ONLINE SUPPLEMENT

The Association of Body Mass Index, Weight Gain and Central Obesity with Activity-Related Breathlessness: The Swedish CArdioPulmonary bioImage Study

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Table S1. Comparison of characteristics between people who were included and excluded in

the analysis

Characteristic	Included	Excluded
N	13,437 (85.0%)	2,373 (15.0%)
Age, mean (SD)	57.5 (4.3)	57.8 (4.3)
Women	7,052 (52.5%)	1,133 (47.7%)
mMRC breathlessness scale		
0	12,154 (90.5%)	1,337 (56.3%)
1	725 (5.4%)	133 (5.6%)
2	444 (3.3%)	115 (4.8%)
3	62 (0.5%)	35 (1.5%)
4	52 (0.4%)	59 (2.5%)
Missing	0 (0.0%)	694 (29.2%)
Current BMI, N (%)		
<20	336 (2.5%)	44 (1.9%)
20 - <25	4,675 (34.8%)	646 (27.2%)
25 - <30	5,697 (42.4%)	1021 (43.0%)
≥ 30	2,729 (20.3%)	660 (27.8%)
Missing	0 (0.0%)	2 (0.1%)
Current BMI, mean (SD)	26.8 (4.3)	28.0 (5.0)
BMI at age 20 (self reported), mean (SD)	21.9 (2.7)	22.2 (3.7)
BMI change since age 20, mean (SD)	4.95 (3.89)	5.91 (5.47)
BMI change/year since age 20, mean (SD)	0.13 (0.11)	0.16 (0.15)
Central obesity	5,595 (41.6%)	1,154 (48.8%)
Waist circumference (cm), mean (SD)	94.0 (12.7)	97.1 (13.5)
Waist hip ratio, mean (SD)	0.92 (0.09)	0.94 (0.09)
WHR high	9,483 (70.6%)	1,811 (77.3%)
FEV_1 (L), mean (SD)	3.26 (0.76)	3.10 (0.77)
FEV_1 % of predicted, mean (SD)	102.1 (13.9)	98.2 (15.3)
FVC (L), mean (SD)	4.19 (0.98)	4.00 (0.98)
FVC % of predicted, mean (SD)	102.6 (12.9)	98.9 (13.8)
FEV_1/FVC, mean (SD)	0.78 (0.06)	0.78 (0.07)
FEV_1/FVC % of predicted, mean (SD)	99.2 (8.1)	99.0 (9.3)
DL_{CO}, mean (SD)	8.54 (1.95)	8.25 (1.94)

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DL_{CO}/V_A, mean (SD)	1.45 (0.33)	1.46 (0.33)
Current smoker		
Yes	1,784 (13.3%)	482 (20.3%)
Missing	0 (0.0%)	532 (22.4%)
Pack years of smoking, mean (SD)	12.0 (24.0)	19.4 (34.8)
Hypertension	2,917 (21.7%)	502 (26.3%)
Diabetes mellitus	513 (3.8%)	153 (8.0%)
Ischemic heart disease	360 (2.7%)	92 (4.8%)
Heart failure	165 (1.2%)	40 (2.1%)
Atrial fibrillation / flutter	244 (1.8%)	37 (2.0%)
Heart disease	699 (5.2%)	145 (7.6%)
Asthma	982 (7.3%)	200 (10.7%)
COPD	171 (1.3%)	51 (2.1%)
OSA	544 (4.0%)	98 (4.1%)
Stroke	175 (1.3%)	38 (1.6%)
Anxiety	2,780 (20.7%)	438 (18.5%)
Missing	0	709 (29.9%)
Depression	1,998 (14.9%)	318 (13.4%)
Missing	0	799 (33.7%)
Level of physical activity		
Low	1,578 (11.7%)	280 (11.8%)
Medium	6,360 (47.3%)	745 (31.4%)
High	5,499 (40.9%)	435 (18.3%)
Missing	0	913 (38.5%)

Heart disease was defined as the presence of any of ischemic heart disease, heart failure or atrial fibrillation/flutter. *Abbreviations:* COPD = chronic obstructive pulmonary disease; DL_{CO} = diffusion lung capacity for carbon monoxide; FEV_1 = forced expired volume in one second; FVC = forced vital capacity; OSA = obstructive sleep apneas; V_A = alveolar volume.

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Table S2. Number of people (%) stratified by measured current body mass index (BMI) and

recalled BMI at age 20

BMI at age 20	Current BMI				
	< 20.0	**20.0 to <25**	**25.0 to <30**	**≥ 30**	**Total**
< 20.0	265 (8.2)	1,700 (52.7)	970 (30.1)	289 (9.0)	3,224 (100)
20.0 to <25	71 (0.8)	2,885 (32.5)	4,245 (47.8)	1,687 (19.0)	8,888 (100)
25.0 to <30	0	84 (7.0)	448 (37.1)	675 (55.9)	1,207 (100)
≥ 30	0	6 (5.1)	34 (28.8)	78 (66.1)	118 (100)
Total	336 (2.5)	4,675 (34.8)	5,697 (42.4)	2,729 (20.3)	13,437 (100)

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Table S3. Associations of change in BMI since age 20 with current obesity factors and

physical activity

Factor (current status)	Mean change in BMI since age 20 (95% CI)	Mean change in BMI since age 20, adjusted for current BMI (95% CI)
Waist circumference (per 1 cm)	0.20 (0.20 – 0.20)	0.08 (0.07 – 0.08)
WHR (per 1 units increase)	12.5 (11.8 – 13.2)	-1.10 (-1.68 – -0.53)
Central obesity		
No	*Ref*	*Ref*
Yes	4.77 (4.66 – 4,87)	1.90 (1.78 – 2.02)
Level of physical exercise		
Low	3.11 (2.90 – 3.33)	1.15 (1.00 - 1.31)
Medium	1.41 (1.27 – 1.55)	0.62 (0.53 – 0.72)
High	*Ref*	*Ref*

Associations between factors (current status) and change in BMI since age 20, unadjusted and adjusted for current BMI, were analyzed using linear regression.

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Table S4. Associations between obesity factors with breathlessness in women and men separately

	Odds ratio for having breathlessness (mMRC ≥ 1) with 95% confidence intervals			
	MEN		**WOMEN**	
Current BMI	**Adjusted for confounders but not FVC**	**Adjusted for confounders and absolute FVC**	**Adjusted for confounders but not FVC**	**Adjusted for confounders and absolute FVC**
< 20	2.12 (1.07-4.20)	1.73 (0.84-3.59)	1.11 (0.57-2.16)	1.10 (0.54-2.22)
20 - <25	1.00	1.00	1.00	1.00
25 - <30	1.47 (1.15-1.88)	1.40 (1.09-1.78)	1.56 (1.40-1.74)	1.47 (1.30-1.68)
≥ 30	2.73 (2.27-3.27)	2.34 (1.95-2.81)	4.04 (3.10-5.28)	3.51 (2.65-4.64)
AUC for model (with all categories)	0.807	0.823	0.793	0.802
BMI change since age 20				
Estimate per 1 unit (kg/m^2) increase since age 20	1.13 (1.11-1.15)	1.11 (1.09-1.13)	1.14 (1.11-1.16)	1.12 (1.10-1.15)
AUC for model	0.816	0.831	0.794	0.804
BMI change/year since age 20				
Estimate per 1 SD/year increase in BMI since age 20	1.62 (1.52-1.74)	1.52 (1.43-1.61)	1.66 (1.52-1.82)	1.57 (1.44-1.70)
AUC for model	0.816	0.831	0.794	0.803
Waist circumference (current)				
Estimate per 1 cm increase	1.03 (1.03-1.04)	1.03 (1.03-1.04)	1.04 (1.04-1.05)	1.04 (1.04-1.05)

AUC for model	0.809	0.828	0.790	0.803
Central obesity (current)				
Estimate compared to without central obesity	1.74 (1.40-2.15)	1.72 (1.39-2.12)	2.49 (1.87-3.33)	2.39 (1.83-3.12)
AUC for model	0.802	0.822	0.783	0.797

Abbreviations: AUC = area under the curve; others and confounders are listed in Table 2.

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FIGURES

Figure S1. Directed acyclic graph (DAG) of assumed associations between study variables. *Abbreviations:* BMI = body mass index; FVC = forced vital capacity; IHD = ischemic heart disease; mMRC = modified Medical Research Council breathlessness scale; VC = vital capacity.

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