

Statistical bulletin

Coronavirus (COVID-19) Infection Survey, antibody and vaccination data, UK: 13 January 2022

Antibody and vaccination data by UK country and regions in England from the Coronavirus (COVID-19) Infection Survey. This analysis has been produced in partnership with the University of Oxford, University of Manchester, UK Health Security Agency, and Wellcome Trust. This study is jointly led by the Office for National Statistics (ONS) and the Department for Health and Social Care (DHSC) working with the University of Oxford and Lighthouse Laboratory to collect and test samples.

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Release date:
13 January 2022

Next release:
26 January 2022

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1 . Main points

The following statistics are the percentage of the adult population aged 16 years and over, that would have tested positive on a blood test for antibodies against SARS-CoV-2, the specific virus that causes coronavirus (COVID-19). This suggests that they have had the infection in the past or have been vaccinated.

- In England, it is estimated that 97.5% of the adult population (95% credible interval: 97.0% to 97.9%) would have tested positive for antibodies against SARS-CoV-2 in the week beginning 20 December 2021.
- In Wales, it is estimated that 96.8% of the adult population (95% credible interval: 95.9% to 97.5%) would have tested positive for antibodies against SARS-CoV-2 in the week beginning 20 December 2021.
- In Northern Ireland, it is estimated that 97.4% of the adult population (95% credible interval: 96.0% to 98.2%) would have tested positive for antibodies against SARS-CoV-2 in the week beginning 20 December 2021.
- In Scotland, it is estimated that 97.7% of the adult population (95% credible interval: 97.1% to 98.2%) would have tested positive for antibodies against SARS-CoV-2 in the week beginning 20 December 2021.
- Academic research on antibody thresholds, using data from when the Delta variant was the dominant strain, indicate that a higher threshold of antibodies is needed to provide protection from new COVID-19 infections for those who are vaccinated.
- It is estimated that more than 88% of the population had antibodies at or above the higher threshold with the booster programme likely leading to the rapid increases in antibodies above this threshold seen in older age groups.

About this bulletin

This bulletin presents the latest estimates on the percentage of adults who would have tested positive for antibodies to SARS-CoV-2 for England, Wales, Northern Ireland, and Scotland based on findings from the Coronavirus (COVID-19) Infection Survey in the UK. People who test positive for antibodies are those who have experienced previous infection and/or vaccination. For the first time, based on academic research we present the percentage of adults with antibodies to SARS-CoV-2 at or above a higher antibody threshold, which provides greater protection against COVID-19 following vaccination in England, Wales, Northern Ireland, and Scotland ([Section 7](#)). We also present data on the percentage of people aged 16 years and over who reported that they have received three or more COVID-19 vaccinations since 13 September 2021.

Modelled vaccination estimates for one or more and two or more COVID-19 vaccinations for England, Wales, Northern Ireland and Scotland require additional quality assurance and have not been updated in our bulletin this time. We will reintroduce these vaccine estimates as soon as possible. [Official government figures on vaccinations are available](#).

Data in this bulletin

The analysis on antibodies in this bulletin is based on blood test results taken from a randomly selected subsample of individuals aged 16 years and over who live in private households. The survey excludes those in hospitals, care homes and/or other communal establishments. The blood samples are used to test for antibodies against SARS-CoV-2. In England, an estimated [90% of people aged 80 years and over live in private households](#) and 10% live in other communal establishments such as care homes.

Our antibodies and vaccination estimates are based on the data we collect from people visited in the Coronavirus (COVID-19) Infection Survey (CIS). We present weekly modelled antibody estimates and vaccine estimates for adults by country, and grouped age for England, Wales, Northern Ireland and Scotland, as well as antibody estimates by regions in England. Further information on our method to model antibodies and vaccinations can be found in our [methods article](#).

There is a clear pattern between vaccination and testing positive for COVID-19 antibodies but the detection of antibodies alone is not a precise measure of the [immunity protection given by vaccination](#). Further information is available on [antibody levels post vaccination](#) from research partners at the University of Oxford.

Modelled vaccine estimates are produced to provide context alongside our antibodies estimates and do not replace the [official government figures on vaccinations](#), which are a more precise count of total vaccines issued. While we would expect the overall trend of our estimated number of people who reported they have received vaccines to increase, it is possible that in some weeks, the estimate may remain the same or decrease as a result of sampling variability (for example, we may have a lower number of participants recording a vaccination in the latest week compared with an earlier week).

National Immunisation Management System (NIMS) administrative data are used to validate CIS self-reported records of vaccination for England. The equivalent of this is currently not included for other countries, meaning the estimates for Wales, Scotland and Northern Ireland are produced from CIS self-reported records of vaccination only.

Our vaccination estimates are explained in more detail in [Section 10: Measuring the data](#).

2 . Understanding antibodies and immunity

Antibody positivity is defined by having a fixed concentration of antibodies in the blood. A negative test result occurs if there are no antibodies, or if antibody levels are too low to reach a threshold at the time of testing. Our standard threshold is 42 nanograms per millilitre (ng/ml). This is the threshold that the test is CE marked against and approved by the Medicines and Healthcare products Regulatory Agency, providing greater than 99% [sensitivity and specificity](#) in identifying people who have had a coronavirus (COVID-19) infection before (“natural immunity”) from people who have not. A negative result means that detected antibody levels are below this threshold and does not necessarily mean that a person has no antibodies or immune protection.

Most people who are vaccinated will increase their antibody level above this threshold and will retain a higher antibody level than before vaccination even if they subsequently drop below the standard threshold value.

There are other parts of the immune system that will offer protection, for example, a person's T-cell response. This will not be detected by blood tests for antibodies. [A person's immune response is affected by a number of factors](#), including health conditions and age.

Equally, antibody levels are expected to decrease over time irrespective of vaccination or natural infection, especially when exposure to the virus is reduced. This is because our bodies stop making antibodies when they are not needed.

Our [blog on antibodies and immunity](#) gives further information on the link between antibodies and immunity and the vaccine programme. Our [blog on vaccine effectiveness](#) provides information on the effectiveness of vaccinations against Alpha and Delta variants, which is based upon the research conducted by partners from the University of Oxford. It is too early to provide information on the effectiveness of vaccinations against the Omicron variant.

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. The [Coronavirus \(COVID-19\) Infection Survey QMI](#) details the strength and limitations of the data.

3 . By UK country

In the week beginning 20 December 2021, the percentage of adults testing positive for coronavirus (COVID-19) antibodies by the standard threshold of 42 ng/ml remained high across the UK.

Table 1: Estimated percentage of adults who would have tested positive for SARS-CoV-2 antibodies, week beginning 20 December 2021, UK countries

Country	Estimated % of adults who would have tested positive for COVID-19 antibodies	95% credible interval	
		Lower	Upper
England	97.5	97.0	97.9
Wales	96.8	95.9	97.5
Northern Ireland	97.4	96.0	98.2
Scotland	97.7	97.1	98.2

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 antibody tests for individuals living in private households.
3. All estimates are subject to uncertainty given that a sample is only part of the wider population. A credible interval gives an indication of the uncertainty of an estimate from data analysis.
4. Estimates show the percentage of adults testing positive for antibodies against SARS-CoV-2 at or above 42 ng/ml.

Figure 1: The percentage of adults testing positive for COVID-19 antibodies remained high across UK countries in the week beginning 20 December 2021

Modelled percentage of adults with antibodies to SARS-CoV-2 and who reported they have received three or more COVID-19 vaccinations, UK countries, 7 December 2020 to 23 December 2021

Notes:

1. All results are provisional and subject to revision.
2. These statistics refer to antibody tests and reported vaccinations for individuals living in private households.
3. All estimates are subject to uncertainty, given that a sample is only part of the wider population. A [credible interval](#) gives an indication of the uncertainty of an estimate from data analysis.
4. The denominators used for both antibodies and vaccinations are the total adults in the sample at that particular time point, then post-stratified by the mid-year population estimate.
5. Estimates show the percentage of adults testing positive for antibodies against SARS-CoV-2 at or above 42 ng/ml.
6. Our estimates of vaccination are provided for context alongside our antibodies estimates but are likely to be different from the official figures. The [daily official government figures](#) provide the recorded actual numbers of vaccines against SARS-CoV-2 issued.

Download the data

[.xlsx](#)

The estimated percentage of adults who reported they have received three or more COVID-19 vaccinations has increased rapidly since September 2021. Modelled vaccination estimates since 13 September 2021 can be found in the [Coronavirus \(COVID-19\) Infection Survey: antibody and vaccination dataset](#). These vaccination estimates will differ from official figures as explained in [Section 1](#).

4 . By regions in England

The percentage of adults testing positive for coronavirus (COVID-19) antibodies by the standard threshold of 42 ng/ml remained at high levels across all regions of England in the week beginning 20 December 2021. Regional data can be found in Tables 1b, 1f and 1i in the [Coronavirus \(COVID-19\) Infection Survey: antibody and vaccination dataset](#).

5 . By age group

In the week beginning 20 December 2021, the percentage of adults testing positive for coronavirus (COVID-19) antibodies by the standard threshold of 42 ng/ml remained high across all age groups across the UK.

In the data used to produce estimates for Wales, Northern Ireland and Scotland, the number of adults sampled who tested positive for antibodies to SARS-CoV-2 or who have been vaccinated is low compared with England. This means there is a higher degree of uncertainty in estimates for these nations when our analysis splits the sample into smaller groups (for example, age groups) as indicated by larger credible intervals.

Figure 2: The percentage of adults testing positive for COVID-19 antibodies remained high for all age groups across the UK in the week beginning 20 December 2021

Modelled percentage of adults with antibodies to SARS-CoV-2 and who reported they have received three or more COVID-19 vaccinations, by age group, UK countries, 7 December 2020 to 23 December 2021

Notes:

1. All results are provisional and subject to revision.
2. These statistics refer to antibody tests and reported vaccinations for individuals living in private households.
3. In Northern Ireland, the number of adults sampled is low compared with England, Wales and Scotland; therefore, adults aged 50 to 69 years are included in the same age group, and those aged 70 years and over are included in the same age group.
4. All estimates are subject to uncertainty, given that a sample is only part of the wider population. A [credible interval](#) gives an indication of the uncertainty of an estimate from data analysis.
5. The denominators used for both antibodies and vaccinations are the total adults in the sample at that particular time point, then post-stratified by the mid-year population estimate.
6. Estimates show the percentage of adults testing positive for antibodies against SARS-CoV-2 at or above 42 ng/ml.
7. Our estimates of vaccination are provided for context alongside our antibodies estimates but are likely to be different from the official figures. The [daily official government figures](#) provide the recorded actual numbers of vaccines against SARS-CoV-2 issued.

Download the data

[.xlsx](#)

6 . By single year of age

Modelled daily estimates of the percentage of adults testing positive for coronavirus (COVID-19) antibodies by the standard threshold of 42 ng/ml by single year of age for England, Wales, Northern Ireland and Scotland separately, between 12 November and 23 December 2021 can be found in the [Coronavirus \(COVID-19\) Infection Survey: antibody and vaccination dataset](#). Modelled data are produced using a different method to the weekly modelled estimates presented in [Section 5](#) and so cannot be compared.

This more granular analysis shows a similar pattern to our grouped age analysis, with antibody positivity remaining high across the UK.

7 . Analysis using an alternative antibody threshold

The standard threshold (42 ng/ml) was determined prior to the development of coronavirus (COVID-19) vaccinations. As the pandemic and vaccinations have evolved, we have reviewed the way that we present information about antibody levels. In this section we have introduced an additional second threshold associated with a higher concentration of antibodies, to estimate the percentage of adults who are likely to have strong protection against getting a new COVID-19 infection. This is based upon [research](#) by our academic partners. A previous COVID-19 infection typically results in a stronger immune response than vaccination. To get a similar level of protection from vaccination alone, a higher concentration of antibodies is needed.

The higher threshold is 179 ng/ml and was identified as [providing a 67% lower risk of getting a new COVID-19 infection with the Delta variant after two vaccinations with either Pfizer or AstraZeneca vaccines](#), compared with someone who was unvaccinated and had not had COVID-19 before. This higher threshold was identified by comparing how the risk of new COVID-19 infections with the most common COVID-19 variant at the time of the [research](#), the Delta variant, varied across different antibody levels. It is unlikely that this threshold will provide equivalent protection against the Omicron variant and analyses of the effectiveness of vaccinations against the Omicron variant are ongoing.

[The test used for spike antibodies](#) measures their concentration in ng/ml. The standard threshold of 42 ng/ml corresponds to 23 binding antibody units (BAU)/ml using the World Health Organization's (WHO) standardised units (enabling comparison across different antibody assays). The higher threshold of 179 ng/ml corresponds to 100 BAU/ml.

Figure 3 shows estimates of the percentage of adults with antibodies against SARS-CoV-2 at or above our standard threshold of 42 ng/ml and, additionally, at or above the second threshold of 179 ng/ml.

Additional breakdowns of the higher threshold data are available in the [Coronavirus \(COVID-19\) Infection Survey: antibody and vaccination dataset](#).

In the week beginning 20 December 2021, the percentage of adults with levels of COVID-19 antibodies at or above the higher threshold of 179 ng/ml were high among all age groups across the UK. The percentage of adults with antibodies at or above the higher threshold increased among those aged below 65 years in England, Wales and Scotland, and among those aged below 70 years in Northern Ireland. The percentage of adults with antibodies at or above the higher threshold remained at a high level for those aged 65 years and over in England, Wales and Scotland, and those aged 70 years and over in Northern Ireland.

Across the UK, antibody waning is more evident among those aged over 50 years from May 2021 to September 2021 using the higher threshold of 179 ng/ml in comparison to the standard 42 ng/ml threshold. There has been a rapid increase in antibody levels that suggests higher protection (levels at or above the 179 ng/ml threshold) across the UK among those aged 50 years and over since early October 2021, likely as a result of the vaccination booster programme.

Figure 3: The percentage of adults with antibodies at or above the higher threshold were high for all age groups across the UK in the week beginning 20 December 2021

Modelled percentage of adults with levels of antibodies to SARS-CoV-2 at or above the standard and higher thresholds, and who reported they have received three or more COVID-19 vaccinations, by age group, UK countries, 7 December 2020 to 23 December 2021

Notes:

1. All results are provisional and subject to revision.
2. These statistics refer to antibody tests and reported vaccinations for individuals living in private households.
3. In Northern Ireland, the number of adults sampled is low compared with England, Wales and Scotland; therefore, adults aged 50 to 69 years are included in the same age group, and those aged 70 years and over are included in the same age group.
4. All estimates are subject to uncertainty, given that a sample is only part of the wider population. A [credible interval](#) gives an indication of the uncertainty of an estimate from data analysis.
5. The denominators used for both antibodies and vaccinations are the total adults in the sample at that particular time point, then post-stratified by the mid-year population estimate.
6. Estimates show the percentage of adults testing positive for antibodies against SARS-CoV-2 at or above 42 ng/ml and 179 ng/ml.
7. The higher threshold of 179 ng/ml was determined from analysis during the period when most COVID-19 infections were with the Delta variant. It is likely that the equivalent level of protection for the Omicron variant will require a different threshold ([see Section 2](#)).
8. Our estimates of vaccination are provided for context alongside our antibodies estimates but are likely to be different from the official figures. The [daily official government figures](#) provide the recorded actual numbers of vaccines against SARS-CoV-2 issued.

Download the data

[.xlsx](#)

8 . Coronavirus (COVID-19) Infection Survey data

[Coronavirus \(COVID-19\) antibody and vaccination data, UK](#)

Dataset | Released 13 January 2022

Antibody and vaccination data by UK country and regions in England from the Coronavirus (COVID-19) Infection Survey. This analysis has been produced in partnership with the University of Oxford, University of Manchester, UK Health Security Agency and Wellcome Trust. This study is jointly led by the ONS and the Department for Health and Social Care (DHSC) working with the University of Oxford and Lighthouse Laboratory to collect and test samples.

9 . Collaboration



The Coronavirus (COVID-19) Infection Survey analysis was produced by the Office for National Statistics (ONS) in collaboration with our research partners at the University of Oxford, the University of Manchester, UK Health Security Agency 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

10 . Glossary

Antibodies

We measure the presence of antibodies in people who live in private households to understand who has had coronavirus (COVID-19) in the past, and the impact of vaccinations. It takes between two and three weeks after infection or vaccination for the body to make enough antibodies to fight the infection. Antibodies can help prevent individuals from getting the same infection again. If they do get infected, people with antibodies are less likely to have severe symptoms. Once infected or vaccinated, antibodies remain in the blood at low levels and can decline over time. The length of time antibodies remain at detectable levels in the blood is not fully known.

SARS-CoV-2

This is the scientific name given to the specific virus that causes COVID-19.

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. A 95% credible interval is calculated so that there is a 95% probability of the true value lying in the interval.

11 . Measuring the data

Reference dates

We produce weekly modelled estimates using standard calendar weeks starting Monday. To provide the most timely and accurate estimates possible for antibody positivity, the model will include data for the first four to seven days of the most recent week available, depending on the availability of test results. The antibody estimates for the most recent week in this publication includes data from 20 to 23 December 2021. The vaccination estimates for those who reported they have received three or more coronavirus (COVID-19) vaccinations for the most recent week in this publication includes data from 13 to 19 December 2021. Modelled vaccination estimates for one or more and two or more COVID-19 vaccinations for England, Wales, Northern Ireland and Scotland require additional quality assurance and have not been updated in our bulletin this time.

More information on [measuring the data](#) is available in the Coronavirus (COVID-19) Infection Survey statistical bulletin.

Our [methodology article](#) provides further information around the survey design, how we process data, and how data are analysed. The [Quality and Methodology Information](#) explains the strengths and limitations of the data, methods used, and data uses and users.

Vaccination estimates

While the [daily official government figures](#) provide the recorded actual numbers of vaccines against SARS-CoV-2 issued, our vaccination estimates are likely to be different from the official figures. This is because they are estimates based on a sample survey of reported vaccine status and are provided for context alongside our antibodies estimates. We control for the effect of ethnicity by post-stratifying our analysis by White and other ethnic groups, rather than individual ethnicities, because of our current sample size. This could result in differences between our survey estimates and the government figures in the numbers of vaccines received for some ethnic minority groups.

Importantly, our survey collects information from the population living in private households and does not include people living in communal establishments such as care homes, hospitals, or prisons.

The value of showing our estimates of vaccines alongside our estimates of people testing positive for antibodies is to illustrate the relationship between the two.

Differences between official figures and the estimates from this survey differ in scale across each of the four UK nations (some survey estimates are closer to the official reported figures than others) because of differences in reporting dates and the inclusion of National Immunisation Management System (NIMS) data for England. In addition, our sampling method for Northern Ireland is different to the other nations, inviting only people who have previously participated in a Northern Ireland Statistics and Research Agency (NISRA) survey, which could result in a sample of individuals who are more likely to get vaccinated. This should be taken into consideration if comparing vaccine and antibody estimates across the four nations, as vaccine status and antibody positivity are related.

12 . Strengths and limitations

More information on strengths and limitations of the data is available in [Coronavirus \(COVID-19\) Infection Survey QMI](#) and in the [Coronavirus \(COVID-19\) Infection Survey statistical bulletin](#).

13 . 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 the University of Oxford, University of Manchester, UK Health Security Agency and Wellcome Trust.

[Coronavirus \(COVID-19\) Infection Survey: characteristics of people testing positive for COVID-19 in England](#)

Bulletin | Updated fortnightly

Characteristics of people testing positive for COVID-19 from the Coronavirus (COVID-19) Infection Survey, including antibody data by UK country, and region and occupation for England. Antibodies data published before 3 February 2021 are available in this series.

[Coronavirus \(COVID-19\) Infection Survey technical article: Analysis of characteristics associated with vaccination uptake](#)

Technical article | Released 15 November 2021

Analysis of populations in the UK by likelihood of being vaccinated against COVID-19 using the Coronavirus (COVID-19) Infection Survey. This survey is being delivered in partnership with University of Oxford, University of Manchester, UK Health Security Agency and Wellcome Trust.

[Coronavirus \(COVID-19\) Infection Survey Technical Article: Impact of vaccination on testing positive in the UK: October 2021](#)

Technical article | Released 18 October 2021

The reduction in risk of testing positive for COVID-19 associated with vaccination overall and by different vaccine types using data from the Coronavirus (COVID-19) Infection Survey. Two time periods were analysed; when the Alpha variant was dominant in the UK (1 December 2020 to 16 May 2021), and when the Delta variant was dominant (17 May to 14 August 2021).

[Coronavirus \(COVID-19\) Infection Survey QMI](#)

QMI | Released 16 July 2021

Quality and Methodology Information for the Coronavirus (COVID-19) Infection Survey (CIS), detailing the strengths and limitations of the data, methods used, and data and users.