Supplemental material file

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eTable 1. Participant characteristics by cases and non-cases of metabolic syndrome (MetS).

Characteristic	All	MetS[a]	No MetS	*P*-value
N (%)	353 (100)	115 (32.6)	238 (67.4)	
Age, years (SD)	72.8 (5.7)	73.5 (5.3)	72.4 (5.9)	0.099
Female, n (%)	223 (63.2)	65 (56.5)	158 (66.4)	0.072
Smoking status, n (%)				
Never	270 (76.5)	87 (75.7)	183 (76.9)	0.569
Former	81 (23.0)	28 (24.4)	53 (22.3)	
Current	2 (0.6)	0	2 (0.8)	
Heavy alcohol consumption[b], n (%)	27 (7.7)	12 (10.4)	15 (6.3)	0.171
400m walk time[c], mins (SD)	4.4 (0.8)	4.7 (0.9)	4.3 (0.7)	**<0.001**
Forced expiratory volume in 1 second (FEV_1), liters (SD)	2.4 (0.6)	2.4 (0.6)	2.4 (0.6)	0.892
FEV_1, percent predicted (SD)	98.9 (12.5)	96.9 (11.5)	99.8 (12.9)	**0.036**
FEV_1, Z-score[d] (SD)	-0.06 (0.75)	-0.18 (0.68)	-0.002 (0.78)	**0.037**
Relative grip strength, kgf/kg (SD)	0.40 (0.11)	0.36 (0.10)	0.42 (0.10)	**<0.001**
Waist circumference, cm (SD)	92.5 (13.4)	103.4 (11.3)	87.3 (10.9)	**<0.001**
Systolic blood pressure, mmHg (SD)	124.8 (16.9)	128.7 (15.5)	122.9 (17.2)	**0.002**
Diastolic blood pressure, mmHg (SD)	71.7 (10.1)	73.6 (9.6)	70 (10.2)	**0.014**
Blood glucose, mg/dL (SD)	98.1 (17.7)	107.7 (22.8)	93.5 (12.1)	**<0.001**
Triglycerides, mg/dL (SD)	110.4 (65.3)	148.6 (91.6)	92.0 (35.4)	**<0.001**
High-density lipoprotein cholesterol (HDL-C), mg/dL (SD)	60.6 (15.7)	51.9 (13.5)	64.8 (14.9)	**<0.001**
Elevated waist circumference, n (%)	158 (44.8)	101 (87.8)	57 (24.0)	**<0.001**
Elevated blood pressure, n (%)	177 (50.1)	92 (80.0)	85 (35.7)	**<0.001**
Elevated blood glucose, n (%)	109 (30.9)	75 (65.2)	34 (14.3)	**<0.001**
Elevated triglycerides, n (%)	166 (47.0)	97 (84.40	69 (29.0)	**<0.001**
Low HDL-C, n (%)	39 (11.1)	36 (31.3)	3 (1.3)	**<0.001**
No. of MetS components, n (%)				
0	67 (19.0)	0	67 (28.2)	**<0.001**
1	94 (26.6)	0	94 (39.5)	
2	77 (21.8)	0	77 (32.4)	
3	70 (19.8)	70 (60.9)	0	
4	34 (9.6)	34 (29.6)	0	
5	11 (3.1)	11 (9.6)	0	

[a]Characterized as having ≥3 of the following characteristics: elevated waist circumference (men: >102cm; women: >88cm); elevated blood pressure (≥130mmHg systolic blood pressure; ≥85mmHg diastolic blood pressure; or drug treatment for hypertension); elevated blood glucose (≥100mg/dL; or drug treatment for elevated glucose); elevated triglycerides (≥150mg/dL; or drug treatment for elevated triglycerides); low high-density lipoprotein cholesterol [HDL-C] (men: <40mg/dL; women: <50mg/dL; or drug treatment for low HDL-C), as defined by the National Cholesterol Education Adult Treatment Panel III (NCEP-ATP III).

[b]Defined as >14 or >7 alcoholic drinks per week for men and women, respectively, as defined by the National Institute on Alcohol Abuse and Alcoholism (NIAAA). [c]A validated surrogate of cardiorespiratory fitness (CRF) in older adults (higher values suggest lower CRF).

[d]A standardized residual indicating the number of standard deviations a measurement falls from a population mean (lower z-scores indicate lower lung function). Both the American Thoracic Society (ATS) and the European Respiratory Society (ERS) recommend the use of z-scores in the interpretation of spirometry.\

eTable 2. Odds ratios (95% confidence intervals) of prevalent metabolic syndrome (MetS) by quartiles of pulmonary function and relative grip strength.

Pulmonary function					
Quartile (Mean ± SD FEV_1 Z-score)[a]	**Number of participants**	**MetS cases (%)**	**Model 1**	**Model 2**	**Model 3**
Upper (0.92 ± 0.42)	88	19 (21.36)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Upper middle (0.16 ± 0.12)	89	33 (37.1)	**2.37 (1.20-4.66)**	**2.25 (1.12-4.53)**	1.64 (0.79-3.39)
Lower middle (-0.33 ± 0.16)	88	32 (36.4)	**2.16 (1.10-4.25)**	**2.17 (1.08-4.36)**	1.81 (0.88-3.74)
Lower (-1.00 ± 0.27)	88	31 (35.2)	**2.12 (1.08-4.19)**	**2.07 (1.02-4.21)**	1.60 (0.76-3.37)
		P for linear trend	0.057	0.073	0.228
	Per SD decrease in FEV1 Z-score		**1.30 (1.04-1.64)**	**1.30 (1.02-1.66)**	1.21 (0.93-1.57)
Relative grip strength					
Quartile (Mean ± SD kg/kg of body mass)	**Number of participants**	**MetS cases (%)**	**Model 1**	**Model 2**	**Model 3**
Upper (0.52 ± 0.07)	88	10 (11.4)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Upper middle (0.43 ± 0.06)	89	21 (23.6)	**2.44 (1.07-5.55)**	**2.38 (1.04-5.45)**	**2.47 (1.08-5.67)**
Lower middle (0.37 ± 0.06)	89	33 (37.1)	**4.74 (2.14-10.50)**	**4.31 (1.92-9.70)**	**4.05 (1.79-9.15)**
Lower (0.28 ± 0.06)	87	51 (58.6)	**11.91 (5.26-27.00)**	**10.06 (4.24-23.86)**	**9.71 (4.08-23.11)**
		P for linear trend	**<0.001**	**<0.001**	**<0.001**
	Per SD decrease in relative grip strength		**2.77 (1.99-3.85)**	**2.52 (1.77-3.58)**	**2.45 (1.72-3.49)**

Abbreviations: FEV_1, Forced Expiratory Volume in 1 second; SD, standard deviation.

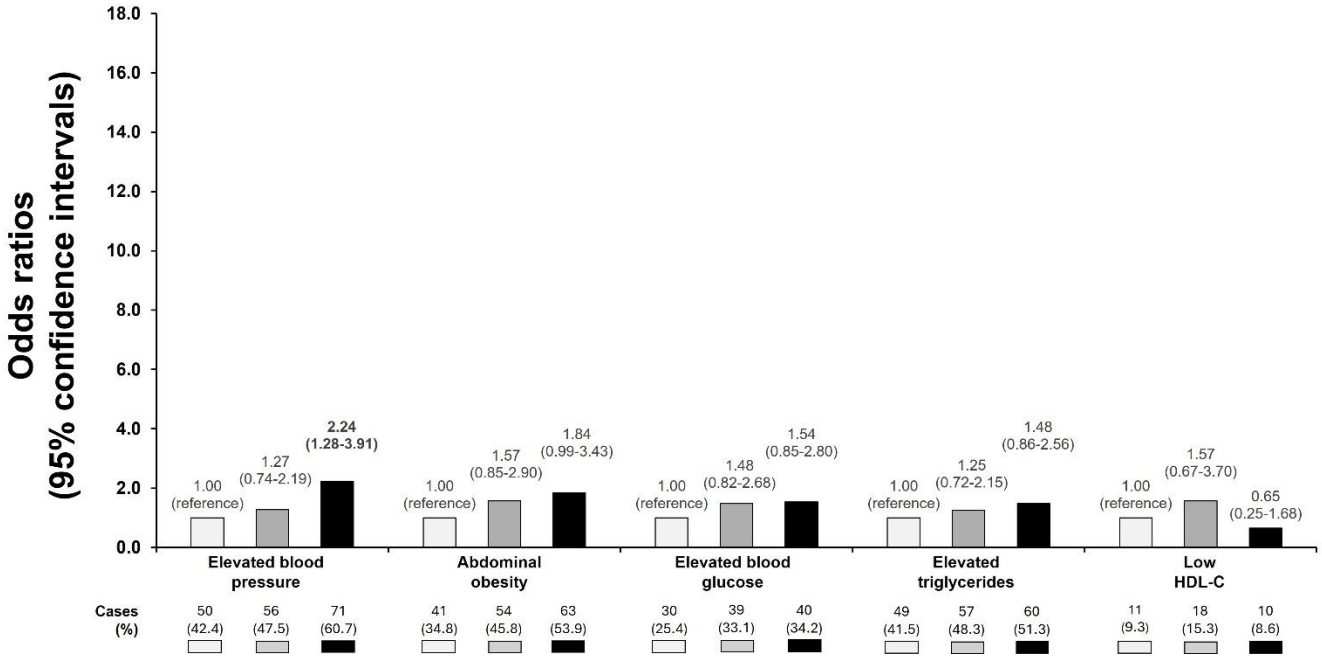
[a]Z-scores are a standardized metric that compares measurements of lung function to a healthy, non-smoking reference population (the reference population used for this analysis was the Global Lung Function Initiative [GLI]). A Z-Score of 0 equates to the mean value of the reference population (i.e., average pulmonary function), with more negative Z-scores reflecting lower lung function. **Model 1** adjusted for age (years) and sex (male or female); **Model 2** adjusted for Model 1 plus smoking status (never, former/current), heavy alcohol consumption (yes/no), and cardiorespiratory fitness (400m walk time); **Model 3** adjusted for Model 2 plus relative grip strength (kg/kg of body mass) in the pulmonary function analysis, and pulmonary function (FEV_1 Z-score) in the relative grip strength analysis.

eTable 3. Odds ratios (95% confidence intervals) of metabolic syndrome (MetS) by tertiles of pulmonary function (% predicted) and relative grip strength (lean mass).

Pulmonary function					
Tertile (Mean ± SD FEV_1 % predicted)[a]	**Number of participants**	**MetS cases (%)**	**Model 1**	**Model 2**	**Model 3**
Upper (112.51 ± 7.56)	118	29 (24.6)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Middle (98.77 ± 3.10)	118	41 (34.8)	1.61 (0.91-2.86)	1.77 (0.97-3.22)	1.58 (0.85-2.95)
Lower (85.19 ± 5.65)	117	45 (38.5)	**1.93 (1.09-3.41)**	**1.95 (1.07-3.54)**	1.64 (0.88-3.05)
		P for linear trend	**0.025**	0.032	0.129
	Per SD decrease in FEV_1 % predicted		**1.28 (1.02-1.62)**	1.27 (0.995-1.624)	1.19 (0.92-1.55)
Relative grip strength					
Tertile (Mean ± SD kg/kg of lean mass)[b]	**Number of participants**	**MetS cases (%)**	**Model 1**	**Model 2**	**Model 3**
Upper (0.79 ± 0.08)	115	23 (20.0)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Upper middle (0.66 ± 0.05)	115	36 (31.3)	1.82 (0.99-3.34)	1.65 (0.89-3.05)	1.64 (0.88-3.04)
Lower middle (0.51 ± 0.09)	114	53 (46.5)	**3.45 (1.87-6.35)**	**2.61 (1.36-4.99)**	**2.45 (1.27-4.72)**
		P for linear trend	**<0.001**	**0.004**	**0.008**
	Per SD decrease in relative grip strength		**3.54 (2.31-5.44)**	**3.15 (2.00-4.97)**	**3.00 (1.90-4.75)**

Abbreviations: FEV_1, Forced Expiratory Volume in 1 second; SD, standard deviation.

[a]Z-scores are a standardized metric that compares measurements of lung function to a healthy, non-smoking reference population (the reference population used for this analysis was the Global Lung Function Initiative [GLI]). A of value of 100% predicted means the observed lung function value is exactly the predicted value. [b]Lean mass was derived from whole-body Dual X-ray Absorptiometry (DEXA), with data available for a subset of the primary analytic sample (N = 344). **Model 1** adjusted for age (years) and sex (male or female); **Model 2** adjusted for Model 1 plus smoking status (never, former/current), heavy alcohol consumption (yes/no), and cardiorespiratory fitness (400m walk time); **Model 3** adjusted for Model 2 plus relative grip strength (kg/kg of body mass) in the pulmonary function analysis, and pulmonary function (FEV_1 Z-score) in the relative grip strength analysis.



eFigure 1. The independent associations of pulmonary function with the individual components of metabolic syndrome.

The logistic regression model adjusted for age (years), sex (male or female), smoking status (never or former/current), heavy alcohol consumption (yes or no), cardiorespiratory fitness (400m walk time), and relative grip strength (kg/kg of body mass). Definitions for the individual components of metabolic syndrome were based on the National Cholesterol Education Adult Treatment Panel III (NCEP-ATP III) criteria. Elevated blood pressure was defined as ≥130mmHg systolic blood pressure, ≥85mmHg diastolic blood pressure, or drug treatment for hypertension. Abdominal obesity was defined as waist circumference >102cm or >88cm for men and women, respectively. Elevated blood glucose was defined as ≥100mg/dL or drug treatment for elevated glucose. Elevated triglycerides was defined as ≥150mg/dL or drug treatment for elevated triglycerides. Low high-density lipoprotein cholesterol [HDL-C] was defined as men: <40mg/dL or <50mg/dL for men and women, respectively.

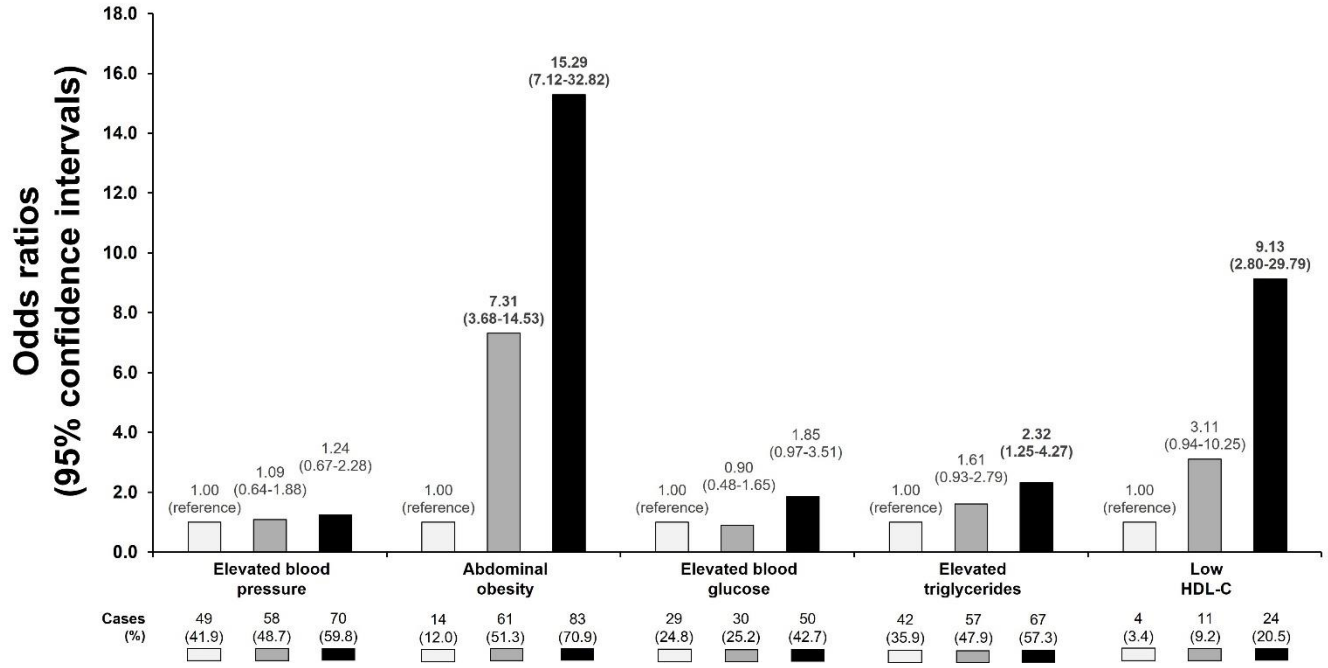


Figure 2. The independent associations of relative grip strength with the individual components of metabolic syndrome.

The logistic regression model adjusted for age (years), sex (male or female), smoking status (never or former/current), heavy alcohol consumption (yes or no), cardiorespiratory fitness (400m walk time), and pulmonary function (FEV_1 Z-score). Definitions for the individual components of metabolic syndrome were based on the National Cholesterol Education Adult Treatment Panel III (NCEP-ATP III) criteria. Elevated blood pressure was defined as ≥130mmHg systolic blood pressure, ≥85mmHg diastolic blood pressure, or drug treatment for hypertension. Abdominal obesity was defined as waist circumference >102cm or >88cm for men and women, respectively. Elevated blood glucose was defined as ≥100mg/dL or drug treatment for elevated glucose. Elevated triglycerides was defined as ≥150mg/dL or drug treatment for elevated triglycerides. Low high-density lipoprotein cholesterol [HDL-C] was defined as men: <40mg/dL or <50mg/dL for men and women, respectively.