascular mortality. It was much lower in young people; in those <50 years the reduction was 80% (HR 0.2; 0.11-0.35), and in those >50 years the reduction was close to 50% (HR 0.53; 0.38-0.75), with no heterogeneity.

An inversely linear and gradual dose–response relationship was seen in all forms of mortality and ICVH metrics. Each per-unit increase in ICVH metrics was associated with 11% lower risk of all-cause mortality, and the decrease was even higher for CV mortality (19%).

The authors concluded: “Our findings suggest that ICVH, and even a 1-point increase in ICVH metrics, can result in substantial reductions in the risk of cardiovascular disease and mortality. In the light of current evidence, we highlight the need to improve the metrics of smoking, diet, physical activity, fasting plasma glucose levels, and blood pressure...”

Ongoing efforts need to improve current policies for enhancing CVH and focus on metrics that will achieve the highest benefits.” (10)

FUSTER-BEWAT SCORE

The AHA metrics implies that the patient has undergone a lab test to have cholesterol and fasting blood glucose measured. A simple risk score has recently been developed and validated, based on 5 similar AHA

metrics, but without the need to use the lab test for predicting cardiovascular risk.

The Fuster-BEWAT ([B] blood pressure, [E] exercise, [W] weight, [A] alimentation, and [T] tobacco) score (FBS) includes information on blood pressure, physical activity, body weight, diet (fruit and vegetable consumption), and smoking; it was validated comparatively with the complete AHA metrics, predicting similar subclinical atherosclerosis. (11)

Given that the Fuster-BEWAT risk score does not rely on lab test results, it can be used as a simple screening tool to identify younger patients that should be the focus for a more aggressive primary prevention. (Table 2)

This score was validated in the PESA prospective cohort study, including 4,184 asymptomatic employees of Banco Santander in Madrid (Spain), 40 to 54 years of age, and free of cardiovascular disease. Complete data for the actual analysis were available for 3,983 participants (95.2%). Mean age was 45.8 ± 4.3 years (62.8% men), and the 10-year Framingham risk score was low, 5.8 ± 4.3 .

Each component was then dichotomized as being ideal versus nonideal, and subjects were classified as having poor, intermediate, or ideal cardiovascular health based on the total number of ideal metrics (0 to 1 poor, 2 to 3 intermediate, 4 to 5 ideal).

Subclinical atherosclerosis was dichotomized as presence of plaque versus no plaque. Coronary artery calcification (CAC) was dichotomized as <1 and ≥ 1 Agatston units. The overall prevalence of a favorable ICVH (at least 6 ideal metrics) or favorable FBS (at least 4 ideal metrics) was 17.8% and 31.0%, respectively

Table 2. Fuster-BEWAT Score measurement

Tobacco	>1 pack/day	0
	<1 pack/day	1
	Non-smoker	3
Weight (BMI)	>30 kg / m ²	0
	25-29.9 kg / m ²	1
	<25 kg / m ²	3
Exercising	<10 min/week moderate to vigorous activity	0
	<75 min/week moderate to vigorous activity	1
	>75-149 min/week moderate to vigorous activity	2
	>75-149 min/week moderate to vigorous activity	3
Alimentation	<1 fruit/vegetable servings daily	0
	1-2 fruit/vegetable servings daily	1
	3-4 fruit/vegetable servings daily	2
	>4 fruit/vegetable servings daily	3
Blood pressure	≥ 140 and/or ≥ 90 mmHg	0
	≥ 130 -139 and/or 85-89 mmHg	1
	≥ 120 -129 and/or 80-84 mmHg	2
	<120 and <80 mmHg	3

Overall, there is a strong inverse association between ICVH and FBS and subclinical atherosclerosis compared with participants categorized as having poor ICVH (0 to 2 ideal factors) or poor FBS (0 to 1 ideal factors) metrics.

Both scores (ICVH and FBS) showed good and comparable predictive values for all outcomes measured in the PESA cohort, including presence of atherosclerotic plaque or presence and amount calcium in the coronary arteries and number or extension of affected arterial sites. (Table 3).

Therefore, better profiles of cardiovascular health conducts and risk factors, reflected by higher ICVH and FBS metrics, are strongly associated with lower prevalence and lower extent of subclinical atherosclerosis in healthy individuals.

Fernández-Alvira et al. state that: “Because the FBS does not require laboratory analyses to be derived and given the comparable predictive value of both scores, the FBS may be considered a practical and affordable option with which to foster primary CV prevention in settings where easy laboratory data are not available.”

DO YOUNG PEOPLE BENEFIT FROM BETTER CARDIOVASCULAR HEALTH?

In the already classic cross-sectional “INTERHEART” study, carried out in several geographical regions, the population attributable risk (PAR) of the 9 modifiable risk factors (which included the 7 ICVH factors and the 5 Fuster-BEWAT factors) was 90% in adult men, but was greater in younger men (<50 years) with PAR 93%, and in women with PAR 96.5%, strongly suggesting that when a preventable traditional behavior or risk factor is present in people under 50 years of age, its impact is even greater. (12)

In the Coronary Artery Risk Development in Young Adults (CARDIA) prospective cohort study (n=3,538 individuals from 4 cities of USA) aged between 18 to 30 years at inclusion, the change in 5 healthy lifestyle factors (not overweight or obese, low alcohol intake, healthy diet, physically activity and no smoking) was associated with lower subclinical atherosclerosis after 20 years of follow-up. (13)

In the Framingham Offspring study, with relatively low mean age, 58 years, and 55% women (2,680 participants), an ICVH score was associated with better known risk biomarkers and subclinical disease reduction (≥1 of the following: increased carotid intima-media thickness or stenosis, left ventricular hypertrophy, left ventricular systolic dysfunction, microalbuminuria, and decreased ankle-brachial index) with odds ratio of 0.74 per 1-unit increase in the CVH score. Finally, CVD incidence was inversely related to the CVH score, with risk reduction (adjusted by age and sex) and 23% HR per 1-unit increase in the CVH score. (14)

Even more interesting, adherence to a favorable lifestyle, as compared to an unfavorable lifestyle, was associated with 45% lower relative risk among participants at low genetic risk, 47% lower relative risk among those at intermediate genetic risk, and also 46% lower relative risk among those at high genetic risk. In other words, despite an unfavorable genetic profile, maintaining a favorable cardiovascular health measurement almost halves the risk of cardiovascular events. (15)

Finally, we should bear in mind that, as shown in the Guo and Zhang meta-analysis involving 193,126 people, the heterogeneity of the meta-analysis disappears when considering baseline age, because the effect of the improvement depended on the admission age. Cardiovascular mortality reduction was significant and substantially higher in those <50 years, with better cardiovascular health index and an unexpected risk reduction of 80% (HR 0.2; 0.11-0.35), compared with those >50 years with about 50% reduction (HR 0.53; 0.38-0.75), and no heterogeneity of the meta-analysis. (10)

DISCUSSION

We are now aware that, given the current lifestyle conditions of our society, the drama of structural damage to the arterial system begins in youth. However, we cannot predict it with the current cardiovascular risk scores used, because this tool, recommended to choose which patients should be treated, rates a much lower true risk, since as their predominant predictor is age, it is totally inadequate for young populations.

Fortunately, by shifting the paradigm, instead of looking for the possible final event of the disease, we

Plaque yes / no	OR	(95% CI)	ROC curve	(95% CI)
Ideal CVH	0.41	(0.31-0.55)	0.694	(0.678-0.711)
Ideal FBS	0.49	(0.36-0.66)	0.692	(0.676-0.709)
CAC ≥ 1				
Ideal CVH	0.41	(0.28-0.60)	0.782	(0.765-0.800)
Ideal FBS	0.53	(0.38-0.74)	0.780	(0.762-0.798)
Extension				
Ideal CVH	0.32	(0.26-0.41)	0.779	(0.759-0.795)
Ideal FBS	0.39	(0.31-0.50)	0.773	(0.752-0.795)
CAC levels				
Ideal CVH	0.40	(0.26-0.58)	0.881	(0.836-0.925)
Ideal FBS	0.52	(0.38-0.72)	0.861	(0.816-0.907)

Table 3

can now focus on the parameters that indicate that cardiovascular health will be maintained throughout life, with the simple AHA *ideal cardiovascular health score*, or the even simpler *Fuster-BEWAT* score.

The AHA *ideal cardiovascular health score* has only 7 items (4 health behaviors and 3 physiological risk factors), and the *Fuster-BEWAT* score does not require any lab measurement and only uses 5 metrics.

Meta-analyses with a great number of patients indicate that, in this simple and practical classification, the more the ideal metrics, the better and noticeable the chances of reduced mortality, cardiovascular mortality, cardiovascular events and stroke risk will be. And those criteria are even more valid in younger populations. We have thus a safe method for cardiovascular health classification, and we also know which parameters must be taken into account in order to bring them as close as possible to the “ideal” state or, else, treat patients with the wide variety of preventive drugs (statins, antihypertensive and antiplatelet agents) available for each situation.

The *Fuster-BEWAT* score has been validated against the better studied *ideal cardiovascular health score* and the same diagnostic confidence is found to predict the presence and extent of subclinical atherosclerotic disease.

The time has come to translate words into actions. It is necessary to change our health care system so that all physicians, and mainly primary care physicians, apply true primary prevention by promoting essential vital improvements in cardiovascular health. But we also need the support of well-trained “community health workers” to reach out everyone in their homes to start and sustain lifestyle changes, bring the medication, and monitor treatment effect and adherence.

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