

Associations of obesity, physical activity level, inflammation and cardiometabolic health with COVID-19 mortality: a prospective analysis of the UK Biobank cohort

Malik Hamrouni, Matthew J Roberts, Alice E Thackray, David J Stensel, Nicolette C Bishop

Supplementary material

Supplemental table 1: Associations of BMI category with COVID-19 mortality after excluding inpatients with a positive SARS-CoV-2 test who did not die from COVID-19 from analysis.

BMI category	N deaths/N total	COVID-19 mortality Odds ratio (95% CI)
Normal	65/87 438	1 (ref.)
Overweight	176/111 415	1.38 (1.03 – 1.84)
Obesity	156/58 825	1.80 (1.33 – 2.43)

Adjusted for baseline age, sex, ethnicity, physical activity level, Townsend deprivation index, smoking status, alcohol intake, educational attainment, number of illnesses, and number of treatments and/or medications taken.

CI, confidence interval; BMI, body mass index

Significant associations ($p < 0.05$) are highlighted in bold.

Supplemental table 2: Associations of physical activity level with COVID-19 mortality after excluding inpatients with a positive SARS-CoV-2 test who did not die from COVID-19 from analysis.

Physical activity level	N deaths/N total	COVID-19 mortality Odds ratio (95% CI)
High	138/105 325	1 (ref.)
Moderate	150/104 866	1.05 (0.83 – 1.33)
Low	109/47 487	1.41 (1.09 – 1.83)

Adjusted for baseline age, sex, ethnicity, BMI, Townsend deprivation index, smoking status, alcohol intake, educational attainment, number of illnesses, and number of treatments and/or medications taken.

CI, confidence interval; BMI, body mass index

Significant associations ($p < 0.05$) are highlighted in bold.

Supplemental table 3: Associations of physical activity level with COVID-19 mortality across BMI categories after excluding inpatients with a positive SARS-CoV-2 test who did not die from COVID-19 from analysis.

Physical activity level	BMI category	N deaths/N total	COVID-19 mortality Odds ratio (95% CI)
High	Normal	27/39 368	1 (ref.)
	Overweight	71/46 068	1.51 (0.97 – 2.36)
	Obesity	40/19 889	1.62 (0.99 – 2.66)
Moderate	Normal	22/35 513	0.93 (0.53 – 1.64)
	Overweight	70/45 647	1.53 (0.98 – 2.38)
	Obesity	58/23 706	1.98 (1.24 – 3.15)
Low	Normal	16/12 557	1.95 (1.05 – 3.62)
	Overweight	35/19 700	1.70 (1.03 – 2.84)
	Obesity	58/15 230	2.86 (1.78 – 4.59)

Adjusted for baseline age, sex, ethnicity, Townsend deprivation index, smoking status, alcohol intake, educational attainment, number of illnesses, and number of treatments and/or medications taken.

CI, confidence interval; BMI, body mass index

Significant associations ($p < 0.05$) are highlighted in bold.

Supplemental table 4. Associations of cardiometabolic and inflammatory biomarkers with COVID-19 mortality after excluding inpatients with a positive SARS-CoV-2 test who did not die from COVID-19 from analysis.

Biomarker	COVID-19 mortality Odds ratio (95% CI)
CRP (mg/L)	1.01 (0.99 – 1.03)
Total leukocyte count (10 ⁹ cells/L)	1.03 (1.01 – 1.05)
Neutrophil count (10 ⁹ cells/L)	1.10 (1.03 – 1.18)
Lymphocyte count (10 ⁹ cells/L)	1.02 (0.98 – 1.07)
Monocyte count (10 ⁹ cells/L)	1.33 (1.04 – 1.69)
Total cholesterol (mmol/L)	0.98 (0.89 – 1.07)
LDL-C (mmol/L)	0.98 (0.87 – 1.11)
HDL-C (mmol/L)	0.99 (0.70 – 1.38)
TG (mmol/L)	1.01 (0.92 – 1.11)
Glucose (mmol/L)	1.05 (1.00 – 1.11)
HbA1c (mmol/L)	1.01 (1.00 – 1.02)

Odds ratio (95% confidence intervals) for COVID-19 mortality per one unit increase in each biomarker. Adjusted for baseline age, sex, ethnicity, BMI, physical activity level, Townsend deprivation index, smoking status, alcohol intake, educational attainment, number of illnesses, and number of treatments and/or medications taken.

CI, confidence interval; CRP, C-reactive protein; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol; TG, triglycerides; HbA1c, glycated haemoglobin. Significant associations ($p < 0.05$) are highlighted in bold.

Supplemental table 5. Effect of biomarker adjustment on the associations of physical activity level with COVID-19 mortality in individuals with obesity after excluding inpatients with a positive SARS-CoV-2 test who did not die from COVID-19 from analysis.

Physical activity level	N deaths/N total	COVID-19 mortality Odds ratio (95% CI)	
		Model 1	Model 2
High	40/19 889	1 (ref.)	1 (ref.)
Moderate	58/23 706	1.15 (0.71 – 1.84)	1.11 (0.69 – 1.78)
Low	58/15 230	1.76 (1.10 – 2.84)	1.70 (1.06 – 2.74)

Model 1: adjusted for baseline age, sex, ethnicity, Townsend deprivation index, smoking status, alcohol intake, educational attainment, number of illnesses, and number of treatments/medications taken.

Model 2: model 1 plus biomarkers associated with COVID-19 mortality: neutrophil count and monocyte count (not adjusted for total leukocyte count to prevent overadjustment).

CI, confidence interval

Significant associations ($p < 0.05$) are highlighted in bold.

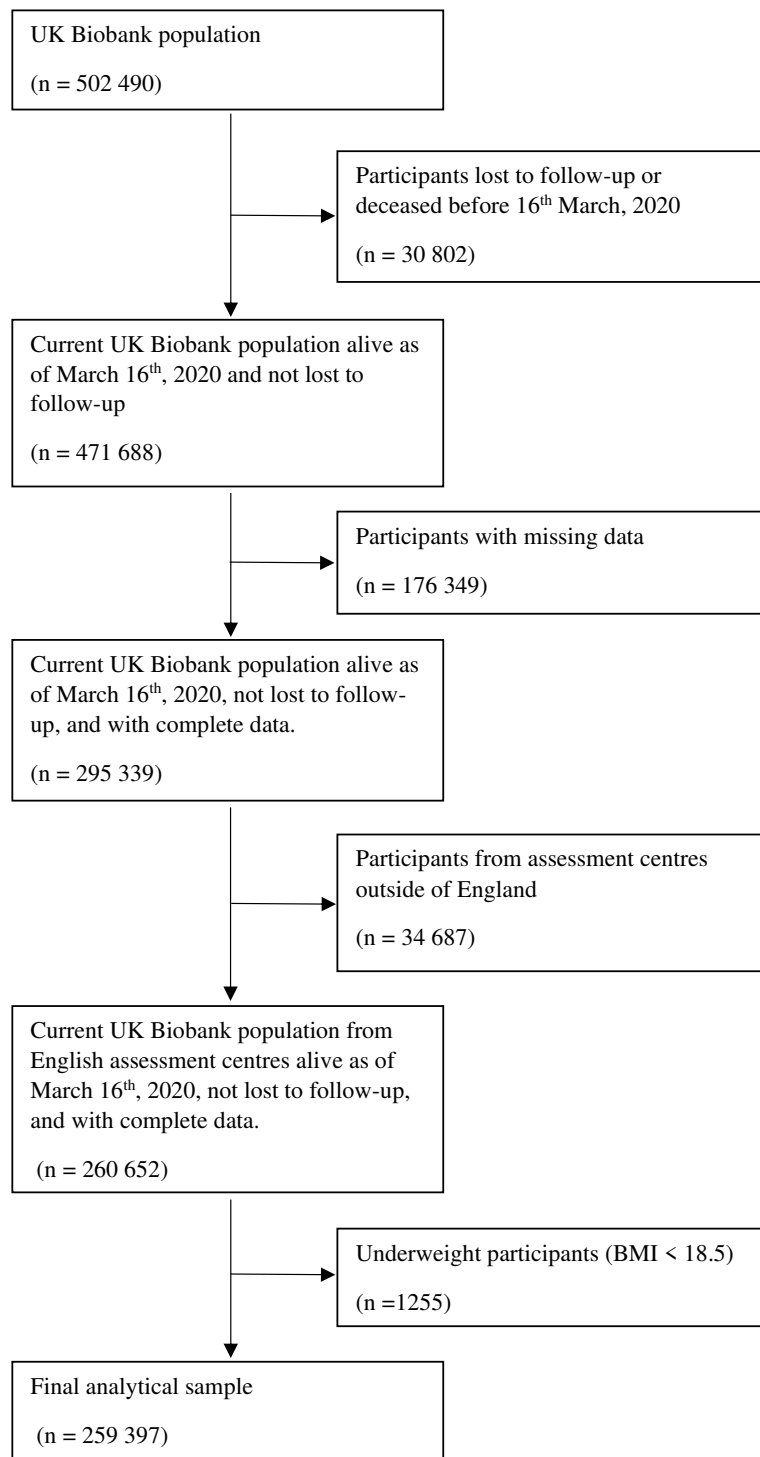


Figure 1. Participant flow diagram.