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OFFICIAL SENSITIVE

Ethnicity and COVID-19: analysis of Public Health England surveillance data

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Executive summary

There is clear evidence that COVID-19 does not affect all population groups equally. Many analyses have shown that older age, male sex and geographical area, for example, are strongly associated with the risk of getting the infection and suffering its complications, including death. This report shows that, in addition to these, ethnicity is also an important factor.

This review is based on four primary data sources. First, data reported to PHE from the start of the epidemic until 26 April 2020, which includes 377,958 individuals who were tested for SARS-CoV-2, of which 109,769 (29.0%) were positive. Second, data reported to PHE about 7,814 hospitalised patients. Third, excess mortality is assessed by examining all deaths registered by ONS between 24 March and 13 April 2020. Fourth, 21,739 deaths in all settings in which the deceased has had a positive test result for COVID-19. Ethnicity information is available either from the primary data sources or by linkage to NHS sources.

The results presented here show that there is an association between belonging to some ethnic groups and the likelihood of being tested, testing positive, being hospitalised, receiving intensive care and dying with COVID-19. These associations exist even after controlling for the effects of age, sex, region and deprivation. These associations are likely to be driven by multiple factors that can be summarised in two groups: factors that increase the risk of acquiring COVID-19 (such as being a key worker and therefore being less able to socially distance) and factors that increase the risk of complications from COVID-19 (such as having underlying conditions like diabetes and obesity).

These analyses show that, when compared with White British, all other ethnic groups (except White Irish) are more likely to be tested. Most are also more likely to test positive.

Among those hospitalised but not in intensive care, the majority (88%) are of White ethnic groups whilst among those in intensive care, this proportion is reduced to 67%. In addition, patients of Black, Asian and “Any other” ethnic groups in intensive care were younger than those of White ethnic groups. It is important to note, however, that hospitalisation data are substantially incomplete, representing a minority of all hospitalised cases; for example, data is not available from most London trusts.

Analysis of ONS death data showed that excess all-cause mortality is increased during the period of the pandemic across all ethnic groups, and is mostly due to deaths from COVID-19 in all ethnic groups. Excess all-cause mortality was however greater in Black and Asian ethnic groups. This was independently corroborated by differences in mortality among confirmed cases, which showed that people of Indian, Pakistani and Bangladeshi ethnicity have an increased risk of death related to COVID-19, as well as some Black ethnic groups, especially those of Black Caribbean ethnicity.

These results suggest that people of Black, Asian and other minority ethnic groups may be more exposed to COVID-19, and therefore are more likely to be tested and test positive. This could be the result of factors associated with ethnicity such as occupation, population density, use of public transport, household composition and housing conditions, which the currently available data did not allow us to explore in this analysis.

Increased risk of death is seen specifically among people of Indian, Pakistani, Bangladeshi and Black Caribbean ethnic groups. This may be partially explained by higher prevalence of pre-existing conditions, among other factors.

These findings highlight a disparity in the risk of severe complications and death due to COVID-19 by ethnicity. Further investigations are needed within a wider framework to understand disparities in factors that may contribute to the increased risk of acquiring COVID-19 and associated complications among people of Black, Asian and other minority ethnic groups.

The information in this study provides a picture of the experience of ethnic minority popualtions during the coronavirus pandemic in England. It is difficult at this stage to provide a full explanation of the observed differences. The report will inform the immediate response to COVID-19 so that all those involved can work towards reducing the risk of acquiring COVID-19 and its complications among all groups, while recognising that the impact of coronavirus is proportionately higher in some groups than others.

Background

The first cases of SARS-COV-2 in England were detected in January 2020. This review analyses data reported to PHE from the start of the epidemic until 26 April 2020, which includes 377,958 individuals who had been tested for SARS-CoV-2, of which 109,769 (29.0%) were positive, of whom 21,739 (19.8%) had died. This review also analyses excess mortality in all deaths registered by the ONS between 24th March and 13th April 2020.

There is evidence to suggest that COVID-19 may have a disproportionate impact on some population groups, including older people, men and people from Black, Asian and minority ethnic (BAME) groups. The latest Intensive Care National Audit and Research Centre (ICNARC) report, published on 24 April showed that Black and Asian patients were over-represented amongst those critically ill with confirmed COVID-19. The report found that 15.4% of critically ill patients were from Asian ethnic groups, compared to 8.3% in the general population, and 10.7% were from Black ethnic groups compared to 3.8% in the general population (1) (2).

However, there have been few published, peer-reviewed studies in the literature which report on the association between ethnicity and COVID-19. This scarcity may reflect poor recording of ethnicity across healthcare data systems. International surveillance reports that include data reported by ethnicity, so far, describe patients from the USA only. The Centers for Disease Control and Prevention published a report on 17 April which analysed demographic data of hospitalised COVID-19 patients from a large network of surveillance hospitals (COVID-NET). Ethnicity was recorded in 45% of patients. Of those where ethnicity was recorded, 33.1% were non-Hispanic black, compared with 18% of non-Hispanic black people in the population of the COVID-NET catchment (3).

The relationship between ethnicity and health is complex and likely to be the result of a combination of individual and contextual factors. Factors such as socio-economic status and education are associated with adverse health outcomes, including increased risk of communicable diseases (4). Individual-level factors are also likely to be important. For example, some co-morbidities which increase the risk of COVID-19 are more common amongst certain ethnic groups. People of Bangladeshi and Pakistani background have higher rates of cardiovascular disease than people from White British ethnicity, and people of Black Caribbean and Black African ethnicity have higher rates of hypertension compared with other ethnic groups (5) (6).

This review presents the differences in outcomes between ethnic groups through the COVID-19 care cascade, starting with being tested, to being hospitalised and to death, using national surveillance data. It does this while taking into account sex, age, geography, deprivation and, for some data, comorbidities. It does not aim to fully explain differences in COVID-19 outcomes between ethnic groups, rather to provide an epidemiological overview of the available data to date. These data are essential in understanding the epidemic and in formulating the public health response to it.

Data sources

All data reported to PHE by 26 April 2020 have been considered in this analysis. Some datasets were linked the Hospital Episode Statistics database to obtain more complete information on ethnicity. The data sources are outlined below.

1.1 Testing and laboratory confirmed cases

- Respiratory Datamart and the Second Generation Surveillance System (SGSS) were used for information about all samples tested and their results (positive and negative) from public health, NHS and private laboratories that report to PHE.
- SGSS is an application that stores and manages notifications and reports of confirmed infections from laboratories, and is the preferred method for capturing routine laboratory surveillance data on infectious diseases and antimicrobial resistance from laboratories across England. Since early March, this database has also accepted reports of people testing negative for SARs-CoV-2.
- Respiratory Datamart is a laboratory-based surveillance system in sentinel laboratories which records people both having tests and testing positive for influenza and other respiratory viruses (including SARS-CoV2 since routine testing began) in England.
- The same individual can receive multiple tests. Records were deduplicated so that a laboratory confirmed case of COVID-19 is any individual who has received a positive test result for the SARS-CoV-2 virus.
- The majority of testing to date has been offered to those in hospital with a medical need. Laboratory confirmed cases therefore are likely to represent people with severe disease, rather than all of those who get infected, many of whom are either asymptomatic or have mild disease.

1.2 Hospitalised cases

- New patients admitted to hospital with COVID-19 are reported daily to the COVID-19 Hospitalisations in England Surveillance System (CHESS) by acute NHS trusts in England through a secure web portal.
- There are two subsets of individual patient level data within CHESS: COVID-19 cases admitted to a lower level of care[1]; COVID-19 cases admitted to ICU/HDU
- Trusts report aggregate numbers by age group of all new hospital (including ICU/HDU) admissions with COVID-19 or acute respiratory illness.
- All acute trusts are asked to report individual level data on all new ICU/HDU admissions with COVID-19.

[1] Admission to a lower level of care is admission to any hospital ward excluding ICU or HDU. It does not include patients who attend A&E or who are out-patients and are not admitted. This also excludes patients who were further admitted to ICU.

- Reporting varies by trusts and not all trusts report daily; as of 26 April, 43 trusts had reported lower level of care patients, and 90 trusts contributed ICU/HDU patient data to the CHESS individual level datasets.
- The majority of trusts in London do not report to CHESS which will impact on the representativeness of the ethnicity profile of hospitalised cases, including those in ICU/HDU, particularly since London has the highest number and rate of COVID-19 cases to date.

1.3 Mortality

- Public Health England receive reports of death from three sources:
    - NHS England & Improvement (NHSE&I) line listing of deaths reported by NHS trusts in the COVID-19 Patient Notification System (CPNS);
    - Health Protection Teams (HPTs) reporting individual deaths notified to them (primarily non-hospital settings);
    - The Demographic Batch Service (DBS) traced data, which takes a complete record level list of all individuals with a positive test in SGSS and links that to the central NHS Digital patient record of all deaths.
- Data from each source are merged and duplicates are removed in order to retain only one record per individual. Cleaned data sets are sent to DBS for tracing of missing information and then merged to form the final dataset.
- This dataset includes deaths in any setting in which the deceased has had a positive test result for COVID-19[2].
- Total mortality from all causes of death was also calculated over the period 24 March to 13 April 2020 by ethnic group using death registration data supplied by the Office for National Statistics. Ethnicity is not recorded at death registration in England, however, ethnicity information was taken from records of hospital admissions, where available.

1.4 Data linkage for assigning ethnicity

- Completeness of ethnicity recording in the above datasets is low; this is common among similar systems.
- To mitigate this, data were linked with Hospital Episode Statitics (HES) database to assign ethnicity information
- HES is a database containing details of all admissions, A&E attendances and outpatient appointments at NHS hospitals in England. HES use ethnic categories as classified by the 2001 ONS census (7)
- Ethnicity was assigned by linking datasets, using NHS number and date of birth, to the latest recording of ethnicity in the Outpatient Hospital Episode Statistics

[2] More detail about the PHE data series on deaths in people with COVID-19 is available here: https://www.gov.uk/government/publications/phe-data-series-on-deaths-in-people-with-covid-19-technical-summary

(HES) database. If no record of ethnicity was found in the Outpatient record the latest recording of ethnicity in the HES Admitted Patient Care was used.

- For the overall mortality ethnicity was assigned by linking to the latest SUS data first, then HES Admitted Patient Care, then Outpatient record and then A&E.
- Records that could not be linked to HES, either because there was not a record to link to within HES or because information on date of birth and/or NHS number was inconsistent or missing, were excluded from the analyses in this report. People from certain ethnic backgrounds may be less likely to have an NHS number or full date of birth than those from other ethnic groups and consideration needs to be given to this in the interpretation of the findings within this report.
- It was possible to obtain ethnicity for:
    - 73% of the SARS-CoV-2 negative cases and 80% of positive cases
    - 88% of cases in the lower level of care subset and 78% of cases in the ICU subset (for hospitalised cases)
    - 93% of the deaths in SARS-CoV-2 positive patients
    - 96% of overall deaths (all cause)

1.5 Population data

- The denominators used to calculate rates are from the ONS 2018 mid-year populations for England, which uses the Harmonised Classification of Ethnic Groups
- Total numbers in the tables may not add up due to rounding of decimals from population estimates
- ONS 2018 mid-year populations for Regions (Former Geographical Office Regions (GORs)) were used for population denominators by region.
- For ethnicity categories to match between HES and ONS denominators, the following were merged:
    - In ONS data, the “Gypsy or Irish Traveller” category was merged into “Any other White background”
    - In HES data, the “Chinese” category was moved to the “Asian or Asian British” grouping
    - In both datasets, the “Arab” category was included in “Any Other Ethnic Group”
- Appendix A provides a comparison of the ONS and HES categories

1.6 Index of Multiple Deprivation (IMD)

- The Index of Multiple Deprivation 2019 is published at Lower Super Output Area (LSOA) level.
- Postcodes are assigned to LSOAs using the May 2019 version of the National Statistics Postcode Lookup (NSPL), and the IMD score for the LSOA which the postcode falls within is used.

Testing and Cases

Individuals tested

By 26 April 2020 PHE had received reports of 377,958 individuals who had been tested for SARS-CoV-2, of which 109,769 were positive. It was possible to link over 70% of these to HES to obtain ethnicity data (table 1).

Table 1. Number of individuals tested for COVID-19 and number and proportion for which it was possible to obtain ethnicity by linking to HES. Data reported to PHE by 26 April 2020 (n=377,958)

Test Result	Number of individuals tested	Number linked to HES	Proportion linked to HES
Positive	109,769	87,482	79.7
Negative	268,189	194,424	72.5
Total	377,958	281,906	74.6

Overall testing rate was 675.2 people tested per 100,000 (table 2). People of "Any other" ethnic group had the highest testing rate (1261.8), followed by people of Black ethnic groups with 605.1. This was mostly driven by people of Black Caribbean and any other Black background.

Table 2. Number of individuals tested for SARS-CoV-2 and testing rate per 100,000 population by ethnicity. Data reported to PHE by 26 April 2020 (n=377,958)

Ethnicity	Individuals tested	Population denominator	Rate per 100,000	95% CI
White	235,007	47,010,724	499.9	(497.9 - 501.9)
British	219,093	43,787,095	500.4	(498.3 - 502.5)
Irish	2,494	482,651	516.7	(496.7 - 537.4)
Any other White background	13,420	2,740,977	489.6	(481.4 - 497.9)
Black / Black British	12,737	2,104,814	605.1	(594.7 - 615.7)
African	5,966	1,151,002	518.3	(505.3 - 531.6)
Caribbean	4,406	617,662	713.3	(692.5 - 734.6)
Any other Black background	2,365	336,150	703.6	(675.6 - 732.4)
Asian / Asian British	22,281	4,686,207	475.5	(469.3 - 481.7)
Bangladeshi	1,515	517,308	292.9	(278.3 - 308.0)
Indian	8,104	1,532,381	528.9	(517.4 - 540.5)
Pakistani	4,720	1,303,426	362.1	(351.9 - 372.6)
Chinese	1,351	412,305	327.7	(310.5 - 345.6)
Any other Asian background	6,591	920,787	715.8	(698.7 - 733.2)
Mixed / Multiple Ethnic Groups	3,996	1,550,543	257.7	(249.8 - 265.8)
Any other Mixed background	1,757	364,390	482.2	(459.9 - 505.2)
White and Asian	921	442,652	208.1	(194.9 -221.9)
White and Black African	527	219,038	240.6	(220.5 - 262.0)
White and Black Caribbean	791	524,463	150.8	(140.4 - 161.7)
Any other ethnic group	7,885	624,889	1261.8	(1234.3 - 1289.8)
No ethnicity information	96,052	-	-	-
Total	377,958	55,977,178	675.2	(673.1 - 677.3)

Test results and laboratory confirmed cases

Positivity is the percentage of people who receive a positive result amongst those who are tested. Overall, 29.0% of people tested for SARS-CoV-2 had a positive test result (table 3). This high proportion is expected as primarily people admitted to hospital are being tested. People of Black ethnic groups had the highest proportion of positive tests at 44.5%, followed by people of Asian ethnic groups with 39.4%.

Table 3. Number of individuals tested for SARS-CoV-2, test result and proportion tested positive (positivity) by ethnicity. Data reported to PHE by 26 April 2020 (n=377,958)

Ethnicity	Individuals tested negative	Individuals tested positive	Total individuals tested	Positivity (%)
White	132,795	68,979	235,007	29.4%
British	155,015	64,078	219,093	29.2%
Irish	1,638	856	2,494	34.3%
Any other White background	9,375	4,045	13,420	30.1%
Black / Black British	5,758	5,662	12,737	44.5%
African	3,335	2,631	5,966	44.1%
Caribbean	2,347	2,059	4,406	46.7%
Any other Black background	1393	972	2,365	41.1%
Asian / Asian British	11,241	8,782	22,281	39.4%
Bangladeshi	908	607	1,515	40.1%
Indian	4,828	3,276	8,104	40.4%
Pakistani	2,790	1,930	4,720	40.9%
Chinese	975	376	1,351	27.8%
Any other Asian background	3,998	2,593	6,591	39.3%
Mixed / Multiple Ethnic Groups	2,473	1,081	3,996	27.1%
Any other Mixed background	1,255	502	1,757	28.6%
White and Asian	698	223	921	24.2%
White and Black African	375	152	527	28.8%
White and Black Caribbean	587	204	791	25.8%
Any other ethnic group	4,907	2,978	7,885	37.8%
No ethnicity information	73,765	22,287	96,052	23.2%
Total	268,189	109,769	377,958	29.0%

Laboratory confirmed cases

A laboratory confirmed case is any individual who receives a positive test result for SARS-CoV-2. By 26 April 2020 PHE had received reports of 109,769 individual who had tested positive for SARS-CoV-2.

Age and sex

Amongst 108,457 (98.8%) laboratory confirmed cases where sex is reported, women represented 51.5% of cases, ranging from 45.2% among cases of Pakistani ethnicity to 59.9% among cases of mixed White and Black African ethnicity. The age distribution differed between

ethnic groups, with cases of White ethnicity having a higher proportion aged over 80 years when compared to all other ethnicities (figure 1).

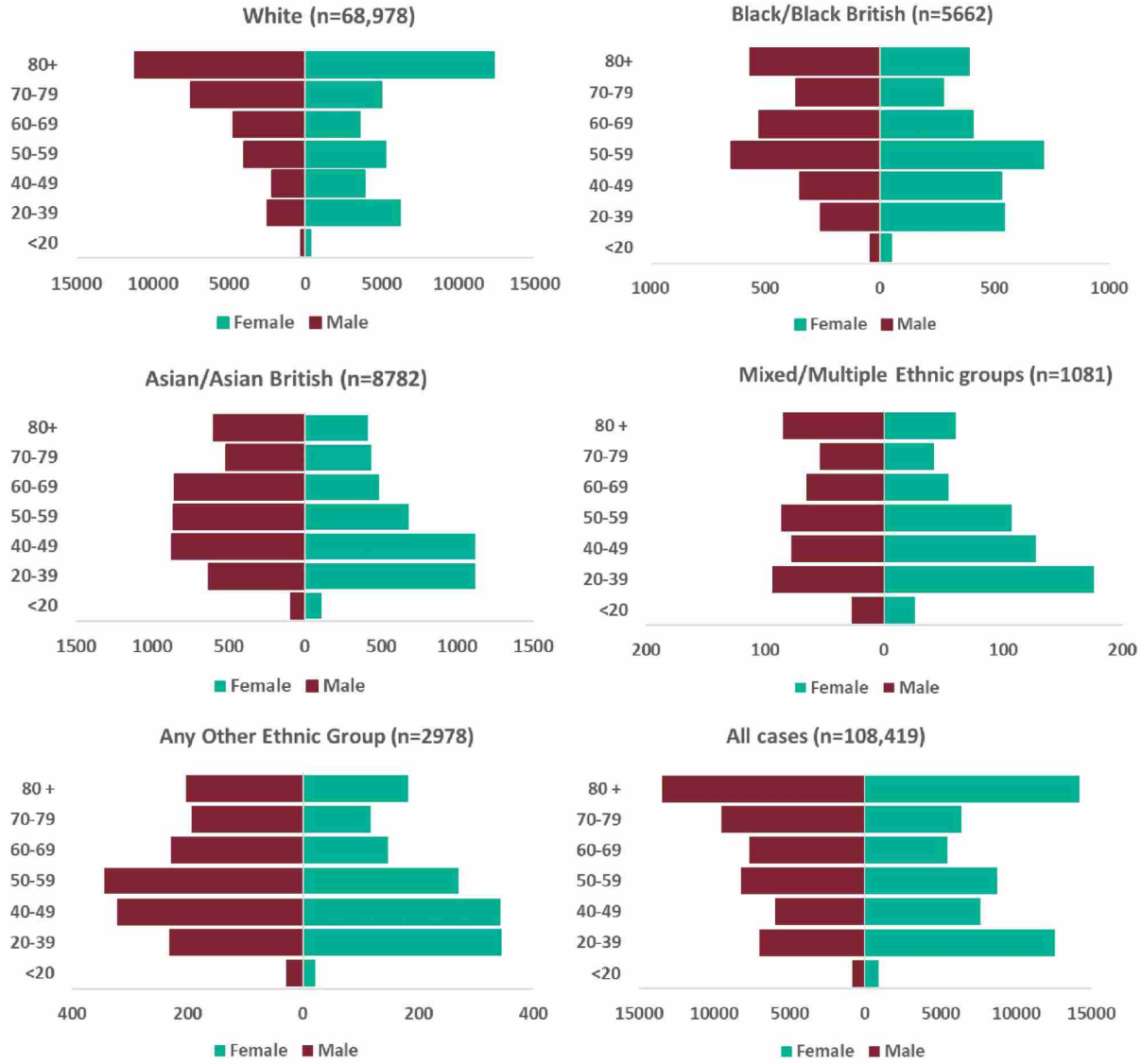


Figure 1. Age-sex pyramids of laboratory confirmed cases by ethnicity and for all cases. Data reported to PHE by 26 April 2020. Note the scale on the X-Axis is different for each pyramid.

Regions (Former Geographical Office Regions (GORs))

Amongst 87,319 laboratory confirmed cases where geographical information and ethnicity were available (80.0%), of all the regions in England, London has the lowest proportion of cases of any White ethnicity (approximately 50.5%) with reported cases in all other regions ranging from 79.8% to 94.6% (figure 2).

Figure 2. Cumulative proportion of individuals positive for SARS-CoV-2 by ethnicity and region of residence. Data reported to PHE by 26 April 2020 (n=87,319). Excludes 4551 cases where postcode of residence was unknown.

Deprivation

Amongst laboratory confirmed cases where it was possible to ascertain Index of Multiple Deprivation (IMD) score and ethnicity (87,482 cases, 80%), the proportion of cases from the two most deprived quintiles was highest for cases of Black ethnic groups and lowest for White ethnic groups (figure 3).

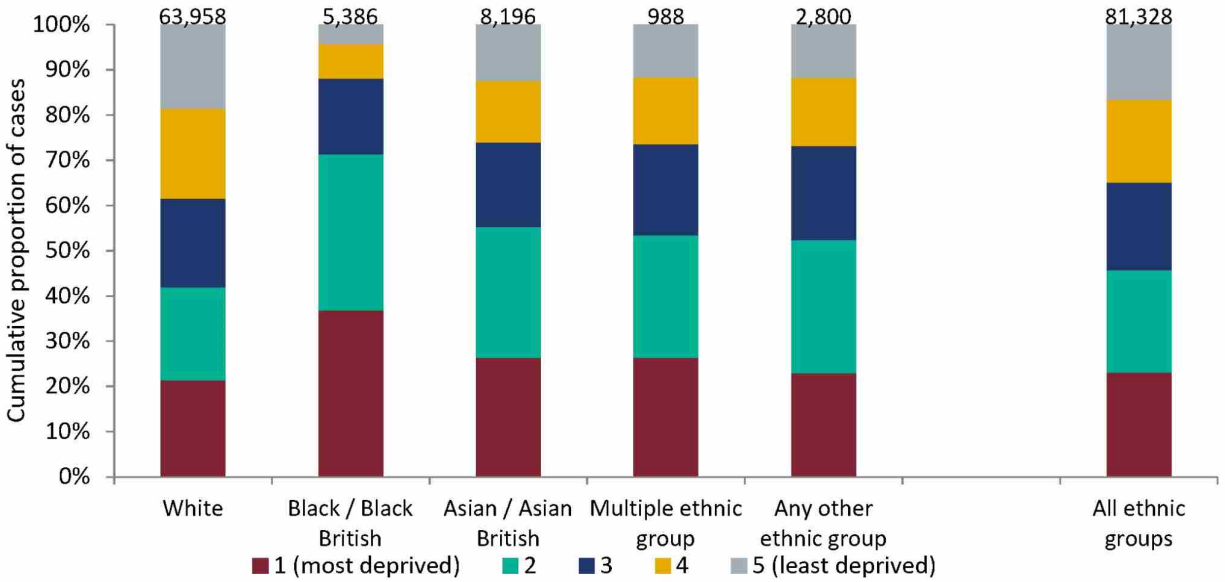


Figure 3. Cumulative proportion of laboratory confirmed cases by ethnicity and Index of Multiple Deprivation (IMD) quintile. Data reported to PHE by 26 April 2020 (n=87,482). This excludes cases where information was not available on IMD.

Population rates of laboratory confirmed cases

Overall, there were 196.1 laboratory confirmed cases of COVID-19 per 100,000 population (table 4). This was highest for the "Any other" ethnic group category (476.6 per 100,000), followed by Black ethnic groups (269.0 per 100,000), within which rates were particularly high for cases of Black Caribbean ethnicity (333.4 per 100,000). This pattern was similar for both men and women (Appendix B table B1).

This overall population rate was highest in London (266.5 per 100,000), closely followed by the North East (261.0 per 100,000) and lowest for the South West (102.8 per 100,000). In all regions, the rate was highest for the "Any other" ethnic group category, followed by Black ethnic groups (table 5).

Table 4. Number of laboratory confirmed cases and rate per 100,000 population by ethnicity. Data reported to PHE by 26 April 2020 (n=109,769).

Ethnicity	Individuals tested positive	Population denominator	Rate per 100,000 population	(95% CI)
White	68,979	47,010,724	146.7	(145.6 -147.8)
British	64,078	43,787,095	146.3	(145.2 - 147.5)
Irish	856	482,651	177.4	(165.7 - 189.6)
Any other White background	4,045	2,740,977	147.6	(143.1 - 152.2)
Black / Black British	5,662	2,104,814	269.0	(262.0 - 276.1)
African	2,631	1,151,002	228.6	(219.9 - 237.5)
Caribbean	2,059	617,662	333.4	(319.1 - 348.0)
Any other Black background	972	336,150	289.2	(271.3 - 307.9)
Asian / Asian British	8,782	4,686,207	187.4	(183.5 - 191.4)
Bangladeshi	607	517,308	117.3	(108.2 - 127.0)
Indian	3,276	1,532,381	213.8	(206.5 - 221.2)
Pakistani	1,930	1,303,426	148.1	(141.5 - 154.8)
Chinese	376	412,305	91.2	(82.2 - 100.9)
Any other Asian background	2,593	920,787	281.6	(270.9 - 292.6)
Mixed / Multiple Ethnic Groups	1081	1,550,543	69.7	(65.5 - 74.0)
Any other Mixed background	502	364,390	137.8	(126.0 - 150.4)
White and Asian	223	442,652	50.4	(44.0 - 57.4)
White and Black African	152	219,038	69.4	(58.8 - 81.3)
White and Black Caribbean	204	524,463	38.9	(33.7 - 44.6)
Any other ethnic group	2,978	624,889	476.6	(459.6 - 494.0)
No ethnicity information	22,287	-	-	-
Total	109,769	55,977,178	196.1	(194.9 - 197.3)

Notes: 95% CI = 95% Confidence Interval

Table 5. Rate per 100,000 of individuals tested positive for SARS-CoV-2 by ethnicity and region of residence. Data reported to PHE by 26 April 2020 (n=87,319).This excludes cases where information was not available on geography and ethnicity.

Ethnicity	East Midlands	East of England	London	North East	North West	South East	South West	West Midlands	Yorkshire and The Humber
White	109.2	119.1	182.6	225.0	205.5	123.8	83.3	171.8	136.5
British	110.6	118.4	184.2	226.8	207.0	121.2	83.0	172.8	136.9
Irish	124.4	157.8	218.0	134.0	189.5	121.1	113.4	217.0	133.4
Any other White background	71.3	123.4	171.8	131.7	157.1	168.7	86.3	128.1	124.2
Black / Black British	164.9	261.7	290.2	238.9	240.3	243.4	162.2	275.4	231.0
African	112.5	238.2	249.5	217.0	202.0	221.5	137.5	185.5	220.5
Caribbean	233.5	270.5	354.6	336.1	324.5	201.7	245.8	394.7	255.8
Any other Black background	211.9	359.4	308.4	357.6	280.4	455.3	116.3	175.3	230.5
Asian / Asian British	143.9	232.5	208.5	219.9	163.7	224.6	135.1	178.4	110.9
Bangladeshi	82.9	101.8	154.1	76.6	64.6	69.1	58.7	102.1	44.9
Indian	156.4	282.9	213.8	398.0	245.1	243.6	161.2	209.2	143.3
Pakistani	166.3	217.7	179.2	109.4	125.3	125.8	79.0	175.1	100.4
Chinese	46.1	90.5	116.1	101.1	100.4	68.4	29.2	120.5	55.9
Any other Asian background	141.1	331.0	279.0	422.3	304.3	391.2	228.3	182.6	193.9
Mixed / Multiple Ethnic Groups	39.2	102.6	66.5	102.2	65.1	77.2	58.2	70.6	63.1
Any other Mixed background	115.1	230.6	104.1	162.5	144.1	164.2	112.3	151.0	176.5
White and Asian	17.6	60.4	44.4	140.7	47.5	62.3	35.7	52.1	47.1
White and Black African	49.4	115.4	65.8	41.2	57.6	53.5	91.9	85.5	70.0
White and Black Caribbean	19.3	38.4	49.2	29.9	36.1	33.0	31.0	51.6	17.2
Any other ethnic group	281.3	591.3	534.9	580.2	348.9	715.3	303.7	281.7	243.1
Total	128.8	157.5	266.5	261.0	234.1	169.0	102.8	200.2	162.3

Univariable and multivariable analyses of cases

A multivariable logistic regression model was used to estimate the odds of testing positive for COVID-19 among the population who were tested. The variables used in this analysis were: age group, sex, IMD decile, ethnicity and region of residence. For all these analyses, statistical significance was tested at α= 0.05.

After adjusting for age group, sex, region of residence and IMD decile, odds of testing positive are significantly higher for all ethnic groups when compared to White British, except Chinese, White Irish and Mixed White and Black Caribbean ethnic groups (table 6). The highest adjusted odds of testing positive were among people of Black African ethnicity (aOR=2.11 (95% CI 1.99 to 2.23)), followed by Asian Pakistani (aOR=1.90 (95% CI=1.78 to 2.02)) and Any other Asian background (aOR=1.81 (95% CI 1.72 to 1.91)).

A significantly increased odds of testing positive for COVID-19 was found among individuals at least 80 years of age (aOR=12.33 (95% 11.7 to 12.98)).

Table 6. Number and proportion of individuals tested positive for COVID-19 among those tested (n= 377,958) and the odds ratio from the univariable and multivariable logistic regression analyses. Data reported to PHE by 26 April 2020.

Characteristic		n/N (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Region	London	23558/62749 (37.54)	Baseline	
	East Midlands	6185/23345 (26.49)	0.60 (0.58 to 0.62)	0.67 (0.64 to 0.69)
	East of England	9318/33098 (28.15)	0.65 (0.63 to 0.67)	0.75 (0.73 to 0.78)
	North East	6931/21117 (32.82)	0.81 (0.79 to 0.84)	1.01 (0.97 to 1.05)
	North West	17028/49776 (34.21)	0.87 (0.84 to 0.89)	1.06 (1.03 to 1.08)
	South East	15785/52387 (30.13)	0.72 (0.70 to 0.74)	0.86 (0.83 to 0.88)
	South West	5747/32680 (17.59)	0.35 (0.34 to 0.37)	0.42 (0.41 to 0.44)
	West Midlands	11789/33128 (35.59)	0.92 (0.89 to 0.94)	1.01 (0.98 to 1.04)
	Yorkshire	8877/33273 (26.68)	0.61 (0.59 to 0.62)	1.32 (1.28 to 1.37)
	unknown	4551/36405 (12.50)	0.24 (0.23 to 0.25)	0.52 (0.49 to 0.54)
Age Group	<20	1729/32033 (5.40)	Baseline	
	20-39	20059/84496 (23.74)	5.46 (5.18 to 5.74)	5.59 (5.31 to 5.89)
	40-49	13873/49036 (28.29)	6.91 (6.56 to 7.29)	6.82 (6.47 to 7.19)
	50-59	17135/54074 (31.69)	8.13 (7.72 to 8.56)	8.19 (7.77 to 8.63)
	60-69	13168/41010 (32.11)	8.29 (7.86 to 8.74)	8.24 (7.81 to 8.7)
	70-79	15956/46473 (34.33)	9.16 (8.7 to 9.65)	9.42 (8.93 to 9.93)
	80 +	27749/70486 (39.37)	11.38 (10.82 to 11.97)	12.33 (11.7 to 12.98)
	Unknown	100/350 (28.57)	7.01 (5.53 to 8.88)	21.91 (16.78 to 28.6)
IMD Decile	1 (most deprived)	10362/32460 (31.92)	Baseline	
	2	11593/33875 (34.22)	1.11 (1.07 to 1.15)	1.06 (1.02 to 1.1)
	3	11821/34500 (34.26)	1.11 (1.08 to 1.15)	1.06 (1.03 to 1.1)
	4	10291/32141 (32.02)	1.00 (0.97 to 1.04)	1.02 (0.98 to 1.05)

	5	9911/31220 (31.75)	0.99 (0.96 to 1.03)	1.04 (1.01 to 1.08)
	6	9397/30505 (30.80)	0.95 (0.92 to 0.98)	1.02 (0.98 to 1.05)
	7	9209/30220 (30.47)	0.93 (0.90 to 0.97)	1.02 (0.98 to 1.06)
	8	8759/28720 (30.50)	0.94 (0.90 to 0.97)	1.01 (0.98 to 1.05)
	9	8537/27938 (30.56)	0.94 (0.91 to 0.97)	1.03 (1.00 to 1.07)
	10 (least deprived)	7693/25873 (29.73)	0.90 (0.87 to 0.93)	1.01 (0.97 to 1.05)
	Unknown	12196/70506 (17.30)	0.45 (0.43 to 0.46)	0.66 (0.64 to 0.69)
Sex	Female	55914/194375 (28.77)	Baseline	
	Male	52561/161091 (32.63)	1.2 (1.18 to 1.22)	1.01 (0.97 to 1.05)
	Unknown	1294/22492 (5.75)	0.15 (0.14 to 0.16)	0.66 (0.64 to 0.69)
Ethnic group	British (White)	64078/219093 (29.25)	Baseline	
	African	2631/5966 (44.10)	1.91 (1.81 to 2.01)	2.11 (1.99 to 2.23)
	Any other Asian background	2593/6591 (39.34)	1.57 (1.49 to 1.65)	1.81 (1.72 to 1.91)
	Any other Black background	972/2365 (41.10)	1.69 (1.55 to 1.83)	1.75 (1.61 to 1.91)
	Any other Mixed background	502/1757 (28.57)	0.97 (0.87 to 1.07)	1.44 (1.29 to 1.61)
	Any other White background	4045/13420 (30.14)	1.04 (1.00 to 1.08)	1.17 (1.13 to 1.22)
	Any other ethnic group	2978/7885 (37.77)	1.47 (1.40 to 1.54)	1.57 (1.49 to 1.65)
	Bangladeshi	607/1515 (40.07)	1.62 (1.46 to 1.79)	1.76 (1.58 to 1.96)
	Caribbean	2059/4406 (46.73)	2.12 (2.00 to 2.25)	1.76 (1.65 to 1.87)
	Chinese	376/1351 (27.83)	0.93 (0.83 to 1.05)	1.10 (0.97 to 1.25)
	Indian	3276/8104 (40.42)	1.64 (1.57 to 1.72)	1.78 (1.69 to 1.86)
	Irish	856/2494 (34.32)	1.26 (1.16 to 1.37)	1.04 (0.96 to 1.13)
	Pakistani	1930/4720 (40.89)	1.67 (1.58 to 1.77)	1.90 (1.78 to 2.02)
	White and Asian	223/921 (24.21)	0.77 (0.66 to 0.90)	1.32 (1.12 to 1.55)
	White and Black African	152/527 (28.84)	0.98 (0.81 to 1.18)	1.41 (1.16 to 1.72)
	White and Black Caribbean	204/791 (25.79)	0.84 (0.72 to 0.99)	1.15 (0.97 to 1.36)
	Unknown	22287/96052 (23.20)	0.73 (0.72 to 0.74)	1.30 (1.28 to 1.33)

While these regression analyses show the differences in odds of being COVID-19 positive among the tested population, they do not account for differences in population structure (age, sex and region) from which the tested individuals are drawn.

Therefore, univariable and multivariable logistic regression models were also used to estimate crude and adjusted odds ratios for a) being tested for COVID-19 (regardless of the test result) and b) being positive for COVID-19 among the general population (as provided by ONS

estimates) which was stratified by region, age and sex; but not IMD score as these were not available in the population denominator.

After adjusting for age, sex, and region, the odds of being tested for COVID-19 was higher in all other ethnic groups compared to White British (except White Irish which had lower odds of being tested). The highest odds of being tested were in "Any other" ethnic group (aOR 4.32 (CI% 4.21 to 4.42)), followed by Any other Black background (aOR 3.20 (95% CI 3.06 to 3.34)) and Mixed White and Black African (aOR 2.48 (95% CI 2.27 to 2.70)). A significantly increased odds of being tested was found among individuals aged 80+ (aOR 17.08 (95% CI 16.79 to 17.37)) (Appendix C table C1).

After adjusting for age, sex and region, the odds of testing positive for COVID-19 was higher in all other ethnic groups (including White Irish) compared with White British. The highest odds of testing positive were in the Mixed White and Black African ethnicity (aOR 8.76 (95% CI 7.45 to 10.28)), followed by Any other Black background (aOR 6.48 (95%CI 6.06 to 6.92)) and White and Asian (Mixed) (aOR 4.95 (95% CI 4.34 to 5.66)). A significantly increased odds of testing positive for COVID-19 was found among individuals aged 80+ (aOR 80.04 (95% CI 75.21 to 85.18)) and males (aOR 1.05 (95% CI 1.04 to 1.07)) (appendix C table C2).

The odds ratios were generally higher for being positive than for being tested, suggesting a greater effect of ethnicity on being a COVID-19 case than on being tested. These additional regression analyses using the England population are consistent with and substantiate the findings from the logistic regression of higher odds of testing positive among individuals tested in most other ethnic groups compared to White British (table 7).

In all univariable and multivariable regression analyses, increasing age was significantly associated with a higher odds of being tested and being COVID-19 positive with a large effect size. To investigate further the influence of age and certain confounders such as occupation and co-morbidities (for which data are not yet available) on being tested and being COVID-19 positive, the multivariable regression analyses were stratified into broad age categories: under 19 years for children (no occupational factors, minimal co-morbidities), 19-65 years for adults of working age (occupational factors and co-morbidities) and over 65 years for older non-working adults (co-morbidities but minimal occupational factors). Ethnic groups were collapsed into the broader ONS categories with White ethnicity as the baseline (table 7).

Results indicate that people from Black and Asian ethnic groups of working age have a significantly higher odds of being tested than the older population. These results were also found among those testing positive for COVID-19 compared to the overall population. Results also indicate that there was no significant difference in odds of testing between children and adults of working age in any of the ethnic groups. However, odds of testing positive are significantly higher for children compared to working age adults in all ethnic groups. Further exploration of the interplay between ethnicity, co-morbidities and occupation are warranted as these data become available.

Table 7. Multivariable regression analyses of odds of being tested and being positive, by ethnicity stratified by children (under 19 years), working age adults (19-65 years) and older adults (>65 years).

Testing among ONS England population			
Ethnicity	**Children**	**Working age adults**	**Older adults**
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**
White	Baseline		
Multiple Ethnic Backgrounds	1.40 (1.04 to 1.87)	1.37 (1.27 to 1.47)	1.88 (1.67 to 2.12)
Black/Black British	3.01 (2.33 to 3.89)	2.91 (2.81 to 3.02)	2.59 (2.46 to 2.72)
Asian/Asian British	2.62 (2.20 to 3.12)	2.20 (2.14 to 2.27)	1.60 (1.54 to 1.67)
Any other ethnic group	7.16 (5.26 to 9.75)	5.78 (5.52 to 6.06)	5.31 (4.93 to 5.70)
Testing Positive among ONS England population			
Ethnicity	**Children**	**Working age adults**	**Older adults**
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**
White	Baseline		
Multiple Ethnic Backgrounds	5.87 (4.37 to 7.87)	1.91 (1.78 to 2.06)	2.40 (2.13 to 2.71)
Black/Black British	5.92 (4.49 to 7.81)	3.13 (3.02 to 3.25)	2.73 (2.60 to 2.87)
Asian/Asian British	4.38 (3.65 to 5.26)	2.27 (2.21 to 2.34)	1.67 (1.60 to 1.74)
Any other ethnic group	24.67 (18.00 to 33.80)	6.67 (6.37 to 6.99)	5.96 (5.54 to 6.42)
Testing Positive among those tested in England			
Ethnicity	**Children**	**Working age adults**	**Older adults**
	OR (95% CI)	**OR (95% CI)**	**OR (95% CI)**
White	Baseline		
Multiple Ethnic Backgrounds	1.23 (0.91 to 1.66)	1.37 (1.25 to 1.49)	1.55 (1.31 to 1.84)
Black/Black British	2.59 (2.00 to 3.35)	2.02 (1.92 to 2.12)	1.67 (1.55 to 1.8)
Asian/Asian British	2.15 (1.79 to 2.57)	1.88 (1.82 to 1.95)	1.48 (1.39 to 1.58)
Any other ethnic group	2.02 (1.48 to 2.75)	1.69 (1.6 to 1.8)	1.28 (1.16 to 1.41)

Hospitalisations

Hospital admissions and level of care

This section reports two subsets of the CHESS data, all of which include hospitalised confirmed COVID-19 cases. As of 26 of April, 43 trusts had reported lower level of care patients (defined as admission to any hospital ward, excluding ICU or HDU), and 90 trusts contributed ICU patient data to CHESS. The lower level of care subset contained 6155 cases of which 5388 (88%) could be linked to HES to assign ethnicity. The ICU subset contained 3092 cases of which 2426 (78%) could be linked to HES to assign ethnicity. Because of smaller numbers, ethnicity categories were collapsed in some of the analyses in this section of the report.

Among cases admitted to lower level of care, 88.3% were of White British ethnicity. However, only 67.0% of those admitted to ICU where White British (figure 4).

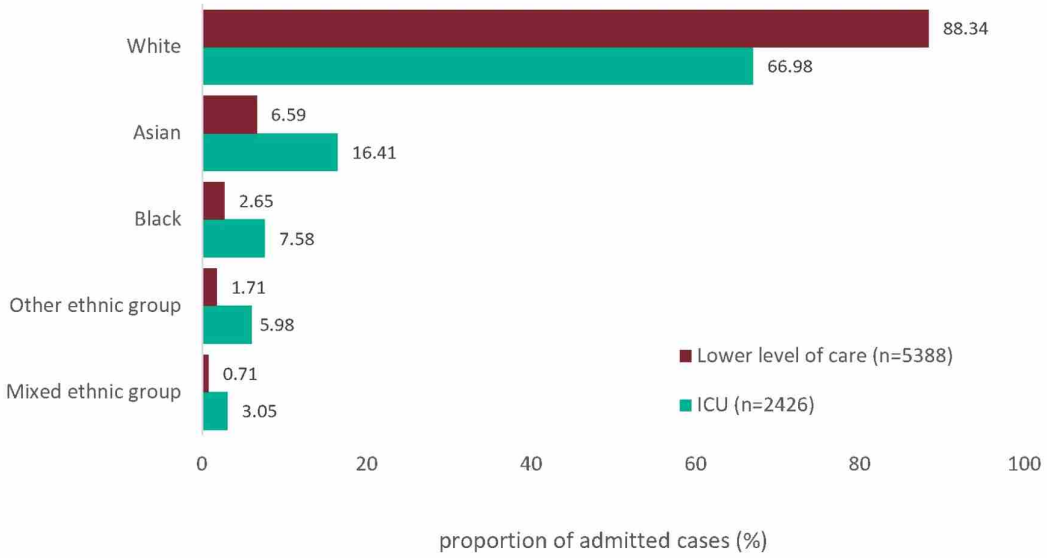


Figure 4. Laboratory confirmed COVID-19 admissions to acute trusts, by level of care and ethnicity. Data reported to PHE by 26 April 2020 (n=7814)

Age and Sex

Figure 5 shows the distribution of age and sex among laboratory confirmed cases admitted to a lower level of care and ICU by ethnic group. Mixed and “Any other” ethnic group were combined due to small numbers. Across all ethnic groups, a higher number of males were admitted to lower level care and ICU than females. However, the age distribution in both levels of care varies between ethnic groups: there was a greater proportion of younger patients amongst Black, Asian, Mixed and “Any other” ethnic groups, when compared with White ethnic groups.

Figure 5. Age-sex pyramids in lower level care admissions (left) and in ICU admissions (right) among cases of White, Asian, Black and Mixed and "Any other" ethnicities. Data reported to PHE by 26 April 2020. Note the scale on the x-Axis is different for each pyramid.

Co-morbidities

Amongst those admitted to lower level of care, 62.9% had at least one underlying medical condition (table 8). This proportion was similar amongst all ethnic groups, except "Any other" ethnic group, where the majority (59.1%) had no underlying condition. Amongst those admitted to ICU, 67.2% had at least one underlying medical condition (table 9). This was highest for patients of Black ethnic groups (77%).

Table 8. Cases admitted to lower level of care by ethnic group and number of underlying medical conditions (n=1157). Data reported to PHE by 26 April 2020

	Number of underlying medical conditions reported								
	None		One		Two		≥Three		Total
Ethnicity	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**
White	357	36.4	217	22.1	197	20.1	210	21.4	981
Asian / Asian British	43	38.4	18	16.1	20	17.9	31	27.7	112
Black / Black British	13	39.4	3	9.1	7	21.2	10	30.3	33
Mixed / Multiple Ethnic Groups	3	33.3	1	11.1	2	22.2	3	33.3	9
Any other ethnic group	13	59.1	4	18.2	4	18.2	1	4.5	22
Total	429	37.1	243	21.0	230	19.9	255	22.0	1,157

Note: Excludes cases for which information was not available on underlying medical conditions.

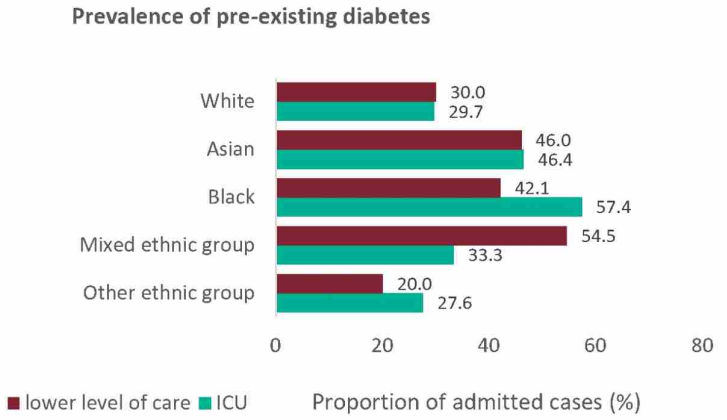
Table 9. Cases admitted to ICU by ethnic group and number of underlying medical conditions (n=1230). Data reported to PHE by 26 April 2020

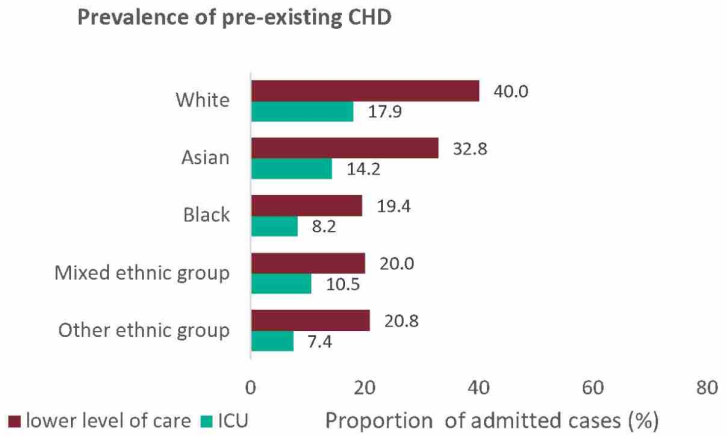
	Number of underlying medical conditions reported								
	None		One		Two		≥Three		Total
Ethnicity	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**
White	256	33.0	253	32.6	165	21.3	102	13.1	776
Asian / Asian British	77	33.2	63	27.2	56	24.1	36	15.5	232
Black / Black British	23	23.0	22	22.0	33	33.0	22	22.0	100
Mixed / Multiple Ethnic Groups	9	27.3	11	33.3	10	30.3	3	9.1	33
Any other ethnic group	38	42.7	28	31.5	12	13.5	11	12.4	89
Total	403	32.8	377	30.7	276	22.4	174	14.1	1,230

Note: Excludes cases for which information was not available on underlying medical conditions.

The proportion of hospitalised cases with cardiovascular disease, hypertension and diabetes by level of care and ethnic group is shown in figure 6. The most prominent finding was that the high prevalence of pre-existing hypertension in Black ethnic groups in the ICU subset when compared to lower level of care (37.8% in the lower level of care subset to 68.5% in the ICU subset). The prevalence of pre-existing diabetes was also the highest amongst all ethnic groups in the ICU subset (57.5%).

Only 58% of the cases included in the ICU subset had information on time to admission. Of these cases (n=1,399), there did not appear to be evidence of variation in the time from onset of symptoms to ICU admission between ethnic groups (appendix D table D1) (Kruskall-Wallis rank test p=0.1451).





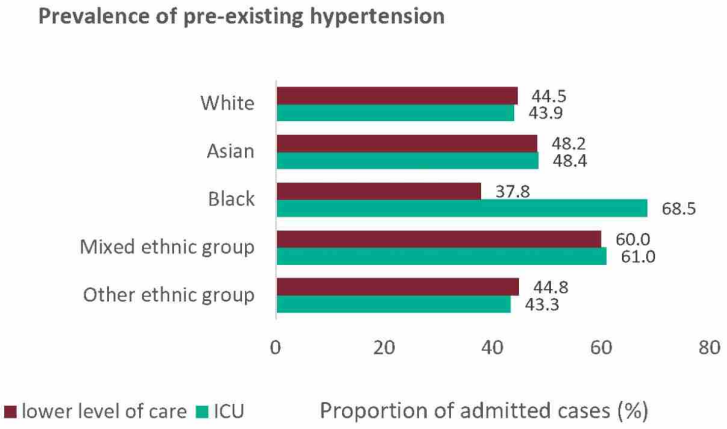


Figure 6. Prevalence of pre-existing co-morbidities among laboratory confirmed cases admitted to acute trusts, by ethnicity and level of care. Data reported to PHE by 26 April 2020. Excludes cases for which information was not available on pre-existing co-morbidities.

Mortality in confirmed cases

There were 21,739 deaths in people with laboratory confirmed COVID-19 reported to PHE by 26 April 2020 (in any setting linkable to a COVID-19 positive test) of which information on ethnicity was available for 93.4%. There were 467 individuals for which the only ethnicity information was "Any other" ethnic group[3].

Age and sex

Of the 21,739 deaths, 13,338 (61.4%) were in men. People over 70 years of age accounted for 79% of all deaths. The proportion of deaths was higher in males in all ethnic groups but there was considerable variation in the age distribution of deaths (figure 7). Among people in White ethnic groups, 84% of deaths were among those aged over 70 years in comparison with 62% of deaths in people aged over 70 years among both Black and Asian ethnic groups.

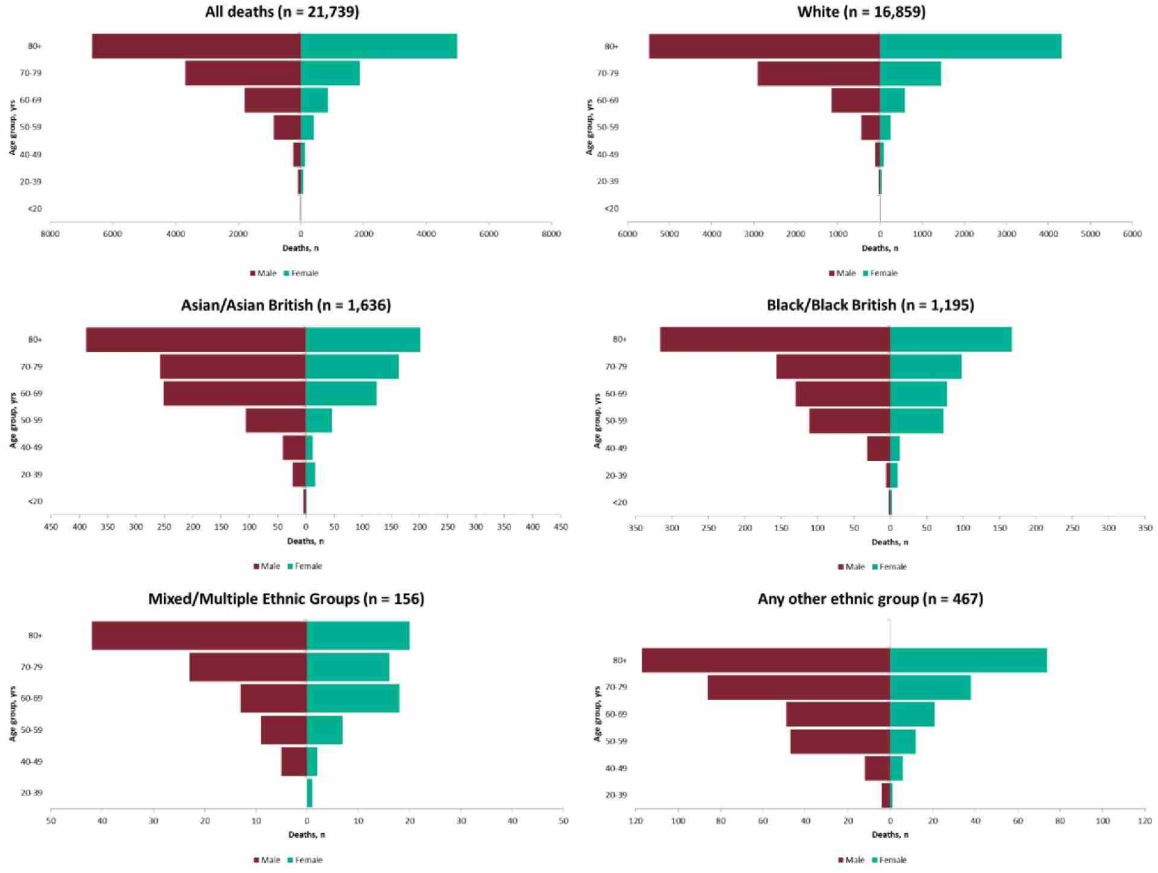


Figure 7. Age-sex pyramids of deaths in individuals tested positive for SARS-CoV-2 by ethnicity. Data reported to PHE by 26 April 2020. Note the scale on the x-Axis is different for each pyramid.

[3] Based on country of birth data (n = 294), 45% of these individuals were born in Europe, 30% in Asia and 18% in Africa.

Regions (Former Geographical Office Regions (GORs))

Amongst the 20,313 COVID-19-associated deaths where ethnicity was known and a region could be assigned, London was the region with the lowest percentage of deaths in those of White ethnicity (55%, compared to >90% in all other regions apart from the West Midlands) (figure 8).

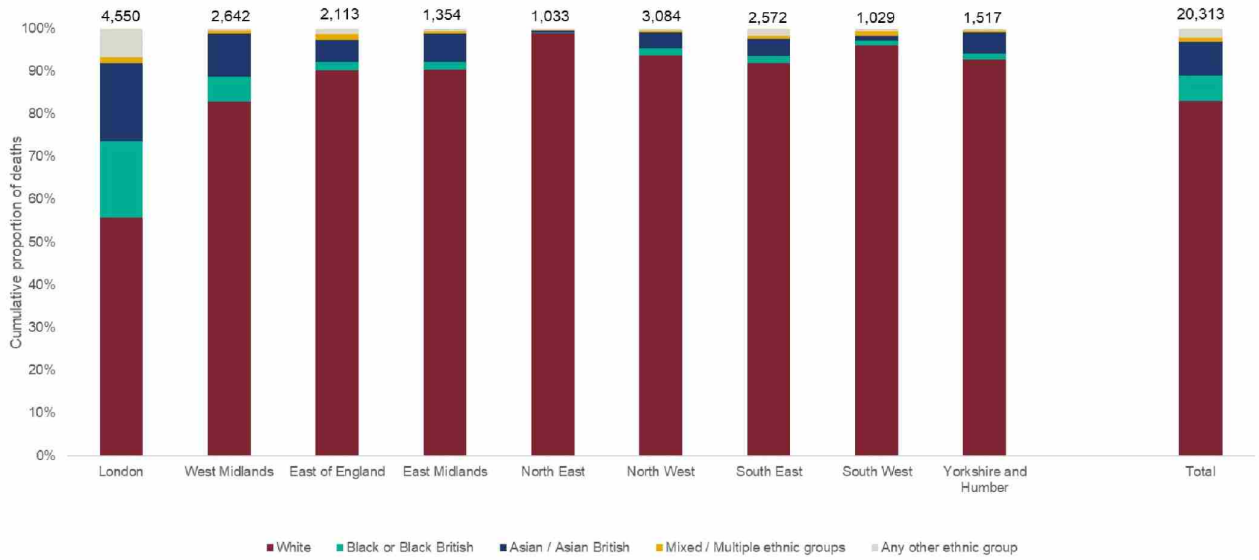


Figure 8. Cumulative number and proportion of deaths in individuals tested positive for SARS-CoV-2 by region and ethnic group. Data reported to PHE by 26 April 2020.

Deprivation

It was possible to link 21,227 (98%) COVID-19 associated deaths to an Index of Multiple Deprivation (IMD) score. Individuals who died that were resident in the least deprived quintiles were more likely to be of White ethnicity, while more than 60% of Black / Black British and Asian / Asian British individuals were in the two most deprived quintiles (figure 9).

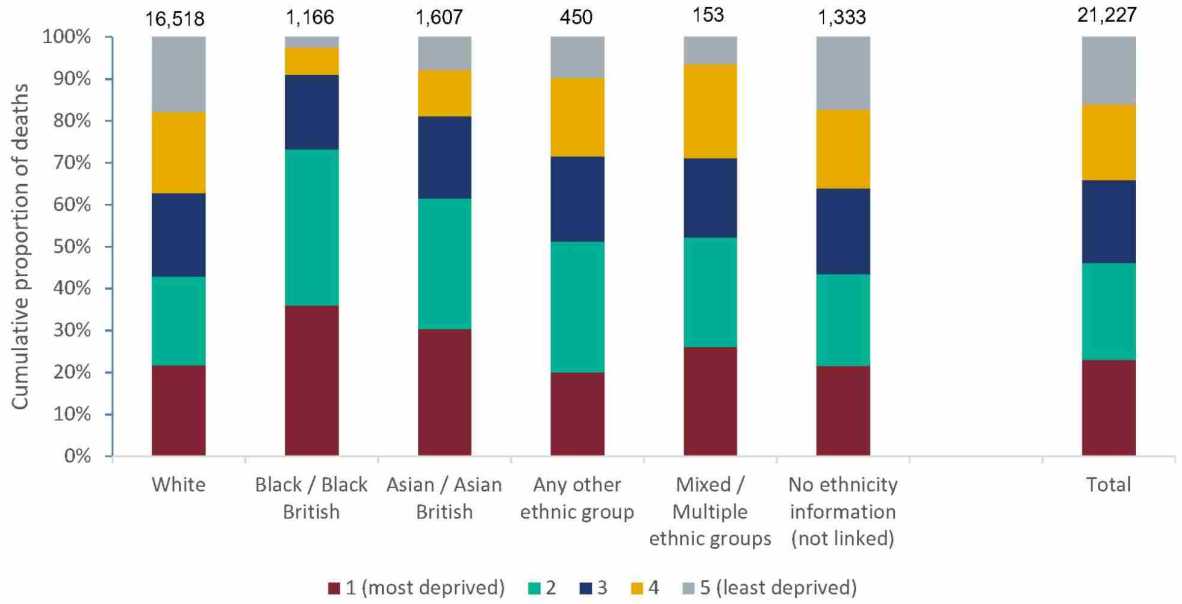


Figure 9. Cumulative number and proportion of deaths in individuals tested positive for SARS-CoV-2 by Index of Multiple Deprivation (IMD) quintile and ethnic groups (n=21,227). Data reported to PHE by 26 April 2020.

Mortality rates

The overall crude mortality rate was 38.3 deaths per 100,000 population (table 10). The "Any other" ethnic group category had the highest crude mortality rates (74.7 per 100,000) followed by Black or Black British ethnic groups (56.8 per 100,000). Crude mortality rates were noticeably high for people of Black Caribbean ethnicity (102.2 deaths per 100,000 population).

Table 10. Number of deaths and crude mortality rates (per 100,000) in people with laboratory confirmed COVID-19 by ethnicity (n= 21,739). Data reported to PHE by 26 April 2020.

Ethnicity	Deaths	Population	Rate (95% C.I.)
White	16,859	47,010,724	35.9 (35.3-36.4)
British (White)	15,872	43,787,095	36.3 (35.7-36.8)
Irish (White)	220	482,651	45.6 (39.8-52.0)
Any other White background	767	2,740,977	28.0 (26.0-30.0)
Black or Black British	1,195	2,104,814	56.8 (53.6-60.1)
African (Black or Black British)	374	1,151,002	32.5 (29.3-36.0)
Caribbean (Black or Black British)	631	617,662	102.2 (94.3-110.5)
Any other Black background	190	336,150	56.5 (48.6-65.2)
Asian / Asian British	1,636	4,686,207	34.9 (33.2-36.6)
Bangladeshi (Asian or Asian British)	162	517,308	31.3 (26.7-36.5)
Indian (Asian or Asian British)	642	1,532,381	41.9 (38.7-45.3)
Pakistani (Asian or Asian British)	420	1,303,426	32.2 (29.2-35.47)
Chinese (Asian or Asian British)	75	412,305	18.2 (14.3-22.8)

Any other Asian background	337	920,787	36.6 (32.8-40.7)
Mixed / Multiple ethnic groups	156	1,550,543	10.1(8.5-11.8)
Any other Mixed background	71	364,390	19.5 (15.2-24.6)
White and Asian (Mixed)	28	442,652	6.3 (4.2-9.1)
White and Black African (Mixed)	19	219,038	8.7 (5.2-13.6)
White and Black Caribbean (Mixed)	38	524,463	7.3 (5.1-10.0)
Any other ethnic group	467	624,889	74.7 (68.1-81.8)
Unknown	1,426	-	-
Total	21,739	55,977,178	38.8 (38.3-39.4)

The overall crude mortality rate for women was 29.7 deaths per 100,000 and 48.2 per 100,000 for men (figure 10 and table 11). Mortality rates were noticeably high for men of Black ethnicity (73.9 per 100,000), particularly for men of Black Caribbean ethnicity (134.6 per 100,000). Similarly, for women, crude mortality rates were high among women of Black ethnicity (40.7 per 100,000), particularly among women of Black Caribbean ethnicity (73.7 per 100,000).

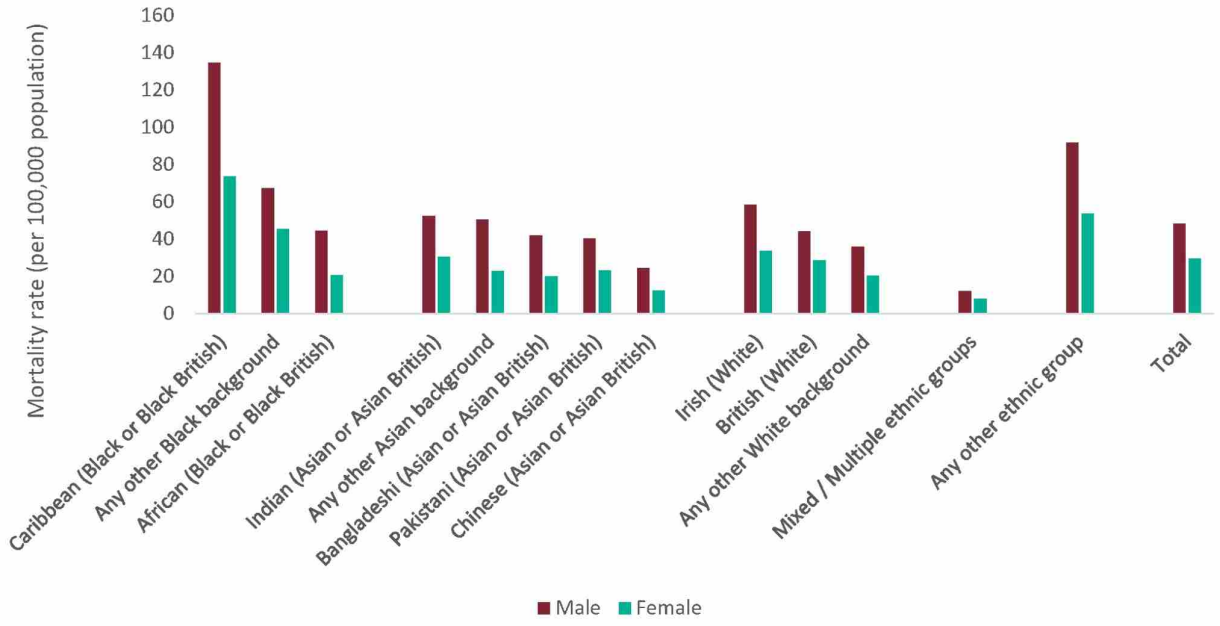


Figure 10. Crude mortality rates (per 100,000) in people with laboratory confirmed COVID-19 by sex and ethnicity (n= 21,739). Data reported to PHE by 26 April 2020.

Table 11. Number of deaths and mortality rates (per 100,000 population) in people with laboratory confirmed COVID-19 by sex and ethnicity (n=17,372). Data reported to PHE by 26 April 2020.

	Females			Males		
Ethnicity	**Deaths (%)**	**Population**	**Rate (95% CI)**	**Deaths (%)**	**Population**	**Rate (95% CI)**
White	6726 (39.9%)	23,846,794	28.21 (27.5-28.9)	10133 (60.1%)	23,163,930	43.7 (42.9-44.6)
British (White)	6348 (40%)	22,171,324	28.6 (27.9-29.3)	9524 (60%)	21,615,771	44.1 (43.2-45)
Irish (White)	84 (38.2%)	249,633	33.6 (26.8-41.7)	136 (61.8%)	233,019	58.4 (49-69)
Any other White background	294 (38.3%)	1,425,838	20.6 (18.3-23.1)	473 (61.7%)	1,315,140	36 (32.8-39.4)
Black / Black British	441 (36.9%)	1,084,554	40.66 (36.9-44.6)	754 (63.1%)	1,020,260	73.9 (68.7-79.4)
African (Black or Black British)	123 (32.9%)	589,483	20.9 (17.3-24.9)	251 (67.1%)	561,519	44.7 (39.3-50.6)
Caribbean (Black or Black British)	243 (38.5%)	329,506	73.7 (64.8-83.6)	388 (61.5%)	288,157	134.6 (121.6-148.7)
Any other Black background	75 (39.5%)	165,565	45.3 (35.6-56.8)	115 (60.5%)	170,585	67.4 (55.7-80.9)
Asian / Asian British	566 (34.6%)	2,323,951	24.36 (22.4-26.4)	1070 (65.4%)	2,362,256	45.3 (42.6-48.1)
Bangladeshi (Asian or Asian British)	50 (30.9%)	250,844	19.9 (14.8-26.3)	112 (69.1%)	266,464	42 (34.6-50.6)
Indian (Asian or Asian British)	231 (36%)	752,154	30.7 (26.9-34.9)	411 (64%)	780,227	52.7 (47.7-58)
Pakistani (Asian or Asian British)	150 (35.7%)	637,860	23.5 (19.9-27.6)	270 (64.3%)	665,566	40.6 (35.9-45.7)
Chinese (Asian or Asian British)	27 (36%)	215,604	12.5 (8.3-18.2)	48 (64%)	196,702	24.4 (18-32.4)
Any other Asian background	108 (32%)	467,490	23.1 (19-27.9)	229 (68%)	453,297	50.5 (44.2-57.5)
Mixed / Multiple ethnic groups	64 (41.0%)	772,274	8.29 (6.4-10.6)	92 (58.0%)	778,269	11.8 (9.5-14.5)
Any other Mixed background	29 (40.8%)	184,790	15.7 (10.5-22.5)	42 (59.2%)	179,601	23.4 (16.9-31.6)
White and Asian (Mixed)	10 (35.7%)	215,381	4.6 (2.2-8.5)	18 (64.3%)	227,271	7.9 (4.7-12.5)
White and Black African (Mixed)	6 (31.6%)	109,261	5.5 (2-12)	13 (68.4%)	109,777	11.8 (6.3-20.3)
White and Black Caribbean (Mixed)	19 (50%)	262,842	7.2 (4.4-11.3)	19 (50%)	261,621	7.3 (4.4-11.3)
Any other ethnic group	152 (32.5%)	281,663	53.97 (45.7-63.3)	315 (67.4%)	343,226	91.8 (81.2-102.5)
Unknown	452 (31.7%)	-	-	974 (68.3%)	-	-
Total	8401 (38.6%)	28,309,236	29.68 (29.0-30.3)	13338 (61.4%)	27,667,942	48.2 (47.4-49.0)

Univariable and multivariable analyses of deaths

Logistic regressions

A multivariable logistic regression model was used to estimate the odds of dying from COVID-19 among the population who tested positive. The variables used in this analysis were age group, sex, IMD quintile and region of residence (table 12).

Both cases and deaths were those reported to PHE up to April 26, 2020. Confirmed cases of COVID-19 were matched by NHS number to reported deaths. Only successfully linked cases and deaths, and records with no missing values were included in the regression analysis (n = 87,402 confirmed cases, n = 19,053 deaths). Cases with no ethnicity information were also excluded (n = 15,009).

In both the univariable and multivariable logistic regressions, age and sex were significantly associated with odds of death. In the fully adjusted regression model, the odds of death associated with COVID-19 infection for males was significantly higher than for females (aOR=1.72 (95% CI 1.66 - 1.79)). Odds of death also increased with age from 40 years onwards, with the highest odds among individuals aged 80 and over (aOR=69.45 (95% CI 38.28 - 125.98)). All regions except for East of England (aOR = 1.14 (95% CI 1.06 – 1.22)) had lower odds of COVID-19-related death than London. Also when fully adjusted, higher deprivation quintiles (1 to 3) were significantly associated with increased odds of death (aOR=1.18 (1.11 - 1.25) for the most deprived quintile, compared with the least deprived).

When compared to White British ethnicity, the odds of COVID-19-related death in a confirmed case were highest among Bangladeshi ethnicity (aOR=2.32 (95% CI 1.85 - 2.90)), Pakistani ethnicity (OR=1.57 (95% CI 1.38 - 1.79)), “Any other” Black background (aOR=1.44 (95% CI 1.20 - 1.74)), Indian ethnicity (aOR=1.24 (95% CI 1.11 - 1.38)) and Black Caribbean ethnicity (aOR=1.20 (95% CI 1.07 - 1.34)). The odds of a COVID-19-related death were lower amongst people of Irish White ethnicity when compared to White British ethnicity in this model (aOR=0.79 (95% CI 0.66 - 0.93)).

Two stratified models were run to evaluate differences in odds of mortality in those under and over 65 years of age (results not shown). The results were broadly consistent with the combined analysis results. However, when compared to White British ethnicity, in the younger age group only Black Caribbean / Black British had higher odds of death (aOR = 1.48 (95% CI 1.19 – 1.84)) and in the older age group higher odds were seen again in Black Caribbean / Black British (aOR = 1.18 (95% CI 1.04 – 1.33)), as well as Bangladeshi (aOR = 2.34 (95% CI 1.74 – 3.14)), Indian (aOR = 1.23 (95% CI 1.09 – 1.40)) and Pakistani (aOR = 1.29 (95% CI 1.10 – 1.52)) ethnicities.

Table 12. A multivariable logistic regression model of the odds of dying from COVID-19 among the population who tested positive. Data reported to PHE by 26 April 2020.

Characteristics		n/N	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Sex	Female	7444/45843 (16.2%)	Reference	
	Male	11609/41559 (27.9%)	2.00 (1.93 - 2.07)*	1.72 (1.66 - 1.79)*
Age Group	<20	11/1039 (1.1%)	Reference	
	20-39	120/12052 (1.0%)	0.94 (0.51 - 1.75)	1.06 (0.57 - 1.97)
	40-49	301/9797 (3.1%)	2.96 (1.62 - 5.43)*	3.13 (1.71 - 5.74)*
	50-59	1029/12971 (7.9%)	8.05 (4.43 - 14.64)*	8.39 (4.61 - 15.26)*
	60-69	2253/11020 (20.4%)	24.02 (13.23 - 43.58)*	23.43 (12.90 - 42.56)*
	70-79	4880/14491 (33.7%)	47.45 (26.17 - 86.04)*	48.27 (26.60 - 87.61)*
	80 +	10459/26032 (40.2%)	62.77 (34.63 - 113.75)*	69.45 (38.28 - 125.98)*
Ethnic Group	British (White)	14956/64029 (23.4%)	Reference	
	African (Black or Black British)	339/2625 (12.9%)	0.49 (0.43 - 0.55)*	1.05 (0.92 - 1.20)
	Any other Asian background	316/2593 (12.2%)	0.46 (0.40 - 0.51)*	1.07 (0.93 - 1.22)
	Any other Black background	182/972 (18.7%)	0.76 (0.64 - 0.89)*	1.44 (1.20 - 1.74)*
	Any other Mixed background	67/501 (13.4%)	0.51 (0.39 - 0.66)*	0.89 (0.66 - 1.19)
	Any other White background	708/4043 (17.5%)	0.70 (0.64 - 0.76)*	0.96 (0.88 - 1.06)
	Any other ethnic group	422/2965 (14.2%)	0.54 (0.49 - 0.60)*	0.97 (0.86 - 1.09)
	Bangladeshi (Asian or Asian British)	153/607 (25.2%)	1.11 (0.92 - 1.33)	2.32 (1.85 - 2.90)*
	Caribbean (Black or Black British)	587/2060 (28.5%)	1.31 (1.19 - 1.44)*	1.20 (1.07 - 1.34)*
	Chinese (other ethnic group)	65/375 (17.3%)	0.69 (0.53 - 0.90)*	1.21 (0.89 - 1.64)
	Indian (Asian or Asian British)	585/3271 (17.9%)	0.71 (0.65 - 0.78)*	1.24 (1.11 - 1.38)*
	Irish (White)	204/854 (23.9%)	1.03 (0.88 - 1.21)	0.79 (0.66 - 0.93)*
	Pakistani (Asian or Asian British)	393/1928 (20.4%)	0.84 (0.75 - 0.94)*	1.57 (1.38 - 1.79)*
	White and Asian (Mixed)	28/223 (12.6%)	0.47 (0.32 - 0.70)*	1.36 (0.87 - 2.14)
	White and Black African (Mixed)	13/152 (8.6%)	0.31 (0.17 - 0.54)*	0.65 (0.35 - 1.20)
	White and Black Caribbean (Mixed)	35/204 (17.2%)	0.68 (0.47 - 0.98)*	1.15 (0.76 - 1.74)

Region	London	4292/18539 (23.2%)	Reference	
	East Midlands	1323/5379 (24.6%)	1.08 (1.01 - 1.16)*	0.87 (0.80 - 0.94)*
	East of England	2033/7705 (26.4%)	1.19 (1.12 - 1.26)*	1.14 (1.06 - 1.22)*
	North East	1005/5986 (16.8%)	0.67 (0.62 - 0.72)*	0.72 (0.66 - 0.79)*
	North West	2956/14679 (20.1%)	0.84 (0.79 - 0.88)*	0.83 (0.78 - 0.88)*
	South East	2446/12611 (19.4%)	0.80 (0.76 - 0.84)*	0.84 (0.78 - 0.89)*
	South West	989/4819 (20.5%)	0.86 (0.79 - 0.93)*	0.75 (0.69 - 0.82)*
	West Midlands	2523/10270 (24.6%)	1.08 (1.02 - 1.14)*	0.90 (0.84 - 0.96)*
	Yorkshire	1486/7414 (20.0%)	0.83 (0.78 - 0.89)*	0.81 (0.75 - 0.87)*
IMD Quintile	1 (most deprived)	4516/20321 (22.2%)	1.06 (1.00 - 1.11)*	1.18 (1.11 - 1.25)*
	2	4294/19721 (21.8%)	1.03 (0.98 - 1.09)	1.09 (1.03 - 1.16)*
	3	3705/16956 (21.9%)	1.04 (0.98 - 1.09)	1.08 (1.02 - 1.14)*
	4	3463/15942 (21.7%)	1.03 (0.97 - 1.09)	1.04 (0.98 - 1.10)
	5 (least deprived)	3075/14462 (21.3%)	Reference	

Note: Asterisks denote significance (p<0.05).

Survival analysis

Cox proportional hazards regression models were used to model survival time among people with confirmed COVID-19 by age, sex, and ethnicity. On the multivariable model, men are have a significantly higher probability of death compared to women regardless of age (aHR=1.48 (95% CI 1.44-1.53) (figure 11). Compared to the youngest age group of patients diagnosed with coronavirus (00-19), the probability of death significantly increased with age up to approximately 60-fold for those aged 80 and over (figure 12). Hazard ratios were lower in the East Midlands (aHR=0.936 (95% CI 0.88-0.99)) and higher in the East of England (aHR=1.18 (95% CI 1.1-1.2) when compared to London. Those living in the least deprived areas had a lower probability of death than those living in the most deprived areas (aHR for the least deprived quintile was 0.87 (95% CI 0.82-0.91) when compared to the most deprived quintile).

Four ethnic groups had significantly higher probability of death in this time period when compared to White British ethnicity: Bangladeshi (aHR=1.98 (95% CI 1.68-2.33)), Pakistani (aHR=1.39 (95% CI 1.25-1.54), Indian (aHR=1.24 (95% CI 1.14-1.35), and other Black (aHR=1.31 (95% CI 1.13-1.52) (figure 13). People of White Irish ethnicity had significantly lower probability of death when compared to White British ethnicity (aHR=0.84 (95% CI 0.73-0.97)).

The same model was stratified by age groups (under 20, 20-39, 40-49, 50-59, 60-69, 70-79, 80+) (output not shown) and the results were replicated for people of Bangladeshi, Indian and Pakistani ethnicities, especially over 50. Higher probability of death among people of other Black ethnic group was observed in 50-59 (aHR=1.53 (95% CI 1.09-2.13) and 80+ (aHR=1.31 (95%CI 1.01-1.70). Other consistent trends were men having higher probability of death and more affluent areas having a lower probability of death compared to the more deprived areas.

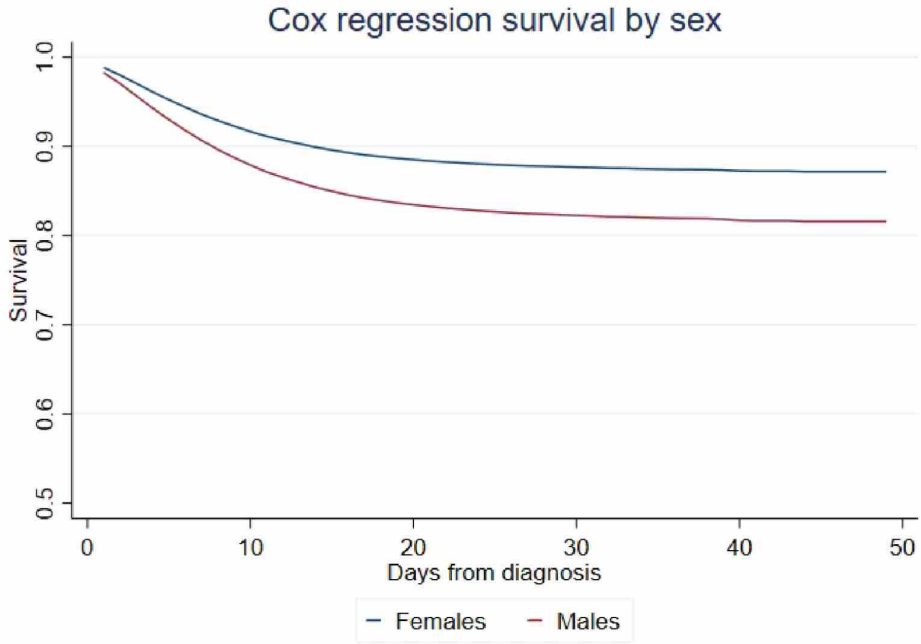


Figure 11. Cox regression survival curve in people tested positive by sex (days from positive sample). Based on multivariable model presented in table 13. Data reported to PHE by 26 April 2020

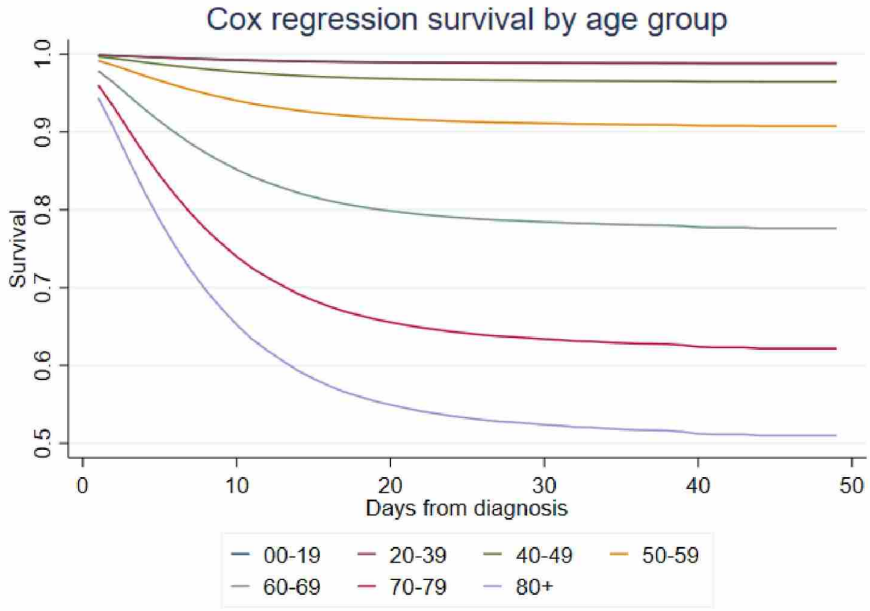


Figure 12. Cox regression survival curve in people tested positive by age group (days from positive sample). Based on multivariable model presented in table 13. Data reported to PHE by 26 April 2020.

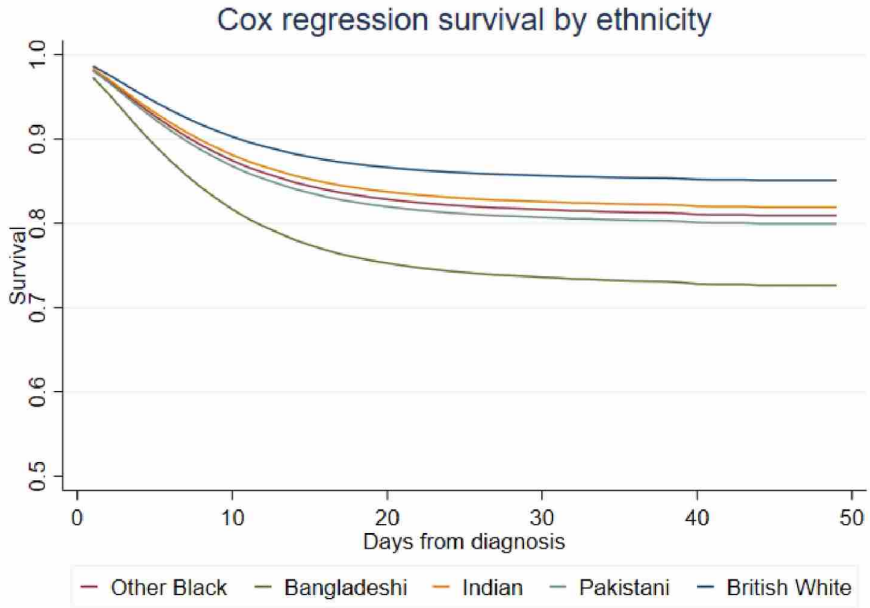


Figure 13. Cox regression survival curve in people tested positive by ethnic group (days from positive sample). Based on multivariate model presented in table 13. Ethnic groups presented are British White (reference) and groups for which hazard ratio was significantly higher than the reference group. Data reported to PHE by 26 April 2020.

Table 13. Univariable and multivariable hazard ratios for death amongst those with laboratory confirmed COVID-19. Data up to 26 April.

	Characteristics	Deaths	Individuals Tested	%	Univariable HR	95% CI	Multivariablee HR	95% CI
Sex	Female	7,296	45,694	16.0%	Reference	N/A	Reference	N/A
	Male	11,385	41,335	27.5%	1.752*	1.702-1.805	1.483*	1.439-1.527
Age Group	<20	10	1,038	1.0%	Reference	N/A	Reference	N/A
	20-39	107	12,038	0.9%	0.957	0.500-1.829	1.033	0.541-1.976
	40-49	279	9,775	2.9%	3.026*	1.611-5.687	3.114*	1.657-5.852
	50-59	991	12,933	7.7%	8.213*	4.405-15.312	8.384*	4.497-15.632
	60-69	2,198	10,965	20.0%	22.582*	12.133-42.028	21.868*	11.748-40.704
	70-79	4,799	14,410	33.3%	41.226*	22.168-76.670	41.041*	22.064-76.340
	80 +	10,297	25,870	39.8%	55.280*	29.734-102.772	58.207*	31.302-108.238
Ethnic Group	British (White)	14,668	63,740	23.0%	Reference	N/A	Reference	N/A
	African (Black or Black British)	329	2,615	12.6%	0.481	0.431-0.536	1.005	0.897-1.126
	Any other Asian background	310	2,587	12.0%	0.477	0.426-0.534	1.093	0.974-1.227
	Any other Black background	179	969	18.5%	0.728	0.628-0.844	1.311*	1.128-1.524
	Any other Mixed background	65	499	13.0%	0.523	0.410-0.667	0.927	0.726-1.183
	Any other White background	698	4,033	17.3%	0.707	0.655-0.762	0.987	0.913-1.067
	Any other ethnic group	413	2,956	14.0%	0.545	0.494-0.601	0.984	0.890-1.089
	Bangladeshi (Asian or Asian British)	150	604	24.8%	1.031	0.878-1.211	1.981*	1.682-2.332
	Caribbean (Black or Black British)	573	2,046	28.0%	1.158	1.065-1.258	1.083	0.993-1.181
	Chinese (other ethnic group)	63	373	16.9%	0.667	0.521-0.855	1.118	0.873-1.433
	Indian (Asian or Asian British)	574	3,260	17.6%	0.726	0.668-0.789	1.237*	1.136-1.347
	Irish (White)	200	850	23.5%	1.012	0.880-1.164	0.844*	0.734-0.971
	Pakistani (Asian or Asian British)	384	1,919	20.0%	0.805	0.727-0.891	1.386*	1.250-1.536
	White and Asian (Mixed)	28	223	12.6%	0.525	0.363-0.761	1.394	0.962-2.021
	White and Black African (Mixed)	12	151	7.9%	0.303	0.172-0.534	0.627	0.356-1.105

	White and Black Caribbean (Mixed)	35	204	17.2%	0.696	0.499-0.969	1.086	0.779-1.514
PHE Region	East Midlands	1,305	5,361	24.3%	1.134*	1.065-1.206	0.936*	0.877-0.998
	East of England	1,996	7,668	26.0%	1.247*	1.182-1.315	1.175*	1.111-1.243
	London	4,245	18,492	23.0%	Reference	N/A	Reference	N/A
	North East	955	5,936	16.1%	0.768*	0.716-0.824	0.874*	0.812-0.942
	North West	2,899	14,621	19.8%	0.927*	0.884-0.971	0.930*	0.883-0.979
	South East	2,386	12,551	19.0%	0.879*	0.836-0.924	0.916*	0.868-0.967
	South West	972	4,802	20.2%	0.955	0.891-1.024	0.848*	0.788-0.912
	West Midlands	2,475	10,222	24.2%	1.154*	1.098-1.212	0.970	0.920-1.022
	Yorkshire and Humber	1,448	7,376	19.6%	0.929*	0.875-0.986	0.916*	0.860-0.976
IMD Quintile	1 (most deprived)	4,421	20,226	21.9%	Reference	N/A	Reference	N/A
	2	4,216	19,643	21.5%	0.963	0.923-1.005	0.939*	0.900-0.981
	3	3,638	16,888	21.5%	0.967	0.926-1.011	0.922*	0.881-0.964
	4	3,391	15,870	21.4%	0.964	0.922-1.009	0.900*	0.859-0.943
	5 (least deprived)	3,015	14,402	20.9%	0.931*	0.889-0.975	0.865*	0.824-0.908

Note: Asterisks denote significance ($p<0.05$).

Overall mortality

This section looks at total mortality from all causes of death over the period 24 March to 13 April 2020 by ethnic group using death registration data supplied by the Office for National Statistics. Ethnicity is not recorded at death registration in England, however, ethnicity information has been taken from records of hospital admissions, where available. For 94% of deaths it was possible to assign an ethnic group in this way.

Between 24 March and 13 April 2020 there were 43,712 deaths among England residents of which 10,707 (24%) had COVID-19 mentioned on the death certificate. These are deaths among people who have not necessarily had a positive test for SARS-CoV-2. For the majority of deaths where COVID-19 was mentioned (96%) it is also stated as the underlying cause of death.

Table 14 shows the number of total deaths by ethnic group, the number where COVID-19 was mentioned on the death certificate and the percentage of deaths by ethnic group. The White ethnic group made up 85% of total deaths over this period compared with 75% of those with COVID-19 mentioned. The proportion of COVID-19 deaths among Black and Asian ethnic groups was more than twice the proportion of all-cause deaths for these groups.

Table 14. Number of total deaths and deaths mentioning COVID-19 by ethnic group in England, 24 March to 13 April 2020

	All causes		COVID-19 mentioned	
Ethnicity	**N**	**%**	**N**	**%**
White	37136	85.0%	8031	75.0%
British	35291	80.7%	7521	70.2%
Irish	463	1.1%	119	1.1%
Any other White background	1382	3.2%	391	3.7%
Asian / Asian British	1977	4.5%	1015	9.5%
Indian	779	1.8%	391	3.7%
Pakistani	481	1.1%	260	2.4%
Bangladeshi	204	0.5%	113	1.1%
Chinese	98	0.2%	45	0.4%
Any other Asian background	415	0.9%	206	1.9%
Black / Black British	1306	3.0%	701	6.5%
African	381	0.9%	224	2.1%
Caribbean	733	1.7%	369	3.4%
Any other Black background	192	0.4%	108	1.0%
Mixed / Multiple Ethnic Groups	193	0.4%	74	0.7%
White and Asian	33	0.1%	12	0.1%
White and Black African	22	0.1%	9	0.1%
White and Black Caribbean	57	0.1%	18	0.2%
Any other Mixed background	81	0.2%	35	0.3%
Any other ethnic group	623	1.4%	278	2.6%
No ethnicity information (not linked)	2477	5.7%	608	5.7%
Total	43712	100.0%	10707	100.0%

Figure 14 shows age-standardised mortality rates for all causes of death and for deaths mentioning COVID-19 by ethnic group. Table E1 in appendix E provides more detail and shows age specific rates.

People in the "Other ethnic group" had the highest mortality rates from all causes and COVID-19 over this time period, followed by people in the Black ethnic group and then the Asian ethnic group. As ethnicity information is derived from hospital records and the populations for the rates are derived from the 2011 Census, it is possible that there are proportionally more people assigned to the Other ethnic group in the hospital data than there are in the census data. This may explain the high mortality rates in the Other group, which requires further investigation. The opposite may be true for the Mixed ethnic group and may explain the comparatively low mortality in this ethnic group.

For both sexes, the mortality rate based on death certificates that mention COVID-19 was nearly 4 times higher in the Asian ethnic group than the White group, and more than 5 times higher in the Black ethnic group. Although these figures take into account the age structure of the population, they do not adjust for other factors such as other comorbidities, deprivation, region, and occupation.

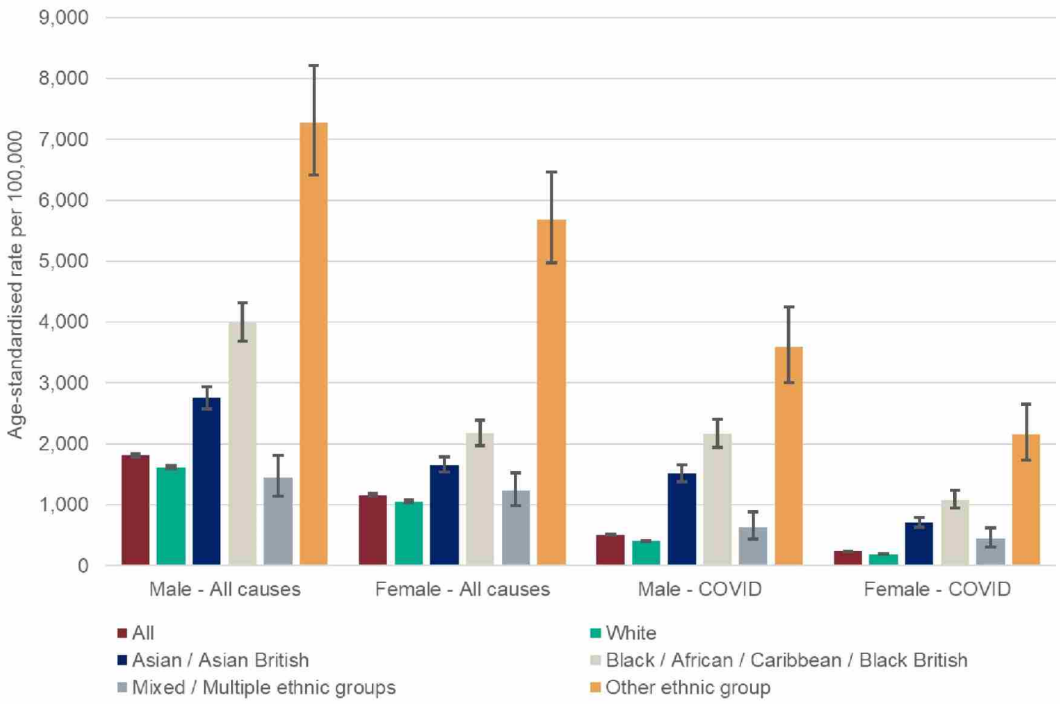


Figure 14. Age-standardised mortality rates for total deaths and deaths mentioning COVID-19 by sex and ethnic group in England, 24 March to 13 April 2020

Table 15 shows age-standardised mortality rates for all causes of death by ethnic group for the years 2014-2018 as a whole compared with the period 24 March to 13 April 2020 and the ratio of these rates. These ratios should be interpreted with caution as the time periods studied are not comparable, however all ethnic groups have experienced higher mortality rates in the three

weeks in 2020 than in 2014-2018. The difference is highest in Black males followed by Black females and Asian males.

Table 15. Age-standardised mortality rates for all causes of death by ethnic group for the years 2014-2018 and the period 24 March to 13 April 2020, England

	2014-2018		24 March to 13 April 2020		Ratio	
Ethnicity	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
White	1084	809	1619	1057	1.49	1.31
Asian / Asian British	881	655	2753	1656	3.12	2.53
Black / Black British	973	686	3992	2174	4.10	3.17
Mixed / Multiple Ethnic Groups	590	487	1450	1231	2.46	2.53
Any other ethnic group	2795	2724	7276	5685	2.60	2.09
No ethnicity information	n/a	n/a	n/a	n/a	n/a	n/a
Total	1108	827	1813	1161	1.64	1.40

Table 16 shows an estimate of the excess age-standardised mortality rate by ethnic group in the period 24 March to 13 April (when compared with years 2014-2018 as a whole) and the proportion of this excess that is due to COVID-19. The proportion of the excess that is due to COVID-19 does not vary much by ethnic group, but is highest in the male Asian and Other groups and lowest in the female Mixed group.

Table 16. Estimated excess age-standardised mortality rates by ethnic group for the period 24 March to 13 April 2020, England

	Excess rate		Covid-19 rate		Proportion of excess due to Covid-19	
Ethnicity	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
White	535	248	404	190	0.75	0.77
Asian / Asian British	1872	1001	1514	706	0.81	0.70
Black / Black British	3020	1488	2167	1085	0.72	0.73
Mixed / Multiple Ethnic Groups	859	744	628	445	0.73	0.60
Any other ethnic group	4481	2960	3592	2156	0.80	0.73
No ethnicity information	n/a	n/a	n/a	n/a	n/a	n/a
Total	705	334	508	239	0.72	0.71

PHE is developing a more sophisticated model to estimate excess mortality rates adjusted for age, sex and region of residence. Currently, the model can be used to estimate the excess number of deaths in each ethnic group, but not excess death rates.

Figure 15 shows the number of excess deaths by sex and ethnic group in the period 20 March to 17 April (a slightly longer period) against a modelled baseline of the number of deaths that would be expected for these dates in 2014-2018. The figure also highlights how many of those have mention of or the underlying cause of death is COVID-19. The model adjusts for age and region of residence. Overall the model suggests that there have been 26,369 excess deaths over the period 20 March to 17 April 2020, of which 22,715 are among the White group, 1,217 Black, 1,850 Asian, 190 Mixed and 398 are in the Other ethnic group.

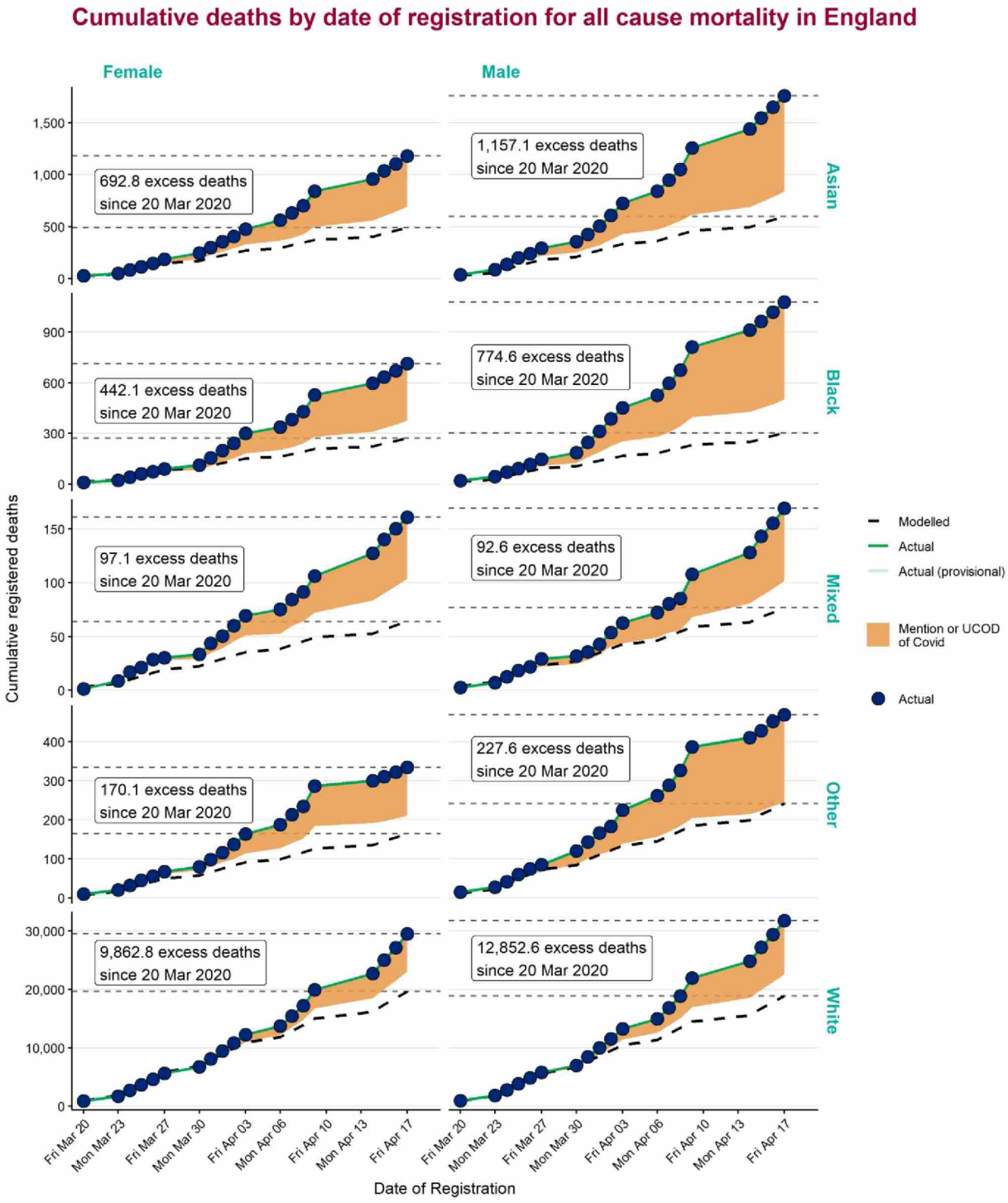


Figure 15. Excess number of deaths by ethnic group, period 20 March to 17 April 2020, England. Note the y-Axis scale is different for each ethnic group.

For each ethnic group, Table 17 compares the cumulative actual deaths in the model as at 17 April with the modelled baseline number of expected deaths, as shown in the charts above, and the ratio of the two. The highest ratio was for Black males, where the cumulative number of deaths on 17 April was 3.5 times higher than the number which would have been expected at

this time of year in 2014-2018. The lowest ratio was for White females, where the deaths were only 1.5 times higher than expected.

Table 17. Estimated ratio of adjusted deaths compared with baseline deaths by ethnic group for the period 20 March to 17 April 2020, England

	Adjusted deaths		Baseline expected deaths		Ratio	
Ethnicity	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
White	31757	29494	18905	19631	1.7	1.5
Asian / Asian British	1757	1182	600	489	2.9	2.4
Black / Black British	1079	714	304	272	3.5	2.6
Mixed / Multiple Ethnic Groups	170	161	77	64	2.2	2.5
Any other ethnic group	469	334	241	164	1.9	2.0
No ethnicity information	n/a	n/a	n/a	n/a	n/a	n/a
Total	35232	31885	20127	20620	1.8	1.5

Table 18 shows the estimated number of excess deaths from the model and the proportion that have COVID-19 mentioned on the death certificate. Among males 73% of this excess is for deaths with COVID-19 mentioned on the death certificate, rising to 79% in Asian males. Among females 66% of the excess is for deaths with COVID-19 mentioned, rising to 76% among Black females.

Table 18. Estimated number of excess deaths from the model and the proportion that have COVID-19 mentioned on the death certificate for the period 20 March to 17 April 2020, England

	Excess deaths		COVID-19 deaths		Proportion of excess due to COVID-19	
Ethnicity	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
White	12853	9863	9164	6410	0.71	0.65
Asian / Asian British	1157	693	920	491	0.79	0.71
Black / Black British	775	442	577	337	0.75	0.76
Mixed / Multiple Ethnic Groups	93	97	68	57	0.73	0.59
Any other ethnic group	228	170	225	123	0.99	0.73
No ethnicity information	n/a	n/a	n/a	n/a	n/a	n/a
Total	15105	11265	10954	7419	0.73	0.66

As mentioned previously, these differences in mortality rates can partly be explained by differences in the socioeconomic status and comorbidities experienced by different ethnic groups.

Tables E2 and E3 in appendix E show all cause and COVID-19 deaths by region of residence and deprivation decile of residence respectively over this period. In the Black ethnic group 60% of COVID-19 deaths are among people resident in the three most deprived decile areas of England and 76% are among London residents. In the Asian group 47% of COVID-19 deaths are among people resident in the three most deprived decile areas and 57% are in London. By comparison only 31% of deaths in the White ethnic group are in the three most deprived decile areas and only 20% are in London. These patterns will partly explain the higher mortality seen in the Black and Asian ethnic groups from COVID-19.

Table 19 shows the proportion of all cause deaths and COVID-19 deaths that have a mention of cardiovascular disease or diabetes on the death certificate.

Table 19. Total deaths and COVID-19 deaths mentioning cardiovascular (CVD) disease and diabetes on the death certificate by ethnic group, England, 24 March to 13 April 2020

	All deaths				COVID-19 mentioned			
Ethnicity	**CVD**	**%**	**Diabetes**	**%**	**CVD**	**%**	**Diabetes**	**%**
White	16357	44%	4689	13%	3746	47%	1517	19%
Black / Black British	679	52%	483	37%	388	55%	331	47%
Asian / Asian British	1109	56%	717	36%	588	58%	448	44%
Mixed / Multiple Ethnic Groups	97	50%	51	26%	42	57%	34	46%
Any other ethnic group	306	49%	138	22%	154	55%	88	32%
No ethnicity information	1082	44%	307	12%	272	45%	140	23%
Total	19630	45%	6385	15%	5190	48%	2558	24%

The proportion of COVID-19 deaths where cardiovascular disease (CVD) is also mentioned is 48% overall. This ranges from 47% in the White group to 58% in the Asian/Asian British group. The proportion of COVID-19 deaths where diabetes is also mentioned is 24% overall. This is significantly higher than the proportion of all deaths where diabetes is mentioned (15%). There was a significantly higher proportion of COVID-19 deaths mentioning diabetes compared with the proportion of all deaths mentioning diabetes in all broad ethnic groups. The proportion of COVID-19 deaths where diabetes is mentioned ranges from 19% in the White group to 47% in the Black/Black British group.

Interpretation of the data

There is clear evidence that COVID-19 does not affect all population groups equally. This and other reports have shown that older age and male sex, for example, are strongly associated with the risk of getting the infection and of suffering from its complications, including death. This report shows that, in addition to these, ethnicity is also associated with the risk of getting the infection and its complications.

We looked at 377,958 individuals who were tested for SARS-CoV-2, which corresponds to 675.2 individuals tested per 100,000 population. People of “Any other” ethnic group were most likely to have been tested (over 1,000 per 100,000), followed by people of Black ethnic groups, with 605.1. This was mostly driven by people of Caribbean and “Any other” Black background.

Overall, 29.0% of people tested had a positive test result. People of Black, Asian and “Any other” ethnic groups were more likely than any others to have a positive test (44.5%, 39.4% and 37.8%, respectively).

We then looked at the 109,769 individuals who tested positive. The age distribution of positive cases differed between ethnic groups, with White ethnicity having a higher proportion aged over 80 years when compared to all other ethnic groups. There were striking differences in the ethnic distribution of cases between regions, such that London had the lowest proportion of cases of any White ethnicity (approximately 50.5%) with all other regions ranging from 79.8% to 94.6%. These can partially be explained by differences in the underlying population. There were also important differences in the distribution of IMD score amongst ethnic groups, with the proportion of cases from the two most deprived quintiles being highest for cases of Black ethnic groups and lowest for White ethnic groups.

Overall, there were 196.1 laboratory confirmed cases per 100,000 population. This rate was highest for people of “Any other” ethnic group (476.6), followed by people of Black ethnic groups (269.0). This pattern was replicated in all England regions.

Multivariable logistic regression models were used to estimate the odds of (a) being tested (b) testing positive once tested and (c) testing positive among the whole population. After adjusting for age, sex and region, the odds of being tested for COVID-19 were higher in all other ethnic groups compared to White British (except White Irish which had lower odds of being tested). After adjusting for age group, sex, region and IMD, odds of testing positive among those who were tested were significantly higher for all ethnic groups when compared to White British, except Chinese, White Irish and Mixed White and Black Caribbean ethnic groups. Finally, among the whole population the odds of testing positive for COVID-19 were higher in all other ethnic groups (including White Irish) compared to White British.

Two subsets of people who were hospitalised, all of whom with confirmed COVID-19 were then examined. This included reports from 43 NHS trusts on patients in lower level of care (5,388 cases) and from 90 trusts on patients in ICU (2,426 cases). Most trusts in London do not report to this surveillance system (CHESS) which impacts on the representativeness of the ethnicity profile of hospitalised cases, particularly since London has the highest number and rate of COVID-19 cases to date.

Amongst cases admitted to lower level of care, 88.3% were of White British ethnicity; this was only 67.0% of those admitted to ICU. The age distribution in both levels of care varied between ethnic groups: there was a greater proportion of younger patients amongst Black, Asian, Mixed and "Any other" ethnic groups, when compared with White ethnic groups. Patients in Black ethnic groups who are admitted to ICU seem to have a higher prevalence of diabetes and hypertension when compared to other ethnic groups and to patients in Black ethnic groups in lower level of care.

Overall, 61.4% of the 21,739 deaths in people with laboratory confirmed COVID-19 were among men. Among people in White ethnic groups, 84% of deaths were among those aged over 70 years in comparison with 62% of deaths among both Black and Asian ethnic groups. The ethnic distribution among deaths was similar for the confirmed cases, with London having the lowest proportion of deaths amongst people of White ethnic groups (55%). Similarly, more than 60% of deaths in people from Black and Asian ethnic groups were in the two most deprived quintiles, when compared to just over 40% of deaths in people from White ethnic groups.

Overall crude mortality rate amongst women with a laboratory confirmed diagnosis was 29.7 deaths per 100,000 and it was 48.2 for men. Crude mortality rates were noticeably high for both men and women of Black Caribbean ethnicity (134.6 and 73.7 per 100,000, respectively).

Two multivariable models were run – one logistic regression and one proportional hazards Cox regression – to look at the association between ethnicity and the odds and risk of dying, respectively. Both models adjusted for age, sex, region and IMD quintile and both showed increased odds and risk of death among people of Pakistani, Bangladeshi, Indian, and "Any other" Black ethnic groups. The multivariable logistic regression also showed increased odds of death among people of Black Caribbean ethnicity. Both models also showed lower odds of death among people of White Irish ethnicity. When stratified by age group, both models showed higher odds and risk of death among people of Indian, Pakistani and Bangladeshi ethnic groups among higher age groups. Results were less consistent for people of "Other Black" or Caribbean Black ethnic groups.

Finally, we looked at total mortality from all causes of death over the period 24 March to 13 April 2020, and compared it to the baseline expected mortality based on death rates for the same period in 2014-2018. Between 24 March and 13 April 2020 there were 43,712 deaths among England residents of which 10,707 (24%) had COVID-19 mentioned on the death certificate. For all causes of death, 85% were among people of White ethnic groups, compared with 75% of deaths where COVID-19 is mentioned.

Age standardised death rates were highest for people in "Any other" ethnic group, followed by people in the Black ethnic group and then the Asian ethnic group, and similar when COVID-19 was mentioned in the certificate. When compared to previous years (2014-2018), age standardised mortality rates were higher than expected for all ethnic groups and both sexes, but they were more than 4 times higher for men of Black ethnic groups and 3 times higher for women of Black ethnic groups and men of Asian ethnic groups.

Most of the excess mortality rate seen in this period is due to COVID-19 among all ethnic groups; this ranges from 60% among women of Mixed ethnic groups to 81% among men of Asian ethnic groups.

The proportion of COVID-19 deaths where diabetes is also mentioned is 24% overall. This is significantly higher than the proportion of all deaths where diabetes is mentioned (15%) and it was observed for all ethnic groups, ranging from 19% in the White ethnic group to 47% in the Black ethnic group. This has had a reflection on excess mortality rates, which are mostly driven by COVID-19 deaths in all ethnic groups.

Limitations

Numbers and rates of tests, as well as the likelihood of a positive result, are likely to be strongly influenced by case definition and testing policy, and must be interpreted under that light. For example, when the case definition included travel history to an area with community transmission during the earlier phase of the pandemic, this may have made it more likely to test people of specific ethnic groups.

Hospitalization data is limited by low reporting rates, especially from London. Because demographic composition of the population is considerably different in London when compared to the rest of the country, the hospitalisation data must be interpreted with caution.

These datasets do not include information about key aspects that are likely to drive some of the association between ethnicity and COVID-19, such as occupation (i.e. key workers, clinical and otherwise, are less likely to be able to practice social distancing for example) and, with exception of the CHESS analyses, comorbidities. Other datasets outside of PHE should be explored to undertand the role of comorbidities in the observed association with the ethnicity.

Ethincity was assigned by linking to HES. The longer lead times for HES data to be made available mean it was not possible to link approximately 20% of records to ethnicity information. This may have introduced some bias by excluding people who are less likely to have a hospital record or ethnicity recorded in their records, which may vary by ethnicity.

As ethnicity information is derived from hospital records and the populations for the rates are derived from the 2011 Census, it is possible that there are proportionally more people assigned to the “Any other” ethnic group in the hospital records than there are in the census data. This may explain high rates seen in several analyses for the “Any other” ethnic group, which requires further investigation. The opposite may be true for the Mixed ethnic group and may explain the comparatively low rates in this ethnic group.

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Appendices

Appendix A: Comparison of HES and ONS ethnicity categorisations

HES ethnicity classification	ONS ethnicity classification
White A British B Irish C Any other White background	White • English / Welsh / Scottish / Northern Irish / British • Irish • Gypsy or Irish Traveller • Any other White background
Mixed D White and Black Caribbean E White and Black African F White and Asian G Any other mixed background	Mixed / Multiple ethnic groups • White and Black Caribbean • White and Black African • White and Asian • Any other Mixed / Multiple ethnic background
Asian or Asian British H Indian J Pakistani K Bangladeshi L Any other Asian background	Asian / Asian British • Indian • Pakistani • Bangladeshi • Chinese • Any other Asian background
Black or Black British M Caribbean N African P Any other Black background	Black / African / Caribbean / Black British • African • Caribbean • Any other Black / African / Caribbean background
Other Ethnic Groups R Chinese S Any other ethnic group	Other ethnic group • Arab • Any other ethnic group

Appendix B: Rate of confirmed cases by sex

Table B1. Number of laboratory confirmed cases and rate per 100,000 population by sex and ethnicity. Data reported to PHE by 26 April 2020 (n=108,475)

Ethnicity	Females			Males		
	n	N	Rate per 100,000	n	N	Rate per 100,000
White	29,663	23,846,794	124.4	28,038	23,163,930	121.0
British (White)	34,013	22,171,324	153.4	30,064	21,615,771	139.1
Irish (White)	436	249,633	174.7	420	233,019	180.2
Any other White background	2,144	1,425,838	150.4	1,901	1,315,140	144.5
Black / Black British	2,616	1,084,554	241.2	2,564	1,020,260	251.3
African (Black or Black British)	1,412	589,483	239.5	1,219	561,519	217.1
Caribbean (Black or Black British)	1018	329,506	308.9	1041	288,157	361.3
Any other Black background	478	165,565	288.7	494	170,585	289.6
Asian / Asian British	3,721	2,323,951	160.1	3,979	2,362,256	168.4
Bangladeshi (Asian or Asian British)	286	250,844	114.0	321	266,464	120.5
Indian (Asian or Asian British)	1,614	752,154	214.6	1,662	780,227	213.0
Pakistani (Asian or Asian British)	872	637,860	136.7	1058	665,566	159.0
Chinese (other ethnic group)	194	215,604	90.0	182	196,702	92.5
Any other Asian background	1,389	467,490	297.1	1,204	453,297	265.6
Mixed / Multiple Ethnic Groups	488	772,274	63.2	429	778,269	55.1
Any other Mixed background	255	184,790	138.0	247	179,601	137.5
White and Asian (Mixed)	126	215,381	58.5	97	227,271	42.7
White and Black African (Mixed)	91	109,261	83.3	61	109,777	55.6
White and Black Caribbean (Mixed)	120	262,842	45.7	84	261,621	32.1
Any other ethnic group	1,425	281,663	505.9	1,553	343,226	452.5
No ethnicity information (not linked)	10,041	n/a	n/a	10,953	n/a	n/a
Total	55,914	28,309,236	197.5	52,561	27,667,942	190.0

Appendix C: Additional univariable and multivariable logistic regression analyses for odds of being tested and testing positive among the ONS population

Table C1. Number of individuals tested for COVID-19 among the ONS 2018 population and the odds ratio from the univariable and multivariable logistic regression analyses. Data reported to PHE by 26 April 2020.

Characteristics		n/N	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Region	London	62749/8908101	Baseline	
	East Midlands	23345/4804158	0.79 (0.78 to 0.81)	0.91 (0.89 to 0.93)
	East of England	33098/6201207	0.84 (0.83 to 0.85)	0.95 (0.93 to 0.96)
	North East	21117/2657962	1.31 (1.29 to 1.34)	1.56 (1.53 to 1.59)
	North West	49776/7292118	1.11 (1.09 to 1.12)	1.30 (1.28 to 1.32)
	South East	52387/9133635	0.86 (0.85 to 0.87)	0.97 (0.96 to 0.99)
	South West	32680/5599761	0.93 (0.92 to 0.94)	1.04 (1.02 to 1.06)
	West Midlands	33128/5900779	0.93 (0.91 to 0.94)	1.04 (1.02 to 1.05)
	Yorkshire	33273/5479604	0.59 (0.58 to 0.60)	0.69 (0.68 to 0.71)
Age Group	<20	32033/13241297	Baseline	
	20-39	84496/14833697	2.25 (2.21 to 2.29)	2.21 (2.17 to 2.25)
	40-49	49036/7189824	3.04 (2.99 to 3.10)	3.01 (2.96 to 3.07)
	50-59	54074/7488816	3.45 (3.39 to 3.51)	3.61 (3.55 to 3.68)
	60-69	41010/5867016	3.66 (3.60 to 3.73)	3.99 (3.92 to 4.07)
	70-79	46473/4587942	5.79 (5.69 to 5.89)	6.50 (6.38 to 6.62)
	80 +	70486/2768733	15.21 (14.96 to 15.47)	17.08 (16.79 to 17.37)
Sex	Female	194375/28309320	Baseline	
	Male	161091/27668005	0.81 (0.81 to 0.82)	0.89 (0.88 to 0.89)
Ethnicity	British (White)	219093/43787107	Baseline	
	African (Black or Black British)	5966/1150985	1.21 (1.18 to 1.24)	1.97 (1.92 to 2.02)
	Any other Asian background	6591/920813	1.64 (1.60 to 1.68)	2.39 (2.33 to 2.45)
	Any other Black background	2365/336155	1.91 (1.84 to 1.99)	3.20 (3.06 to 3.34)
	Any other Mixed background	1757/624900	1.34 (1.28 to 1.41)	2.55 (2.43 to 2.68)
	Any other White background	13420/364380	1.03 (1.01 to 1.05)	1.42 (1.39 to 1.45)
	Any other ethnic group	7885/2740979	2.91 (2.84 to 2.98)	4.32 (4.21 to 4.42)
	Bangladeshi (Asian or Asian British)	1515/517319	0.96 (0.91 to 1.01)	1.53 (1.46 to 1.62)
	Caribbean (Black or Black British)	4406/617694	1.80 (1.75 to 1.86)	1.86 (1.81 to 1.92)
	Chinese (other ethnic group)	1351/412317	1.02 (0.96 to 1.08)	1.34 (1.26 to 1.42)
	Indian (Asian or Asian British)	8104/1532393	1.19 (1.16 to 1.22)	1.55 (1.51 to 1.58)

	Irish (White)	2494/482647	1.49 (1.43 to 1.55)	0.95 (0.91 to 0.99)
	Pakistani (Asian or Asian British)	4720/1303438	0.86 (0.83 to 0.88)	1.37 (1.33 to 1.41)
	White and Asian (Mixed)	921/442663	0.82 (0.76 to 0.87)	1.70 (1.58 to 1.81)
	White and Black African (Mixed)	527/219069	1.25 (1.14 to 1.36)	2.48 (2.27 to 2.70)
	White and Black Caribbean (Mixed)	791/524466	0.68 (0.63 to 0.73)	1.27 (1.18 to 1.37)

Table C2. Number of individuals positive for COVID-19 among the ONS 2018 population and the odds ratio from the univariable and multivariable logistic regression analyses. Data reported to PHE by 26 April 2020

Characteristics		**n/N**	**Unadjusted OR (95% CI)**	**Adjusted OR (95% CI)**
Region	London	23558/8908101	Baseline	
	East Midlands	6185/4804158	0.53 (0.51 to 0.54)	0.78 (0.75 to 0.80)
	East of England	9318/6201207	0.57 (0.55 to 0.58)	0.81 (0.79 to 0.84)
	North East	6931/2657962	1.02 (0.99 to 1.05)	1.61 (1.56 to 1.67)
	North West	17028/7292118	0.89 (0.87 to 0.91)	1.40 (1.37 to 1.44)
	South East	15785/9133635	0.58 (0.57 to 0.59)	0.88 (0.86 to 0.90)
	South West	5747/5599761	0.38 (0.37 to 0.39)	0.56 (0.54 to 0.58)
	West Midlands	11789/5900779	0.80 (0.78 to 0.82)	1.12 (1.09 to 1.15)
	Yorkshire	8877/5479604	0.63 (0.61 to 0.65)	0.95 (0.92 to 0.98)
Age Group	<20	1729/13241297	Baseline	
	20-39	20059/14833697	6.55 (6.15 to 6.98)	5.51 (5.17 to 5.87)
	40-49	13873/7189824	10.48 (9.83 to 11.17)	8.74 (8.20 to 9.32)
	50-59	17135/7488816	13.18 (12.37 to 14.04)	12.39 (11.63 to 13.2)
	60-69	13168/5867016	14.24 (13.37 to 15.18)	14.77 (13.86 to 15.74)
	70-79	15956/4587942	23.82 (22.36 to 25.37)	26.55 (24.93 to 28.28)
	80 +	27749/2768733	70.76 (66.51 to 75.29)	80.04 (75.21 to 85.18)
Sex	Female	55914/28309320	Baseline	
	Male	52561/27668005	0.94 (0.92 to 0.95)	1.05 (1.04 to 1.07)
Ethnicity	British (White)	64078/43787107	Baseline	
	African (Black or Black British)	2631/1150985	2.17 (2.08 to 2.25)	3.96 (3.80 to 4.13)
	Any other Asian background	2593/920813	2.72 (2.61 to 2.83)	4.19 (4.02 to 4.37)
	Any other Black background	972/336155	4.12 (3.86 to 4.39)	6.48 (6.06 to 6.92)
	Any other Mixed background	502/624900	3.00 (2.75 to 3.28)	5.76 (5.27 to 6.30)
	Any other White background	4045/364380	1.30 (1.26 to 1.34)	1.91 (1.85 to 1.98)

	Any other ethnic group	2978/2740979	4.70 (4.53 to 4.87)	7.18 (6.90 to 7.46)
	Bangladeshi (Asian or Asian British)	607/517319	1.89 (1.75 to 2.05)	3.11 (2.87 to 3.38)
	Caribbean (Black or Black British)	2059/617694	3.44 (3.30 to 3.60)	3.10 (2.96 to 3.24)
	Chinese (other ethnic group)	376/412317	2.06 (1.86 to 2.28)	2.77 (2.50 to 3.06)
	Indian (Asian or Asian British)	3276/1532393	1.93 (1.87 to 2.00)	2.45 (2.36 to 2.54)
	Irish (White)	856/482647	2.43 (2.27 to 2.60)	1.22 (1.14 to 1.30)
	Pakistani (Asian or Asian British)	1930/1303438	1.74 (1.66 to 1.82)	2.51 (2.39 to 2.62)
	White and Asian (Mixed)	223/442663	2.89 (2.54 to 3.30)	4.95 (4.34 to 5.66)
	White and Black African (Mixed)	152/219069	4.62 (3.94 to 5.42)	8.76 (7.45 to 10.28)
	White and Black Caribbean (Mixed)	204/524466	2.22 (1.93 to 2.55)	3.69 (3.21 to 4.23)

Appendix D: Time from symptom onset to ICU admission

Only 58% of the cases included in the ICU subset had information on time to admission. Of these cases (n=1399), there was no significant variation in the time from onset of symptom to ICU admission between ethnic groups.

Table D1. Days from symptom onset to ICU admission (count, minimum, maximum, median and 25 and 75 percentiles) by ethnic group

Ethnicity	**Time from symptom onset to ICU admission (days)**					
	count	**min**	**max**	**median**	**p25**	**p75**
African (Black or Black British)	35	1	26	9.0	4.0	14.0
Any other Asian background	82	1	28	9.0	5.0	12.0
Any other Black background	20	3	70	9.0	5.5	13.0
Any other Mixed background	16	1	19	9.5	4.0	13.5
Any other White background	48	2	22	8.0	6.0	12.0
Any other ethnic group	76	1	32	10.0	7.0	13.0
Bangladeshi (Asian or Asian British)	8	3	18	10.0	7.5	14.0
British (White)	902	1	71	8.0	4.0	12.0
Caribbean (Black or Black British)	44	1	34	9.0	6.0	14.5
Chinese (other ethnic group)	9	3	27	10.0	8.0	15.0
Indian (Asian or Asian British)	77	1	34	9.0	5.0	14.0
Irish (White)	12	3	25	11.0	4.0	16.0
Pakistani (Asian or Asian British)	48	1	21	8.0	5.5	12.0
White and Asian (Mixed)	11	3	22	12.0	8.0	19.0
White and Black African (Mixed)	2	14	15	14.5	14.0	15.0
White and Black Caribbean (Mixed)	9	1	17	7.0	6.0	12.0
Total	1399	1	71	8.0	5.0	12.0

Appendix E: Excess mortality tables

Table E1. Age-specific rates for all cause deaths and COVID-19 deaths, by ethnicity and sex.

		All cause deaths		COVID-19 deaths	
Ethnicity	**Age group**	**Male**	**Female**	**Male**	**Female**
All ethnicities	< 20	29.27	24.04	0.77	0.81
	20 – 39	80.18	47.62	10.49	8.06
	40 – 59	480.78	298.40	116.41	67.43
	60 – 69	1770.09	1054.07	518.10	252.07
	70 – 79	4854.89	2868.99	1518.01	686.66
	80 +	18492.87	13820.01	5158.08	2553.09
Ethnicity	**Age group**	**Male**	**Female**	**Male**	**Female**
White	< 20	10.61	10.85	0.33	0.35
	20 – 39	63.88	40.87	4.40	5.63
	40 – 59	416.45	270.93	74.37	51.06
	60 – 69	1503.63	929.48	350.91	171.99
	70 – 79	4332.65	2597.17	1244.42	521.41
	80 +	16932.09	12862.73	4279.99	2186.52
Ethnicity	**Age group**	**Male**	**Female**	**Male**	**Female**
Black / Black British	< 20	31.24	21.42	0.00	5.35
	20 – 39	77.23	47.06	16.55	20.91
	40 – 59	797.16	496.32	467.09	250.95
	60 – 69	4257.28	2315.24	2696.28	1395.08
	70 – 79	11153.24	5203.13	6130.59	3121.88
	80 +	37485.03	20048.82	20381.20	8984.53
Ethnicity	**Age group**	**Male**	**Female**	**Male**	**Female**
Asian / Asian British	< 20	27.32	25.93	2.48	2.59
	20 – 39	59.55	43.39	30.80	19.52
	40 – 59	429.03	229.76	222.12	69.53
	60 – 69	2962.55	1377.91	1851.60	777.85
	70 – 79	7551.07	4455.12	4427.43	2545.78
	80 +	24765.13	17005.17	13522.38	6229.17
Ethnicity	**Age group**	**Male**	**Female**	**Male**	**Female**
Mixed / Multiple ethnic groups	< 20	8.64	8.98	0.00	0.00
	20 – 39	43.50	7.30	0.00	0.00
	40 – 59	117.43	301.73	33.55	127.04
	60 – 69	1312.24	1514.16	605.65	801.61
	70 – 79	4718.26	2696.79	2555.73	1348.39
	80 +	15684.09	13612.48	6120.62	3630.00
Ethnicity	**Age group**	**Male**	**Female**	**Male**	**Female**
Any other ethnic group	< 20	37.30	39.67	0.00	0.00
	20 – 39	223.39	144.68	69.81	18.08
	40 – 59	1113.44	526.14	538.16	150.33
	60 – 69	3766.61	3346.98	2331.71	1295.61
	70 – 79	17449.09	11920.05	9250.12	5960.02
	80 +	80584.09	68834.30	39502.01	24160.38

Table E2. Total deaths and COVID-19 deaths by ethnic group and region, England, 24th March to 13th April.

		All cause deaths		COVID-19 deaths	
Ethnicity	**Region**	**Count**	**%**	**Count**	**%**
White	North East	2068	5.6%	477	5.9%
	North West	5884	15.8%	1400	17.4%
	Yorkshire and The Humber	3493	9.4%	537	6.7%
	East Midlands	3127	8.4%	563	7.0%
	West Midlands	4267	11.5%	1015	12.6%
	East of England	4427	11.9%	822	10.2%
	London	4141	11.2%	1644	20.5%
	South East	5916	15.9%	1112	13.8%
	South West	3810	10.3%	460	5.7%
	Total	**37133**	**100.0%**	**8030**	**100.0%**
Ethnicity	**Region**	**Count**	**%**	**Count**	**%**
Black / Black British	North East	4	0.3%	1	0.1%
	North West	42	3.2%	17	2.4%
	Yorkshire and The Humber	29	2.2%	9	1.3%
	East Midlands	30	2.3%	9	1.3%
	West Midlands	202	15.5%	96	13.7%
	East of England	47	3.6%	18	2.6%
	London	899	68.8%	530	75.6%
	South East	45	3.4%	19	2.7%
	South West	8	0.6%	2	0.3%
	Total	**1306**	**100.0%**	**701**	**100.0%**
Ethnicity	**Region**	**Count**	**%**	**Count**	**%**
Asian / Asian British	North East	13	0.7%	4	0.4%
	North West	153	7.7%	65	6.4%
	Yorkshire and The Humber	101	5.1%	30	3.0%
	East Midlands	132	6.7%	47	4.6%
	West Midlands	343	17.3%	185	18.2%
	East of England	122	6.2%	58	5.7%
	London	964	48.8%	576	56.7%
	South East	131	6.6%	47	4.6%
	South West	18	0.9%	3	0.3%
	Total	**1977**	**100.0%**	**1015**	**100.0%**

Table E2 (continued). Total deaths and COVID-19 deaths by ethnic group and region, England, 24th March to 13th April.

		All cause deaths		COVID-19 deaths	
Ethnicity	**Region**	**Count**	**%**	**Count**	**%**
Mixed / Multiple ethnic groups	North East	3	1.6%	1	1.4%
	North West	10	5.2%	0	0.0%
	Yorkshire and The Humber	9	4.7%	3	4.1%
	East Midlands	16	8.3%	3	4.1%
	West Midlands	22	11.4%	11	14.9%
	East of England	26	13.5%	5	6.8%
	London	76	39.4%	40	54.1%
	South East	22	11.4%	8	10.8%
	South West	9	4.7%	3	4.1%
	Total	**193**	**100.0%**	**74**	**100.0%**
Ethnicity	**Region**	**Count**	**%**	**Count**	**%**
Any other ethnic group	North East	6	1.0%	0	0.0%
	North West	34	5.5%	9	3.2%
	Yorkshire and The Humber	14	2.2%	3	1.1%
	East Midlands	29	4.7%	7	2.5%
	West Midlands	38	6.1%	12	4.3%
	East of England	24	3.9%	8	2.9%
	London	399	64.0%	216	77.7%
	South East	66	10.6%	22	7.9%
	South West	13	2.1%	1	0.4%
	Total	**623**	**100.0%**	**278**	**100.0%**
Ethnicity	**Region**	**Count**	**%**	**Count**	**%**
No ethnicity information (not linked)	North East	79	3.2%	20	3.3%
	North West	313	12.6%	83	13.7%
	Yorkshire and The Humber	243	9.8%	45	7.4%
	East Midlands	189	7.6%	32	5.3%
	West Midlands	276	11.1%	74	12.2%
	East of England	360	14.5%	63	10.4%
	London	417	16.8%	189	31.1%
	South East	385	15.5%	72	11.8%
	South West	215	8.7%	30	4.9%
	Total	**2477**	**100.0%**	**608**	**100.0%**
	Grand total	**43709**	**100.0%**	**10706**	**100.0%**

Table E3. Total deaths and COVID-19 deaths by ethnic group and deprivation decile, England, 24th March to 13th April.

		All cause deaths		COVID-19 deaths	
Ethnicity	**Deprivation decile**	**Count**	**%**	**Count**	**%**
White	Most deprived	3772	10.2%	766	9.5%
	Second most deprived	3688	9.9%	888	11.1%
	Third most deprived	3483	9.4%	839	10.4%
	Fourth most deprived	3707	10.0%	784	9.8%
	Fifth most deprived	3722	10.0%	755	9.4%
	Fifth least deprived	3870	10.4%	809	10.1%
	Fourth least deprived	3835	10.3%	791	9.9%
	Third least deprived	3871	10.4%	862	10.7%
	Second least deprived	3685	9.9%	785	9.8%
	Least deprived	3500	9.4%	751	9.4%
	Total	**37133**	**100.0%**	**8030**	**100.0%**
Ethnicity	**Deprivation decile**	**Count**	**%**	**Count**	**%**
Black / Black British	Most deprived	204	15.6%	98	14.0%
	Second most deprived	287	22.0%	156	22.3%
	Third most deprived	293	22.4%	166	23.7%
	Fourth most deprived	169	12.9%	101	14.4%
	Fifth most deprived	137	10.5%	78	11.1%
	Fifth least deprived	88	6.7%	50	7.1%
	Fourth least deprived	56	4.3%	22	3.1%
	Third least deprived	29	2.2%	12	1.7%
	Second least deprived	30	2.3%	14	2.0%
	Least deprived	13	1.0%	4	0.6%
	Total	**1306**	**100.0%**	**701**	**100.0%**
Ethnicity	**Deprivation decile**	**Count**	**%**	**Count**	**%**
Asian / Asian British	Most deprived	299	15.1%	143	14.1%
	Second most deprived	302	15.3%	165	16.3%
	Third most deprived	308	15.6%	172	16.9%
	Fourth most deprived	265	13.4%	144	14.2%
	Fifth most deprived	210	10.6%	113	11.1%
	Fifth least deprived	180	9.1%	91	9.0%
	Fourth least deprived	132	6.7%	61	6.0%
	Third least deprived	117	5.9%	52	5.1%
	Second least deprived	83	4.2%	34	3.3%
	Least deprived	81	4.1%	40	3.9%
	Total	**1977**	**100.0%**	**1015**	**100.0%**

Table E3 (continued). Total deaths and COVID-19 deaths by ethnic group and deprivation decile, England, 24th March to 13th April.

		All cause deaths		COVID-19 deaths	
Ethnicity	**Deprivation decile**	**Count**	**%**	**Count**	**%**
Mixed / Multiple ethnic groups	Most deprived	29	15.0%	11	14.9%
	Second most deprived	25	13.0%	9	12.2%
	Third most deprived	26	13.5%	8	10.8%
	Fourth most deprived	18	9.3%	7	9.5%
	Fifth most deprived	24	12.4%	8	10.8%
	Fifth least deprived	19	9.8%	11	14.9%
	Fourth least deprived	15	7.8%	7	9.5%
	Third least deprived	15	7.8%	6	8.1%
	Second least deprived	13	6.7%	5	6.8%
	Least deprived	9	4.7%	2	2.7%
	Total	**193**	**100.0%**	**74**	**100.0%**
Ethnicity	**Deprivation decile**	**Count**	**%**	**Count**	**%**
Any other ethnic group	Most deprived	47	7.5%	18	6.5%
	Second most deprived	86	13.8%	40	14.4%
	Third most deprived	123	19.7%	60	21.6%
	Fourth most deprived	64	10.3%	30	10.8%
	Fifth most deprived	63	10.1%	30	10.8%
	Fifth least deprived	59	9.5%	24	8.6%
	Fourth least deprived	50	8.0%	23	8.3%
	Third least deprived	39	6.3%	20	7.2%
	Second least deprived	50	8.0%	16	5.8%
	Least deprived	42	6.7%	17	6.1%
	Total	**623**	**100.0%**	**278**	**100.0%**
Ethnicity	**Deprivation decile**	**Count**	**%**	**Count**	**%**
No ethnicity information (not linked)	Most deprived	250	10.1%	70	11.5%
	Second most deprived	287	11.6%	92	15.1%
	Third most deprived	260	10.5%	74	12.2%
	Fourth most deprived	285	11.5%	63	10.4%
	Fifth most deprived	238	9.6%	55	9.0%
	Fifth least deprived	254	10.3%	59	9.7%
	Fourth least deprived	271	10.9%	54	8.9%
	Third least deprived	210	8.5%	50	8.2%
	Second least deprived	214	8.6%	42	6.9%
	Least deprived	208	8.4%	49	8.1%
	Total	**2477**	**100.0%**	**608**	**100.0%**
	Grand total	**43709**	**100.0%**	**10706**	**100.0%**