

Statistical bulletin

Coronavirus (COVID-19) Infection Survey, characteristics of people testing positive for COVID-19, UK: 1 December 2021

Estimates for England, Wales, Northern Ireland and Scotland. This survey is being delivered in partnership with University of Oxford, University of Manchester, UK Health Security Agency and Wellcome Trust.

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1 . Main points

Characteristics associated with testing positive from 1 to 14 November 2021:

- Those who have received at least one dose of a coronavirus (COVID-19) vaccine continued to be less likely to test positive for COVID-19 than those not vaccinated; people who reported receiving three vaccinations (including booster vaccinations) were even less likely to test positive than those who had a second dose of Astra Zeneca or Pfizer more than 90 days ago in the fortnight ending 14 November 2021.
- People working in the education sector continued to be more likely to test positive in comparison to other working adults in the fortnight ending 14 November 2021; the higher risk is likely related to the recent high infection levels among school-aged children.
- Those who reported that they "never" or only "sometimes" wore a face covering at work or school were more likely to test positive than those who reported that they always wore a face covering at work or school in the fortnight ending 14 November 2021.
- People who spent more time socialising with others outside their household were more likely to test positive for COVID-19 in the fortnight ending 14 November 2021.

Reinfections from July 2020 to November 2021:

- While remaining low overall, the risk of reinfection was higher in the Delta-dominant period (defined in this analysis as after 17 May 2021) than during the Alpha-dominant period (prior to 17 May 2021), as well as for those with a long-term health condition and younger age groups.
- Risk of reinfection was higher if a participant had a lower viral load or did not report symptoms during their first infection; this may be on account of a weaker immune response in first "milder" infections.

About this bulletin

In this bulletin, we present the latest analysis of the characteristics associated with testing positive for SARS-CoV-2, the coronavirus causing the COVID-19 disease in the UK. Then we focus on reinfections and present analysis on characteristics associated with getting reinfected with coronavirus (COVID-19). This is part of our series of [analysis on the characteristics of people testing positive for COVID-19](#).

In this bulletin, we refer to the number of current COVID-19 infections within the population living in private residential households. We exclude those in hospitals, care homes and/or other communal establishments. In communal establishments, rates of COVID-19 infection are likely to be different.

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 about coronavirus

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

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 weekly bulletin](#). Our [methodology article](#) provides more information on the methods used for our models.

2 . Characteristics associated with testing positive, UK

This analysis was first presented in our [analysis of populations in the UK by risk of testing positive for coronavirus \(COVID-19\)](#) September 2021 publication, which provides a more detailed explanation of the methods used. We present findings for the most recent fortnight in this section, but a longer time series covering 23 May to 14 November 2021 is available in the [Coronavirus \(COVID-19\) Infection Survey, characteristics of people testing positive for COVID-19, UK dataset](#).

Estimates of the likelihood of some specific characteristics affecting an individual testing positive can fluctuate from one fortnight to another, meaning that findings that were significant in one period may not necessarily be significant in another period. This may be because the effect of a characteristic is genuinely changing, or because we do not have sufficient individuals with that characteristic in a particular fortnight to exclude any differences we find being down to chance.

Our latest data for the fortnight from 1 November to 14 November 2021 show similar conclusions to our last publication, namely:

- those who reported receiving at least one dose of a coronavirus vaccine continued to be less likely to test positive for COVID-19 than those not vaccinated; those who reported receiving three vaccinations (including booster vaccinations) were even less likely to test positive than those who had a second Astra Zeneca or Pfizer vaccination more than 90 days ago
- those who have had a COVID-19 infection previously continued to be less likely to test positive than those who had not
- those living in a household of multiple occupancy continued to be more likely to test positive than those living in single occupancy households
- those who live in a household with someone aged under 16 years continued to be more likely to test positive
- school-aged children and adults aged around 40 to 50 years continued to be more likely to test positive than other ages
- people working in the [education sector](#) continued to be more likely to test positive in comparison with other working adults; this is likely related to the continuing higher infection levels among school-aged children; we have seen this result consistently since mid-September
- people working in patient-facing healthcare roles continued to be less likely to test positive in comparison with other working adults
- people who live in a household where someone had contact with a hospital continued to be less likely to test positive, in comparison with households where no-one had contact
- those from major urban areas were less likely to test positive than those from urban cities/towns or rural areas; in contrast, in periods over the spring and summer, those in major urban areas had been more likely to test positive, although in recent weeks there has been no statistical evidence of a difference

Figure 1: Those who have received at least one coronavirus vaccine were less likely to test positive for coronavirus (COVID-19) than those not vaccinated

Estimated likelihood of testing positive for coronavirus on nose and throat swabs by vaccination status and previous infection, UK, 1 November to 14 November 2021

Notes:

1. The core demographic variables, sex, ethnicity, age, geographical region, urban or rural classification of address, deprivation percentile, household size, and whether the household was multigenerational are included to adjust for these factors. More information is available in [Coronavirus \(COVID-19\) Infection Survey technical article: analysis of populations in the UK by risk of testing positive for COVID-19, September 2021](#)). We do not draw conclusions about the core demographic variables in this model.
2. An odds ratio indicates the likelihood of an individual testing positive for COVID-19 given a particular characteristic/variable. See [glossary](#) for full definition.
3. The confidence interval for 'Vaccination status: 2 dose, AstraZeneca, 15 to 90 days' is very large (0.04 to 0.74). We display the lower confidence interval on the graph as 0.1 so that the scale of the graph is not skewed.
4. Figures 1 and 2 present results from the same model. We have divided up the results to make the graphs more accessible to users.

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Figure 2: Those who work in education or live in a household with someone aged 16 years or under were more likely to test positive for coronavirus (COVID-19) than those who do not

Estimated likelihood of testing positive for coronavirus on nose and throat swabs by screened characteristics, UK, 1 November to 14 November 2021

Notes:

1. The core demographic variables, sex, ethnicity, age, geographical region, urban or rural classification of address, deprivation percentile, household size, and whether the household was multigenerational are included to adjust for these factors. More information is available in [Coronavirus \(COVID-19\) Infection Survey technical article: analysis of populations in the UK by risk of testing positive for COVID-19, September 2021](#)). We do not draw conclusions about the core demographic variables in this model.
2. An odds ratio indicates the likelihood of an individual testing positive for COVID-19 given a particular characteristic/variable. See [glossary](#) for full definition.
3. Figures 1 and 2 present results from the same model. We have divided up the results to make the graphs more accessible to users.

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An additional model examines the effect of behavioural characteristics on the likelihood of testing positive, while controlling for the core demographic variables and significant screening characteristics shown above. This means that we can identify which behavioural characteristics are associated with testing positive while taking other differences into account.

Our findings suggest that in the fortnight ending 14 November 2021:

- those who reported that they "never" or only "sometimes" wore a face covering at work or school were more likely to test positive than those who reported they always wore a face covering at work or school
- those who had 1-5 or 6-10 physical contacts with those aged under 18 years were more likely to test positive
- those who spent more time socialising with others outside their household were more likely to test positive

The effect of face coverings on a person's risk of testing positive is not a consistent finding, and in our last analysis (in the fortnight ending 6 November 2021) there was not sufficient statistical evidence in our data to suggest that face coverings affected a person's likelihood of testing positive. Results of the use of face coverings over time can be found in the [accompanying dataset](#) alongside other variables used in the model.

Figure 3: Behavioural characteristics of people associated with being more or less likely to test positive for coronavirus (COVID-19)

Estimated likelihood of testing positive for coronavirus on nose and throat swabs by behavioural characteristic variables, UK, 1 November to 14 November 2021

Notes:

1. The core demographic variables and screened characteristic variables presented in Figure 1 (as explained in the [Coronavirus \(COVID-19\) Infection Survey technical article: analysis of populations in the UK by risk of testing positive for COVID-19, September 2021](#)) are included to adjust for these factors. We do not draw conclusions about the core demographic variables or screened characteristic variables in this model.
2. An odds ratio indicates the likelihood of an individual testing positive for COVID-19 given a particular characteristic/variable. See [glossary](#) for full definition.
3. For "time spent socialising outside the home", the odds ratio is per additional occasion spent socialising with people outside of the participants household in the last seven days.

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About this analysis

This analysis is based on models that are fitted at the UK level and include all participants aged two years and over. Key demographic variables were age, region, sex, ethnicity, deprivation, household size, multi-generational household, and urban or rural classification. Additional variables are included only if found to be significant in the two weeks presented in the bulletin. More information on the methods used in this analysis can be found in our [Coronavirus \(COVID-19\) Infection Survey technical article: analysis of populations in the UK by risk of testing positive for COVID-19, September 2021](#).

3 . Reinfections with COVID-19, UK

This section looks at the rate of coronavirus (COVID-19) reinfections in the UK between 2 July 2020 and 22 November 2021. We first presented results of reinfection analysis in our [Coronavirus \(COVID-19\) Infection Survey technical article: analysis of reinfections of COVID-19: June 2021](#). The technical article provides a more detailed explanation of the methods used, some of which have since been updated. Improvements to our modelling approach apply to data published from 6 October 2021 onward.

Tables 5a to 5e in the [accompanying dataset](#) for this bulletin provide the updated data.

The analysis presented in this section includes individuals who have had at least one positive test recorded in the survey and meet our criteria for being "at risk" of reinfection where:

- 120 days has elapsed since an individual's first positive test in the survey and their most recent test result was negative
- if 120 days has not passed since their first positive test in the survey, the individual's last positive test has been followed by four consecutive negative tests

An individual being classified as "at risk" reflects that it was possible for a test of theirs to be considered a reinfection if it turns out to be positive. The "at-risk period" refers to the period following the first time we could have defined a reinfection. A reinfection is therefore defined as when an "at risk" individual has a positive test.

All estimates of COVID-19 reinfections in this analysis were unweighted. The sample for this analysis includes only those who have tested positive for COVID-19 on a swab test, and so there was no known population of which weighted estimates could be representative.

The analysis included 22,313 participants "at risk" of reinfection and 438 reinfections identified between 2 July 2020 and 22 November 2021. The median time between positive episodes in those with reinfections was 243 days or about eight months (table 5b in [accompanying dataset](#) for this bulletin).

The rate of reinfections was low overall, and reinfections with a high viral load (which are more likely to cause illness) was even lower. The estimated rate for all reinfections including those with a lower viral load was 12.4 per 100,000 participant days at risk (95% confidence interval: 11.2 to 13.6) over the entire at-risk period. We use a proxy for viral load, using how quickly the virus can be detected. This is measured by [Cycle Threshold \(Ct values\)](#), which are lower with a high viral load. Lower viral loads take more time to detect, so the Ct value will be higher. The estimated rate for reinfections with a high viral load (strong positive test where Ct values were less than 30) was 7.0 per 100,000 participant days at risk (95% confidence interval: 6.2 to 7.9) over the entire at-risk period. Participant days at risk and Ct values are further defined in our [glossary](#).

From 17 May 2021, significant numbers of Delta infections were observed in the survey. We looked at the difference between initial infections and reinfections in terms of viral load both before and after this time to examine the impact variants had on the viral load of reinfections. Analysis of Ct values between the first infection episode and second infection episode for individuals with suspected reinfections, before 17 May 2021, show that the median Ct value was higher (indicating a lower viral load) at second infection than at first infection. However, from 17 May 2021, the median Ct value was lower (indicating a higher viral load) at second infection than at first infection. These findings indicate that viral loads at reinfection are higher where reinfections are predominantly from the Delta variant, compared with other variants.

Before 17 May 2021, the likelihood of an individual having symptoms of COVID-19 and a higher Ct value (lower viral load) in their second infection is lower compared with their first infection. This was not seen for individuals infected from 17 May 2021, where people are just as likely to have symptoms of COVID-19 and a low Ct value (high viral load) in their second infection as their first infection.

Table 1: Rate of reinfections per 100,000 participant days at risk
 Estimated rate of COVID-19 reinfections per 100,000 participant days at risk, averaged for entire at-risk period, 2 July 2020 to 22 November 2021, UK

| Definition | Number of participants at risk | Number of identified reinfections | Estimated rate of reinfections (per 100,000 participant days at risk) | Lower 95% confidence interval | Upper 95% confidence interval |
|--|--------------------------------|-----------------------------------|---|-------------------------------|-------------------------------|
| All reinfections definition | 22,313 | 438 | 12.4 | 11.2 | 13.6 |
| Reinfections with Ct less than 30 | 22,313 | 248 | 7.0 | 6.2 | 7.9 |

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

Notes

1. For the purposes of this analysis we define reinfection as a new positive test 120 days or more after an initial first positive test, which was preceded by at least one negative test. This definition also refers to an individual having had a subsequent positive test following four consecutive negative tests, regardless of the time since the first positive.
2. A confidence interval gives an indication of the degree of uncertainty of an estimate, showing the precision of a sample estimate. A wider interval indicates more uncertainty in the estimate.

4 . Risk factors associated with COVID-19 reinfections, UK

This section presents updated analysis of the risk factors associated with a coronavirus (COVID-19) reinfection identified among participants across the UK between 2 July 2020 and 15 November 2021.

[Coronavirus \(COVID-19\) Infection Survey technical article: analysis of reinfections of COVID-19: June 2021](#)

outlines the model used to investigate how the rate of reinfection varies over time and between individuals. This model explores multiple factors including age, sex, ethnicity, cycle threshold (Ct) value observed in the initial infection, deprivation, household size, work in patient-facing healthcare, long-term health conditions, vaccination status and the period during which an individual was at risk. We define the Alpha-dominant period as prior to 17 May 2021, and the Delta-dominant period from 17 May 2021.

For updated methodology, please refer to our technical article.

Interpreting the charts

This analysis included 21,774 participants "at risk" of reinfection and 411 reinfections identified between 2 July 2020 and 15 November 2021. The median time between positive episodes in those with reinfections was 235 days or about seven to eight months. These are slightly different results from those reported in the section above because this model covers a different time period. Therefore, the dataset is slightly different.

The risk of reinfection continued to be lower in the period before 17 May 2021, compared with the period after. This is measured by a [hazard ratio](#) of 0.64 (95% confidence interval: 0.46 to 0.88), which implies a 36% lower risk (95% confidence interval: 12% to 54%). This reflects a higher risk of reinfection during the period when the Delta variant of COVID-19 was the dominant strain. People with a long-term health condition were also more likely to be reinfected, shown by a hazard ratio of 1.34 (95% confidence interval: 1.05 to 1.72), equating to a 34% greater risk of reinfection. This is compared with people who have no long-term health condition.

People who reported symptoms within 35 days of the first positive test in their first infection were less likely to be reinfected, with a hazard ratio of 0.67 (95% confidence interval: 0.54 to 0.85). Older people were less likely to be reinfected, shown by a hazard ratio of 0.87 (95% confidence interval: 0.82 to 0.93) for every 10 years older, meaning that the risk of reinfection reduces by 13% for every 10 years older.

Tables 6a to 6c in the [accompanying dataset](#) provide relevant data.

Figure 4: There was a higher risk of reinfection from 17 May 2021, during the period when the Delta variant of COVID-19 was the dominant strain, compared with before 17 May 2021

Reinfection hazard ratios for factors included in the model, UK, 2 July 2020 to 15 November 2021

Notes:

1. This figure includes hazard ratios for all factors in the model except for Ct value.
2. A hazard ratio of greater than 1 indicates more risk in the specified group compared with the reference group, and a hazard ratio of less than 1 indicates less risk.
3. Deprivation is based on an index of multiple deprivation (IMD) score or equivalent scoring method for the devolved administrations, from 1, which represents most deprived up to 100, which represents least deprived. The odds ratio shows how a 10 unit increase in deprivation score, which is equivalent to 10 percentiles or 1 decile, affects the likelihood of testing positive for COVID-19.
4. We define the Alpha dominant period as before 17 May 2021, and the Delta dominant period as from 17 May 2021.
5. Although included in the model, the effect of Ct values is not included in this figure and are presented separately in Figure 6.

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Risk of reinfection by viral load

Figure 5 shows that the risk of reinfection in the Delta period is higher in individuals who had a higher Ct value (lower viral load) at their first infection; this may be because of a weaker immune response in "milder" primary infections. For example, individuals with an initial infection with a Ct value of 34 or more were twice as likely to get reinfected, compared with those with a first infection with a Ct value of 20. Risk of reinfection and associated confidence intervals as compared with the reference category (Ct value of 20) are available in the [accompanying dataset](#). Confidence intervals for these values are wide owing to fewer reinfections within this group.

Figure 5: The risk of reinfection in the Delta period was higher if a participant had a low viral load (indicated as a high Ct value) during their initial infection

Reinfection hazard ratios for Ct values across the initial infection episode, UK, 2 July 2020 to 15 November 2021

Notes:

1. All hazard ratios are compared against a Ct value of 20.
2. A hazard ratio of greater than 1 indicates more risk in the specified group, compared with the reference group, and a hazard ratio of less than 1 indicates less risk.
3. A confidence interval gives an indication of the degree of uncertainty of an estimate, showing the precision of a sample estimate. A wider interval indicates more uncertainty in the estimate.

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Risk of reinfection over time

Data for the risk of reinfection over time are available in Table 6c in the accompanying dataset. The data show no change to the risk of reinfection over time.

5 . Characteristics of people testing positive for COVID-19 data

[Coronavirus \(COVID-19\) Infection Survey, characteristics of people testing positive for COVID-19, UK](#)

Dataset | Released 1 December 2021

Characteristics of people testing positive for coronavirus (COVID-19) taken from the COVID-19 Infection Survey.

6 . 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, UK Health Security Agency and Wellcome Trust. Of particular note are:

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

7 . 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.

Cycle threshold (Ct) values

The strength of a positive coronavirus (COVID-19) test is determined by how quickly the virus is detected, measured by a cycle threshold (Ct) value. The lower the Ct value, the higher the viral load and stronger the positive test. Positive results with a high Ct value can be seen in the early stages of infection when virus levels are rising, or late in the infection, when the risk of transmission is low.

Deprivation

Deprivation is based on an index of multiple deprivation (IMD) score or equivalent scoring method for the devolved administrations, from 1, which represents most deprived up to 100, which represents least deprived. The odds ratio shows how a 10 unit increase in deprivation score, which is equivalent to 10 percentiles or 1 decile, affects the likelihood of testing positive for COVID-19.

Education sector

Work sectors are self-reported and cover a wide variety of occupations; for example, someone working in the education sector could be a teacher at a primary school or could be a chef at a college.

Hazard ratio

A measure of how often a particular event happens in one group compared with how often it happens in another group, over time. When a characteristic (for example, being male) has a hazard ratio of one, this means that there is neither an increase nor a decrease in the risk of reinfection compared with a reference category (for example, being female).

Multi-generational household

A household was classed as multi-generational if it included individual(s) aged school Year 11 or younger and individual(s) aged school Year 12 to those aged 49 years and individual(s) aged 50 years and over.

Odds ratio

An odds ratio indicates the likelihood of an individual testing positive for COVID-19 given a particular characteristic or variable. When a characteristic or variable has an odds ratio of one, this means there is neither an increase nor a decrease in the likelihood of testing positive for COVID-19 compared with the reference category. An odds ratio greater than one indicates an increased likelihood of testing positive for COVID-19 compared with the reference category. An odds ratio less than one indicates a decreased likelihood of testing positive for COVID-19 compared with the reference category.

For more information, see our [methodology page on statistical uncertainty](#).

Participant days at risk

The risk of reinfection varies from person to person, depending on when they were first infected. People who were first infected in the early part of the survey have had more opportunity to become reinfected compared with someone who has experienced their first infection more recently. Therefore, this analysis uses "participant days at risk" to determine the number of reinfections.

8 . Measuring the data

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.

9 . Strengths and limitations

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

10 . 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. 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 laboratories to collect and test samples.

[Coronavirus \(COVID-19\) Infection Survey: antibody and vaccination data for the UK](#)

Article | Updated fortnightly

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 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 Laboratories to collect and test samples.

[Coronavirus \(COVID-19\) Infection Survey technical article: predictors of positivity across countries of the UK, 28 October 2021](#)

Technical article | Released 28 October 2021

Analysis of predictors of positivity across countries of the UK for coronavirus (COVID-19) from the COVID-19 Infection Survey. This survey is being delivered in partnership with University of Oxford, University of Manchester, Public Health England and Wellcome Trust.

[Coronavirus \(COVID-19\) Infection Survey technical article: analysis of reinfections of COVID-19: June 2021](#)

Technical article | Released 29 June 2021

Data about reinfections from the Coronavirus (COVID-19) Infection Survey. This analysis has been produced in partnership with the University of Oxford.

[COVID-19 Infection Survey: methods and further information](#)

Methods article | Updated 26 March 2021

Information on the methods used to collect the data, process it, and calculate the statistics produced from the COVID-19 Infection Survey pilot.