

Appendix

Supplementary Table S1 Sample selection and number of participants

Inclusion criteria	Cohort size
All enumerated at 2011 Census in England and Wales, aged 31-55 in 2011*	17,407,025
Linked to the NHS 2011-2013 Patient Register	16,731,578
Alive on 24th January 2020	16,413,324
Living in England and linked to 2019 English primary care records	14,339,794
Living in private households	14,295,900

Note: *These people would be 40 to 64 in 2020

Supplementary Table S2 Occupation classification and associated SOC 2010 codes

Occupation	SOC 2010 code(s)
Corporate managers and director (excluding those in retail and wholesale)	11
Other managers and proprietors	12
Science, research, engineering and technology professionals	21
Health professionals	22
Teaching and educational professionals	23
Business, media and public service professionals	24
Science, engineering and technology associate professionals	31
Health and social care associate professionals	32
Protective service occupations	33
Culture, media and sports occupations	34
Business and public service associate professionals	35
Administrative occupations	41
Secretarial and related occupations	42
Skilled agricultural and related trades	51
Skilled metal, electrical and electronic trades	52
Skilled construction and building trades	53
Textiles, printing and other (excluding food preparation and hospitality) skilled trades	54
Caring personal service occupations (excluding care workers and home carers)	61
Leisure, travel and related personal service occupations	62
Sales occupations	71
Customer service occupations	72
Assemblers and construction operatives	81
Mobile machine and other drivers	82
Elementary trades and related occupations	91

Other elementary occupations	92
Food preparation and hospitality trades	543
Caring personal services	614
Process operatives	811
Plant and machine operatives	812
Elementary administration occupations	921
Elementary cleaning occupations (excluding cleaners and domestics)	923
Elementary security occupations	924
Other elementary occupations	927
Managers and directors in retail and wholesale	1190
Care workers and home carers	6145
Large goods vehicle drivers	8211
Van drivers	8212
Bus and coach drivers	8213
Taxi and cab drivers and chauffeurs	8214
Cleaners and domestics	9233
<u>Elementary storage occupations</u>	<u>9260</u>

Note: Caring personal service occupations (excluding care workers and home carers) include childcare and Related Personal Services, Animal Care and Control Services, Nursing auxiliaries and assistants, Ambulance staff (excluding paramedics), Dental nurses, Houseparents and residential wardens, Senior care workers, Care escorts, Undertakers, mortuary and crematorium assistants. Elementary cleaning occupations (excluding cleaners and domestics) include Window cleaners; Street cleaners; Cleaners and domestics; Launderers, dry cleaners and pressers; Refuse and salvage occupations; Vehicle valeters and cleaners. Elementary administration occupations include Postal workers, mail sorters, messengers and couriers & Elementary administration occupations not elsewhere classified. Protective service occupations include NCOs and other ranks; Police officers (sergeant and below); Fire service officers (watch manager and below); Prison service officers (below principal officer); Police community support officers and Protective service associate professionals not elsewhere classified. Elementary trades and related occupations include Elementary Agricultural Occupations, such as Farm workers or Forestry workers, Elementary Construction Occupations, Elementary Process Plant Occupations, such as Industrial cleaning process occupations or Packers, bottlers, canners and fillers. Other elementary occupations include Hospital porters, Kitchen and catering assistants, Waiters and waitresses, Bar staff and Leisure and theme park attendants.

Supplementary Table S3: Covariates included in the Cox regression models

Variable	Coding	Source
Age variables		
Single year of age	Second-order polynomial	2011 Census
Self-reported ethnic group	Bangladeshi, Black African, Black Caribbean, Chinese, Indian, Mixed, Pakistani, White British, White Other, Other	2011 Census
Geographical variables		
Region of residence in 2019	Region-specific baseline hazard	2019 GDPPR
Urban-rural classification	Urban major conurbation, Urban minor conurbation, Urban city and town, Urban city & town in a sparse setting, Rural town and fringe, Rural village, Rural hamlet & isolated dwellings, Rural town & fringe in a sparse setting, Rural village in a sparse setting Rural hamlet & isolated dwellings, in a sparse setting	2019 GDPPR
Population density of Lower Super Output Area (LSOA)	Second-order polynomial, allowing for a different slope beyond the 99 th percentile of the distribution to account for extreme values	2019 GDPPR
Sociodemographic variables		
Index of Multiple Deprivation (IMD)	Dummy variables representing deciles of deprivation	2019 GDPPR
Household deprivation (see table note)	Not deprived, deprived in one dimension, deprived in two dimensions, deprived in three dimensions, deprived in four dimensions	2011 Census
Level of highest qualification	Degree, A-level or equivalent, GCSE or equivalent, no qualification	2011 Census
Type of accommodation	Detached house; Semi-detached house; Terraced; Flat (purposed built); Flat (converted); Flat (Commercial building); Other	
Household tenure	Own outright, own with mortgage, social rented, private rented, other	2011 Census
Household variables		
Household size	1-2 people, 3-4 people, 5-6 people, 7+ people	2011 Census
Household with children	At least one child aged 9 to 18	2011 Census
Overcrowding	Overcrowded household (occupancy rating < -1)	2011 Census
Health-related variables		
Body Mass Index (kg/m ²)	< 18.5, 18.5 – 25, 25 to 30, >= 30, missing	2015-2019 GDPPR
Chronic kidney disease (CKD)	No CKD, CKD3, CKD4, CKD5	2000-2019 GDPPR
Learning disability	No learning disability, Down's Syndrome, other learning disability	2000-2019 GDPPR
Cancer and immunosuppression	Dummies for blood cancer, solid organ transplant, prescribed immunosuppressant medication by GP, Prescribed leukotriene or long-acting beta blockers, Prescribed regular prednisolone,	2000-2019 GDPPR
Other conditions	Diabetes, Chronic obstructive pulmonary disease (COPD), Asthma, Rare pulmonary diseases, Pulmonary hypertension or pulmonary fibrosis, Coronary heart disease, Stroke, Atrial Fibrillation,	2000-2019 GDPPR, HES

Congestive cardiac failure , Venous thromboembolism , Peripheral vascular disease , Congenital heart disease , Dementia , Parkinson's disease , Epilepsy , Rare neurological conditions , Cerebral palsy , Severe mental illness (bipolar disorder, schizophrenia, severe depression), Osteoporotic fracture , Rheumatoid arthritis or Systemic lupus erythematosus , Cirrhosis of the liver

Note: Household deprivation is defined according to four dimensions: employment (at least one household member is unemployed or long-term sick, excluding full-time students); education (no household members have at least Level 2 education, and no one aged 16-18 years is a full-time student); health and disability (at least one household member reported their health as being 'bad'/'very bad' or has a long-term health problem); and housing (the household's accommodation is overcrowded, with an occupancy rating -1 or less, or is in a shared dwelling, or has no central heating). 2015-2019 GDPPR: General Practice Extraction Service (GPES) Data for pandemic planning and research; HES: Hospital Episode Statistics.

Supplementary Table S4 Characteristics of the study population and those who died from a cause related to COVID-19

		Population	COVID-19 deaths
		n(%)	n(%)
Sex	Male	6,964,839 (48.72)	2,970 (65.25)
	Female	7,331,061 (51.28)	1,582 (34.75)
Age	Mean (SD)	52.19 (6.96)	57.05 (5.84)
Ethnicity	Bangladeshi	76,776 (0.54)	77 (1.69)
	Black African	235,255 (1.65)	191 (4.20)
	Black Caribbean	179,185 (1.25)	132 (2.90)
	Chinese	82,158 (0.57)	14 (0.31)
	Indian	411,615 (2.88)	282 (6.20)
	Mixed	172,402 (1.21)	51 (1.12)
	Other	363,548 (2.54)	214 (4.70)
	Pakistani	210,678 (1.47)	196 (4.31)
	White British	11,762,187 (82.28)	3,218 (70.69)
	White other	802,096 (5.61)	177 (3.89)
Occupation	Administrative occupations	1,252,049 (8.76)	302 (6.63)
	Bus and coach drivers	71,019 (0.50)	67 (1.47)
	Business and public service associate professionals	904,207 (6.32)	159 (3.49)
	Business, media and public service professionals	717,153 (5.02)	148 (3.25)
	Care workers and home carers	397,620 (2.78)	188 (4.13)
	Caring personal service occupations	470,906 (3.29)	75 (1.65)
	Caring personal services	218,019 (1.53)	68 (1.49)
	Cleaners and domestics	339,484 (2.37)	170 (3.73)
	Corporate managers and directors	871,555 (6.10)	187 (4.11)
	Culture, media and sports occupations	259,159 (1.81)	39 (0.86)
	Customer service occupations	198,344 (1.39)	67 (1.47)
	Elementary administration and service occupations	46,135 (0.32)	19 (0.42)
	Elementary administration occupations	133,518 (0.93)	57 (1.25)
	Elementary cleaning occupations	80,885 (0.57)	42 (0.92)
	Elementary security occupations	182,686 (1.28)	120 (2.64)

Elementary storage occupations	212,772 (1.49)	120 (2.64)
Elementary trades and related occupations	277,084 (1.94)	141 (3.10)
Food preparation and hospitality trades	246,335 (1.72)	105 (2.31)
Health and social care associate professionals	178,277 (1.25)	51 (1.12)
Health professionals	579,622 (4.05)	145 (3.19)
Large goods vehicle drivers	139,955 (0.98)	69 (1.52)
Leisure, travel and related personal service occupations	299,868 (2.10)	89 (1.96)
Managers and directors in retail and wholesale	254,033 (1.78)	82 (1.80)
Other elementary services occupations	279,992 (1.96)	145 (3.19)
Other managers and proprietors	549,931 (3.85)	171 (3.76)
Plant and machine operatives	144,901 (1.01)	78 (1.71)
Process operatives	167,785 (1.17)	101 (2.22)
Process, plant and machine operatives	225,487 (1.58)	105 (2.31)
Protective service occupations	187,510 (1.31)	27 (0.59)
Sales occupations	774,754 (5.42)	284 (6.24)
Science, engineering and technology associate professionals	214,286 (1.50)	72 (1.58)
Science, research, engineering and technology professionals	627,758 (4.39)	103 (2.26)
Secretarial and related occupations	457,792 (3.20)	86 (1.89)
Skilled agricultural and related trades	136,740 (0.96)	32 (0.70)
Skilled construction and building trades	542,774 (3.80)	171 (3.76)
Skilled metal, electrical and electronic trades	522,167 (3.65)	214 (4.70)
Taxi and cab drivers and chauffeurs	103,956 (0.73)	124 (2.72)
Teaching and educational professionals	626,682 (4.38)	93 (2.04)
Textiles, printing and other skilled trades	125,133 (0.88)	52 (1.14)
Transport and mobile machine drivers and operatives	132,163 (0.92)	78 (1.71)

	Van drivers	145,404 (1.02)	106 (2.33)	
Population density	Mean (SD)	4,334 (4,439)	5,432 (4,958)	
Household deprivation	Not deprived	8,205,368 (57.40)	1,400 (30.76)	
	Deprived in 1 dim	3,924,394 (27.45)	1,326 (29.13)	
	Deprived in 2 dim	1,581,906 (11.07)	1,188 (26.10)	
	Deprived in 3 dim	530,985 (3.71)	566 (12.43)	
	Deprived in 4 dim	53,247 (0.37)	72 (1.58)	
	IMD decile	1	1,194,115 (8.35)	769 (16.89)
		2	1,304,257 (9.12)	733 (16.10)
3		1,380,385 (9.66)	633 (13.91)	
4		1,418,340 (9.92)	473 (10.39)	
5		1,446,665 (10.12)	399 (8.77)	
6		1,460,724 (10.22)	347 (7.62)	
7		1,488,026 (10.41)	311 (6.83)	
8		1,510,579 (10.57)	311 (6.83)	
9		1,536,770 (10.75)	308 (6.77)	
10		1,556,039 (10.88)	268 (5.89)	
Household tenancy	Owned outright	2,195,290 (15.36)	749 (16.45)	
	Owned with a mortgage	8,129,192 (56.86)	1,984 (43.59)	
	Shared ownership	111,491 (0.78)	33 (0.72)	
	Social rented (from council)	962,972 (6.74)	669 (14.70)	
	Social rented (other)	855,694 (5.99)	507 (11.14)	
	Private rented	1,935,044 (13.54)	567 (12.46)	
	Living rent free	106,217 (0.74)	43 (0.94)	
Household size	1 to 2	7,450,777 (52.12)	2,591 (56.92)	
	3 to 4	6,082,685 (42.55)	1,635 (35.92)	
	5+	698,290 (4.88)	276 (6.06)	
	Missing	64,148 (0.45)	50 (1.10)	
Type of accommodation	Detached house	3,591,537 (25.12)	716 (15.73)	
	Semi-detached house	4,983,098 (34.86)	1,585 (34.82)	
	Terraced	3,765,594 (26.34)	1,374 (30.18)	
	Flat (purposed built)	1,397,292 (9.77)	699 (15.36)	
	Flat (converted)	426,624 (2.98)	123 (2.70)	
	Flat (Commercial building)	109,598 (0.77)	50 (1.10)	
	Other	22,157 (0.15)	5 (0.11)	
	Body Mass Index	< 18.5	88,164 (0.62)	64 (1.41)

		2,740,824	
	>= 30	(19.17)	1,759 (38.64)
		2,584,788	
	18.5 to 25	(18.08)	459 (10.08)
		3,055,559	
	25 to 30	(21.37)	776 (17.05)
		5,826,565	
	Missing	(40.76)	1,494 (32.82)
Learning disability		14,217,431	
	None	(99.45)	4,436 (97.45)
	Other learning disability	76,935 (0.54)	110 (2.42)
	Down's syndrome	1,534 (0.01)	6 (0.13)
Chronic kidney disease		14,226,514	
	No	(99.51)	4,292 (94.29)
	CDK 3	58,016 (0.41)	127 (2.79)
	CDK4	5,045 (0.04)	42 (0.92)
	CDK 5	6,325 (0.04)	91 (2.00)
Cancer or immunosuppression:			
	Blood cancer	117,266 (0.82)	243 (5.34)
	Respiratory cancer	1,832 (0.01)	19 (0.42)
	Taking immunosuppressants	2,761 (0.02)	*
	Taking anti-leukotriene or long acting beta2-agonists	883,283 (6.18)	919 (20.19)
	Taking oral steroids in the last 6 months	105,793 (0.74)	379 (8.33)
	Solid organ transplant	1,662 (0.02)	20 (0.44)
Other comorbidities			
	Cerebral Palsy	1,417 (0.01)	*
		1,671,518	
	Asthma	(11.69)	792 (17.40)
	Atrial Fibrillation	149,245 (1.04)	217 (4.77)
	Coronary heart disease	338,388 (2.37)	543 (11.93)
	COPD	262,762 (1.84)	455 (10.00)
	Cystic fibrosis or bronchiectasis or alveolitis	95,458 (0.67)	258 (5.67)
	Dementia	8,530 (0.06)	60 (1.32)
	Diabetes	1,115,628 (7.80)	1,653 (36.31)
	Epilepsy	138,775 (0.97)	128 (2.81)
	Heart failure	85,025 (0.59)	311 (6.83)
	Liver cirrhosis	35,476 (0.25)	136 (2.99)
	Neurological disease	9,089 (0.06)	32 (0.70)
	Parkinson's disease	13,742 (0.10)	30 (0.66)
	Peripheral vascular disease	54,255 (0.38)	161 (3.54)
	Fracture of hip, wrist, spine or humerus	1,800 (0.01)	10 (0.22)
	Pulmonary hypertension or fibrosis	21,516 (0.15)	177 (3.89)
	Rheumatoid arthritis or SLE	115,701 (0.81)	109 (2.39)

	3,127,670	
Severe mental illness	(21.88)	1,364 (29.96)
Stroke or TIA	168,292 (1.18)	314 (6.90)
Thrombosis or pulmonary embolus	2,309 (0.02)	*

Supplementary Table S5: Proportion remaining in the same major group occupation in 2011 and 2019, by major group occupation and sex

Major occupation group	Men	Women
Managers, directors and senior officials	72.1	60.8
Professional occupations	78.9	73.9
Associate professional and technical occupations	68.6	65.8
Administrative and secretarial occupations	63.0	69.4
Skilled trades occupations	74.5	62.1
Caring, leisure and other service occupations	56.1	74.4
Sales and customer service occupations	42.1	61.4
Process, plant and machine operatives	76.2	57.9
Elementary occupations	77.0	68.3
Overall	72.4	68.1

Source: Understanding Society [ref]

Supplementary Table S6 Hazard ratios for COVID-19 related death for men aged 40 to 64, compared to corporate managers and directors

	Model 1	Model 2	Model 3	Model 4	Model 5
Taxi and cab drivers and chauffeurs	4.62 [3.64 - 5.87]	3.44 [2.70 - 4.37]	1.82 [1.41 - 2.34]	1.57 [1.21 - 2.02]	1.49 [1.15 - 1.92]
Other elementary occupations	4.22 [3.23 - 5.52]	3.34 [2.55 - 4.37]	2.11 [1.60 - 2.79]	1.55 [1.17 - 2.05]	1.65 [1.25 - 2.18]
Secretarial and related occupations	3.89 [2.39 - 6.34]	3.29 [2.02 - 5.36]	2.67 [1.64 - 4.36]	2.13 [1.30 - 3.48]	2.31 [1.42 - 3.77]
Care workers and home carers	3.75 [2.75 - 5.12]	3.24 [2.37 - 4.42]	2.36 [1.72 - 3.22]	1.77 [1.29 - 2.43]	1.57 [1.14 - 2.15]
Elementary security occupations	3.67 [2.82 - 4.79]	2.90 [2.22 - 3.79]	2.00 [1.52 - 2.62]	1.53 [1.16 - 2.01]	1.21 [0.92 - 1.59]
Bus and coach drivers	3.50 [2.61 - 4.70]	2.75 [2.05 - 3.70]	1.96 [1.45 - 2.65]	1.54 [1.14 - 2.08]	1.18 [0.86 - 1.61]
Cleaners and domestics	3.23 [2.35 - 4.44]	2.61 [1.89 - 3.59]	1.69 [1.22 - 2.34]	1.25 [0.90 - 1.74]	1.27 [0.92 - 1.77]
Customer service occupations	2.97 [2.06 - 4.29]	2.51 [1.74 - 3.63]	2.14 [1.48 - 3.10]	1.77 [1.22 - 2.56]	1.72 [1.19 - 2.49]
Caring personal services	2.72 [2.12 - 3.50]	2.33 [1.81 - 3.00]	1.74 [1.35 - 2.25]	1.36 [1.05 - 1.77]	1.33 [1.03 - 1.73]
Van drivers	2.66 [1.75 - 4.02]	2.31 [1.53 - 3.50]	1.85 [1.22 - 2.81]	1.52 [1.00 - 2.31]	1.37 [0.90 - 2.08]
Process operatives	2.55 [1.94 - 3.36]	2.23 [1.69 - 2.94]	1.54 [1.16 - 2.04]	1.20 [0.91 - 1.60]	1.21 [0.91 - 1.61]
Food preparation and hospitality trades	2.48 [1.87 - 3.27]	2.00 [1.52 - 2.65]	1.23 [0.92 - 1.65]	0.99 [0.74 - 1.32]	0.96 [0.71 - 1.28]
Sales occupations	2.46 [1.92 - 3.15]	2.13 [1.66 - 2.73]	1.58 [1.23 - 2.04]	1.19 [0.92 - 1.54]	1.22 [0.94 - 1.58]
Elementary storage occupations	2.44 [1.90 - 3.12]	2.06 [1.61 - 2.63]	1.46 [1.13 - 1.87]	1.18 [0.92 - 1.52]	1.17 [0.91 - 1.51]
Health and social care associate professionals	2.27 [1.49 - 3.46]	1.91 [1.25 - 2.92]	1.78 [1.16 - 2.71]	1.49 [0.98 - 2.28]	1.33 [0.87 - 2.04]
Mobile machine and other drivers	2.27 [1.72 - 2.99]	2.03 [1.54 - 2.68]	1.61 [1.22 - 2.13]	1.28 [0.97 - 1.70]	1.27 [0.95 - 1.68]
Leisure, travel and related personal service occupations	2.17 [1.55 - 3.04]	1.79 [1.28 - 2.52]	1.44 [1.02 - 2.02]	1.18 [0.84 - 1.66]	1.23 [0.87 - 1.73]
Health professionals	2.12 [1.58 - 2.84]	1.93 [1.44 - 2.59]	1.68 [1.25 - 2.27]	1.63 [1.21 - 2.20]	1.65 [1.23 - 2.23]
Elementary trades and related occupations	2.05 [1.59 - 2.64]	1.85 [1.44 - 2.39]	1.27 [0.98 - 1.65]	0.89 [0.69 - 1.16]	0.93 [0.72 - 1.22]
Administrative occupations	2.00 [1.45 - 2.76]	1.68 [1.22 - 2.33]	1.31 [0.94 - 1.81]	1.09 [0.79 - 1.52]	1.18 [0.85 - 1.65]
Elementary administration occupations	1.97 [1.57 - 2.48]	1.69 [1.34 - 2.13]	1.53 [1.21 - 1.93]	1.32 [1.05 - 1.67]	1.33 [1.05 - 1.68]

Textiles, printing and other (excl. food prep and hospitality) skilled trades	1.90 [1.28 - 2.82]	1.65 [1.11 - 2.45]	1.22 [0.82 - 1.82]	0.93 [0.62 - 1.39]	1.00 [0.67 - 1.49]
Elementary cleaning occupations excl. cleaners and domestics	1.90 [1.34 - 2.67]	1.68 [1.19 - 2.37]	1.33 [0.94 - 1.89]	1.11 [0.78 - 1.57]	1.11 [0.78 - 1.58]
Assemblers and construction operatives	1.83 [1.39 - 2.41]	1.64 [1.25 - 2.17]	1.27 [0.96 - 1.68]	1.01 [0.76 - 1.34]	1.01 [0.76 - 1.33]
Plant and machine operatives	1.75 [1.30 - 2.35]	1.59 [1.18 - 2.13]	1.24 [0.92 - 1.68]	0.97 [0.72 - 1.32]	0.90 [0.67 - 1.22]
Large goods vehicle drivers	1.75 [1.30 - 2.35]	1.65 [1.23 - 2.23]	1.56 [1.16 - 2.11]	1.39 [1.03 - 1.87]	1.47 [1.09 - 1.98]
Managers and directors in retail and wholesale	1.69 [1.27 - 2.24]	1.63 [1.23 - 2.17]	1.33 [1.00 - 1.78]	1.13 [0.85 - 1.52]	1.07 [0.80 - 1.42]
Science, engineering and technology associate professionals	1.67 [1.24 - 2.25]	1.62 [1.20 - 2.19]	1.35 [1.00 - 1.82]	1.32 [0.98 - 1.78]	1.29 [0.96 - 1.75]
Skilled metal, electrical and electronic trades	1.54 [1.25 - 1.90]	1.44 [1.17 - 1.77]	1.27 [1.03 - 1.58]	1.09 [0.88 - 1.35]	1.10 [0.89 - 1.36]
Other managers and proprietors	1.45 [1.15 - 1.85]	1.40 [1.10 - 1.77]	1.14 [0.89 - 1.44]	1.06 [0.83 - 1.35]	1.05 [0.82 - 1.33]
Caring personal service occupations excl. care workers and home carers	1.36 [0.70 - 2.67]	1.24 [0.63 - 2.43]	1.11 [0.56 - 2.17]	0.91 [0.46 - 1.78]	0.84 [0.43 - 1.66]
Skilled construction and building trades	1.22 [0.98 - 1.52]	1.14 [0.92 - 1.42]	0.97 [0.78 - 1.22]	0.82 [0.66 - 1.03]	0.86 [0.69 - 1.08]
Business, media and public service professionals	1.05 [0.82 - 1.35]	0.96 [0.75 - 1.24]	1.06 [0.82 - 1.36]	1.02 [0.79 - 1.32]	1.00 [0.77 - 1.29]
Culture, media and sports occupations	1.01 [0.68 - 1.49]	0.86 [0.58 - 1.27]	0.92 [0.62 - 1.36]	0.82 [0.56 - 1.22]	0.90 [0.61 - 1.33]
Business and public service associate professionals	1.01 [0.79 - 1.29]	0.97 [0.76 - 1.24]	0.98 [0.76 - 1.25]	0.95 [0.74 - 1.21]	0.94 [0.74 - 1.20]
Teaching and educational professionals	0.99 [0.71 - 1.38]	0.90 [0.65 - 1.25]	1.03 [0.73 - 1.44]	0.96 [0.69 - 1.35]	1.05 [0.75 - 1.47]
Skilled agricultural and related trades	0.91 [0.61 - 1.36]	1.14 [0.76 - 1.70]	0.94 [0.63 - 1.41]	0.77 [0.52 - 1.16]	0.85 [0.56 - 1.28]

Science, research, engineering and technology professionals	0.81 [0.62 - 1.05]	0.79 [0.61 - 1.02]	0.84 [0.65 - 1.09]	0.80 [0.62 - 1.04]	0.82 [0.63 - 1.06]
Protective service occupations	0.74 [0.48 - 1.13]	0.74 [0.48 - 1.13]	0.71 [0.47 - 1.09]	0.68 [0.45 - 1.04]	0.65 [0.43 - 1.00]

Model 1: Age; Model 2: Model 1 + geographical factors (region, population density, urban/rural classification); Model 3: Model 2+ ethnicity and education; Model 4: Model 3 + socio-economic characteristics (IMD decile, household deprivation, educational attainment, social grade), household tenancy, type of accommodation, household size, overcrowding; Model 5: Model 4 + health (Body Mass Index, Chronic kidney disease (CKD), Learning disability, Cancer and immunosuppression, other conditions) See Supplementary Tables S3 for more details. Occupation classification and associated SOC 2010 codes are given in Supplementary Table S2.

Supplementary Table S7 Hazard ratios for COVID-19 related death for women aged 40 to 64, compared to corporate managers and directors

	Model 1	Model 2	Model 3	Model 4	Model 5
Taxi and cab drivers and chauffeurs	6.39 [2.49 - 16.39]	6.14 [2.39 - 15.76]	4.22 [1.64 - 10.88]	2.89 [1.12 - 7.47]	2.77 [1.07 - 7.16]
Plant and machine operatives	5.54 [3.04 - 10.10]	4.40 [2.41 - 8.04]	2.96 [1.61 - 5.45]	1.86 [1.01 - 3.44]	1.66 [0.89 - 3.08]
Bus and coach drivers	4.79 [1.87 - 12.29]	4.33 [1.69 - 11.13]	3.18 [1.23 - 8.19]	2.16 [0.84 - 5.57]	1.94 [0.75 - 5.01]
Elementary cleaning occupations excl. cleaners and domestics	4.29 [2.25 - 8.18]	3.73 [1.95 - 7.11]	2.57 [1.34 - 4.94]	1.75 [0.91 - 3.37]	1.98 [1.03 - 3.81]
Process operatives	3.19 [1.90 - 5.35]	2.72 [1.62 - 4.58]	2.00 [1.18 - 3.38]	1.34 [0.79 - 2.28]	1.28 [0.75 - 2.17]
Elementary trades and related occupations	3.12 [1.97 - 4.95]	2.72 [1.71 - 4.31]	1.88 [1.18 - 3.02]	1.20 [0.75 - 1.92]	1.21 [0.75 - 1.94]
Elementary security occupations	3.03 [1.88 - 4.87]	2.66 [1.65 - 4.29]	1.92 [1.19 - 3.12]	1.57 [0.97 - 2.55]	1.36 [0.83 - 2.21]
Care workers and home carers	2.98 [2.02 - 4.38]	2.67 [1.81 - 3.93]	2.12 [1.43 - 3.14]	1.47 [0.99 - 2.18]	1.29 [0.87 - 1.92]
Cleaners and domestics	2.89 [1.95 - 4.27]	2.54 [1.72 - 3.76]	1.74 [1.17 - 2.61]	1.24 [0.83 - 1.86]	1.24 [0.83 - 1.85]
Elementary storage occupations	2.81 [1.50 - 5.26]	2.43 [1.29 - 4.55]	1.79 [0.95 - 3.37]	1.31 [0.70 - 2.48]	1.58 [0.84 - 2.98]
Other elementary occupations	2.80 [1.86 - 4.21]	2.52 [1.67 - 3.79]	1.81 [1.19 - 2.75]	1.28 [0.84 - 1.95]	1.26 [0.83 - 1.92]
Assemblers and construction operatives	2.62 [1.59 - 4.34]	2.18 [1.32 - 3.62]	1.49 [0.89 - 2.49]	1.02 [0.61 - 1.70]	1.03 [0.61 - 1.73]
Van drivers	2.58 [1.01 - 6.63]	2.50 [0.97 - 6.41]	1.77 [0.69 - 4.55]	1.24 [0.48 - 3.20]	1.43 [0.55 - 3.69]
Sales occupations	2.37 [1.63 - 3.46]	2.15 [1.48 - 3.14]	1.57 [1.07 - 2.30]	1.22 [0.83 - 1.79]	1.13 [0.77 - 1.67]
Mobile machine and other drivers	2.33 [0.71 - 7.60]	2.19 [0.67 - 7.14]	1.90 [0.58 - 6.20]	1.47 [0.45 - 4.81]	1.31 [0.40 - 4.31]
Skilled metal, electrical and electronic trades	2.15 [0.76 - 6.09]	1.86 [0.66 - 5.27]	1.39 [0.49 - 3.95]	0.98 [0.34 - 2.77]	0.88 [0.31 - 2.51]
Food preparation and hospitality trades	2.00 [1.23 - 3.27]	1.83 [1.12 - 2.98]	1.46 [0.89 - 2.40]	1.11 [0.68 - 1.83]	0.99 [0.60 - 1.63]
Customer service occupations	1.96 [1.20 - 3.21]	1.77 [1.08 - 2.88]	1.45 [0.88 - 2.37]	1.21 [0.74 - 1.98]	1.14 [0.70 - 1.87]
Managers and directors in retail and wholesale	1.88 [1.10 - 3.22]	1.80 [1.05 - 3.07]	1.47 [0.86 - 2.52]	1.26 [0.74 - 2.16]	1.37 [0.80 - 2.35]
Textiles, printing and other (excl. food prep and hospitality) skilled trades	1.84 [0.93 - 3.65]	1.73 [0.87 - 3.43]	1.29 [0.65 - 2.58]	0.94 [0.47 - 1.87]	1.03 [0.52 - 2.06]
Caring personal services	1.82 [1.15 - 2.88]	1.65 [1.04 - 2.62]	1.38 [0.87 - 2.20]	1.10 [0.69 - 1.76]	1.00 [0.63 - 1.59]
Leisure, travel and related personal service occupations	1.74 [1.11 - 2.73]	1.65 [1.05 - 2.59]	1.35 [0.85 - 2.13]	1.12 [0.71 - 1.77]	1.25 [0.79 - 1.97]
Science, engineering and technology associate professionals	1.59 [0.82 - 3.09]	1.54 [0.79 - 2.98]	1.41 [0.73 - 2.75]	1.27 [0.65 - 2.47]	1.32 [0.68 - 2.58]
Other managers and proprietors	1.59 [1.02 - 2.47]	1.59 [1.02 - 2.47]	1.45 [0.93 - 2.26]	1.26 [0.81 - 1.97]	1.21 [0.78 - 1.89]

Health and social care associate professionals	1.57 [0.94 - 2.63]	1.44 [0.86 - 2.42]	1.40 [0.83 - 2.35]	1.17 [0.70 - 1.97]	1.21 [0.72 - 2.04]
Elementary administration occupations	1.54 [0.73 - 3.23]	1.41 [0.67 - 2.95]	1.05 [0.50 - 2.21]	0.80 [0.38 - 1.68]	0.80 [0.38 - 1.69]
Health professionals	1.38 [0.92 - 2.08]	1.31 [0.87 - 1.97]	1.53 [1.01 - 2.31]	1.37 [0.91 - 2.08]	1.30 [0.86 - 1.97]
Administrative occupations	1.36 [0.93 - 1.99]	1.27 [0.87 - 1.86]	1.10 [0.75 - 1.61]	1.00 [0.68 - 1.46]	1.01 [0.69 - 1.49]
Skilled construction and building trades	1.34 [0.32 - 5.58]	1.27 [0.30 - 5.29]	1.02 [0.24 - 4.27]	0.78 [0.19 - 3.26]	0.87 [0.21 - 3.62]
Caring personal service occupations excl. care workers and home carers	1.28 [0.84 - 1.95]	1.22 [0.80 - 1.86]	1.08 [0.71 - 1.65]	0.96 [0.63 - 1.47]	0.99 [0.65 - 1.52]
Business, media and public service professionals	1.28 [0.81 - 2.01]	1.24 [0.79 - 1.94]	1.40 [0.89 - 2.21]	1.35 [0.86 - 2.12]	1.35 [0.86 - 2.12]
Skilled agricultural and related trades	1.23 [0.44 - 3.49]	1.60 [0.56 - 4.54]	1.39 [0.49 - 3.94]	1.19 [0.42 - 3.37]	1.13 [0.39 - 3.23]
Secretarial and related occupations	1.19 [0.78 - 1.82]	1.16 [0.76 - 1.77]	0.98 [0.64 - 1.49]	0.91 [0.59 - 1.39]	0.94 [0.62 - 1.44]
Business and public service associate professionals	1.08 [0.70 - 1.69]	1.05 [0.68 - 1.64]	1.02 [0.66 - 1.60]	0.97 [0.62 - 1.52]	1.01 [0.65 - 1.58]
Teaching and educational professionals	0.88 [0.56 - 1.37]	0.86 [0.55 - 1.34]	1.01 [0.64 - 1.59]	0.98 [0.63 - 1.54]	1.06 [0.67 - 1.66]
Science, research, engineering and technology professionals	0.80 [0.41 - 1.60]	0.79 [0.40 - 1.57]	0.90 [0.45 - 1.78]	0.87 [0.44 - 1.73]	0.93 [0.47 - 1.84]
Culture, media and sports occupations	0.67 [0.32 - 1.40]	0.67 [0.32 - 1.39]	0.72 [0.34 - 1.51]	0.68 [0.32 - 1.42]	0.70 [0.33 - 1.50]
Protective service occupations	0.45 [0.11 - 1.88]	0.45 [0.11 - 1.86]	0.39 [0.09 - 1.63]	0.37 [0.09 - 1.54]	0.38 [0.09 - 1.61]

Model 1: Age; Model 2: Model 1 + geographical factors (region, population density, urban/rural classification); Model 3: Model 2+ socio-economic characteristics (IMD decile, household deprivation, educational attainment, social grade); Model 4: Model 3 + household tenancy, type of accommodation, household size, multigenerational household, household with children; Model 5: Model 4 + ethnicity; Model 6: Model 5 + health (Body Mass Index, Chronic kidney disease (CKD), Learning disability, Cancer and immunosuppression, other conditions) See Supplementary Tables S3 for more details. Occupation classification and associated SOC 2010 codes are given in Supplementary Table S2.

Supplementary Table S8 Hazard ratios for COVID-19 related death for adults aged 40 to 64, compared to all other occupations, by sex

Occupation	Men		Women	
	Age adjusted	Fully adjusted	Age adjusted	Fully adjusted
Taxi and cab drivers and chauffeurs	2.81 [2.34 - 3.38]	1.32 [1.09 - 1.60]	3.62 [1.5 - 8.7]	2.34 [0.97 - 5.64]
Other elementary occupations	2.55 [2.04 - 3.18]	1.47 [1.17 - 1.84]	1.67 [1.34 - 2.09]	1.09 [0.87 - 1.36]
Secretarial and related occupations	2.32 [1.46 - 3.68]	2.07 [1.30 - 3.29]	0.64 [0.5 - 0.82]	0.83 [0.65 - 1.06]
Care workers and home carers	2.25 [1.72 - 2.94]	1.39 [1.05 - 1.82]	1.84 [1.54 - 2.19]	1.14 [0.95 - 1.36]
Elementary security occupations	2.21 [1.78 - 2.75]	1.06 [0.85 - 1.32]	1.81 [1.3 - 2.52]	1.14 [0.81 - 1.61]
Bus and coach drivers	2.10 [1.63 - 2.70]	1.04 [0.79 - 1.36]	2.83 [1.18 - 6.81]	1.57 [0.65 - 3.8]
Cleaners and domestics	1.93 [1.46 - 2.55]	1.12 [0.84 - 1.49]	1.82 [1.51 - 2.19]	1.12 [0.92 - 1.36]
Customer service occupations	1.77 [1.27 - 2.47]	1.54 [1.10 - 2.15]	1.12 [0.79 - 1.59]	1.04 [0.73 - 1.47]
Van drivers	1.64 [1.34 - 2.00]	1.20 [0.98 - 1.46]	1.42 [0.59 - 3.42]	1.32 [0.55 - 3.17]
Caring personal services	1.58 [1.07 - 2.32]	1.21 [0.82 - 1.79]	1.05 [0.77 - 1.42]	0.9 [0.66 - 1.23]
Process operatives	1.53 [1.21 - 1.92]	1.08 [0.86 - 1.36]	2.06 [1.4 - 3.03]	1.05 [0.71 - 1.55]
Food preparation and hospitality trades	1.48 [1.17 - 1.87]	0.82 [0.64 - 1.04]	1.21 [0.85 - 1.71]	0.9 [0.63 - 1.28]
Elementary storage occupations	1.48 [1.22 - 1.79]	1.09 [0.90 - 1.33]	1.66 [0.98 - 2.82]	1.33 [0.78 - 2.25]
Sales occupations	1.46 [1.21 - 1.77]	1.03 [0.85 - 1.25]	1.38 [1.18 - 1.62]	0.98 [0.84 - 1.16]
Mobile machine and other drivers	1.35 [1.08 - 1.70]	1.14 [0.91 - 1.44]	1.34 [0.43 - 4.17]	1.29 [0.41 - 4]
Health and social care associate professionals	1.35 [0.91 - 2.00]	1.19 [0.80 - 1.77]	0.91 [0.62 - 1.34]	1.04 [0.71 - 1.54]
Leisure, travel and related personal service occupations	1.29 [0.96 - 1.75]	1.10 [0.81 - 1.48]	1 [0.75 - 1.35]	1.06 [0.79 - 1.43]
Health professionals	1.26 [0.99 - 1.62]	1.54 [1.19 - 1.99]	0.82 [0.66 - 1.03]	1.23 [0.96 - 1.57]
Elementary trades and related occupations	1.22 [1.00 - 1.49]	0.82 [0.67 - 1.01]	2.03 [1.49 - 2.75]	1.04 [0.76 - 1.42]
Elementary administration occupations	1.19 [0.89 - 1.58]	1.05 [0.79 - 1.40]	0.91 [0.47 - 1.75]	0.7 [0.36 - 1.36]
Administrative occupations	1.18 [0.99 - 1.40]	1.20 [1.01 - 1.43]	0.73 [0.62 - 0.86]	0.84 [0.71 - 0.99]
Elementary cleaning occupations excl. cleaners and domestics	1.13 [0.78 - 1.63]	0.89 [0.62 - 1.28]	2.69 [1.56 - 4.65]	1.8 [1.04 - 3.12]
Textiles, printing and other (excl. food prep and hospitality) skilled trades	1.13 [0.83 - 1.53]	1.00 [0.73 - 1.36]	1.05 [0.58 - 1.9]	0.85 [0.47 - 1.54]
Assemblers and construction operatives	1.09 [0.87 - 1.37]	0.90 [0.71 - 1.13]	1.67 [1.15 - 2.41]	0.82 [0.56 - 1.2]
Plant and machine operatives	1.04 [0.81 - 1.33]	0.80 [0.62 - 1.04]	3.42 [2.09 - 5.6]	1.67 [1.02 - 2.75]
Science, engineering and technology associate professionals	1.04 [0.80 - 1.34]	1.35 [1.04 - 1.74]	0.91 [0.51 - 1.6]	1.12 [0.63 - 1.97]
Large goods vehicle drivers	1.00 [0.79 - 1.27]	0.96 [0.76 - 1.22]	-	-
Managers and directors in retail and wholesale	0.99 [0.76 - 1.28]	1.17 [0.90 - 1.52]	1.05 [0.7 - 1.59]	1.25 [0.82 - 1.88]

Skilled metal, electrical and electronic trades	0.91 [0.79 - 1.05]	1.01 [0.87 - 1.16]	1.28 [0.48 - 3.41]	0.73 [0.27 - 1.95]
Other managers and proprietors	0.86 [0.71 - 1.03]	0.94 [0.78 - 1.13]	0.92 [0.7 - 1.21]	1.14 [0.86 - 1.5]
Caring personal service occupations excl. care workers and home carers	0.81 [0.42 - 1.55]	0.75 [0.39 - 1.44]	0.7 [0.55 - 0.89]	0.85 [0.66 - 1.09]
Skilled construction and building trades	0.71 [0.60 - 0.83]	0.77 [0.66 - 0.90]	0.77 [0.19 - 3.08]	0.8 [0.2 - 3.2]
Business, media and public service professionals	0.61 [0.50 - 0.74]	0.91 [0.74 - 1.12]	0.75 [0.56 - 1.01]	1.25 [0.93 - 1.7]
Culture, media and sports occupations	0.60 [0.42 - 0.85]	0.82 [0.57 - 1.17]	0.39 [0.2 - 0.75]	0.68 [0.35 - 1.31]
Business and public service associate professionals	0.58 [0.48 - 0.70]	0.86 [0.70 - 1.04]	0.6 [0.45 - 0.79]	0.89 [0.67 - 1.18]
Teaching and educational professionals	0.58 [0.43 - 0.78]	0.96 [0.71 - 1.30]	0.48 [0.36 - 0.64]	0.93 [0.69 - 1.26]
Corporate managers and directors excl. those in retail and wholetrade	0.57 [0.49 - 0.67]	0.92 [0.78 - 1.08]	0.55 [0.39 - 0.78]	0.86 [0.61 - 1.23]
Skilled agricultural and related trades	0.53 [0.37 - 0.77]	0.77 [0.53 - 1.13]	0.66 [0.25 - 1.76]	0.99 [0.36 - 2.7]
Science, research, engineering and technology professionals	0.46 [0.38 - 0.57]	0.73 [0.59 - 0.91]	0.48 [0.26 - 0.87]	0.84 [0.46 - 1.53]
Protective service occupations	0.43 [0.29 - 0.64]	0.59 [0.40 - 0.88]	0.24 [0.06 - 0.97]	0.37 [0.09 - 1.46]

Note: each line represents a separate regression in which each occupational group is compared with all other workers. Fully adjusted Cox regression models include geographical factors (region, population density, urban/rural classification), ethnicity, socio-economic characteristics (IMD decile, household deprivation, educational attainment, social grade, household tenancy, type of accommodation, household size, multigenerational household, household with children), health (Body Mass Index, Chronic kidney disease (CKD), Learning disability, Cancer and immunosuppression, other conditions) See Supplementary Tables S3 for more details.

Supplementary Table S9 Hazard ratios for COVID-19 related death for adults aged 40 to 64, Major occupational group, stratified by sex

Occupation	Men		Women	
	Age adjusted	Fully adjusted	Age adjusted	Fully adjusted
skilled trades occupations	2.15 [1.87 - 2.47]	1.13 [0.98 - 1.32]	2.07 [1.66 - 2.58]	1.08 [0.86 - 1.36]
professional occupations	2.12 [1.74 - 2.58]	1.17 [0.96 - 1.43]	1.68 [1.33 - 2.12]	1.02 [0.80 - 1.29]
process, plant and machine operatives	2.12 [1.73 - 2.59]	1.19 [0.96 - 1.46]	1.41 [1.13 - 1.77]	1.01 [0.81 - 1.27]
sales and customer service occupations	2.01 [1.76 - 2.30]	1.16 [1.01 - 1.34]	2.39 [1.80 - 3.17]	1.16 [0.87 - 1.56]
caring, leisure and other service occupations	1.69 [1.40 - 2.05]	1.32 [1.09 - 1.61]	0.94 [0.75 - 1.18]	0.87 [0.69 - 1.10]
elementary occupations	1.19 [1.04 - 1.37]	0.96 [0.83 - 1.10]	1.32 [0.95 - 1.84]	0.82 [0.59 - 1.15]
associate professional and technical occupations	0.94 [0.79 - 1.10]	0.99 [0.84 - 1.17]	0.81 [0.62 - 1.07]	0.90 [0.68 - 1.18]
administrative and secretarial occupations	0.86 [0.74 - 1.01]	0.95 [0.80 - 1.12]	0.82 [0.65 - 1.05]	1.05 [0.81 - 1.35]

Note: Reference – Managers and directors. Fully adjusted Cox regression models include geographical factors (region, population density, urban/rural classification), ethnicity, socio-economic

characteristics (IMD decile, household deprivation, educational attainment, social grade, household tenancy, type of accommodation, household size, multigenerational household, household with children), health (Body Mass Index, Chronic kidney disease (CKD), Learning disability, Cancer and immunosuppression, other conditions) See Supplementary Tables S3 for more details.