SUPPLEMENTARY DATA

Table 1 of the supplementary data

Comparison of the Healthy Heart Score components between participants in the development cohorts (HPFS, NHS), CARDIA, JHS, and the validation (ENRICA) cohort[a]

	Men					Women				
		ENRICA					ENRICA			
	HPFS	Overall cohort	Participants without prior chronic diseases	CARDIA	JHS	NHS	Overall cohort	Healthy cohort	CARDIA	JHS
Age, y	52 ± 9	47 ± 16	45 ± 16	25 ± 4	52 ± 12	52 ± 7	48 ± 17	46 ± 16	25 ± 4	53 ± 13
Smoking, %										
Never	49	39	40	57	62	44	56	54	57	78
Past	42	32	30	13	21	35	19	20	14	13
Current	9	29	30	30	17	21	25	26	29	9
Body mass index, kg/m^2	25 ± 3	27 ± 4	27 ± 4	24 ± 4	29 ± 6	25 ± 4	26 ± 5	26 ± 5	25 ± 6	32 ± 7
Waist circumference, cm										
Physical activity, h/wk	2 ± 2	4 ± 4	4 ± 4	3 ± 2	1 ± 2	2 ± 2	2 ± 2	2 ± 2	2 ± 2	1 ± 2
Alcohol, g/d	11 ± 14	14 ± 19	13 ± 19	13 ± 17	8 ± 18	6 ± 10	4 ± 10	4 ± 10	5 ± 10	2 ± 7
Dietary components, serving/d										
Fruit and vegetables	5 ± 3	3 ± 2	3 ± 2	3 ± 2	7 ± 4	6 ± 3	3 ± 2	3 ± 2	4 ± 3	7 ± 5
Sugar-sweetened beverages	0 ± 1	1 ± 1	1 ± 1	2 ± 2	2 ± 2	0 ± 1	1 ± 1	1 ± 1	1 ± 2	2 ± 2

Red and processed meats	1 ± 1	2 ± 1	2 ± 1	3 ± 2	3 ± 2	1 ± 1	1 ± 1	1 ± 1	3 ± 2	2 ± 2
Cereal fiber, g/d	6 ± 3	9 ± 4	9 ± 4	3 ± 3	2 ± 3	4 ± 2	8 ± 4	8 ± 4	3 ± 3	2 ± 3
Nuts	1 ± 1	0 ± 1	0 ± 1	1 ± 1	0.5 ± 1	0.3 ± 1	0.2 ± 1	0.2 ± 1	0.5 ± 1	0.4 ± 1
Diet score	1 ± 2	0 ± 2	0 ± 2	−4 ± 4	−4 ± 4	4 ± 2	1.5 ± 3	1.5 ± 3	−3 ± 5	−2 ± 5
Healthy Heart Score[b]	7	7 ± 1	7 ± 1	5 ± 1	8 ± 1	7	7 ± 2	6 ± 2	4 ± 1	7 ± 1

CARDIA, Coronary Artery Risk Development in Young Adults; ENRICA, Study on Nutrition and Cardiovascular Risk in Spain; HPFS, Health Professionals Follow-up Study; JHS, Jackson Heart Study; NHS, Nurses' Health Study.

[a]Unless otherwise indicated, data are expressed as mean ± standard deviation.

[b]Standard deviations for mean Healthy Heart Score values were not available in the original publication by Chiuve et al.[1]

Table 2 of the supplementary data

Performance of the HHS in all-cause mortality prediction at mean follow-up (12 years) in the ENRICA cohort

	Men	Women
	Total (n = 5649)	Total (n = 6292)
Overall cohort		
All-cause mortality	525 (9.29)	413 (6.56)
HHS association, HR	3.9 (3.1, 4.9)	3.2 (2.7, 3.9)
Calibration		
Slope (95%CI)	1.4 (1.3, 1.5)	1.05 (0.97, 1.13)
Discrimination		
Harrel c-statistic	0.88 (0.86, 0.89)	0.88 (0.86, 0.89)
Gonen & Heller smoothed c-statistic	0.84 (0.83, 0.85)	0.83 (0.82, 0.84)
Participants without prior chronic diseases	Total (n = 4794)	Total (n = 5434)
All-cause mortality	304 (6.34)	260 (4.78)
HHS association, HR	4.0 (3.5, 4.5)	3.0 (2.7, 3.3)
Calibration		
Slope	1.4 (1.3, 1.5)	1.1 (1.0, 1.2)
Discrimination		
Harrel c-statistic	0.88 (0.86, 0.89)	0.89 (0.87, 0.91)
Gonen & Heller smoothed c-statistic	0.84 (0.82, 0.85)	0.83 (0.82, 0.84)

95%CI, 95% confidence interval; HHS, Healthy Hearth Score; HR, hazard ratio.

The data are expressed as No. (%) or c-statistic (95%CI)

Figure 1 of the supplementary data

Formula to estimate the 20-year Risk of CVD based on lifestyle predictors in women (Nurses' Health Study) and men (Health Professionals Follow-up)

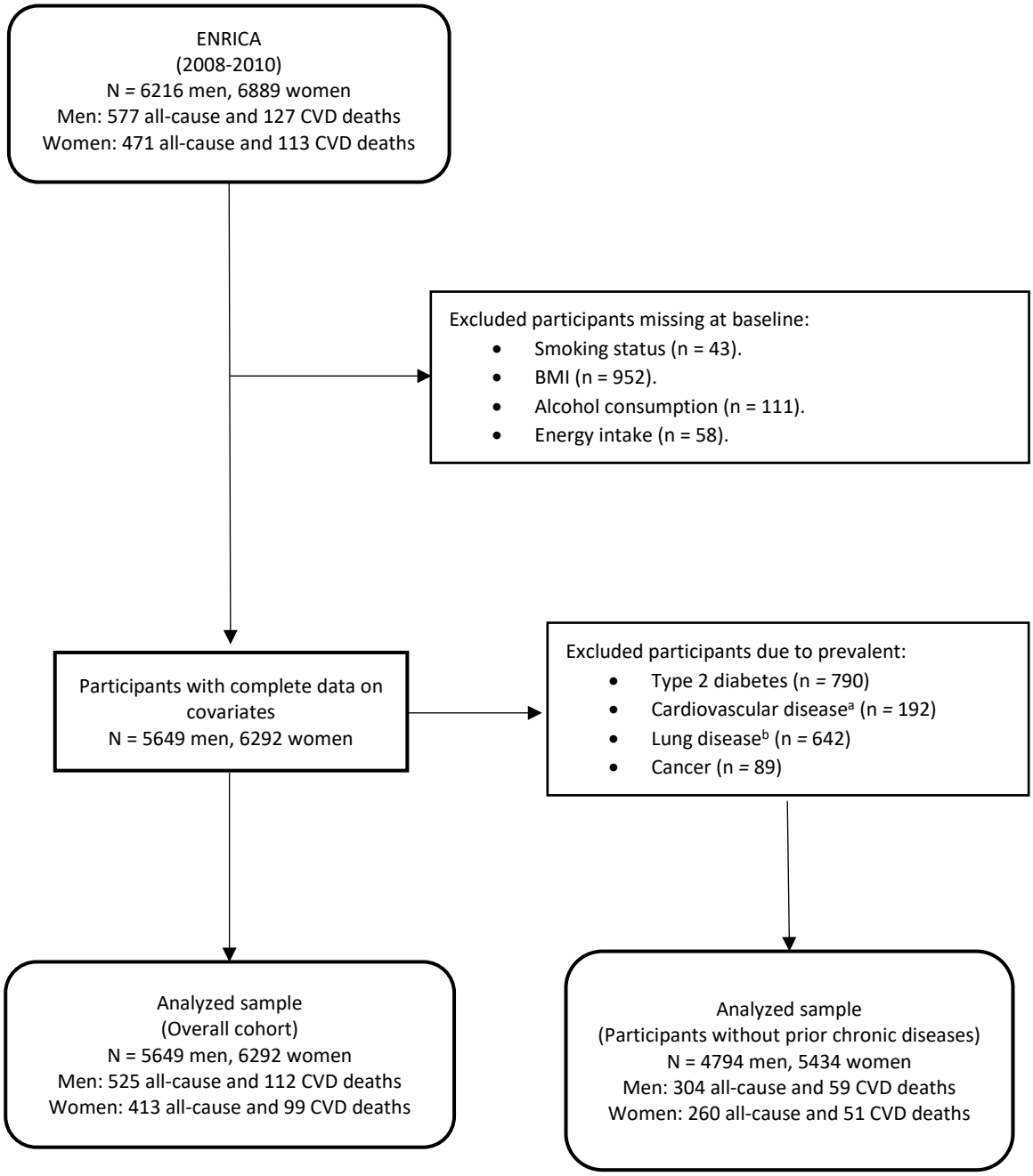
WOMEN
20-year CVD risk (%) "Healthy Heart Score" = $[1 - 0.9660^{(\exp [W - 6.57301)}] \times 100\%$ where W = 0.10820 × age + 0.15285 (if **past smoker**) + 0.90138 (if **current smoker**) + 0.04676 × **BMI** – 0.01923 × **g/d of alcohol** + 0.0004 × (g/d of alcohol)^2 – 0.02951 × **h/wk of physical activity** - 0.05113 × **diet score**[*] [*]Diet score = (0.03326 × g/d of cereal fiber + 0.18283 [if fruits + vegetables ≥ 3 servings/d] + 0.14522 [if nuts 0.1-1 servings/d] + 0.2444 [if nuts > 1 servings/d] - 0.14631 × servings/d of sugar-sweetened beverages – 0.15624 × servings/d of red and processed meats) × 10
MEN
20-year CVD risk (%) "Healthy Heart Score" = $[1 - 0.96368^{(\exp [W - 7.2437)}] \times 100\%$ where W = 0.13580 × age – 0.0005 × (age)^2 + 0.06979 (if **past smoker**) + 0.42305 (if **current smoker**) + 0.07424 × **BMI** – 0.00898 × **g/d of alcohol** + 0.0001 × (grams/d of alcohol)^2 – 0.01755 × **h/wk of physical activity** - 0.06691 × **diet score**[*]

*Diet score = (0.01816 × g/d of cereal fiber + 0.08819 [if fruits + vegetables ≥ 3 servings/d] + 0.00535 [if nuts 0.1-1 servings/d] + 0.14285 [if nuts > 1 servings/d] - 0.14734 × servings/d of sugar-sweetened beverages – 0.07112 × servings/d of red and processed meats) × 10

BMI, body mass index; CVD, cardiovascular disease.

Figure 2 of the supplementary data

Flow diagram of included participants from the ENRICA study.



BMI, body mass index; CVD, cardiovascular disease.

[a]Myocardial infarction, heart failure, or stroke.

[b]Asthma, chronic obstructive pulmonary disease.

Figure 3 of the supplementary data

Formula to estimate the 12-year risk of CVD death based on lifestyle predictors in women and men from the ENRICA cohort (adjusting only the baseline survival).

WOMEN
12-year CVD risk (%) "Healthy Heart Score-CVDm" = [1 − 0.9999937 $^{(\exp(W))}$] × 100% where W= 0.10820 × age + 0.15285 (if **past smoker**) + 0.90138 (if **current smoker**) + 0.04676 × **BMI** – 0.01923 × **g/d of alcohol** + 0.0004 × (grams/d of alcohol)^2 – 0.02951 × **hs/wk of physical activity** - 0.05113 × **diet score*** *Diet score = (0.03326 × g/d of cereal fiber + 0.18283 [if fruits + vegetables ≥3 servings/d] + 0.14522 [if nuts 0.1-1 servings/d] + 0.2444 [if nuts >1 servings/d] - 0.14631 × servings/d of sugar-sweetened beverages – 0.15624 × servings/d of red and processed meats) × 10
MEN
12-year CVD risk (%) "Healthy Heart Score-CVDm" = [1 − 0.9999935 $^{(\exp(W))}$] × 100% where W = 0.13580 × age- 0.0005 × (age)^2 + 0.06979 (if **past smoker**) + 0.42305 (if **current smoker**) + 0.07424 × **BMI** – 0.00898 × **g/d of alcohol** + 0.0001 × (g/d of alcohol)^2 – 0.01755 × **h/wk of physical activity** - 0.06691 × **diet score***

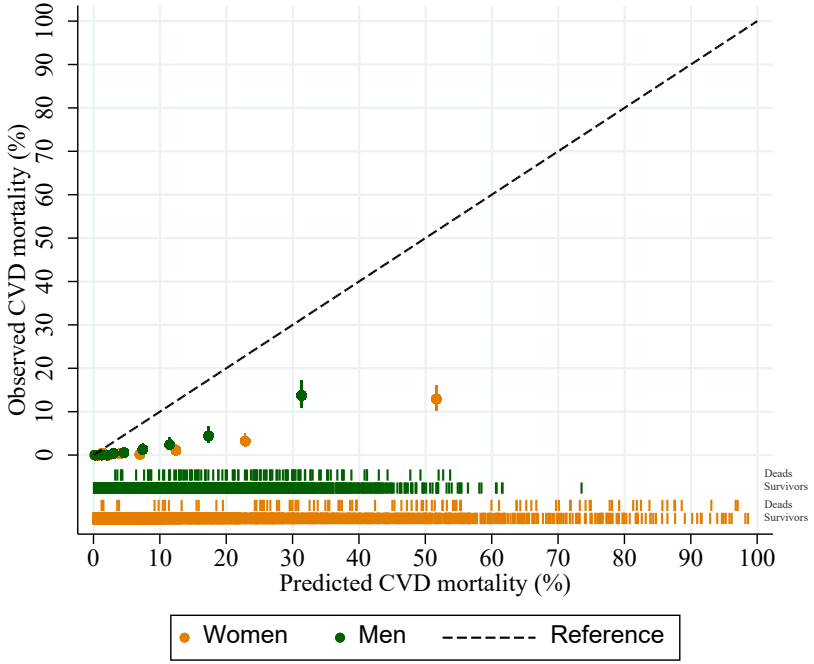
*Diet score = (0.01816× g/d of cereal fiber + 0.08819 [if fruits + vegetables ≥ 3 servings/d] + 0.00535 [if nuts 0.1-1 servings/d] + 0.14285 [if nuts > 1 servings/d] - 0.14734 × servings/d of sugar-sweetened beverages – 0.07112 × servings/d of red and processed meats) × 10

BMI, body mass index; CVD, cardiovascular disease; CVDm, cardiovascular disease model.

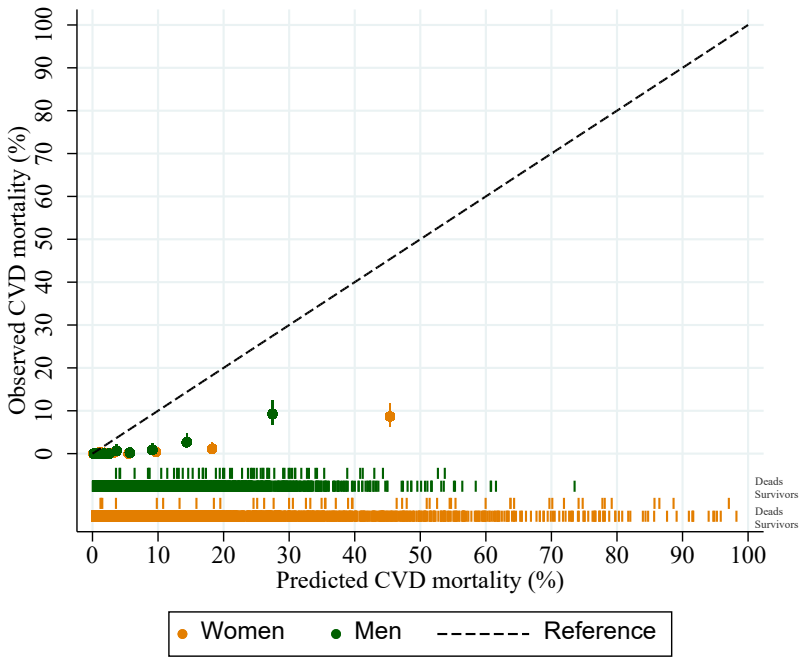
Figure 4 of the supplementary data

Calibration plots (95%CI) of the HHS for the prediction of CVD mortality at mean follow-up (12 years) among the overall ENRICA cohort and in participants without prior chronic diseases[a] using the same baseline survival as in the original cohort for CVD risk at 20 years (ie, assuming all events occurred in the first 12 years of follow-up).

Overall cohort [b]



Participants without prior chronic diseases [c]



95%CI, 95% confidence interval; HHS, Healthy Hearth Score; CVDm, cardiovascular disease model; CVD, cardiovascular disease.

[a]Participants free of type 2 diabetes, cardiovascular disease (myocardial infarction, heart failure, stroke), lung disease (asthma, chronic obstructive pulmonary disease), and cancer at baseline.

[b]n = 211/N = 11941 (men 112/5649, women 99/6292).

[c]n = 110/N = 10228 (men 59/4794, women 51/5434). Baseline survival function for men, 0.96368; baseline survival function for women 0.9660.

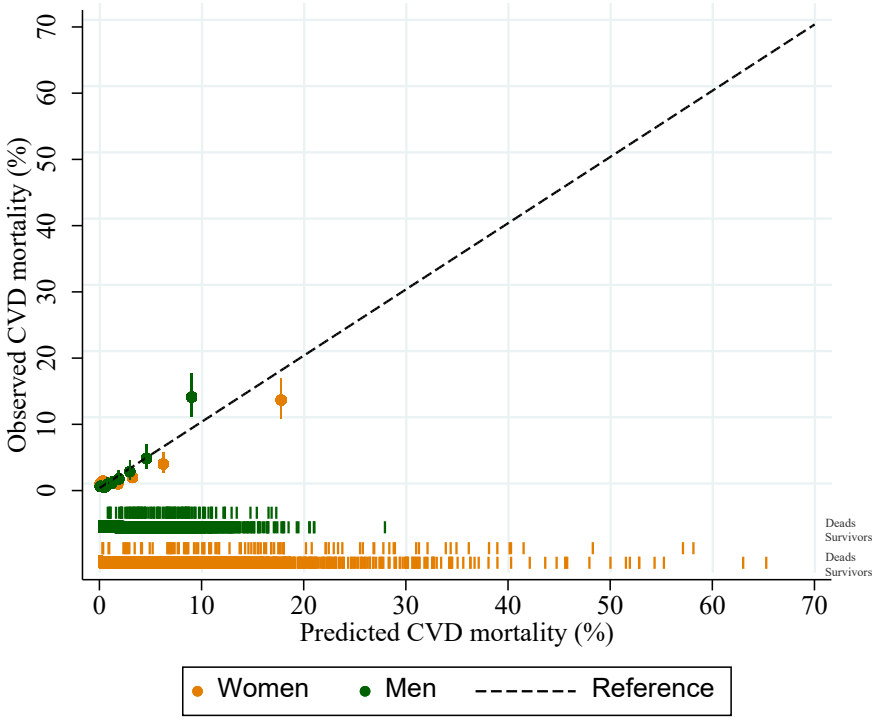
Cambios a la figura 4

Cambiar “Deads” por “Nonsurvivors”

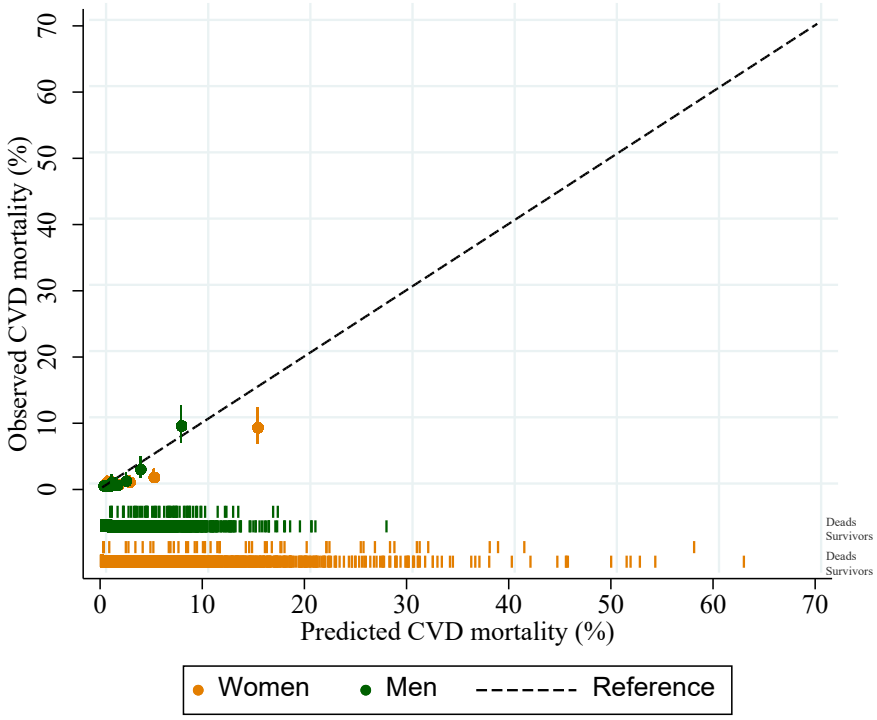
Figure 5 of the supplementary data

Calibration plots (95%CI) of the HHS for the prediction of CVD mortality at mean follow-up (12 years) among ENRICA participants assuming a 12-year baseline survival function 4 times higher than at 20 years in the original development cohorts (ie, assuming most of the events occurred beyond 12 years of follow-up).

Overall cohort [b]



Participants without prior chronic diseases [c]



95%CI, 95% confidence interval; HHS, Healthy Hearth Score; CVDm, cardiovascular disease model; CVD, cardiovascular disease.

[a]Participants free of type 2 diabetes, cardiovascular disease (myocardial infarction, heart failure, stroke), lung disease (asthma, chronic obstructive pulmonary disease), and cancer at baseline

[b]n = 211/N = 11 941 (men 112/5649, women 99/6292).

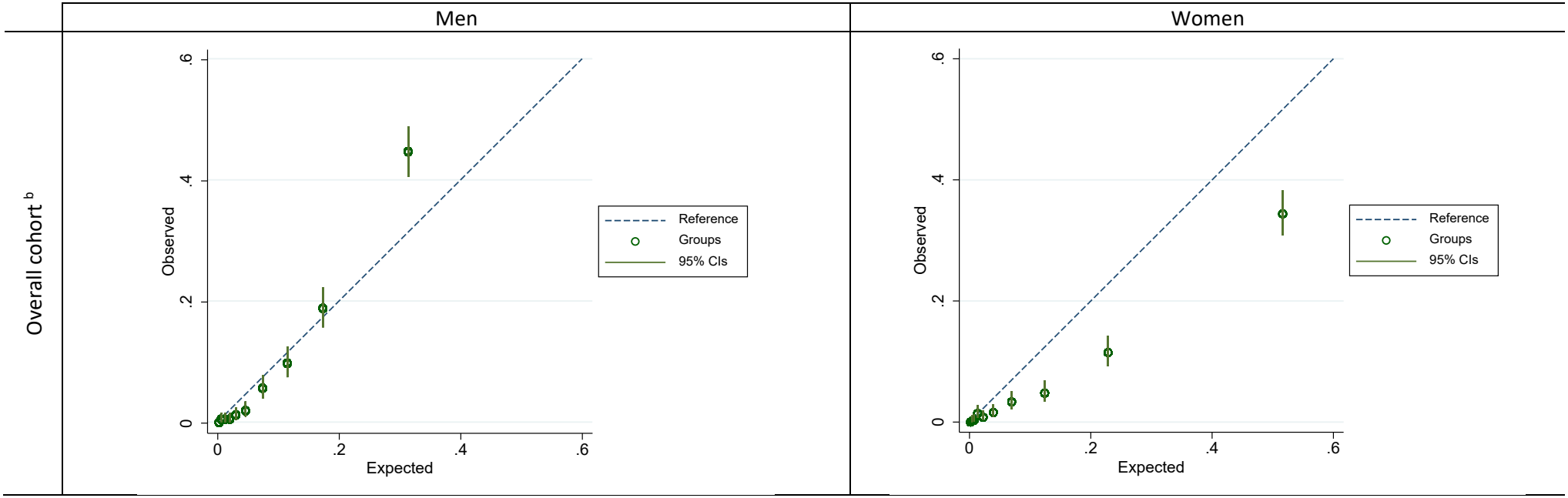
[c]n = 110/N = 10 228 (men 59/4794, women 51/5434). Baseline survival function for men, 0.99092; baseline survival function for women 0.9915.

Cambios a la figura 5

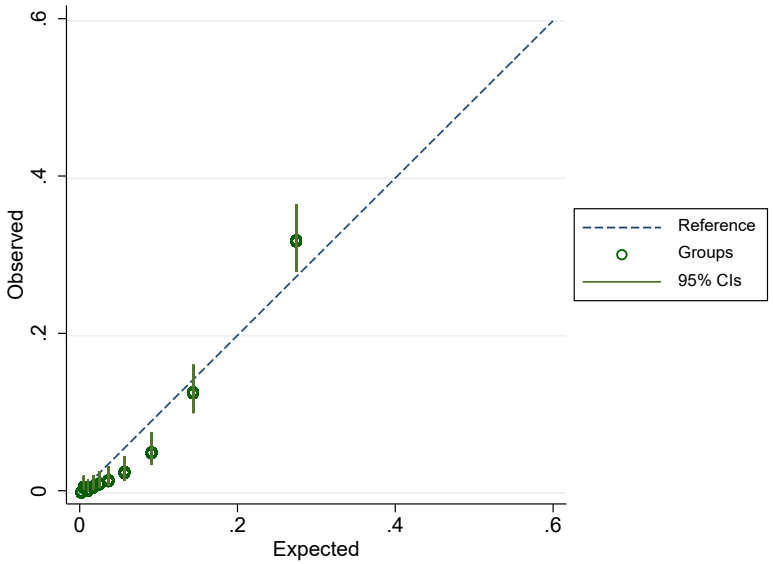
Cambiar “Deads” por “Nonsurvivors”

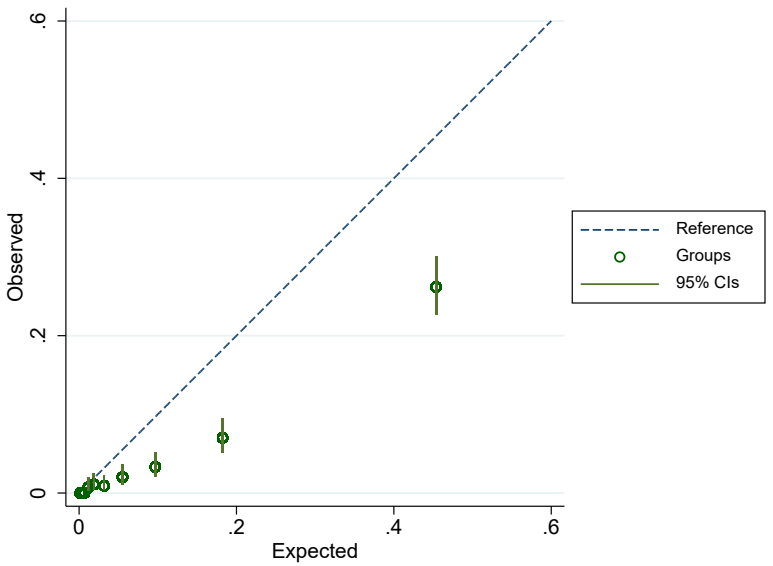
Figure 6 of the supplementary data

Calibration plots of HHS for the prediction of all-cause mortality at mean follow-up (12 years) among the overall ENRICA cohort and for a subset of participants without prior chronic diseases (apparently "healthy participants") [a] using the same baseline survival as in the original cohort for CVD-risk at 20 years.



Healthy participants [c]





95%CI, 95%confidence interval; HHS, Healthy Hearth Score; CVD, cardiovascular disease.

[a] Participants free of type 2 diabetes, cardiovascular disease (myocardial infarction, heart failure, stroke), lung disease (asthma, chronic obstructive pulmonary disease), and cancer at baseline.

[b] n = 708 / N = 11 941 (men 410/5649, women 298/6292).

[c] n = 412 / N=10 228 (men 229/4794, women 183/5434). Baseline survival function for men, 0.96368; baseline survival function for women 0.9660.

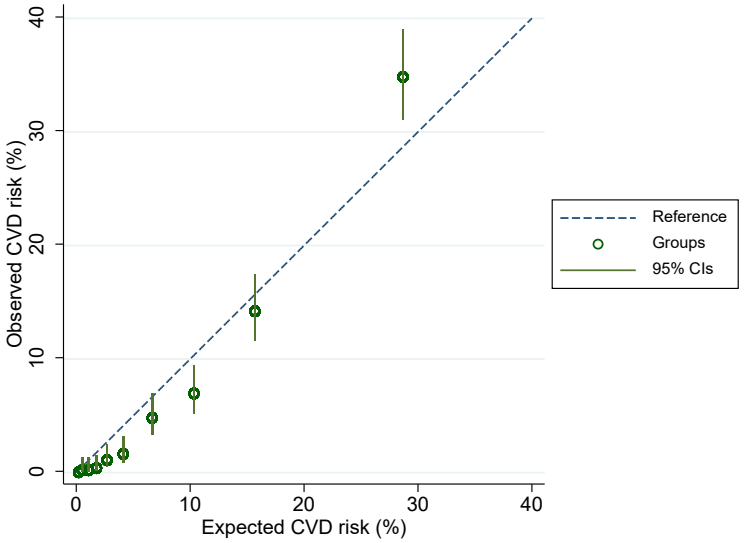
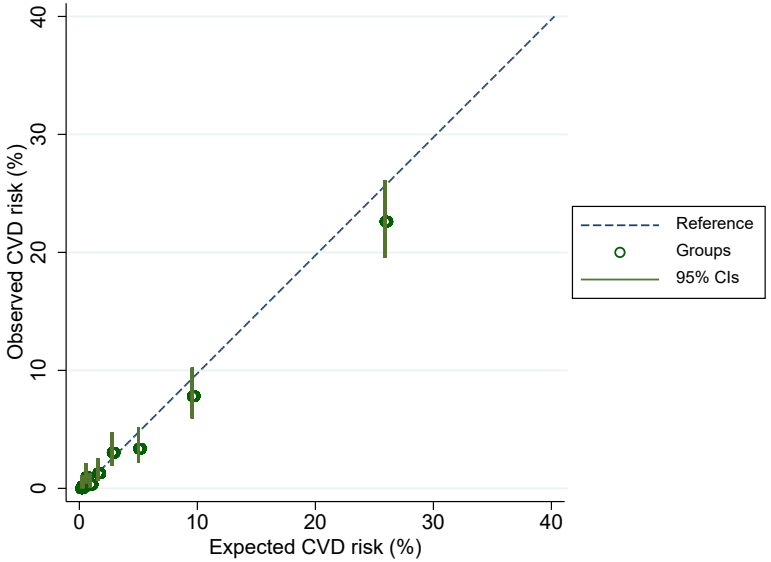
Corrección a la figura 6

Cambiar “Reference Groups” por “Reference groups”

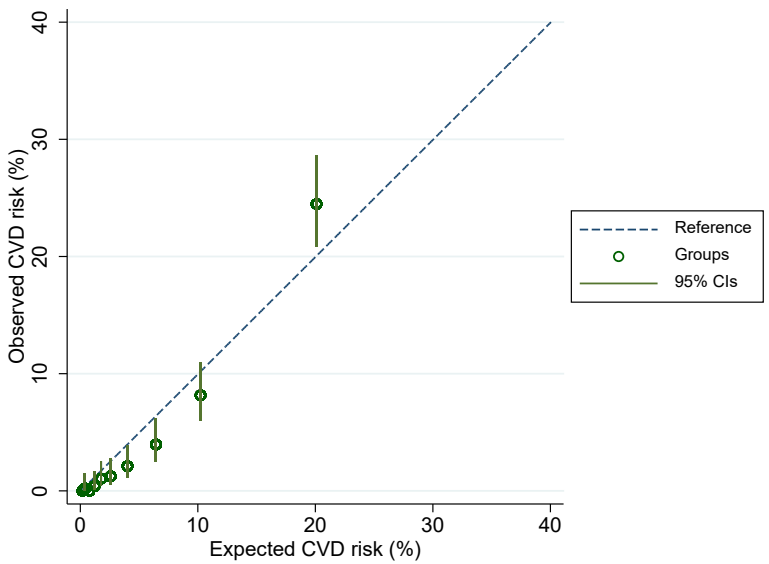
Cambiar “95% CI” a “95%CI”.

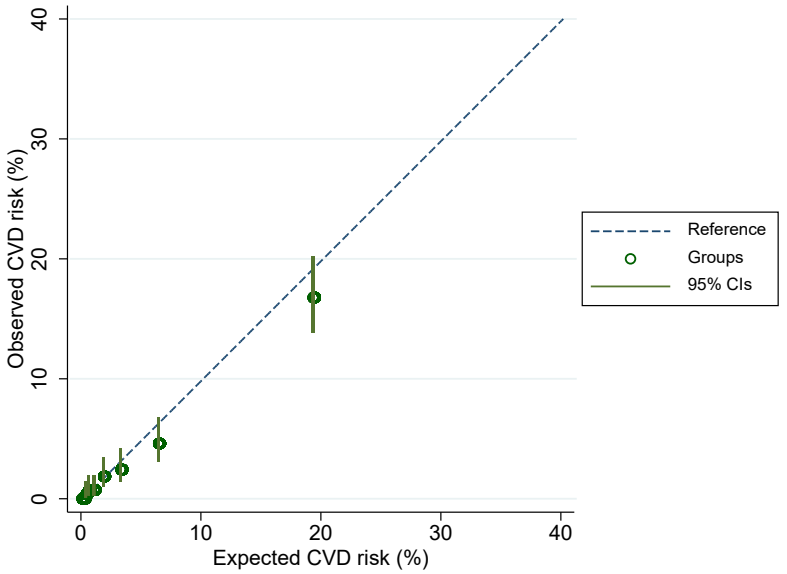
Figure 7 of the supplementary data

Calibration plots of HHS-CVDm for the prediction of all-cause mortality at mean follow-up (12 years) among the overall ENRICA cohort and for a subset of participants without prior chronic diseases (apparently "healthy participants")[a] recalibrating by the baseline survival function of the ENRICA cohort.

	Men	Women
Overall cohort [b]		

Healthy participants [c]





95%CI, 95%confidence interval; HHS, Healthy Hearth Score; CVD, cardiovascular disease.

[a]Participants free of type 2 diabetes, cardiovascular disease (myocardial infarction, heart failure, stroke), lung disease (asthma, chronic obstructive pulmonary disease), and cancer at baseline.

[b]n = 708/N=11 941 (men 410/5649, women 298/6292).

[c]n = 412/N=10 228 (men 229/4794, women 183/5434). Baseline survival function for men, 0.9999935; baseline survival function for women 0.9999937.

Corrección a la figura 6

Cambiar “Reference Groups” por “Reference groups”

Cambiar “95% CI” a “95%CI”.

References of the supplementary data

1. Chiuve SE, Cook NR, Shay CM, et al. Lifestyle-based prediction model for the prevention of CVD: the Healthy Heart Score. *J Am Heart Assoc.* 2014. https://doi.org/10.1161/JAHA.114.000954.