

Statistical bulletin

New-onset, self-reported long COVID after coronavirus (COVID-19) reinfection in the UK: 23 February 2023

The likelihood of new-onset, self-reported long COVID after a second coronavirus (COVID-19) infection compared with a first infection, using data from the COVID-19 Infection Survey. Experimental Statistics.

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1 . Main points

- 4.0% of adults (aged 16 years and over) and 1.0% of children and young people (aged 2 to 15 years) reported having long COVID 12 to 20 weeks after a first coronavirus (COVID-19) infection, from 1 November 2021.
- Among those who did not report having long COVID after a first COVID-19 infection, 2.4% of adults and 0.6% of children and young people reported long COVID following a second COVID-19 infection.
- After adjusting for factors related to the risk of both COVID-19 reinfection and self-reported long COVID (sociodemographic characteristics, vaccination status, and the date of infection as an indicator of the variant type), the odds of new-onset, self-reported long COVID among adults were 28% lower after a second COVID-19 infection, compared with a first infection.
- Among children and young people, there was no statistical evidence of a difference in the adjusted odds of new-onset, self-reported long COVID between first and second COVID-19 infections.
- Similar differences in adjusted odds between first and second infections were observed when focussing on new-onset long COVID that limited daily activities, but at lower levels of prevalence: 2.8% for first infections compared with 1.6% for second infections among adults, and 0.6% and 0.4%, respectively, among children and young people.
- There was no evidence of differences in the relative risk of reporting new-onset long COVID after a second COVID-19 infection, compared with a first infection, by age, sex, ethnicity, pre-existing health status, area deprivation quintile group, or vaccination status.

If you are worried about new or ongoing symptoms four or more weeks after having COVID-19, there are resources available to help. See the NHS webpages [Long-term effects of coronavirus](#) and [Your COVID Recovery](#), which can help you to understand what has happened and what you might expect as part of your recovery. The time it takes to recover from COVID-19 is different for everyone, and the length of your recovery is not necessarily related to the severity of your initial illness or whether you were in hospital.

Long COVID is an emerging phenomenon that is not yet fully understood. These are [Experimental Statistics](#). The estimates are currently under development, which means that they may change as scientific understanding of long COVID improves. We advise caution when using the data.

Statistician's comment

"Today's analysis shows that adults who were infected with coronavirus (COVID-19) for a second time from 1 November 2021 were nearly 30% less likely to report new-onset long COVID, compared with those infected for the first time over the same period, even after adjusting for factors such as vaccination status and calendar date of infection as a proxy for variant. However, there remains some risk of new-onset long COVID after a second COVID-19 infection, with around 1 in 40 adults and 1 in 165 children and young people reporting long COVID symptoms 12 to 20 weeks after a second infection."

Daniel Ayoubkhani, Data and Analysis for Social Care and Health Division, Office for National Statistics

Figure 1: The adjusted odds of new-onset, self-reported long COVID were 28% lower in adults following a second coronavirus (COVID-19) infection, compared with a first infection

Adjusted odds ratios for new-onset, self-reported long COVID 12 to 20 weeks after a second COVID-19 infection, compared with a first infection, in adults (aged 16 years and over) and children and young people (aged 2 to 15 years), UK: 1 November 2021 to 8 October 2022

Notes:

1. Estimates for adults are adjusted for age, sex, ethnicity, area deprivation quintile group, the presence of pre-existing health conditions, vaccination status when infected, mode of response to the survey at long COVID follow-up, number of days from infection to long COVID follow-up, and calendar date of infection.
2. Estimates for children and young people are adjusted for age, sex, number of days from infection to long COVID follow-up, and calendar date of infection.
3. Confidence intervals are at the 95% level.

Download the data

[.xlsx](#)

2 . New-onset, self-reported long COVID after coronavirus (COVID-19) reinfection in the UK data

[New-onset, self-reported long COVID after coronavirus \(COVID-19\) reinfection in the UK](#)

Dataset | Released 23 February 2023

The likelihood of new-onset, self-reported long COVID after a second coronavirus (COVID-19) infection compared with a first infection, using data from the COVID-19 Infection Survey. Experimental Statistics.

3 . Glossary

Coronavirus and COVID-19

Coronaviruses are a family of viruses that cause disease in people and animals. They can cause the common cold or more severe diseases, such as COVID-19. COVID-19 is the name used to refer to the disease caused by the SARS-CoV-2 virus, which is a type of coronavirus. The Office for National Statistics (ONS) takes COVID-19 to mean the presence of SARS-CoV-2 with or without symptoms.

Cycle threshold (Ct) values

The strength of a positive 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 the 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.

Logistic regression

Logistic regression is a statistical modelling technique for quantifying the strength of association between the occurrence of an event, such as self-reported long COVID, and a set of characteristics. The model can be used to understand the independent relationship between the event and a particular characteristic of interest. This is while “adjusting” or “controlling” for other characteristics, which may be related to both the event and the characteristics of interest.

Long COVID

Long COVID was self-reported according to the Coronavirus (COVID-19) Infection Survey (CIS) question: “Would you describe yourself as having long COVID, that is, you are still experiencing symptoms more than 4 weeks after you first had COVID-19, that are not explained by something else?” Participants were also asked whether symptoms limited their ability to undertake daily activities. We considered participants' first responses in the interval 12 to 20 weeks after the start of each infection.

Odds ratio

An odds ratio (OR) for a particular group (for example, a second COVID-19 infection) describes the relative difference in the likelihood of reporting long COVID in that group compared with a reference group (for example, a first COVID-19 infection). An OR higher than 1 indicates a greater likelihood, while an OR less than 1 indicates a lower likelihood.

Restricted cubic spline

The relationship between a continuous variable (such as age) and the risk of self-reported long COVID may not be linear. For example, a one-year difference in age among younger people may not correspond to the same change in risk as a one-year difference in age among older people. Transforming a continuous variable using a cubic spline is a way of modelling such a non-linear relationship. A restricted cubic spline is a special type of cubic spline whereby the relationship is forced to be linear for people in the lower and upper extremes of the range, where fewer data points are available with which to fit the model.

4 . Measuring the data

Study data

The analysis used data from [our Coronavirus \(COVID-19\) Infection Survey \(CIS\)](#), linked to National Immunisation Management System and Pillar 1 and 2 COVID-19 testing records (for participants in England only).

The sample consisted of CIS participants who tested positive for COVID-19 between 1 November 2021 and 8 October 2022. Infections were identified using polymerase chain reaction (PCR) tests during CIS follow-up (all participants), PCR or lateral flow tests obtained from national testing programmes (participants in England), and self-reported positive swab tests (PCR or lateral flow tests) taken outside of the CIS (all participants).

We excluded participants if they had any of the following:

- a positive test for COVID-19 S-antibodies more than 14 days before their first positive swab and before receiving a first COVID-19 vaccine
- suspected COVID-19 more than 14 days before their first positive swab
- reported long COVID before their first positive swab
- no response to the long COVID survey question 12 to 20 weeks after their first positive swab
- a second infection (as defined in Identifying reinfections, Section 4) between their first positive swab and their first response to the long COVID survey question 12 to 20 weeks later

We also excluded second infections if the participant:

- did not have a first infection that met the above criteria
- reported long COVID symptoms prior to (and including) the start of their second infection
- did not respond to the long COVID survey question 12 to 20 weeks after the start of their second infection
- had a third infection (as defined in Identifying reinfections, Section 4) between the start of their second infection and their first response to the long COVID survey question 12 to 20 weeks later

We then excluded any infections occurring before 1 November 2021. This date was chosen to ensure a reasonable degree of overlap in the calendar date of infection between first and second infection episodes (the fifth percentile of the calendar date distribution was 6 December 2020 for first infections but 13 November 2021 for second infections among adults; and 10 December 2020 and 20 October 2021, respectively, among children and young people).

Identifying reinfections

Positive swab test results from any source above were grouped into infection episodes to allow for long durations of PCR positivity in some individuals. This was achieved using information from genetic sequencing, S-gene target positivity and cycle threshold (Ct) values, together with negative PCR test results from CIS only. A new infection was identified in this analysis if any one of the following three conditions (time since previous infection and number of negative tests, high viral load, and different variant types) were met.

For time since previous infection and number of negative tests, if there was any of:

- a positive test more than 120 days after an initial first positive test and following one or more negative tests
- a positive test more than 90 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 more than 60 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 had a high viral load, or there was a large increase in viral load between the first positive test and subsequent positive tests, given the time between them
- we also split infection episodes where a new positive lateral flow test was recorded 27 days or more after the start of an infection episode, or 19 days or more after a previous positive PCR or lateral flow test, since this again indicates high viral load and actively replicating virus, more likely associated with a new infection

For evidence of different variant types:

- where there was evidence, based on either genetic sequencing data or S-gene positivity from multiple PCR swab tests with Ct less than 30, that there was a new infection with a different variant

Statistical modelling

We used logistic regression to estimate adjusted odds ratios for self-reported long COVID comparing first and second COVID-19 infections. Separate models were used for adults (aged 16 years and over) and children and young people (aged 2 to 15 years).

Estimates for adults were adjusted for:

- age
- sex
- ethnicity (White or Non-White)
- area deprivation quintile group
- the presence of self-reported, pre-existing health conditions (yes or no)
- vaccination status when infected (unvaccinated, one dose at least 14 days before infection, two or more doses 14 to 89 days before infection, two or more doses 90 to 179 days before infection, two or more doses 180 to 269 days before infection, or two or more doses at least 270 days before infection)
- mode of response to the survey when the long COVID question was answered (face-to-face interview or digital)
- number of days from infection to when the long COVID question was answered
- calendar date of infection

Estimates for children and young people were adjusted only for age, sex, number of days from infection to when the long COVID question was answered, and calendar date of infection because of insufficient sample sizes to adjust for other characteristics. All continuous variables were modelled as restricted cubic splines.

Collaboration

This analysis was produced in collaboration with:

- Professor Nisreen Alwan, University of Southampton
- Dr Margaret O'Hara, Long Covid Support
- Professor Sarah Walker, University of Oxford

5 . Strengths and limitations

Strengths

This analysis uses data from the Coronavirus (COVID-19) Infection Survey (CIS). The CIS comprises individuals from a large, random sample of private households (excluding communal establishments such as hospitals, care homes, schools, halls of residence, and prisons) from across the UK. Over 530,000 individuals from over 260,000 households have participated in the study since it began in April 2020. The sample is broadly representative of the population in terms of age, sex, and location.

All CIS participants, including those who carry the virus but have no symptoms, are asked to provide swab samples at every follow-up visit. This analysis is therefore applicable to all people with COVID-19, not just those with symptoms during the acute (initial) phase of infection.

Using COVID-19 tests from a variety of data sources (the CIS, NHS Pillar 1 and 2, self-reported tests) and rules based on multiple sources of evidence (time and number of negative tests between positive tests, cycle threshold (Ct) values, polymerase chain reaction (PCR) gene positivity, genetic sequencing) meant that we could identify COVID-19 reinfections with reasonable accuracy.

Limitations

Long COVID status was self-reported by study participants and so misclassification is possible. For example, some participants may be experiencing symptoms because of a health condition unrelated to COVID-19 infection. Others who do have symptoms caused by COVID-19 may not describe themselves as experiencing long COVID (for example, because of a lack of awareness of the term or not knowing they were initially infected with COVID-19, or stigma associated with long COVID).

Like all household surveys, not all sampled households who are invited to participate in the study actually enrol (see Tables 2a to 2f of our [CIS technical dataset](#) for data on response rates). Other households may drop out of the study over time. If the likelihood of responding to the survey is related to long COVID status (for example, participants being more willing, or less able, to respond because of their symptoms) then this may bias the estimates.

This analysis only includes infections occurring between 1 November 2021 and 8 October 2022. The Omicron COVID-19 variant was first identified in the UK on 27 November 2021 and quickly became the main variant in circulation. Most first and second infections in our sample are therefore Omicron infections, and it is unclear whether our findings are representative of infections with other COVID-19 variants.

We only assessed the risk of new-onset, self-reported long COVID following a second COVID-19 infection. Therefore, nothing can be inferred about the risk of new-onset, self-reported long COVID following three or more infections, or after infection with any new COVID-19 variants that may emerge in the future.

6 . Related links

[Prevalence of ongoing symptoms following coronavirus \(COVID-19\) infection in the UK](#)

Bulletin | Released monthly

Estimates of the prevalence of self-reported long COVID and associated activity limitation, using UK Coronavirus (COVID-19) Infection Survey data. Experimental Statistics.

[Coronavirus \(COVID-19\) Infection Survey quality report: December 2022](#)

Methodology | Last revised 21 December 2022

Information on the Coronavirus (COVID-19) Infection Survey data collection method change from study worker home visit to remote data collection.

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

Methodology | Last revised 1 February 2023

This methodology is intended to provide information on the methods used to collect the data, process it, and calculate the statistics produced from the Coronavirus (COVID-19) Infection Survey.

[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 Office for National Statistics and other official sources.

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

Bulletin | Released monthly

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

7 . Cite this statistical bulletin

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