

UK Biobank SARS-CoV-2 Serology Study

16th September 2020

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1. Executive Summary

UK Biobank are collecting blood samples from approximately 20,200 individuals on a monthly basis for six months to determine the extent of past infection with SARS-CoV-2 in different population subgroups across the United Kingdom.

By the end of month 2 of the study period (between 27th May and 14th August 2020), 18,750 individuals (93%) had provided at least one sample. Of these, 16 individuals were excluded as their sample(s) could not be analysed. Of the remaining 18,734 individuals, 8.2% ($N=1,545$) had at least one sample that was seropositive for SARS-CoV-2.

Across the two months of the study, $N=1,147$ (6.1%) were seropositive in both months, $N=64$ (0.3%) were seropositive in month one but were classified as seronegative in month two, 100 (0.5%) were positive in month one but had a failed or missing sample for month two, $N=44$ (0.2%) had a failed or missing sample in month one and a positive sample in month two, and $N=190$ (1.0%) became newly seropositive in month two.

There were significant differences in seroprevalence by age, ethnicity, geographic region and socioeconomic status, further details of which are found in Section 3 of this report.

2. Study population

An overview of the participant characteristics is shown in Table 1.

Table 1 Participant characteristics for 18,734 participants who have provided at least one sample

Characteristics		N	%
Gender	Men	8,137	43.4
	Women	10,597	56.6
Age Group (years)	<30	2,031	10.8
	30-39	2,865	15.3
	40-49	2,327	12.4
	50-59	3,698	19.7
	60-69	3,857	20.6
	70+	3,956	21.1
Ethnicity*	White	16,347	87.4
	Black	455	2.4
	Chinese	146	0.8
	Mixed	703	3.8
	Other	518	2.8
	South Asian	527	2.8
Region	East Midlands	1,125	6.0
	East of England	881	4.7
	London	5,566	29.7
	North East	776	4.1
	North West	2,023	10.8
	Scotland	1,161	6.2
	South East	2,426	12.9
	South West	1,293	6.9
	Wales	737	3.9
	West Midlands	1,289	6.9
	Yorkshire	1,457	7.8
Location of Residence	Rural	2,577	13.8
	Urban	16,157	86.2
Townsend Deprivation Index	Less Deprived	6,526	34.8
	Average	7,673	41.0
	More Deprived	4,535	24.2

*Ethnicity counts exclude 38 individuals with missing information.

3. Seroprevalence of SARS-CoV-2 infection

Of the 18,734 participants who have provided at least one sample, 8.2% ($N=1,545$) had at least one sample that was seropositive for SARS-CoV-2 (i.e. they have had at least one positive test result during the study period to date); 91.8% ($N=17,189$) were seronegative.

Among those who have ever been seropositive, changes in serostatus between month one and month two are shown in Figure 1:

- Individuals who have remained seropositive across both months ($N=1,147$; 6.1%)
- Individuals who were seropositive in month one but seronegative in month two ($N=64$; 0.3%)
- Individuals who were seropositive in month one but had a failed test or did not submit a sample in month two ($N=100$; 0.5%)
- Individuals who had a failed test, or did not submit a test in month one but were positive in month two ($N=44$; 0.2%)
- Individuals who became newly seropositive in month two ($N=190$; 1.0%)

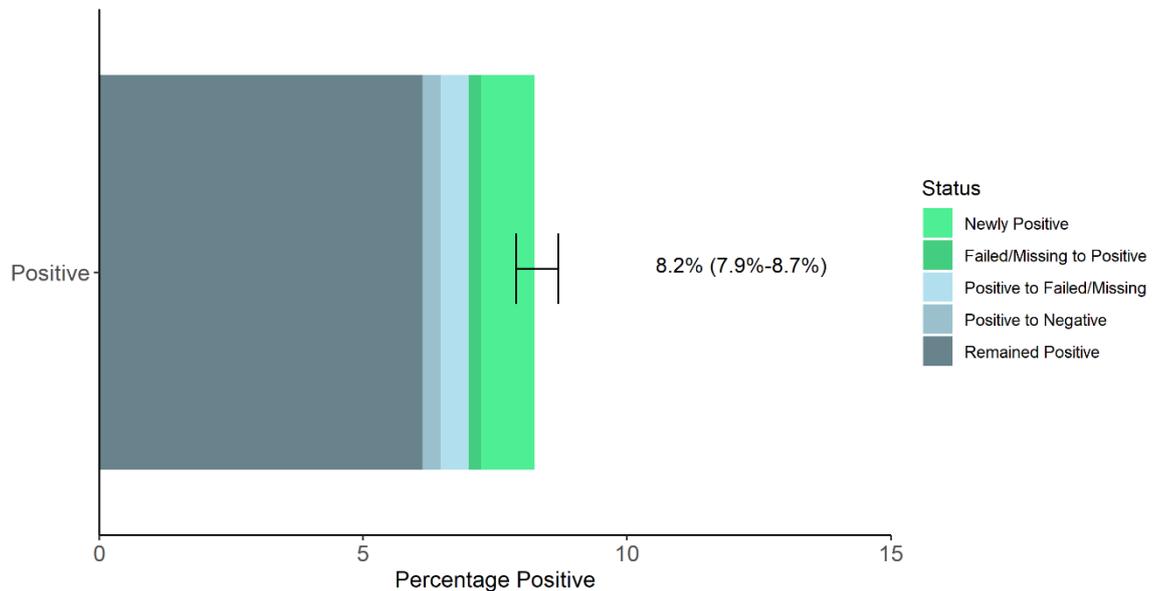


Figure 1 Percentage* of individuals ever seropositive for SARS-CoV-2 infection and changes in serostatus between month one and month two.

* The black lines indicate the 95% confidence intervals around the proportion of ever positives in the sample.

3.1 Gender

There was no evidence of a difference in seroprevalence by gender ($P_{\text{test for heterogeneity}} = 0.63$) with 8.3% of women and 8.1% of men being seropositive for SARS-CoV-2 infection (Figure 2).

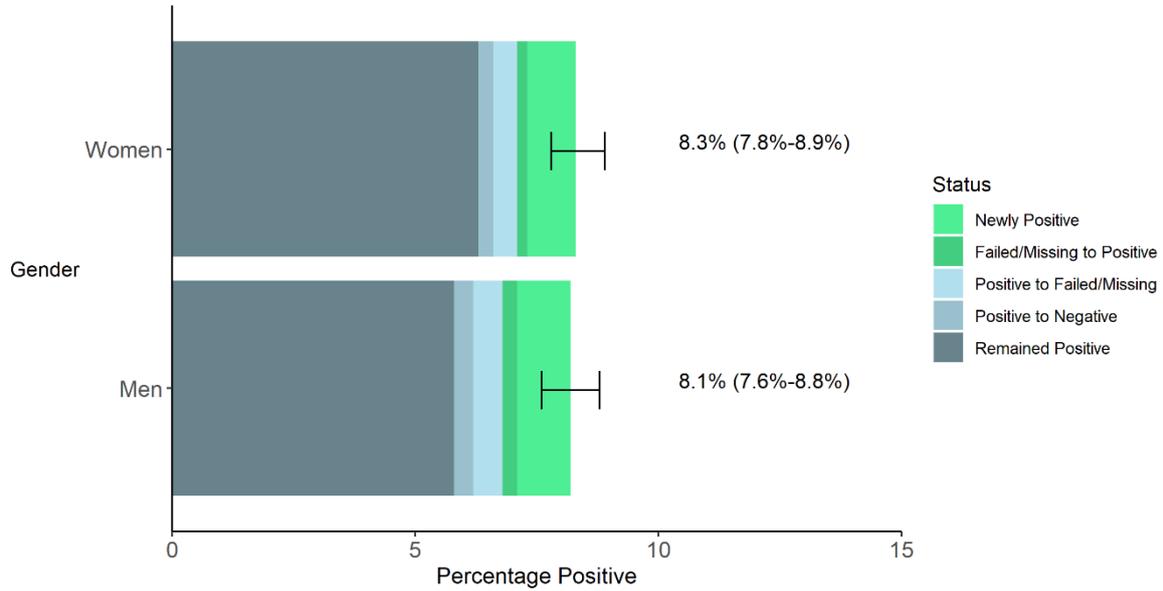


Figure 2 Percentage* of individuals ever seropositive for SARS-CoV-2 infection by gender.

* The black lines indicate the 95% confidence intervals around the proportion of ever positives in the sample.

3.2 Age

Seroprevalence of SARS-CoV-2 infection differed by age ($P_{\text{test for heterogeneity}} < 0.001$), ranging from 11.6% among those aged <30 years to 6.1% among those aged 70+ years (Figure 3).

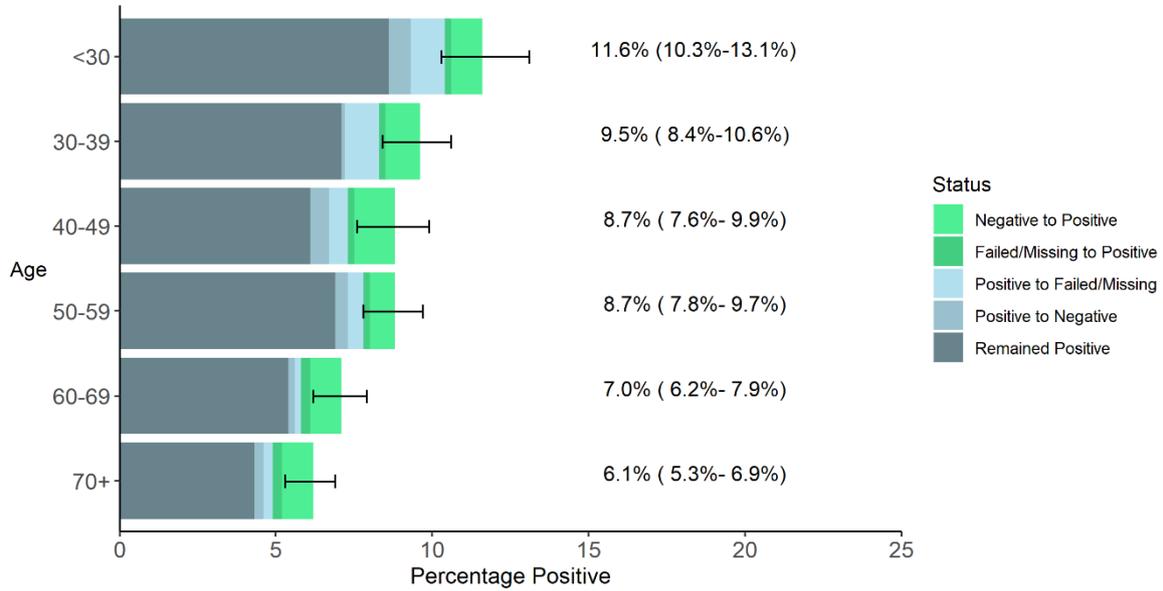


Figure 3 Percentage* of individuals ever seropositive for SARS-CoV-2 infection by age.

* The black lines indicate the 95% confidence intervals around the proportion of ever positives in the sample.

3.3 Ethnicity

Seroprevalence of SARS-CoV-2 differed by ethnicity ($P_{\text{test for heterogeneity}} < 0.001$), being highest among those of Black ethnicity (15.4%) and lowest among those of White ethnicity (7.8%; Figure 4).

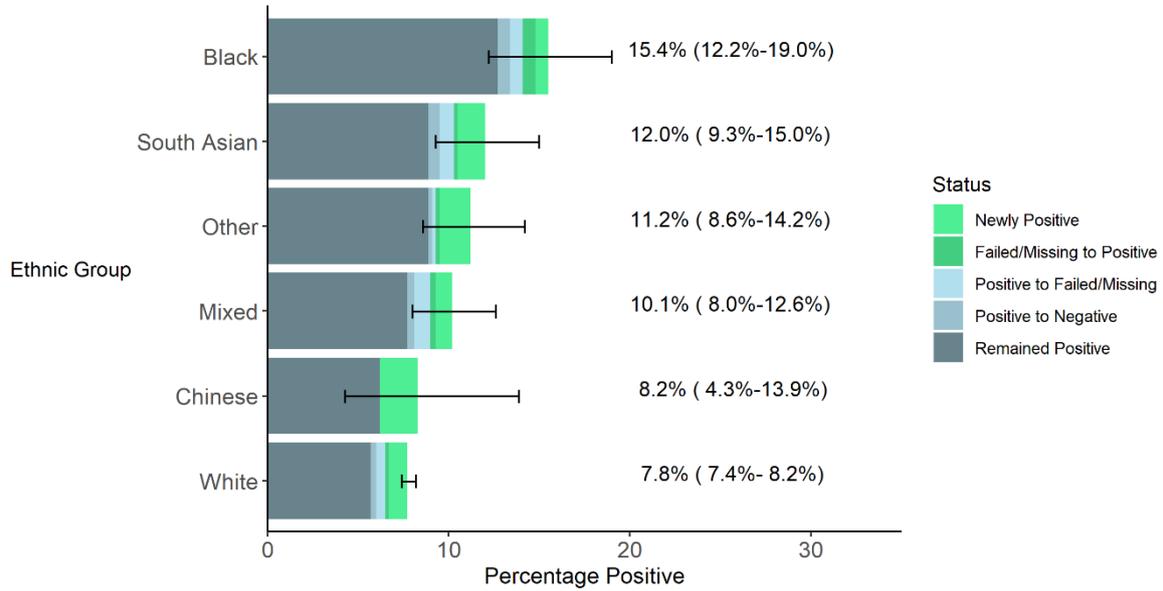


Figure 4 Percentage* of individuals ever seropositive for SARS-CoV-2 infection by ethnic group.

* The black lines indicate the 95% confidence intervals around the proportion of ever positives in the sample.

3.4 Region

Seroprevalence of SARS-CoV-2 infection varied by region ($P_{\text{test for heterogeneity}} < 0.001$), being highest in London (11.6%) and lowest in Wales (4.7%; Figure 5a and 5b).

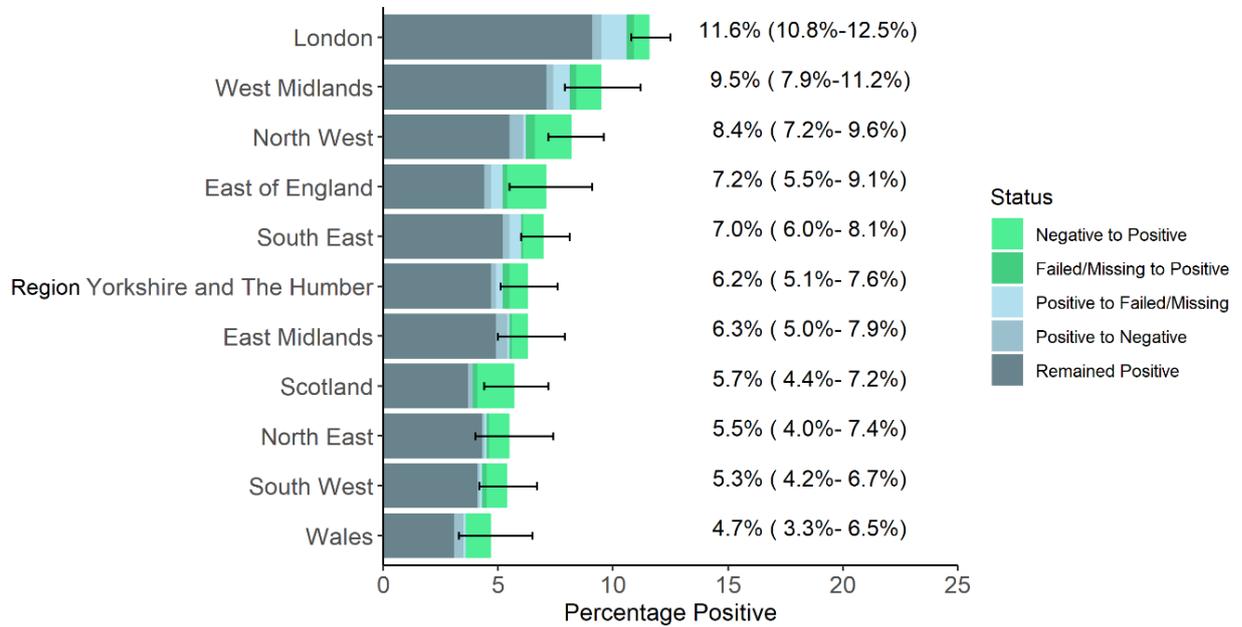


Figure 5a Percentage* of individuals ever seropositive for SARS-CoV-2 infection by region.

* The black lines indicate the 95% confidence intervals around the proportion of ever positives in the sample.

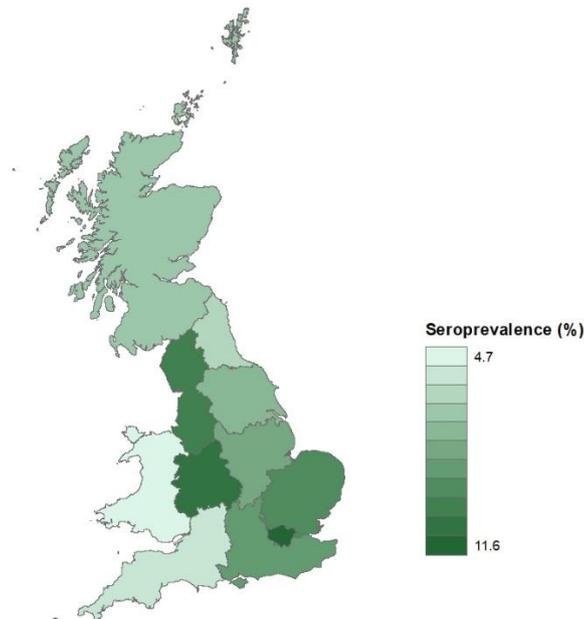


Figure 5b Map of the percentage of individuals ever seropositive for SARS-CoV-2 infection by region.

3.5 Rural/Urban

Seroprevalence of SARS-CoV-2 infection varied by urban-rural location of residence ($P_{\text{test for heterogeneity}} < 0.001$), being higher in those living in urban (8.7%) compared to rural areas (5.5%; Figure 6).

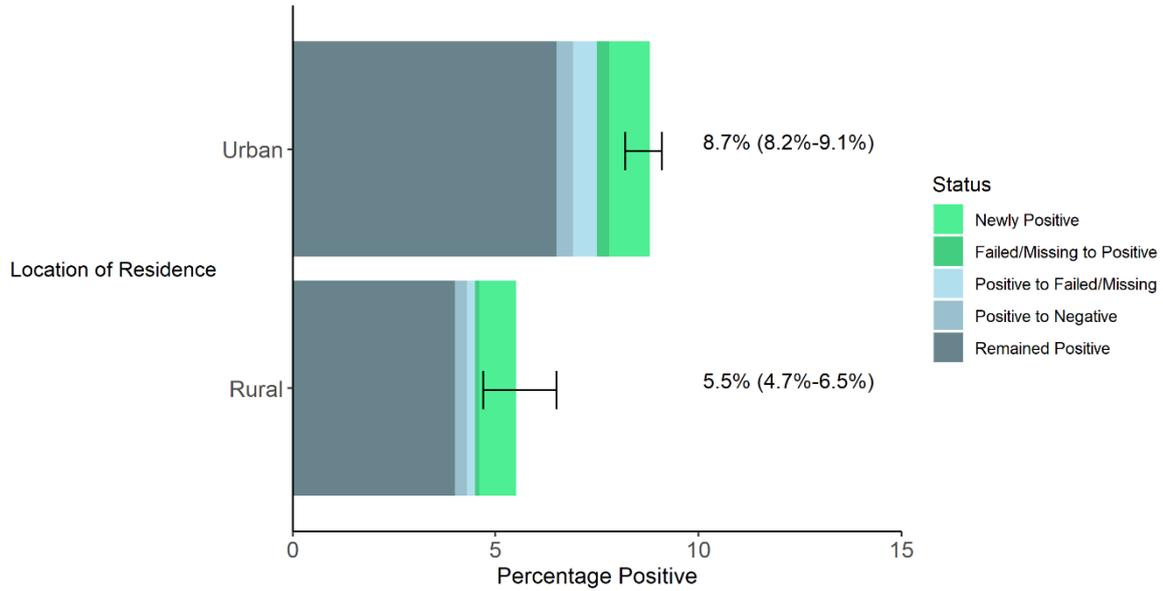


Figure 6 Percentage* of individuals ever seropositive for SARS-CoV-2 infection by location of residence.

* The black lines indicate the 95% confidence intervals around the proportion of ever positives in the sample.

3.6 Townsend Deprivation Index

Seroprevalence of SARS-CoV-2 infection varied significantly by Townsend Deprivation Index ($P_{\text{test for heterogeneity}} < 0.001$), being 10.6% in areas of higher socio-economic deprivation, compared with 7.1% in areas of lower socioeconomic deprivation (Figure 7).

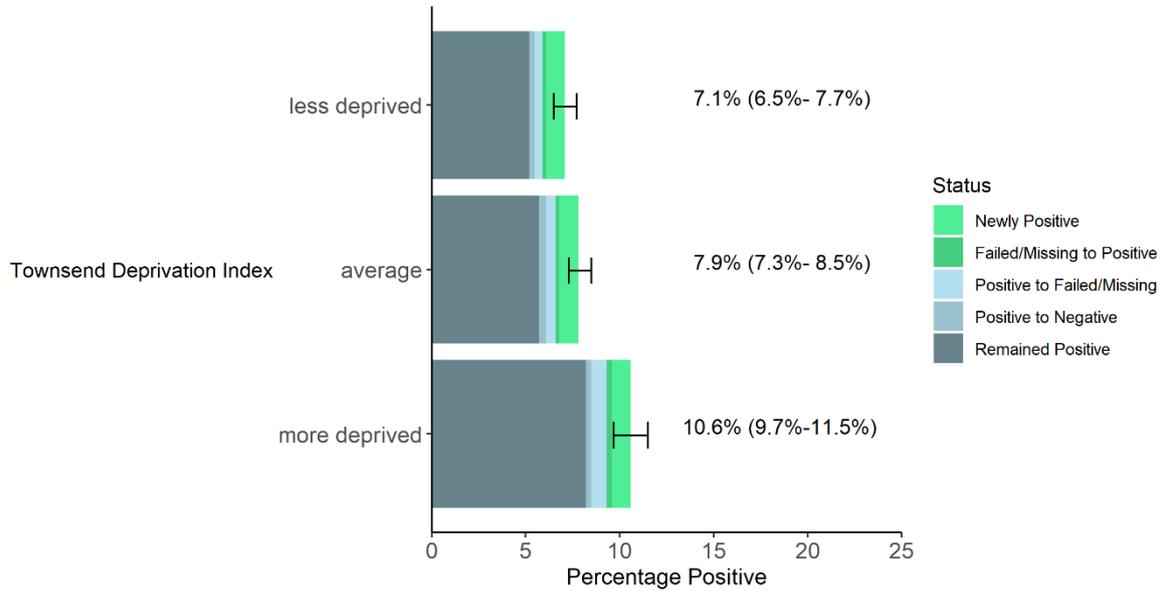


Figure 7 Percentage* of individuals ever seropositive for SARS-CoV-2 infection by Townsend Deprivation Index**.

* The black lines indicate the 95% confidence intervals around the proportion of ever positives in the sample.

**Townsend Deprivation Index categories are defined as: <-2 (less deprived), -2 to <2 (average), 2+ (more deprived)

4. Seroprevalence of SARS-CoV-2 infection in London

Samples from participants who live in London accounted for 29.7% of all samples analysed ($N=5,566$).

4.1 Seroprevalence across boroughs (London only)

Seroprevalence estimates differed across London ($P_{\text{test for heterogeneity}} < 0.001$), being highest in East and Central London (14.1%) and lowest in West London (9.2%; $P_{\text{test for heterogeneity}} < 0.001$; Figures 8a and 8b), although even here, the seroprevalence estimate was higher than the UK as a whole.

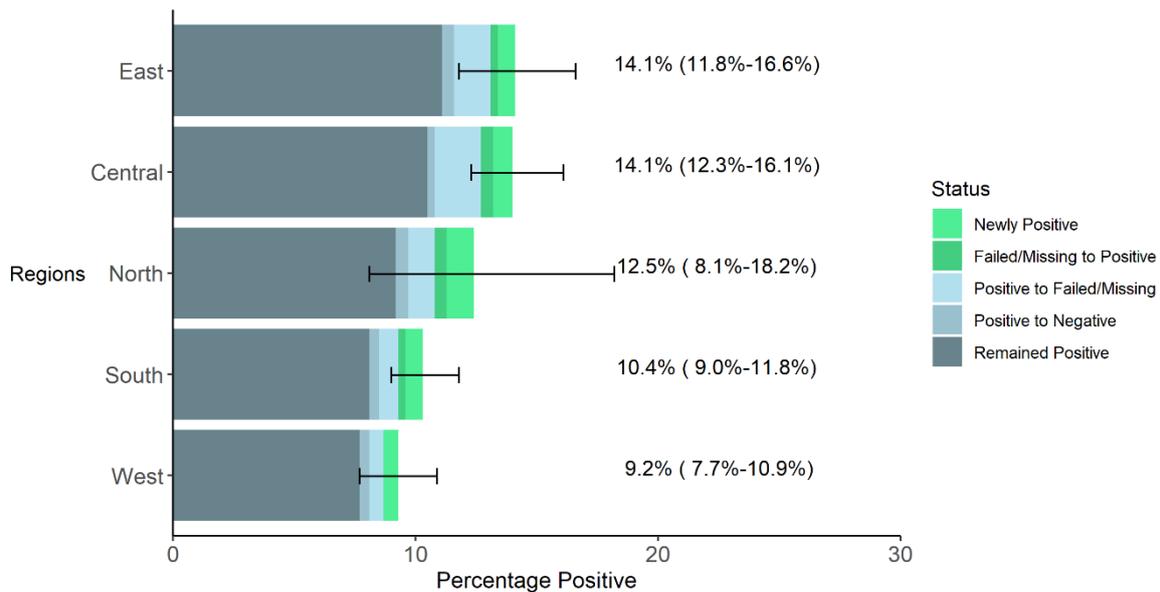


Figure 8a Percentage* of individuals ever seropositive for SARS-CoV-2 infection by region of London.

* The black lines indicate the 95% confidence intervals around the proportion of ever positives in the sample.

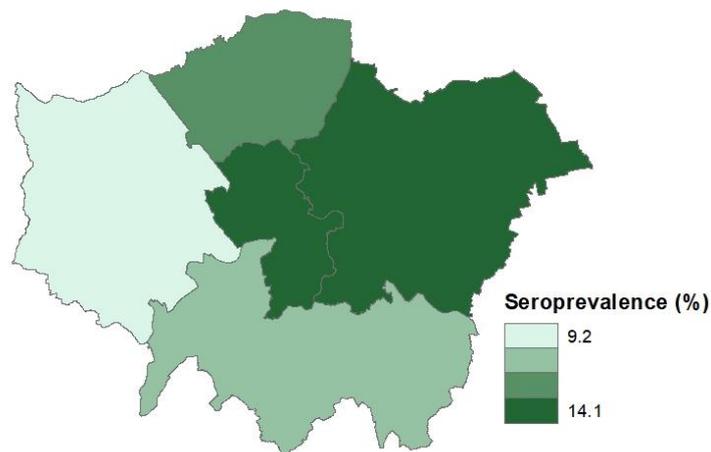


Figure 8b Map of percentage of individuals ever seropositive for SARS-CoV-2 infection by region of London

4.2 Seroprevalence by age (London only)

In London, the pattern of seroprevalence estimates by age followed that of the rest of the country, being highest in those less than 30 years of age (16.3%) and lowest in those 70 years or older (7.1%; Figure 9; $P_{\text{test for heterogeneity}} < 0.001$).

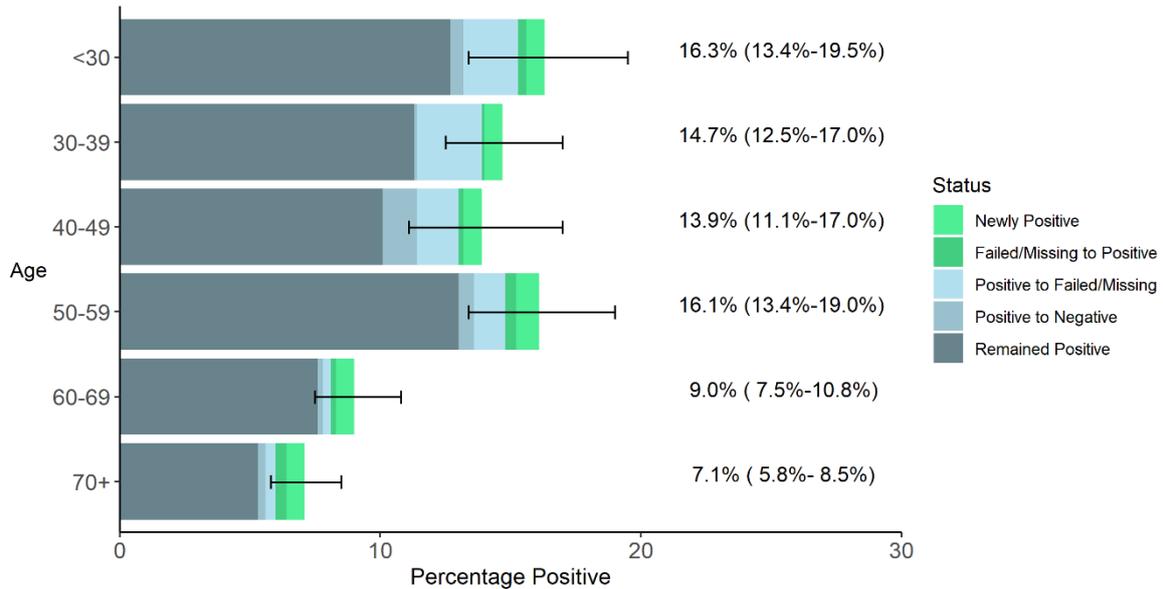


Figure 9 Percentage* of individuals ever seropositive for SARS-CoV-2 infection by age (London only).

* The black lines indicate the 95% confidence intervals around the proportion of ever positives in the sample.

4.3 Seroprevalence by ethnicity (London only)

In London, seroprevalence of SARS-CoV-2 was highest among those of Black ethnicity (19.8%) and lowest among those of White ethnicity (11.1%; $P_{\text{test for heterogeneity}}=0.006$; Figure 10).

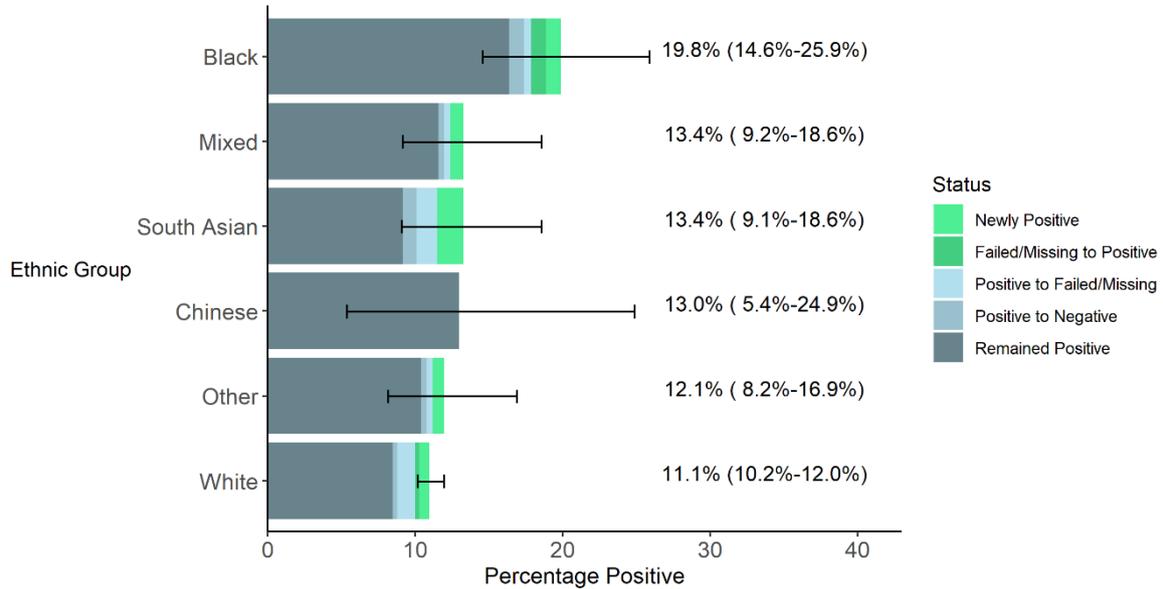


Figure 10 Percentage* of individuals ever seropositive for SARS-CoV-2 infection by ethnic group (London only).

* The black lines indicate the 95% confidence intervals around the proportion of ever positives in the sample.

5. Ethnicity and SARS-CoV-2 seropositivity

Individuals belonging to Black, Asian and minority ethnic (BAME) groups had a greater likelihood of being seropositive for SARS-CoV-2. Seropositivity was highest among Black individuals (15.4%) and lowest among White individuals (7.8%).

We have investigated whether these differences are explained by known socio-demographic factors using logistic regression. Table 2 shows the odds of being seropositive in different ethnic groups compared with participants of White ethnicity. Those with a Black ethnic background were more than twice as likely to be seropositive compared to their White counterparts (OR of 2.16, 95% CI: 1.65-2.79). After adjusting for age, sex, socio-economic deprivation, region and urban/rural status, the odds of being seropositive among Black ethnic minority participants was reduced but remained significantly higher than that of White participants (OR: 2.05; 95% CI: 1.55-2.68). Individuals of South Asian ethnicity and those belonging to 'Other' ethnic groups were all also more likely to be seropositive compared to their White counterparts following adjustment for sociodemographic factors (Table 2).

Table 2 Association between ethnic group and SARS-CoV-2 infection status before and after adjustment for sociodemographic factors.

Ethnicity	OR (95% CI)	
	Unadjusted	Adjusted for age, sex, Townsend Deprivation Index, region and urban/rural status
White	1.00 (ref)	1.00 (ref)
Black	2.16 (1.65-2.79)	2.05 (1.55-2.68)
South Asian	1.61 (1.22-2.10)	1.63 (1.22-2.14)
Chinese	1.06 (0.56-1.84)	1.15 (0.60-2.00)
Mixed	1.33 (1.03-1.70)	1.27 (0.98-1.63)
Other	1.50 (1.12-1.96)	1.56 (1.16-2.07)

Abbreviations: OR (odds ratio), 95% CI (95% Confidence Interval)