

Statistical bulletin

Coronavirus (COVID-19) Infection Survey, characteristics of people testing positive for COVID-19, UK: 21 September 2022

Characteristics of people testing positive for COVID-19 from the Coronavirus (COVID-19) Infection Survey. This survey is delivered in partnership with University of Oxford, University of Manchester, UK Health Security Agency (UKHSA) and Wellcome Trust, working with the University of Oxford and partner laboratories to collect and test samples.

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Release date:
21 September 2022

Next release:
To be announced

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1 . Main points

- The latest estimated rate of coronavirus (COVID-19) reinfections up to 3 September 2022 was 44.4 per 100,000 participant days at risk (95% confidence interval: 43.4 to 45.3).
- Of all identified reinfections, 91.6% occurred during the period when the Omicron variants were dominant.
- The risk of reinfection was approximately five times higher in the period when the Omicron variants were dominant (20 December 2021 to 3 September 2022), compared with when the Delta variant was dominant (17 May to 19 December 2021).
- People who were unvaccinated were generally more likely to be reinfected than those who had been vaccinated.
- The risk of reinfection was lower in people who reported symptoms during a first infection than in people who did not report symptoms.

About this bulletin

In this bulletin, we present the latest analysis on reinfections and risk factors associated with reinfection 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 COVID-19 infections within the population living in private residential households. We exclude those in hospitals, care homes and/or other communal establishments. We include 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 and analysis](#) from the ONS and other sources.
- View [all coronavirus data](#).

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.

Survey data up to July 2022 were collected via study worker home visits. In July 2022, we collected data both from study worker home visits and remotely, and data have been collected fully remotely since 1 August 2022. We are continuing to investigate any impact of our change in data collection methods on these estimates. Additionally, there have been some changes to laboratory testing that we are also investigating.

2 . Reinfections with COVID-19, UK

This section estimates the rate of coronavirus (COVID-19) reinfections in the UK, from 22 March 2021 to 3 September 2022. Table 1a in the [accompanying dataset](#) for this bulletin contains these reinfection rates. This analysis includes individuals who have had at least one positive swab test recorded in the survey and meet our criteria for being "at risk" of reinfection. An individual is classified as "at risk" if it is 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 based on a combination of the number of days between initial and subsequent positive tests and the number of immediately preceding negative tests, and the viral load and variant type of initial and subsequent positive tests. A reinfection is therefore only identified when an "at risk" individual has a positive test.

The [technical article on reinfections](#) provides a more detailed explanation of the methods used, however the definition of reinfections used in this technical article has since been updated. Full details of the up-to-date definition used to identify a reinfection in this analysis can be found in [Section 7: Measuring the data](#).

Figure 1 presents the rate of reinfections per 100,000 participant days at risk from 22 March 2021 to 3 September 2022.

The estimated rate for reinfections has increased dramatically since Omicron variants became dominant.

There has been a large increase in the rates for all first reinfections since the Omicron variants became dominant, from 12.7 per 100,000 participant days at risk (95% confidence interval: 11.8 to 13.7) on 20 December 2021, to a high of 50.2 per 100,000 participant days at risk (95% confidence interval: 48.8 to 51.5) on the 25 April 2022. The rate has decreased slightly since, likely owing to varying levels of protection provided by past infections, including with Omicron BA.1, and changing background infection levels among the population.

Figure 1: There has been a large increase in the rates of reinfections since Omicron variants became dominant

Estimated rate of reinfections per 100,000 participant days at risk, UK, 22 March 2021 to 3 September 2022

Notes:

1. These estimates include first reinfections only (that is, second infections).

Download the data

[.xlsx](#)

Figure 2 shows the relationship between first and second infections by the period in which different variants were dominant for participants who have had two infections in the survey.

Of all identified reinfections, most have been in the period when the Omicron variants were dominant.

Of all identified reinfections, most have been in the period when the Omicron variants were dominant (91.6%). A large proportion of these reinfections had first infections in the periods when Alpha (35.0%) and Delta (35.6%) variants were dominant. A small proportion of people have had a first and second infection during the period when the same variant was dominant, but the rate is highest for those in the period when the Omicron variants were dominant (21.0%) because this period includes BA.1, BA.2, BA.4 and BA.5.

Figure 2: Of all identified reinfections, most have been in the period when the Omicron variants were dominant

Percentage of first and second infections by period in which different variants were dominant, UK, 2 July 2020 to 3 September 2022

Notes:

1. These estimates include first reinfections only (that is, second infections).
2. We define the Alpha period as prior to 17 May 2021, the Delta period as 17 May to 19 December 2021, and the Omicron period as 20 December 2021 onwards. These are the periods during which these respective variants were most common. Other variants were in circulation at the time.

Download the data

[.xlsx](#)

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

This section presents analysis of the risk factors associated with a coronavirus (COVID-19) reinfection identified among participants across the UK who had previously tested positive in the survey. This analysis included reinfections identified between 2 July 2020 and 3 September 2022.

Our [reinfections technical article](#) 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
- reported symptoms and [cycle threshold \(Ct\) value](#) observed in the initial infection
- deprivation
- household size
- working in patient-facing healthcare
- long-term health conditions
- vaccination status
- the period during which an individual was at risk for a reinfection

We define the Alpha variant period as prior to 17 May 2021, the Delta variant period as 17 May to 19 December 2021, and the Omicron variants period as 20 December 2021 onwards.

People are now around five times more likely to be reinfected in the period when the Omicron variants were dominant than in the period when the Delta variant was dominant.

This risk of reinfection has decreased since earlier in the Omicron period, where in March 2022, people were around 10 times more likely to be reinfected. This is likely both owing to varying levels of protection provided by past infections, including with Omicron BA.1, and changing background infection levels among the population.

The risk of reinfection by characteristic is measured in terms of hazard ratios and presented in Table 2a of our [accompanying dataset](#).

The data show:

- People who reported symptoms within 35 days of their first infection were less likely to be reinfected.
- Those with a lower viral load at their first infection were more likely to be reinfected.
- The risk of reinfection was approximately five times higher in the period when the Omicron variants were dominant (defined in this analysis as from 20 December 2021) compared to during the period when the Delta variant was dominant (defined in this analysis as 17 May to 19 December 2021).
- People who were unvaccinated were generally more likely to be reinfected than those who had been vaccinated.

We are reviewing our categories by vaccination for this analysis.

In addition to this data, we also looked at the effect of [Ct values](#) and symptoms at the first infection and the rate of reinfection during the periods when different variants became dominant. These data can be found in Tables 2b and 2c of our [accompanying dataset](#).

4 . 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 21 September 2022

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

5 . 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 (UK HSA) 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
- Anna Seale - University of Warwick, Warwick Medical School: Professor of Public Health; UK Health Security Agency, Data, Analytics and Surveillance: Scientific Advisor

6 . 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 \(IMD\)](#) (PDF, 2.18MB) score or equivalent scoring method for the devolved administrations, from 1, which represents most deprived up to 100, which represents least deprived. The hazard or 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.

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 1, 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 1 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.

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).

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.

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

7 . 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.

Reinfections with COVID-19 analysis

All estimates of COVID-19 reinfections in Sections 2 and 3 are unweighted. The sample for this analysis includes only those who have tested positive for COVID-19 on a swab test, and so there is no known population of which weighted estimates could be representative.

Since the bulletin published 30 March 2022, we have updated our definition of a reinfection to reflect the shorter time between reinfections that have occurred during the period when most infections were with the Omicron variants, compared with earlier variants. A reinfection was identified in this analysis if any one of the following three conditions were met.

For time since previous infection and number of negative tests, if there is either:

- a positive test 120 or more days after an initial first positive test and following one or more negative tests
- a positive test 90 or more days after an initial first positive test and following two or more negative tests, or, for positive tests on or after 20 December 2021 when Omicron became the main variant, following one or more negative tests
- a positive test 60 or more days after an initial first positive test and following three or more negative tests
- a positive test after an initial first positive test and following four or more negative tests

For high viral load:

Where both the first positive test and subsequent positive test have a high viral load, or there has been an increase in viral load between first positive test and subsequent positive tests.

For evidence of different variant types:

Where there is evidence, based on either genetic sequencing data or gene positivity from the polymerase chain reaction (PCR) swab test, that the variant differs between positive tests.

8 . Strengths and limitations

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

9 . Related links

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

Bulletin | Updated weekly

Estimates for England, Wales, Northern Ireland and Scotland.

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

Bulletin | Updated fortnightly

Antibody and vaccination data by UK country and regions in England from the Coronavirus (COVID-19) Infection Survey.

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

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.

[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.

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

Methodology article | Updated 5 August 2022

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

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

Methodology article | Updated 8 August 2022

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

10 . Cite this statistical bulletin

Office for National Statistics (ONS), released 21 September 2022, ONS website, statistical bulletin, [Coronavirus \(COVID-19\) Infection Survey, characteristics of people testing positive for COVID-19, UK: 21 September 2022](#)