

SUPPLEMENTARY MATERIAL

Supplementary Table 1. Characteristics of men who were or were not subsequently diagnosed with heart failure, stratified by muscular strength tertile.

	High muscular strength (≥2171 Newtons)			Medium muscular strength (1900-2170 Newtons)			Low muscular strength (<1900 Newtons)		
	No HF n (%)	HF n (%)	Rate ^a	No HF n (%)	HF n (%)	Rate ^a	No HF n (%)	HF n (%)	Rate ^a
Overall	482,107 (100.0)	3,171 (100.0)	21.9	426,988 (100.0)	4,502 (100.0)	28.8	409,804 (100.0)	4,038 (100.0)	29.0
Aerobic fitness, tertiles									
High (≥289 Watts)	237,772 (49.3)	668 (21.1)	10.8	133,619 (31.3)	320 (7.1)	9.3	94,832 (23.1)	190 (4.7)	7.4
Medium (240-288 Watts)	165,349 (34.3)	1,464 (46.2)	26.8	164,394 (38.5)	1,171 (26.0)	22.2	131,512 (32.1)	805 (19.9)	18.4
Low (<240 Watts)	78,896 (16.4)	1,039 (32.8)	36.7	128,975 (30.2)	3,011 (66.9)	43.7	183,460 (44.8)	3,043 (75.4)	43.2
Height, tertiles									
High (≥181.5 cm)	213,887 (44.4)	1,363 (43.0)	21.5	142,850 (33.5)	953 (21.2)	21.5	104,289 (25.5)	666 (16.5)	20.9
Medium (175.0-181.4 cm)	169,265 (35.1)	1,096 (34.6)	21.5	157,041 (36.8)	1,107 (24.6)	22.4	137,814 (33.6)	942 (23.3)	21.2
Low (<175.0 cm)	98,955 (20.5)	712 (22.4)	23.6	127,097 (29.8)	2,442 (54.2)	39.1	167,701 (40.9)	2,430 (60.2)	38.6
Weight, tertiles									
High (≥71.4 kg)	279,644 (58.0)	2,188 (69.0)	26.5	126,427 (29.6)	1,250 (27.8)	32.3	74,684 (18.2)	637 (15.8)	29.1
Medium (64.0-71.3 kg)	159,238 (33.0)	766 (24.2)	15.8	179,078 (41.9)	1,078 (23.9)	19.2	123,721 (30.2)	862 (21.3)	21.4
Low (<64.0 kg)	43,225 (9.0)	217 (6.8)	15.8	121,483 (28.5)	2,174 (48.3)	35.4	211,399 (51.6)	2,539 (62.9)	32.9
Body mass index									
Normal	416,580 (86.4)	2,245 (70.8)	17.9	403,502 (94.5)	4,047 (89.9)	27.1	392,260 (95.7)	3,770 (93.4)	28.2
Overweight	45,986 (9.5)	530 (16.7)	39.2	17,421 (4.1)	288 (6.4)	54.1	12,822 (3.1)	160 (4.0)	42.2
Obese	19,541 (4.1)	396 (12.5)	70.0	6,065 (1.4)	167 (3.7)	91.6	4,722 (1.2)	108 (2.7)	68.2
Education, years									
<12	62,874 (13.0)	846 (26.7)	40.1	59,067 (13.8)	1,365 (30.3)	51.6	60,329 (14.7)	1,296 (32.1)	53.4
12-14	224,354 (46.5)	1,515 (47.8)	23.0	188,347 (44.1)	1,884 (41.9)	28.5	177,472 (43.3)	1,780 (44.1)	30.3
≥15	194,879 (40.4)	810 (25.5)	14.0	179,574 (42.1)	1,253 (27.8)	19.6	172,003 (42.0)	962 (23.8)	17.1
Neighborhood SES									
Low	76,399 (15.9)	665 (21.0)	29.3	73,679 (17.3)	644 (14.3)	28.3	74,516 (18.2)	807 (20.0)	33.5
Medium	303,730 (63.0)	2,071 (65.3)	22.0	266,455 (62.4)	3,432 (76.2)	31.5	253,755 (61.9)	2,778 (68.8)	30.5
High	101,978 (21.1)	435 (13.7)	15.7	86,854 (20.3)	426 (9.5)	17.3	81,533 (19.9)	453 (11.2)	18.9
Hypertension									
No	456,538 (94.7)	1,545 (48.7)	11.5	403,563 (94.5)	2,279 (50.6)	15.8	388,060 (94.7)	2,165 (53.6)	16.8
Yes	25,569 (5.3)	1,626 (51.3)	162.8	23,425 (5.5)	2,223 (49.5)	185.4	21,744 (5.3)	1,873 (46.4)	185.3

Ischemic heart disease								
No	473,719 (98.3)	1,945 (61.3)	13.8	418,267 (98.0)	2,384 (53.0)	15.8	401,423 (97.9)	2,387 (59.1)
Yes	8,388 (1.7)	1,226 (38.7)	335.6	8,721 (2.0)	2,118 (47.0)	394.3	8,381 (2.1)	1,651 (40.9)
Valvular heart disease								
No	480,156 (99.6)	2,716 (85.6)	18.9	424,988 (99.5)	3,827 (85.0)	24.6	407,777 (99.5)	3,422 (84.7)
Yes	1,951 (0.4)	455 (14.4)	553.3	2,000 (0.5)	675 (15.0)	592.1	2,027 (0.5)	616 (15.3)
Diabetes mellitus								
No	470,024 (97.5)	2,363 (74.5)	16.9	415,878 (97.4)	3,287 (73.0)	21.9	398,256 (97.2)	2,905 (71.9)
Yes	12,083 (2.5)	808 (25.5)	178.0	11,110 (2.6)	1,215 (27.0)	184.8	11,548 (2.8)	1,133 (28.1)
Family history of HF								
No	386,313 (80.1)	1,918 (60.5)	17.2	335,333 (78.5)	3,191 (70.9)	26.0	325,283 (79.4)	2,519 (62.4)
Yes	95,794 (19.9)	1,253 (39.5)	37.9	91,655 (21.5)	1,311 (29.1)	38.4	84,521 (20.6)	1,519 (37.6)
								23.7

^aHF incidence rate per 100,000 person-years.

HF = heart failure, SES = socioeconomic status.

Supplementary Table 2. Interactions between aerobic fitness and BMI in relation to risk of heart failure.^a

BMI	Aerobic fitness tertile						HRs for medium aerobic fitness within strata of BMI	HRs for low aerobic fitness within strata of BMI
	High (≥ 289 Watts)		Medium (240-288 Watts)		Low (<240 Watts)			
	Rate (no. cases) ^b	HR (95% CI)	Rate (no. cases) ^b	HR (95% CI)	Rate (no. cases) ^b	HR (95% CI)		
Normal	7.8 (847)	1.00	19.4 (2,690)	1.25 (1.16, 1.34); <i>P</i> <0.001	40.5 (6,461)	1.60 (1.48, 1.72); <i>P</i> <0.001	1.25 (1.16, 1.34); <i>P</i> <0.001	1.60 (1.48, 1.72); <i>P</i> <0.001
Overweight	20.3 (202)	1.79 (1.58, 2.02); <i>P</i> <0.001	52.3 (452)	1.92 (1.65, 2.22); <i>P</i> <0.001	72.8 (353)	2.03 (1.82, 2.27); <i>P</i> <0.001	1.07 (0.89, 1.26); <i>P</i> =0.44	1.14 (0.99, 1.29); <i>P</i> =0.08
Obesity	38.4 (149)	2.41 (2.10, 2.78); <i>P</i> <0.001	90.4 (310)	2.87 (2.52, 3.26); <i>P</i> <0.001	107.9 (247)	3.04 (2.57, 3.60); <i>P</i> <0.001	1.19 (0.99, 1.38); <i>P</i> =0.06	1.26 (1.01, 1.51); <i>P</i> =0.04
HRs (95% CI) for overweight within strata of aerobic fitness		1.79 (1.58, 2.02); <i>P</i> <0.001		1.54 (1.32, 1.76); <i>P</i> <0.001		1.27 (1.16, 1.39); <i>P</i> <0.001		
HRs (95% CI) for obesity within strata of aerobic fitness		2.41 (2.10, 2.78); <i>P</i> <0.001		2.30 (2.04, 2.57); <i>P</i> <0.001		1.90 (1.59, 2.22); <i>P</i> <0.001		
Interaction on additive scale, lowest vs. highest tertiles: RERI (95% CI)						0.03 (-0.55, 0.61); <i>P</i> =0.92		
Interaction on multiplicative scale, lowest vs. highest tertiles: Ratio of HRs (95% CI)						0.79 (0.62, 0.96); <i>P</i> =0.02		

^aHRs are adjusted for age, year of military conscription examination, muscular strength, education, neighborhood SES, hypertension, ischemic heart disease, valvular heart disease, diabetes mellitus, and family history of heart failure.

^bIncidence rate per 100,000 person-years, and total number of cases.

BMI = body mass index, HR = hazard ratio, RERI = relative excess risk due to interaction, SES = socioeconomic status.

Supplementary Table 3. Interactions between muscular strength and BMI in relation to risk of heart failure.^a

BMI	Muscular strength tertile						HRs for medium muscular strength within strata of BMI	HRs for low muscular strength within strata of BMI
	High (≥ 2171 Newtons)		Medium (1900-2170 Newtons)		Low (<1900 Newtons)			
	Rate (no. cases) ^b	HR (95% CI)	Rate (no. cases) ^b	HR (95% CI)	Rate (no. cases) ^b	HR (95% CI)		
Normal	17.9 (2,240)	1.00	27.1 (4,002)	1.13 (1.07, 1.19); <i>P</i> <0.001	28.2 (3,756)	1.14 (1.08, 1.20); <i>P</i> <0.001	1.13 (1.07, 1.19); <i>P</i> <0.001	1.14 (1.08, 1.20); <i>P</i> <0.001
Overweight	39.2 (535)	1.48 (1.35, 1.62); <i>P</i> <0.001	54.1 (300)	1.58 (1.41, 1.78); <i>P</i> <0.001	42.2 (172)	1.56 (1.34, 1.82); <i>P</i> <0.001	1.07 (0.93, 1.22); <i>P</i> =0.33	1.05 (0.88, 1.23); <i>P</i> =0.55
Obesity	70.0 (405)	2.10 (1.90, 2.32); <i>P</i> <0.001	91.6 (179)	2.09 (1.80, 2.43); <i>P</i> <0.001	68.2 (122)	2.32 (1.93, 2.79); <i>P</i> <0.001	1.00 (0.83, 1.17); <i>P</i> =0.97	1.10 (0.88, 1.33); <i>P</i> =0.36
HRs (95% CI) for overweight within strata of muscular strength		1.48 (1.35, 1.62); <i>P</i> <0.001		1.40 (1.24, 1.56); <i>P</i> <0.001		1.36 (1.16, 1.57); <i>P</i> <0.001		
HRs (95% CI) for obesity within strata of muscular strength		2.10 (1.90, 2.32); <i>P</i> <0.001		1.86 (1.58, 2.13); <i>P</i> <0.001		2.03 (1.66, 2.40); <i>P</i> <0.001		
Interaction on additive scale, lowest vs. highest tertiles: RERI (95% CI)						0.08 (-0.39, 0.54); <i>P</i> =0.74		
Interaction on multiplicative scale, lowest vs. highest tertiles: Ratio of HRs (95% CI)						0.97 (0.77, 1.17); <i>P</i> =0.75		

^aHRs are adjusted for age, year of military conscription examination, aerobic fitness, education, neighborhood SES, hypertension, ischemic heart disease, valvular heart disease, diabetes mellitus, and family history of heart failure.

^bIncidence rate per 100,000 person-years, and total number of cases.

BMI = body mass index, HR = hazard ratio, RERI = relative excess risk due to interaction, SES = socioeconomic status.