Web Material

Explaining Ethnic Differentials in Coronavirus Disease 2019 Mortality: A Cohort Study

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Web Table 1. Baseline characteristics of the analytical sample according to ethnic group (2006-10)

	Black	South Asian	Other	White
Number	6,816	7,839	7,744	426,265
Women, N (%)	4012 (58.9)	3741 (47.7)	4695 (60.6)	236372 (55.5)
Age, years, mean (SD)	51.7 (7.9)	53.1 (8.4)	52.1 (7.8)	56.4 (8.0)
Higher education, N (%)	2371 (34.8)	3382 (43.1)	3627 (46.8)	141140 (33.1)
Household ≥4 people, N (%)	2195 (32.2)	3991 (50.9)	2455 (31.7)	78889 (18.5)
High neighbourhood deprivation, N (%)	4370 (64.1)	2873 (36.7)	3371 (43.5)	78997 (18.5)
Manual occupation, N (%)	1597 (31.2)	1527 (26.7)	1280 (22.8)	54710 (17.9)
Alcohol intake daily, N (%)	451 (6.6)	546 (7)	777 (10)	89829 (21.1)
Current smoking, N (%)	795 (11.7)	704 (9.0)	1047 (13.5)	41163 (9.7)
Hypertension, N (%)	4200 (61.6)	4327 (55.2)	3769 (48.7)	246517 (57.8)
Diabetes, N (%)	700 (10.3)	1239 (15.8)	588 (7.6)	18342 (4.3)
Cardiovascular disease, N (%)	280 (4.1)	577 (7.4)	284 (3.7)	21422 (5)
Chronic bronchitis, N (%)	38 (0.6)	70 (0.9)	64 (0.8)	5622 (1.3)
Seen a psychiatrist, N (%)	565 (8.3)	760 (9.7)	967 (12.5)	48070 (11.3)
BMI, kg/m,^{2} mean (SD)	29.6 (5.4)	27.1 (4.4)	26.0 (5.0)	27.3 (4.7)
Waist to hip ratio, mean (SD)	0.87 (0.08)	0.90 (0.08)	0.86 (0.08)	0.87 (0.09)
White blood cells, 10^9/L, mean (SD)	5.78 (1.66)	7.30 (1.75)	6.76 (1.93)	6.85 (1.96)
HbA1c, mmol/mol, mean (SD)	39.2 (9.9)	40.1 (9.8)	37.3 (8.0)	35.8 (6.2)
HDL-cholesterol, mmol/L, mean (SD)	1.44 (0.36)	1.27 (0.33)	1.42 (0.38)	1.46 (0.38)

**Web Table 2. Odds ratios (95% confidence intervals) for
the association of ethnicity (2006-10) with COVID-19 mortality (2020-21) –
sub-sample with biomarker data (N=358,820; 578 deaths)**

Ethnicity (no. deaths/no people)	Adjustment	Odds ratio	95% confidence interval	P-value	Attenuation (%)
Black (19/4,445)	Age- and sex-adjusted	4.87	3.07, 7.73	<0.001	
	+ Social factors	3.07	1.91, 4.91	<0.001	-29.2
	+ Lifestyle factors	3.69	2.31, 5.90	<0.001	-17.5
	+ Comorbidities	4.27	2.68, 6.80	<0.001	-8.3
	+ Biomarkers	4.69	2.93, 7.53	<0.001	-2.3
	Multiply-adjusted	3.10	1.91, 5.05	<0.001	-28.5
South Asian (14/6,005)	Age- and sex-adjusted	1.92	1.13, 3.28	0.08	
	+ Social factors	1.82	1.06, 3.14	0.17	-8.0
	+ Lifestyle factors	1.52	0.88, 2.62	0.26	-36.4
	+ Comorbidities	1.48	0.86, 2.53	0.20	-40.3
	+ Biomarkers	1.35	0.79, 2.32	0.32	-53.6
	Multiply-adjusted	1.36	0.78, 2.39	0.53	-52.8
Other (7/5,943)	Age- and sex-adjusted	1.29	0.61, 2.73	0.43	
	+ Social factors	1.10	0.52, 2.33	0.67	-62.8
	+ Lifestyle factors	1.06	0.50, 2.25	0.64	-76.9
	+ Comorbidities	1.17	0.55, 2.47	0.51	-39.4
	+ Biomarkers	1.14	0.54, 2.41	0.55	-49.2
	Multiply-adjusted	0.98	0.46, 2.08	0.83	-107.9

The reference category is White ethnicity (538 deaths in 342,427 people). Socioeconomic status: education, area deprivation index, household size; Lifestyle factors: alcohol consumption, cigarette smoking, body mass index, waist to hip ratio; Comorbidities: hypertension, diabetes, cardiovascular disease, chronic bronchitis, consultation with a psychiatrist; Biomarkers: HDL-cholesterol, white blood cell count, glycated haemoglobin.

Web Table 3. Odds ratios (95% confidence intervals) for the association of ethnicity (2006-10) with COVID-19 mortality (2020-21) in a sub-sample with occupational data (N=322,353; 328 deaths)

Ethnicity (no. deaths/no people)	Adjustment	Odds ratio	95% confidence interval	P-value	Attenuation (%)
Black (20/5,099)	Age- and sex-adjusted	6.46	4.09, 10.20	<0.001	
	+ Social factors plus occupation	3.96	2.46, 6.36	<0.001	-26.3
	+ Lifestyle factors	4.53	2.83, 7.25	<0.001	-19.0
	+ Comorbidities	5.57	3.51, 8.85	<0.001	-7.9
	Multiply-adjusted	3.30	2.02, 5.37	<0.001	-36.1
South Asian (8/5,709)	Age- and sex-adjusted	1.68	0.83, 3.40	0.15	
	+ Social factors plus occupation	1.51	0.74, 3.08	0.26	-21.2
	+ Lifestyle factors	1.18	0.57, 2.42	0.66	-68.6
	+ Comorbidities	1.34	0.66, 2.72	0.42	-44.1
	Multiply-adjusted	1.09	0.52, 2.28	0.82	-83.6
Other (4/5,620)	Age- and sex-adjusted	1.15	0.43, 3.09	0.78	
	+ Social factors plus occupation	0.95	0.35, 2.55	0.91	-139.0
	+ Lifestyle factors	0.90	0.33, 2.44	0.84	-173.8
	+ Comorbidities	1.04	0.39, 2.81	0.93	-69.2
	Multiply-adjusted	0.82	0.30, 2.22	0.70	-242.0

The reference category is White ethnicity (296 deaths in 305,925 people). Socioeconomic status: education, area deprivation index, household size, occupation; Lifestyle factors: alcohol consumption, cigarette smoking, body mass index, waist to hip ratio; Comorbidities: hypertension, diabetes, cardiovascular disease, chronic bronchitis, consultation with a psychiatrist.

Web Table 4. Odds ratios (95% confidence intervals) for the association of ethnicity (2006-10) with COVID-19 (2020-21) – based on 2 imputed datasets (N= 470,665; 781 deaths)

Ethnicity (no. deaths/no people)	Adjustment	Odds ratio	95% confidence interval	P-value	Attenuation (%)
Black (29/7,779)	Age- and sex-adjusted	3.99	2.74, 5.80	<0.001	
	+ Social factors	2.66	1.81, 3.90	<0.001	-29.3
	+ Social factors plus occupation	2.52	1.71, 3.69	<0.001	-33.3
	+ Lifestyle factors	3.06	2.09, 4.47	<0.001	-19.3
	+ Comorbidities	3.39	2.32, 4.95	<0.001	-11.8
	+ Biomarkers	3.84	2.62, 5.62	<0.001	-2.8
	Multiply-adjusted without biomarkers	2.35	1.59, 3.47	<0.001	-38.3
	Multiply-adjusted	2.58	1.74, 3.84	<0.001	-31.4
South Asian (22/9,489)	Age- and sex-adjusted	1.87	1.22, 2.87	0.004	
	+ Social factors	1.81	1.17, 2.80	0.01	-5.7
	+ Social factors plus occupation	1.74	1.12, 2.70	0.01	-12.0
	+ Lifestyle factors	1.53	0.99, 2.38	0.06	-32.0
	+ Comorbidities	1.40	0.91, 2.16	0.12	-46.1
	+ Biomarkers	1.33	0.86, 2.04	0.20	-55.0
	Multiply-adjusted without biomarkers	1.44	0.91, 2.27	0.12	-42.2
	Multiply-adjusted	1.40	0.88, 2.20	0.15	-46.9
Other (10/8,756)	Age- and sex-adjusted	1.23	0.66, 2.30	0.52	
	+ Social factors	1.06	0.56, 1.98	0.86	-72.7
	+ Social factors plus occupation	1.03	0.55, 1.93	0.93	-86.8
	+ Lifestyle factors	1.02	0.54, 1.91	0.95	-90.1
	+ Comorbidities	1.09	0.58, 2.05	0.78	-56.7
	+ Biomarkers	1.08	0.58, 2.03	0.80	-60.7
	Multiply-adjusted without biomarkers	0.95	0.51, 1.79	0.88	-124.2
	Multiply-adjusted	0.96	0.51, 1.81	0.91	-118.5

The reference category is White ethnicity (720 deaths in 444,641). Socioeconomic status: education, area deprivation index, household size; Lifestyle factors: alcohol consumption, cigarette smoking, body mass index, waist to hip ratio; Comorbidities: hypertension, diabetes, cardiovascular disease, chronic bronchitis, consultation with a psychiatrist; Biomarkers: HDL-cholesterol, white blood cell count, glycated haemoglobin

Web Table 5. Comparison of the self-declared ethnic groups in UK Biobank (2006– 2010) with UK censuses in 2001 and 2011 – all comparisons are for people aged 40– 69 years at assessment

Ethnicity groups in present analyses	UK Biobank (n = 499,877)	2001 UK Census[23] (n = 20,198,307)	2011 UK Census[24] (n = 23,146,612)
White	94.6 (472,837)	94.5 (19,085,322)	91.3 (21,133,317)
Black/Black British	1.6 (8,066)	1.5 (302,073)	2.4 (565,777)
South Asian	1.6 (8,024)	2.5 (519,566)	3.2 (757,423)
Other	2.2 (10,950)	1.5 (291,346)	3.1 (690,095)

Results are % (N)

Web Table 6. Age- and sex-adjusted hazard ratios (95% confidence intervals) for the relation of ethnicity with mortality outcomes in UK Biobank

		White	Other	South Asian	Black
COVID-19*	N cases / N risk	650/426265	8/7744	19/7839	28/6816
	Odds ratios (95% CI)	1.0 (ref)	1.19 (0.59, 2.40)	2.05 (1.30, 3.25)	4.81 (3.28, 7.05)
All deaths	N cases / N risk	32483/472729	374/9091	469/9882	342/8061
	Hazard ratios (95% CI)	1.0	0.90 (0.81, 1.00)	0.86 (0.78, 0.94)	0.93 (0.84, 1.04)
CHD	N cases / N risk	5293/472729	56/9091	169/9882	42/8061
	Hazard ratios (95% CI)	1.0	0.91 (0.61, 1.19)	1.82 (1.57, 2.13)	0.77 (0.57, 1.05)
Stroke	N cases / N risk	1973/472729	23/9091	33/9882	28/8061
	Hazard ratios (95% CI)	1.0	1.01 (0.69, 1.52)	1.07 (0.76, 1.51)	1.38 (0.95, 2.01)
All cancers	N cases / N risk	16609/472729	206/9091	174/9882	159/8061
	Hazard ratios (95% CI)	1.0	0.88 (0.76, 1.01)	0.59 (0.50, 0.68)	0.77 (0.66, 0.91)

*Results from present manuscript. Deaths from COVID-19 are from 5th March 2020, to 24th January, 2021; deaths from other causes are from 10th May 2006 to 18th December 2020.