Office for National Statistics

Article

# Coronavirus (COVID-19) Infection Survey: characteristics of people testing positive for COVID-19 in England and antibody data for the UK: December 2020

Characteristics of people testing positive for COVID-19 from the Coronavirus (COVID-19) Infection Survey, including antibody data by UK country, and region for England. This survey is being delivered in partnership with University of Oxford, University of Manchester, Public Health England and Wellcome Trust.

Contact:
Kara Steel and Eleanor Fordham
infection.survey.analysis@ons.gov.uk
+44 (0)1633 455829

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# 1 . Main points

- In England, an estimated 8.7% (95% confidence interval: 8.2% to 9.3%) of people would have tested positive for antibodies against SARS-CoV-2 on a blood test in November, suggesting they had the infection in the past; there is substantial variation in antibody positivity between regions, from 12.8% (95% confidence interval: 11.4% to 14.5%) in London compared with 3.9% (95% confidence interval: 2.8% to 5.3%) in the South West.
- In Wales, an estimated 5.5% (95% confidence interval: 3.6% to 8.0%) of people would have tested positive for antibodies against SARS-CoV-2 on a blood test in November, suggesting they had the infection in the past.
- In Northern Ireland, an estimated 3.3% (95% confidence interval: 1.6% to 6.0%) of people would have tested positive for antibodies against SARS-CoV-2 on a blood test in November, suggesting they had the infection in the past.
- In Scotland, an estimated 7.3% (95% confidence interval: 5.0% to 10.3%) of people would have tested positive for antibodies against SARS-CoV-2 on a blood test in November, suggesting they had the infection in the past.
- Looking in more detail at those testing positive for COVID-19 in England on a nose and throat swab, there is evidence that rates of positivity have decreased in those in non-patient-facing roles, and those in patient-facing roles aged under 35 years in the most recent week.
- Across regions, people from the "Other" ethnic groups had the highest risk of testing positive compared with those in the "White" ethnic group in the following occupations: personal services, social care, and the arts, entertainment and recreation industry.

# 2 . Overview

In this article, we refer to the number of coronavirus (COVID-19) infections within the community population; community in this instance refers to private residential households, and it excludes those in hospitals, care homes and/or other institutional settings in England.

This article presents analysis on past infections, which we define as testing positive for antibodies to SARS-CoV-2 for England, Wales, Northern Ireland and Scotland – based on findings from the Coronavirus (COVID-19) Infection Survey (CIS) in the UK. This article also presents analysis on the characteristics of those testing positive for SARS-CoV-2 – the coronavirus causing the COVID-19 disease in England. We include current COVID-19 infections, which we define as testing positive for SARS-CoV-2, with or without having symptoms, on a swab taken from the nose and throat.

More information on our headline estimates of the overall number of positive cases in England, Wales, Northern Ireland and Scotland are available in our latest bulletin. It should be noted that the analysis on the characteristics and behaviours of those testing positive in this article is for an older time period than the headline figures presented in the most recent bulletin. The reference periods for the various analyses are clearly stated at the start of each section.

Further information on what the analysis covers is provided at the start of each section.

**More about coronavirus**

- Find the latest on coronavirus (COVID-19) in the UK.
- All ONS analysis, summarised in our coronavirus roundup.
- View all coronavirus data.
- Find out how we are working safely in our studies and surveys.

# 3 . Likelihood of testing positive for COVID-19 antibodies in England, Wales, Northern Ireland and Scotland

## About this analysis

The analysis in this section of the article is based on blood test results taken from a randomly selected subsample of individuals aged 16 years and over, which are used to test for antibodies against SARS-CoV-2. This can be used to identify individuals who have had the infection in the past.

It takes between two and three weeks for the body to make enough antibodies to fight the infection but once a person recovers, antibodies remain in the blood at low levels, although these levels can decline over time to the point that tests can no longer detect them. Having antibodies can help to prevent individuals from getting the same infection again.

We measure the presence of antibodies to understand who has had COVID-19 in the past, although the length of time antibodies remain at detectable levels in the blood is not fully known. It is also not yet known how having detectable antibodies, now or at some time in the past, affects the chance of getting COVID-19 again.

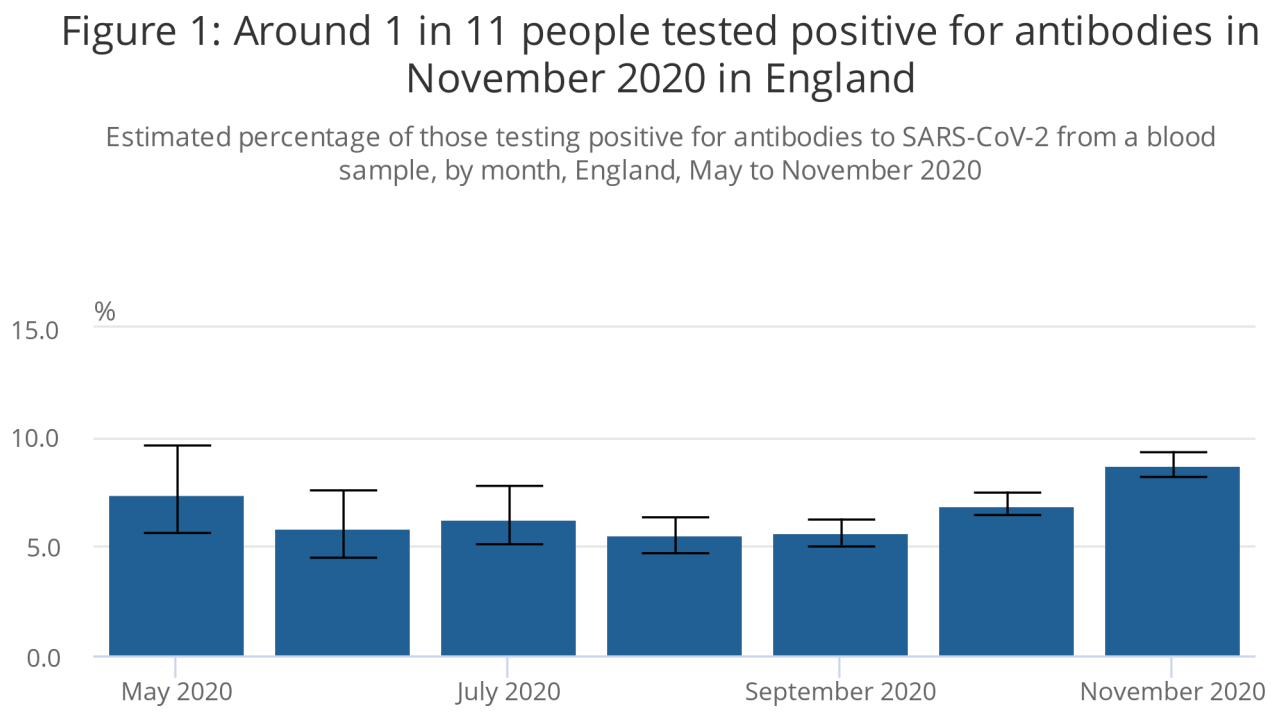
The analysis in this section is different to the analysis and results presented in later sections of this article, which are based on swab test results identifying current infections. We present weighted monthly estimates of antibody positivity for England, Wales, Northern Ireland and Scotland. We also present the weighted estimates of antibody positivity for regions of England.

## Antibody data for England

In November 2020, an estimated 8.7% (95% confidence interval: 8.2% to 9.3%) of the population in England would have tested positive for antibodies to SARS-CoV-2 from a blood sample. The estimate is weighted to be representative of the overall population, and suggests that an average of 3.9 million people aged 16 years and over in England would have tested positive for antibodies to SARS-CoV-2 during this time (95% confidence interval: 3.7 million to 4.2 million). This equates to 1 in 11 people aged 16 years and over (95% confidence interval: 1 in 12, to 1 in 11). Weighted estimates of the percentage of people testing positive for SARS-CoV-2 antibodies by month in England are presented in Figure 1; the estimates suggest there has been an increase in antibody positivity in the most recent month.

**Figure 1: Around 1 in 11 people tested positive for antibodies in November 2020 in England**

**Estimated percentage of those testing positive for antibodies to SARS-CoV-2 from a blood sample, by month, England, May to November 2020**




**Source: Office for National Statistics – Coronavirus (COVID-19) Infection Survey**

**Notes:**

1. All results are provisional and subject to revision.
2. These statistics refer to infections reported in the community, by which we mean private households. These figures exclude infections reported in hospitals, care homes and/or other institutional settings.
3. Data up to 27 November was included in the November 2020 estimate.

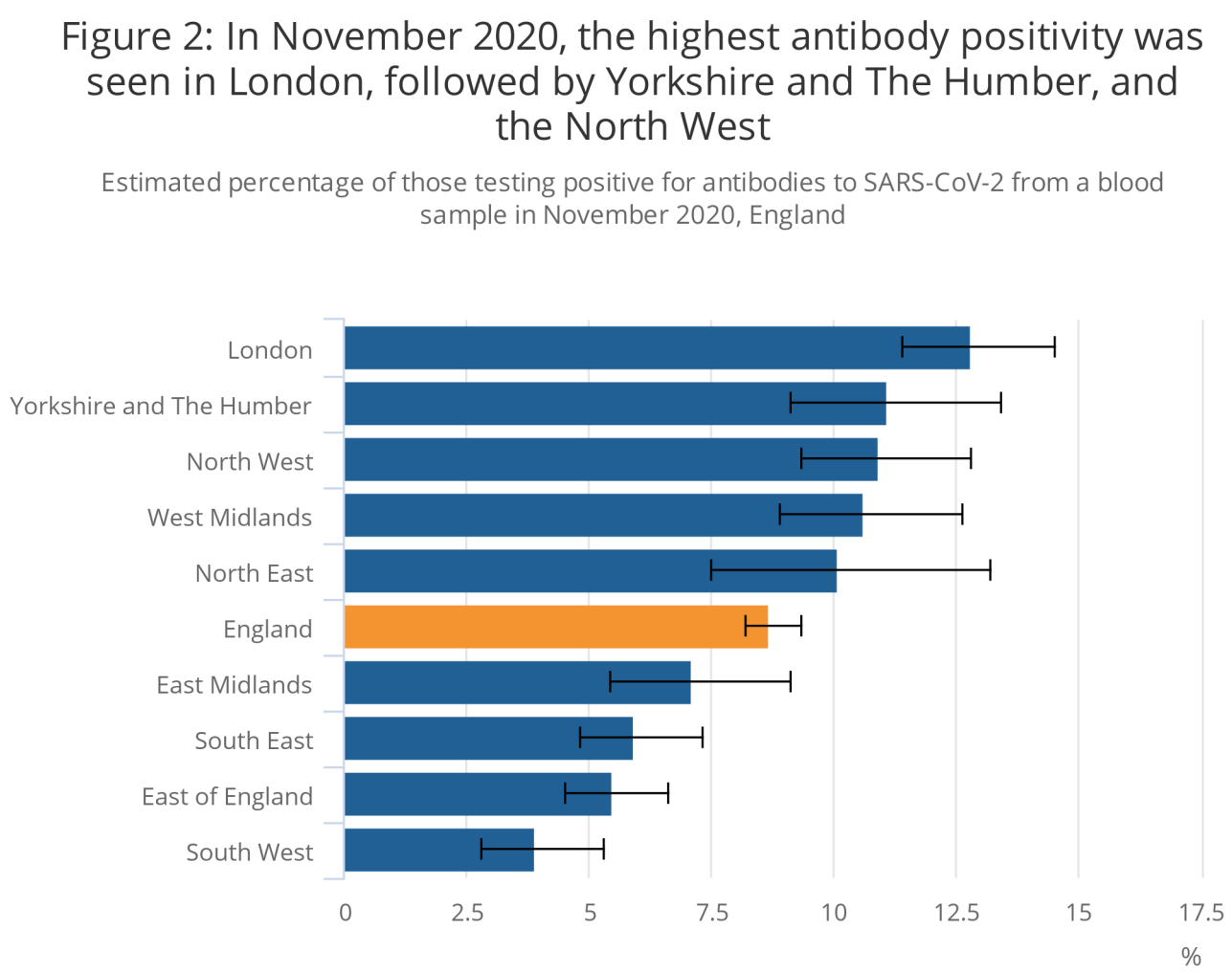
## Regional analysis of antibody data for England

The analysis in this section uses data taken from November 2020 to produce weighted antibodies estimates. There is substantial variation in antibody positivity between regions, from 12.8% (95% confidence interval: 11.4% to 14.5%) in London compared with 3.9% (95% confidence interval: 2.8% to 5.3%) in the South West. The populations in the South and East of England have positivity rates below the England national average.

Confidence intervals are large for some regions indicating high uncertainty in those estimates but there is still evidence of differences in the percentage of people testing positive for antibodies between regions.

**Figure 2: In November 2020, the highest antibody positivity was seen in London, followed by Yorkshire and The Humber, and the North West**

**Estimated percentage of those testing positive for antibodies to SARS-CoV-2 from a blood sample in November 2020, England**




**Source: Office for National Statistics – Coronavirus (COVID-19) Infection Survey**

**Notes:**

1. All results are provisional and subject to revision.

2. These statistics refer to infections reported in the community, by which we mean private households. These figures exclude infections reported in hospitals, care homes and/or other institutional settings.

3. Data up to 27 November was included in the November 2020 estimate.

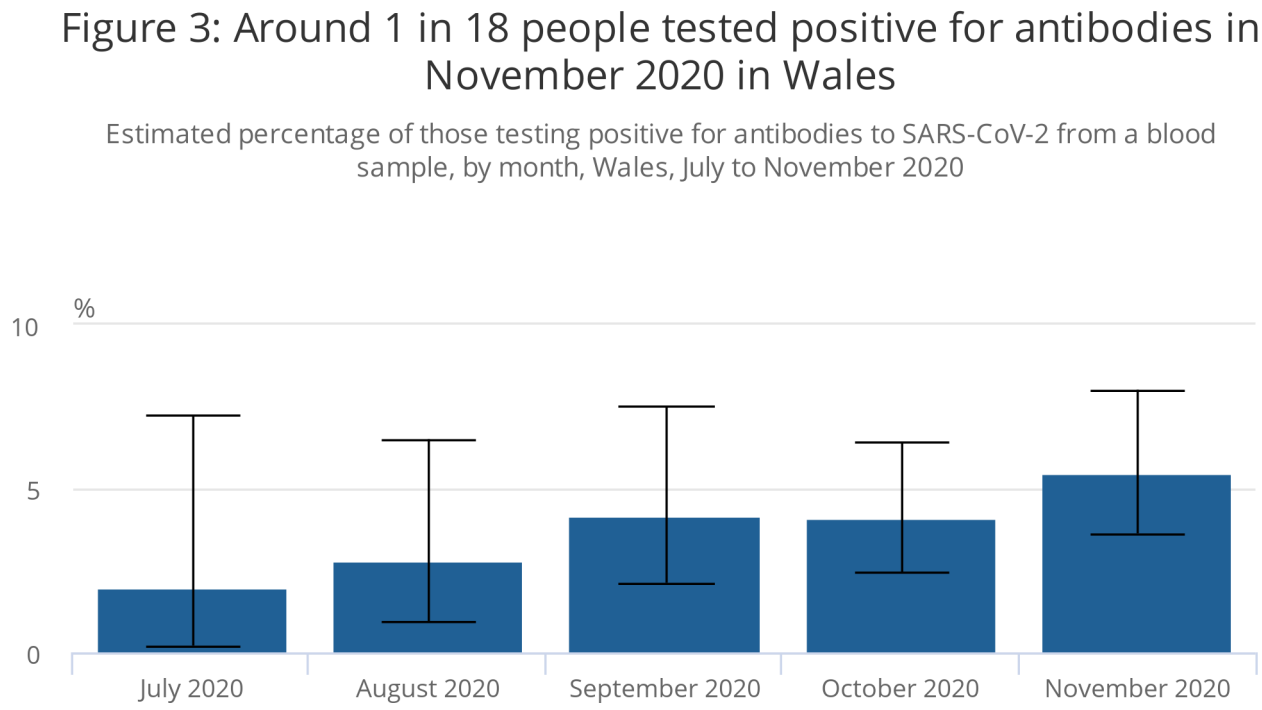
## Antibody data for Wales

In November 2020, an estimated 5.5% of the population in Wales would have tested positive for antibodies to SARS-CoV-2 from a blood sample (95% confidence interval: 3.6% to 8.0%). It is estimated that an average of 140,000 people aged over 16 years in Wales would have tested positive for antibodies during this time (95% confidence interval: 91,000 to 203,000). This equates to 1 in 18 people aged 16 years and over (95% confidence interval: 1 in 28, to 1 in 12).

While it appears that antibody rates have increased since the summer, uncertainty is high as the confidence intervals are wide.

**Figure 3: Around 1 in 18 people tested positive for antibodies in November 2020 in Wales**

**Estimated percentage of those testing positive for antibodies to SARS-CoV-2 from a blood sample, by month, Wales, July to November 2020**




**Source: Office for National Statistics – Coronavirus (COVID-19) Infection Survey**

**Notes:**

1. All results are provisional and subject to revision.
2. These statistics refer to infections reported in the community, by which we mean private households. These figures exclude infections reported in hospitals, care homes and/or other institutional settings.
3. Data up to 27 November were included in the November 2020 estimate.

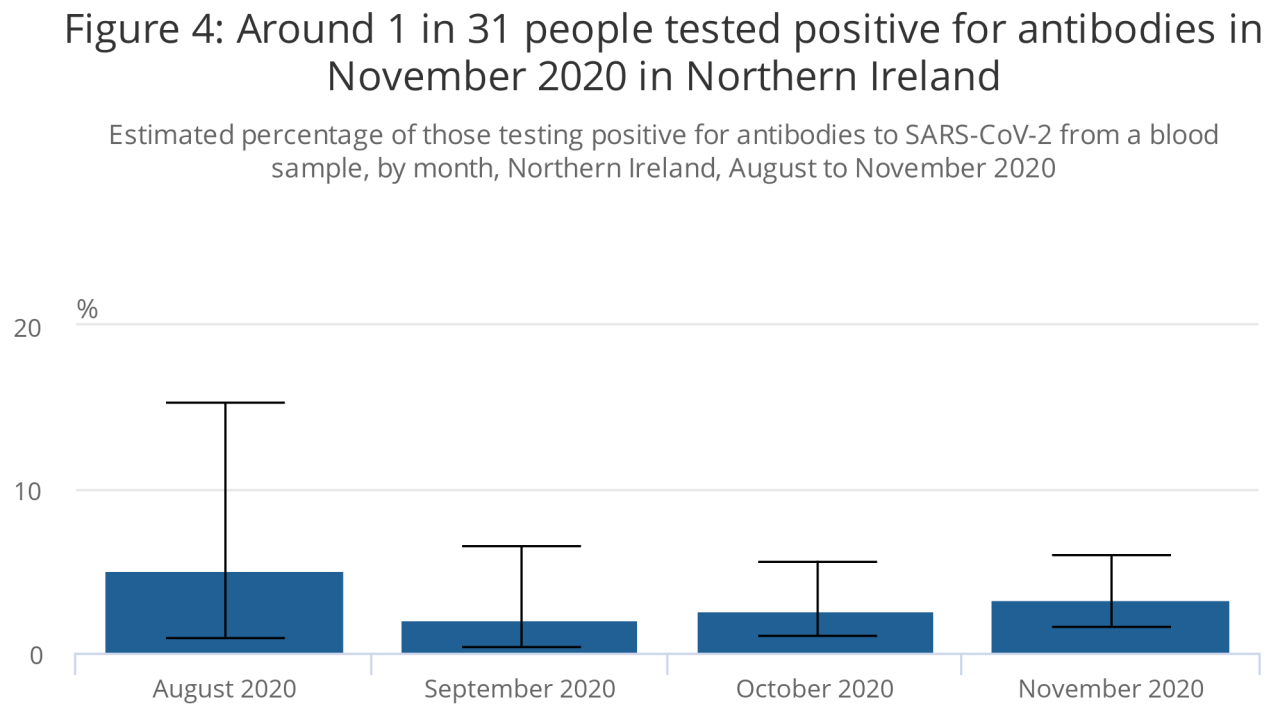
## Antibody data for Northern Ireland

In November 2020, an estimated 3.3% of the population in Northern Ireland would have tested positive for SARS-CoV-2 from a blood sample (95% confidence interval: 1.6% to 6.0%). It is estimated that an average of 49,000 people aged over 16 years in Northern Ireland would have tested positive for antibodies during this time (95% confidence interval: 23,000 to 89,000). This equates to 1 in 31 people aged 16 years and over (95% confidence interval: 1 in 64, to 1 in 17).

There is no evidence of a trend over time and confidence intervals are wide.

**Figure 4: Around 1 in 31 people tested positive for antibodies in November 2020 in Northern Ireland**

**Estimated percentage of those testing positive for antibodies to SARS-CoV-2 from a blood sample, by month, Northern Ireland, August to November 2020**




**Source: Office for National Statistics – Coronavirus (COVID-19) Infection Survey**

**Notes:**

1. All results are provisional and subject to revision.
2. These statistics refer to infections reported in the community, by which we mean private households. These figures exclude infections reported in hospitals, care homes and/or other institutional settings.
3. Data up to 27 November was included in the November 2020 estimate.

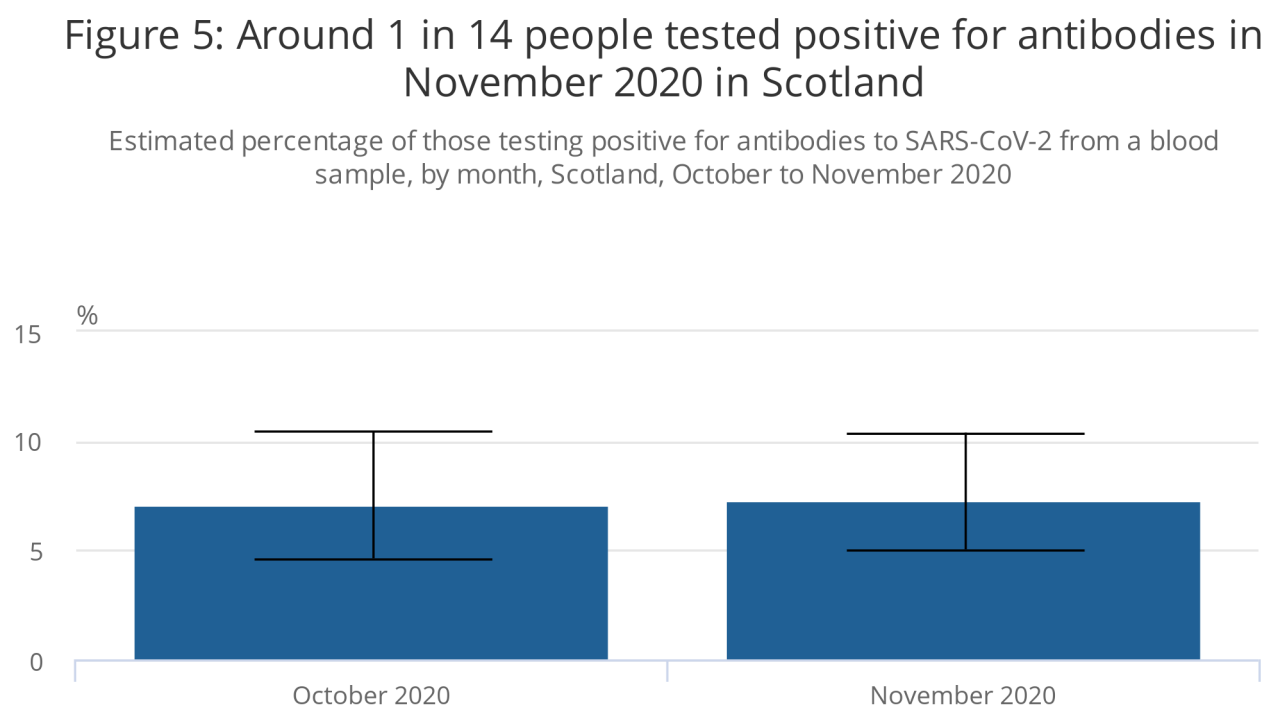
## Antibody data for Scotland

In November 2020, an estimated 7.3% of the population in Scotland would have tested positive for antibodies to SARS-CoV-2 from a blood sample (95% confidence interval: 5.0% to 10.3%). It is estimated that an average of 326,000 people aged over 16 years in Scotland would have tested positive for antibodies during this time (95% confidence interval: 222,000 to 458,000). This equates to 1 in 14 people aged 16 years and over (95% confidence interval: 1 in 20, to 1 in 10).

There is no evidence of a trend over time, as the confidence intervals are wide and we do not currently have estimates for enough months to analyse the trend.

**Figure 5: Around 1 in 14 people tested positive for antibodies in November 2020 in Scotland**

**Estimated percentage of those testing positive for antibodies to SARS-CoV-2 from a blood sample, by month, Scotland, October to November 2020**




**Source: Office for National Statistics – Coronavirus (COVID-19) Infection Survey**

**Notes:**

1. All results are provisional and subject to revision.
2. These statistics refer to infections reported in the community, by which we mean private households. These figures exclude infections reported in hospitals, care homes and/or other institutional settings.
3. Data up to 27 November was included in the November 2020 estimate.
4. Estimates for Scotland do not include data for Orkney, Shetland or the Western Isles because of operational issues. We are working to resolve these issues as soon as possible.

# 4 . COVID-19 positivity rates from nose and throat swab test results in England by characteristics

## About this analysis

The total percentage of people in England estimated to have had the coronavirus (COVID-19) over time from the start of the survey up until the most recent week available is presented in our weekly bulletin, which reports the percentage of people testing positive continues to decrease in the most recent week (between 29 November and 5 December 2020).

This section provides the modelled estimates on positivity rates by patient-facing and non-patient-facing roles by age, with the two occupational groups split between those aged under 35 years and those 35 years and above. The modelling used is similar to that used to produce national trend modelling of COVID-19 infections in our weekly bulletin. More information about the methods used in the model is available in our methodology article.

The models used to produce positivity rates for patient-facing and non-patient-facing roles include only swab test results from individuals of working-age (aged 16 to 74 years), as these characteristics are only relevant for this group of people. This analysis covers the time period between 1 August and 28 November 2020, which is from the lowest point of positivity rates over the summer to the most recent data available for this analysis.

## In the most recent week, there is evidence that rates of positivity have decreased in all groups apart from those in a patient-facing role aged 35 years and over in England

In the most recent week (22 to 28 November 2020), the proportion of those testing positive has decreased in all groups apart from those in a patient-facing role aged 35 years and over, where there is less certainty in the direction of the trend.

This contrasts with analysis in our previous article published in November, where we reported there was evidence that rates were higher among those working in patient-facing roles aged under 35 years compared with those not working in patient-facing roles aged under 35 years. Additionally, positivity rates had increased in both patient-facing and non-patient-facing roles for both those aged under 35 years and those aged 35 years and over.

### Figure 6: In the most recent week, there is evidence that rates of positivity have decreased in all groups apart from those in a patient-facing role aged 35 and over

Estimated percentage of the population testing positive for COVID-19 on nose and throat swabs by patient-facing role and age from 1 August to 28 November 2020

**Notes:**

1. All results are provisional and subject to revision.
2. These statistics refer to infections reported in the community, by which we mean private households. These figures exclude infections reported in hospitals, care homes and/or other institutional settings.

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# 5 . Likelihood of testing positive for COVID-19 from nose and throat swabs by ethnicity in England

## About this analysis

This section covers the likelihood of individuals testing positive for the coronavirus (COVID-19) from nose and throat swabs by ethnicity, region and occupation. For this analysis, because of low numbers, ethnicity has been grouped into two categories; White ethnic group and Other ethnic group. The results are presented in two types of analyses:

### 1. Analyses investigating variation by time

This analysis considers the impacts of ethnicity on the likelihood of testing positive for COVID-19 and whether this effect varies over time. It includes all swab test results from the entire population regardless of age (individuals aged two years and over) between 4 October and 28 November 2020.

### 2. Analyses investigating the overall impact of testing positive since September

This analysis considers whether people ever tested positive or always tested negative on swab tests between 1 September and 28 November 2020. It includes all participants of working-age (those aged 16 to 74 years).

Both analyses adjust for a set of general characteristics: age, region and ethnicity.

The second analysis also adjusts for sex in all the models, and most models also adjust for sociodemographics: household size, whether the household was multigenerational, and Index of Multiple Deprivation (PDF, 2.19MB) score[1].

Estimates are modelled to identify the risk associated with each characteristic, while controlling for the effects of other characteristics. This gives a better reflection of the true risk associated with each characteristic. This approach differs from our previous article, in which positivity rates over time for each characteristic were presented. More information on the modelling used is available in Section 7: COVID-19 Infection Survey methodology.

## Interpreting the charts

Results are presented as odds ratios. When a characteristic (for example, being male) has an odds ratio of one, this means that there is neither an increase nor a decrease in the likelihood of infection compared with a reference category (for example, being female). An odds ratio of higher than one means that there is an increased likelihood of infection compared with the reference category. An odds ratio of lower than one means that there is a reduced likelihood of infection compared with the reference category. For the purpose of this analysis, the models always show the likelihood of individuals in the “Other” ethnic group testing positive for COVID-19 compared with individuals in the “White” ethnic group (the reference category).

The odds ratios are presented with 95% confidence intervals. If the range of the confidence interval crosses the threshold of one, we cannot say with any certainty whether infection is more or less likely for that characteristic compared with the reference category, even if the estimate is not close to one. In some instances, this will be because we estimate there to be no differences (where the odds ratio estimate is close to one), but it can also reflect less information about a characteristic in our sample.

## The impacts of ethnicity on the likelihood of testing positive for COVID-19 over time in England

The first part of this analysis considers the impacts of ethnicity on the likelihood of testing positive and whether this effect varies over time, using the variation over time model. The analysis showed that the impact of region and age on the likelihood of testing positive varied significantly over time, as in our main bulletins. Having adjusted for changing positivity rates in different regions and ages, there was evidence that the effect of ethnicity varied across the different regions.

Individuals from the Other ethnic group had significantly greater positivity rates in the North West, Yorkshire and The Humber, East Midlands, West Midlands, and the South East. Confidence intervals were wide for the South West and the North East so it is not possible to say whether individuals from the Other ethnic group were more likely to test positive in those regions.

There was no evidence supporting a lower risk of testing positive in those from the Other ethnic group in any region.

After adjusting for differential effects of ethnicity by region, there was no evidence that the effect of ethnicity varied over time or by age.

### Figure 7: Individuals from the 'Other' ethnic group had significantly greater positivity rates in the North West, Yorkshire and The Humber, East Midlands, West Midlands, and the South East

The odds ratios of individuals in the 'Other' ethnic group testing positive for coronavirus (COVID-19) on a swab test compared with individuals from the White ethnic group by region, England, between 4 October and 28 November 2020

**Notes:**

1. These results are provisional and subject to revision.
2. These statistics refer to infections reported in the community, by which we mean private households. These figures exclude infections reported in hospitals, care homes and/or other institutional settings.

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## The likelihood of working-age individuals ever testing positive for COVID-19 in England, dependent on ethnicity and sociodemographic factors

The second part of this analysis considers whether the impact of ethnicity varies by occupation. In order to do this, we produced a series of models factoring in a range of key variables that are likely to affect positivity rates to better isolate the impact of ethnicity and occupation.

We explored the likelihood of working-age individuals ever testing positive between 1 September and 28 November 2020 dependent on ethnicity, adjusting only for region, sex and age, using a second model. This was done in order to subsequently assess the additional effect of occupation. The results from this model can be found in our dataset. As in Figure 7, there was strong evidence that the effect of ethnicity varied by region.

The exact odds ratios vary slightly from those presented in Figure 7 as the model included a different age range, time period, and outcome (ever or never positive since September) however, the overall findings are consistent between the two analyses.

Our third model, presented in Figure 8, considered how much of the total effect of ethnicity could be explained by the sociodemographics: household size, whether the household was multigenerational, and Index of Multiple Deprivation score.[1]

Adjusting for these factors slightly reduced the effect of ethnicity, however variation across regions remained similar to the previous model. This suggests that likelihood of testing positive varies by ethnicity and region, even when taking into account the sociodemographic factors.

### Figure 8: Likelihood of testing positive varies by ethnicity and region, even when taking into account the sociodemographic factors

The odds ratios of individuals from the 'Other' ethnic group testing positive for coronavirus (COVID-19) on a swab test compared with individuals of White ethnicity by region, England, between 1 September and 28 November 2020

### Notes:

1. These results are provisional and subject to revision.
2. These statistics refer to infections reported in the community, by which we mean private households. These figures exclude infections reported in hospitals, care homes or other institutional settings.

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## The likelihood of working-age individuals ever testing positive for COVID-19 in England, dependent on ethnicity, region and occupation

In the final model we added occupational sector to explore whether this explains variation in the likelihood of people of different ethnicities testing positive, and whether there is any evidence that it changes this likelihood.

This analysis found that the effect of ethnicity varied both by region and by occupation sector, meaning that the effect of being from the Other ethnic group compared with the White ethnic group in different occupation sectors varied by region. However, while levels vary by region, the pattern of which occupations have a higher or lower risk for those of White ethnicity compared with the Other ethnicity group is relatively similar across all regions.

An example of these similar patterns is displayed in Figure 9 and Figure 10, odds ratios for the East Midlands and London, respectively. Data for all other regions can be found in the accompanying dataset.

Across regions, people from the Other ethnic group had the highest risk of testing positive compared with those in the White ethnic group in the following occupations; social care, personal services and the arts, entertainment and recreation industry.

The lowest relative risk for people from the Other ethnic group was for those working in information technology.

There was also a higher relative risk for those in the Other ethnic group who were not working because they were retired or unemployed.

In some regions excess risk was also apparent in those working in financial services, and other occupations; in the North West and East Midlands, the overall higher risk associated with those in the Other ethnic group compared with the White ethnic group meant that excess risk was apparent in most occupations.

### Figure 9: In the East Midlands, people in the 'Other' ethnic group had the highest risk of testing positive in social care, personal services and the arts/entertainment/recreation occupations

The odds ratios of individuals in the 'Other' ethnic group testing positive for coronavirus (COVID-19) on a swab test compared with individuals of the White ethnic group in the East Midlands by occupation, England, between 1 September and 28 November 2020

### Notes:

1. These results are provisional and subject to revision.

2. These statistics refer to infections reported in the community, by which we mean private households. These figures exclude infections reported in hospitals, care homes or other institutional settings.

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### Figure 10: In London, people in the 'Other' ethnic group had the highest risk of testing positive in social care, personal services and the arts/entertainment/recreation occupations

The odds ratios of individuals of the 'Other' ethnic group testing positive for coronavirus (COVID-19) on a swab test compared with individuals in the 'White' ethnic group in London by occupation, England, between 1 September and 28 November 2020

### Notes:

1. These results are provisional and subject to revision.

2. These statistics refer to infections reported in the community, by which we mean private households. These figures exclude infections reported in hospitals, care homes or other institutional settings.

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### Notes for section 5: Likelihood of testing positive for COVID-19 by ethnicity in England

1. The Index of Multiple Deprivation (IMD) (PDF, 2.19MB) is the official measure of relative deprivation in England. It combines indicators of individuals' living conditions from seven domains – income, employment, education, health, crime, housing and environment – to rank the deprivation experienced by people in small areas of England in relation to other small areas in England. People can be regarded as deprived if they lack any kind of resources, not just income.

# 6 . Number and age of people individuals had contact with in England

## About this analysis

The analysis in this section looks at the number of people outside their own home that individuals report having socially distanced and physical contact with, regardless of whether they tested positive or negative for the coronavirus (COVID-19). We provide the number of contacts for school-age children (school Year 11 and below) and adults (older than school Year 11), and categorise contacts as follows:

- 0 (no reported contact)
- 1 to 5 (reported contacts)
- 6 to 10 (reported contacts)
- 11 to 20 (reported contacts)
- 21 or more (reported contacts)

We asked individuals how many people aged 17 years and under, 18 to 69 years, and 70 years and over, outside their household, they have had contact with up to seven days prior to each visit. “Contact” refers to either of the following:

- socially distanced contact – direct contact with social distancing only
- physical contact – physical contact, such as a handshake or personal care, including PPE if worn

This analysis covers the time period between 27 September and 30 November 2020, which is when questions on contacts were included in our survey. We have produced estimates that have been weighted to be representative of the total population in England.

## The number of socially distanced contacts with people aged 17 years and under and aged 18 to 60 years are higher during term time for school-age children in England

We present the proportion of school-age children by each category of socially distanced contact in Figure 11. Our analysis suggests that there was an increase in “21 or more” socially distanced contacts with people aged 17 years and under from September onwards, corresponding to school-age individuals going back to school and coming into contact with their peers.

There was a decrease in the number of socially distanced contacts with people aged 17 years and under in late October to early November, corresponding to the half term break from school, which then returned to a similar number of contacts as before half term.

There is a similar pattern of increased socially distanced contacts with people aged 18 to 69 years from September onwards, which is likely to relate to the increased contact with teachers and parents.

Over time, the number of socially distanced contacts with people aged 70 years and over has decreased.

### Figure 11: In school age children, the number of socially-distanced contacts with people aged 17 and under and aged 18 to 60 are higher during term-time

Proportion of school age children by age and number of socially-distanced contacts, from 27 September to 30 November 2020

### Notes:

1. These results are provisional and subject to revision.
2. These statistics refer to infections reported in the community, by which we mean private households. These figures exclude infections reported in hospitals, care homes or other institutional settings.
3. This analysis includes all participants between 27 September and 30 November, regardless of whether they tested positive or negative for COVID-19.

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Across all ages of socially distanced contacts, in adults the number of socially distanced contacts has decreased over time from late September or early October, which could be because of tighter local and national restrictions.

### Figure 12: In adults, the number of socially-distanced contacts has decreased across all ages and numbers of contacts

Proportion of adults by age and number of socially distanced contacts, from 27 September to 30 November 2020

### Notes:

1. These results are provisional and subject to revision.
2. These statistics refer to infections reported in the community, by which we mean private households. These figures exclude infections reported in hospitals, care homes or other institutional settings.
3. This analysis includes all participants between 27 September and 30 November, regardless of whether they tested positive or negative for COVID-19.

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## The number of physical contacts with people aged 17 years and under and aged 18 to 60 years are higher from September onwards for school-age children in England

The trends in physical contacts in school-age children are very similar to socially distanced contacts trends, aligning to schools returning in September.

The greatest increase was in “21 or more” physical contacts with people aged 17 years and under in mid to late September, however this increase was proportionally less than the socially distanced contact counts presented. There is a similar pattern of increased physical contacts with people aged 18 to 69 years from September, likely because of schools reopening.

Trends in physical contacts over time in adults are very similar to socially distanced contact trends, but there are more respondents that have had contact with zero individuals.

The results of our physical contacts analysis can be found in our dataset.

# 7 . Coronavirus (COVID-19) Infection Survey data

Coronavirus (COVID-19) infections in the community in England
Dataset | Released 14 December 2020
Characteristics of people testing positive for the coronavirus (COVID-19) in England taken from the COVID-19 Infection Survey.

# 8 . Collaboration

The Coronavirus (COVID-19) Infection Survey analysis was produced by the Office for National Statistics (ONS) in partnership with the University of Oxford, the University of Manchester, Public Health England and Wellcome Trust. Of particular note are:

- Sarah Walker – University of Oxford, Nuffield Department for Medicine: Professor of Medical Statistics and Epidemiology and Study Chief Investigator
- Koen Pouwels – University of Oxford, Health Economics Research Centre, Nuffield Department of Population Health: Senior Researcher in Biostatistics and Health Economics
- Thomas House – University of Manchester, Department of Mathematics: Reader in mathematical statistics

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ONS COVID-19 Infection Survey dissemination team – Hannah Donnarumma, Byron Davies, Sarah Proud, George Feldman, Alice McTiernan

# 9 . Glossary

## Confidence interval

A confidence interval gives an indication of the degree of uncertainty of an estimate, showing the precision of a sample estimate. The 95% confidence intervals are calculated so that if we repeated the study many times, 95% of the time the true unknown value would lie between the lower and upper confidence limits. A wider interval indicates more uncertainty in the estimate. Overlapping confidence intervals indicate that there may not be a true difference between two estimates.

For more information, see our methodology page on statistical uncertainty.

## Credible interval

A credible interval gives an indication of the uncertainty of an estimate from data analysis. 95% credible intervals are calculated so that there is a 95% probability of the true value lying in the interval.

## Odds ratio

An odds ratio is a measure of how likely an outcome is given a particular characteristic. In the COVID-19 context, they can be used to determine whether a characteristic (for example, age) is a risk factor for testing positive for the disease. The odds ratio measures can also be compared with each other to compare the different levels of risk associated with different characteristics (for example, age groups).

# 10 . Measuring the data

The characteristic models presented in Section 5: Likelihood of testing positive for COVID-19 by ethnicity in England are multivariable regression models, which simultaneously estimate the effect of different factors that have an impact on the likelihood of ever testing positive for the coronavirus (COVID-19) within the specified time frame. They are based on tests conducted on nose and throat swabs provided by survey participants.

The model over time includes all test results from all participants over the period, with a complementary log-log link between the outcome (swab positivity) and the predictors. This was done to match as closely as possible the main multi-level regression and post-stratification models reported each week. A frequentist framework was used for estimation because Bayesian models would not converge.

The models considering whether participants were ever positive since September take one observation per participant in the period – their latest positive if they test positive and otherwise their latest negative result. The models used a logistic link between the outcome (ever positive) and the predictors.

The odds ratios for each predictor explain the relative likelihood of infection while controlling for the effects of the other characteristics. The odds are presented as compared with the odds for testing positive in a reference category (that is, as an odds ratio). This reference category was always the category for which we had the largest sample. The random effect allows for the variation at the regional level to be accounted for in these calculations.

We included characteristics within the models to describe two different groups of the population, one of the entire population, and one of the working-age population. We did not compare multiple models to compare model fit but instead included appropriate characteristics selected based on the interest of stakeholders (government and the public) and based on previously described variation from univariate and other analyses conducted. Because of the relatively low number of positives in the sample across the period, results should be interpreted cautiously.

Our methodology article provides further information around the survey design, how we process data, and how data are analysed. The study protocol specifies the research for the study.

# 11 . Related links

Coronavirus (COVID-19) Infection Survey, UK
Bulletin | Updated weekly
Estimates for England, Wales, Northern Ireland and Scotland. This survey is being delivered in partnership with University of Oxford, University of Manchester, Public Health England and Wellcome Trust.

Coronavirus (COVID-19) weekly insights: latest health indicators in England
Article | Updated weekly
Brings together data about the coronavirus (COVID-19) pandemic in England and explores how these measures interact with each other can improve understanding of the severity and spread of the pandemic.

COVID-19 Infection Survey (Pilot): methods and further information
Methods article | Updated 21 September 2020
Information on the methods used to collect the data, process it, and calculate the statistics produced from the COVID-19 Infection Survey pilot.

COVID-19 Infection Survey (CIS)
Article | Updated 14 May 2020
Whether you have been invited to take part, or are just curious, find out more about our COVID-19 Infection Survey and what is involved.

Coronavirus (COVID-19) roundup
Web page | Updated as and when data become available
Catch up on the latest data and analysis related to the coronavirus pandemic and its impact on our economy and society.

Coronavirus (COVID-19) latest insights
Interactive tool | Updated as and when data become available
Explore the latest data and trends about the coronavirus (COVID-19) pandemic from the ONS and other official sources