Office for National Statistics

Statistical bulletin

Self-reported long COVID and labour market outcomes, UK: 2022

Estimates of associations between self-reported long COVID and labour market outcomes, using UK Coronavirus (COVID-19) Infection Survey data. Experimental Statistics.

Contact:
Daniel Ayoubkhani and Vahé Nafilyan
health.data@ons.gov.uk
+44 1633 455825

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Correction

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Figure 4 has been revised because it was previously displaying incorrect data values. This was caused by human error.

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1 . Main points

- In July 2022, 23.3% of people aged 16 to 64 years with self-reported long COVID (symptoms at least four weeks after a confirmed or suspected coronavirus (COVID-19) infection that could not be explained by something else) were economically inactive (not working and not looking for work), compared with 21.4% of those without self-reported long COVID.

- Between July 2021 and July 2022, the inactivity rate among working-age people with self-reported long COVID grew by 3.8 percentage points, compared with 0.4 percentage points among working-age people without self-reported long COVID.

- Among working-age people not in full-time education, the odds of inactivity (excluding retirement) for those reporting long COVID 30 to 39 weeks or 40 to 51 weeks after a first test-confirmed COVID-19 infection were 45.5% and 34.3% higher, respectively, compared with before infection; this was after adjusting for background rates of inactivity in the labour market.

- The relationship between self-reported long COVID and inactivity (excluding retirement) was strongest for people aged 50 to 64 years, where the higher odds of inactivity compared with pre-infection peaked at a 71.2% increase among people reporting long COVID 30 to 39 weeks post-infection.

- Compared with before a first test-confirmed COVID-19 infection, employed people with self-reported long COVID were more likely to experience long-term workplace absence (for example, through sickness) 18 to 29 weeks after infection, but not beyond this.

- Among people aged 50 to 64 years who were in employment 12 to 20 weeks after a first test-confirmed COVID-19 infection, transition to retirement occurred at similar rates for participants with and without self-reported long COVID, at 69.1 and 68.4 retirements, respectively, per 1,000 people per year.

If you are worried about new or ongoing symptoms four or more weeks after having COVID-19, there are resources available to help. See Long-term effects of coronavirus (NHS) and Your COVID Recovery (NHS), 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 working-age people are less likely to participate in the labour market after developing long COVID symptoms than they were before being infected with coronavirus (COVID-19). Furthermore, this relationship between self-reported long COVID and inactivity for reasons other than education or retirement is strongest among people aged 50 years or above. Long COVID may therefore have contributed to the decreasing levels of participation seen in the UK labour market during the coronavirus pandemic. However, it is unlikely to be the only reason, and further research is needed into other possible factors such as indirect health effects of the pandemic."

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

2 . Monthly estimates of economic inactivity rates by self-reported long COVID status

We have previously reported on increasing levels of economic inactivity in our article, Half a million more people are out of the labour force because of long-term sickness, published 10 November 2022. In this article, we explore the relationship between self-reported long COVID and inactivity.

This section presents estimated rates of economic inactivity among working-age people (those aged 16 to 64 years) living in private households in the UK. The inactive population includes students, people who are retired, those who are out of work because of long-term illness or looking after family members, and those who are otherwise not in and not looking for paid work (see Section 7, Glossary for how we measured inactivity for this analysis). The inactive population does not include people who are working (either as employees or self-employed, including those who are on long-term sick leave), or those who are not working but are looking for work and able to start (these people are defined as being unemployed).

For this analysis, we define self-reported long COVID as symptoms lasting more than four weeks after a confirmed or suspected COVID-19 infection that could not be explained by something else.

The reported confidence intervals are unlikely to fully reflect the uncertainty inherent in the estimates because the weights used in this analysis are based on survey estimates rather than known population totals. Further details can be found in Section 8, Measuring the data.

Figure 1: The rate of inactivity grew more quickly among people with self-reported long COVID than without

Estimated percentage of people aged 16 to 64 years who are economically inactive by self-reported long COVID status, UK: February 2021 to July 2022

Notes:

1. Estimates include people living in private households and do not include those in most communal establishments.

Download the data

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The inactivity rate in July 2022 among people with self-reported long COVID was 23.3% (representing 375,000 inactive individuals), compared with 21.4% among people without self-reported long COVID (Figure 1). Between July 2021 and July 2022, the inactivity rate among people with self-reported long COVID grew by 3.8 percentage points (an additional 217,000 individuals), compared with just 0.4 percentage points among people without self-reported long COVID. Estimated inactivity rates and totals by age group and sex can be found in our accompanying dataset.

It is not possible to say from this analysis how many people with self-reported long COVID are inactive because of their symptoms, and some may have been inactive for reasons unrelated to a previous COVID-19 infection.

Differences in the trends in inactivity between people with and without self-reported long COVID may reflect a combination of factors. People with long COVID may have been increasingly likely to leave employment, or less likely to enter it, because of ill-health.

However, the estimates do not consider the differing personal characteristics (such as age and sex) of people with and without self-reported long COVID, and these factors may also be related to the likelihood of inactivity. Some people with self-reported long COVID may recover over time, while other people will have been infected with COVID-19 and started reporting long COVID symptoms during the study period. The socio-demographic make-up of the groups with and without self-reported long COVID will therefore have changed over time as people move between the groups. The estimates may also be influenced by patterns in COVID-19 infection. For example, people who are not in employment may be at less risk of COVID-19 infection, and therefore long COVID, than those who are working.

Figure 2: The difference in inactivity rates between people with and without self-reported long COVID was greatest among those aged 35 to 49 years in July 2022

Estimated percentage of people aged 16 to 64 years who are economically inactive by self-reported long COVID status and age group, UK: February 2021 to July 2022

Notes:

1. Estimates include people living in private households and do not include those in most communal establishments.

Download the data

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The difference in inactivity rates between people with and without self-reported long COVID in July 2022 was greatest among those aged 35 to 49 years, with rates of 19.9% and 12.0%, respectively (Figure 2).

Students are handled differently between the population to which these estimates are weighted and the sample from which the estimates themselves are derived. Further details can be found in Section 8, Measuring the data. These estimates should therefore be interpreted with caution, particularly for people aged 16 to 24 years.

The growth in inactivity rates between July 2021 and July 2022 among people with self-reported long COVID was greatest for those aged 35 to 49 years, at 6.4 percentage points, compared with just 0.1 percentage points among people in the same age group without self-reported long COVID.

3 . Economic inactivity (excluding retirement) before and after COVID-19 infection

In this section, we use statistical modelling techniques to explore the relationship between coronavirus (COVID-19) infection, with or without self-reported long COVID, and economic inactivity, but excluding retirement. The sample consists of monthly assessments for 206,000 study participants aged 16 to 64 years and not in full-time education. Unlike the previous section, to be identified as reporting long COVID, participants had to have had a positive swab test for COVID-19 at least 12 weeks previously.

The analysis evaluates the labour market status over time before and after a first test-confirmed COVID-19 infection within the same individual, rather than making comparisons between different individuals at a point in time. This means that, unlike in the previous section, this analysis controls for characteristics that may be related to both self-reported long COVID and inactivity, as long as these characteristics do not change over time (which is the case for many socio-demographic factors). Further details of the modelling methodology can be found in Section 7, Glossary and Section 8, Measuring the data.

These results relate to statistical associations and do not necessarily imply cause-and-effect relationships.

After adjusting for the overall trend in inactivity over the study period, the odds of being inactive (excluding retirement) within 12 weeks of a first COVID-19 infection were 4.7% lower than before participants were infected (Figure 3). The odds of inactivity (excluding retirement) were also lower 12 to 17 weeks after infection, irrespective of current self-reported long COVID status. This reduction in the likelihood of inactivity may reflect the acute effects of COVID-19 infection, whereby participants are less likely to leave employment during, or shortly after returning from, a period of short-term sickness absence.

Among participants without self-reported long COVID to date, there was no evidence of differences in the odds of inactivity (excluding retirement) before and at least 18 weeks after COVID-19 infection. The same was true for participants who had previously reported long COVID but were no longer doing so.

However, participants currently reporting long COVID 30 to 39 weeks or 40 to 51 weeks after a first COVID-19 infection were 45.5% and 34.3%, respectively, more likely to be inactive (excluding retirement) compared with pre-infection. The increase in the odds of inactivity (excluding retirement) compared with pre-infection reduced to 19.9% for participants currently reporting long COVID at least one year after infection, though the data were also consistent with no increase in the odds compared with pre-infection.

Despite this statistical relationship between inactivity (excluding retirement) and self-reported long COVID, long COVID is unlikely to be the sole driver of increasing levels of inactivity in the UK labour market during the COVID-19 pandemic. Following a period of stable inactivity rates, the number of working-age adults who are inactive mainly because of ill-health has been rising since 2019, as reported in our article, Half a million more people are out of the labour force because of long-term sickness, published 10 November 2022. This was before the arrival of COVID-19 in the UK. Furthermore, the increasing levels of inactivity in the UK during the pandemic have not been seen in many other Organisation for Economic Co-operation and Development (OECD) countries, as shown on the OECD's labour market statistics webpage, despite long COVID having a global impact as shown in analysis published in the Journal of Infectious Diseases. Besides long COVID, indirect health effects of the pandemic and extended NHS waiting lists may be contributing to decreasing levels of labour market participation related to ill-health, but further research is required to establish this.

Figure 3: People with self-reported long COVID 30 to 51 weeks after a first COVID-19 infection were more likely to be inactive (excluding retirement) compared with the time before they were infected

Adjusted odds ratios for economic inactivity (excluding retirement) among people aged 16 to 64 years and not in full-time education, by time since first COVID-19 infection and self-reported long COVID-19 status compared with before COVID-19 infection, UK

Notes:

1. Odds ratios estimated from a conditional logit model adjusted for calendar day of study assessment interacted with current age, sex, and self-reported health status at CIS enrolment.

Download the data

.xlsx

The relationship between self-reported long COVID and inactivity (excluding retirement) was strongest among people aged 50 to 64 years. Participants in this age group currently reporting long COVID had higher odds of inactivity (excluding retirement) than before COVID-19 infection for all time intervals from 24 weeks post-infection, peaking at a 71.2% increase for those reporting long COVID 30 to 39 weeks post-infection.

There was also variation in the relationship between self-reported long COVID and inactivity (excluding retirement) by sex. Compared with before COVID-19 infection, the higher odds of inactivity (excluding retirement) for participants currently reporting long COVID had reduced by one year post-infection for males, but remained 41.3% higher beyond one year post-infection than pre-infection for females. Full modelling results by age group and sex can be found in our accompanying dataset.

4 . Long-term absence before and after COVID-19 infection

We also investigated the relationship between self-reported long COVID and long-term absence from work. This analysis was restricted to monthly study assessments when participants were in employment, and only those from 1 October 2021 to avoid effects of the furlough scheme, representing 148,000 participants.

Long-term absence includes sickness leave for at least four weeks, or any other reason for being away from work for an extended period while still in employment, such as maternity or paternity leave.

After adjusting for the overall trend in long-term absence over the study period, the odds of long-term absence within 12 weeks of a first coronavirus (COVID-19) infection were 9.2% higher than before infection (Figure 4). A first COVID-19 infection 12 to 17 weeks ago without reporting long COVID to date was associated with 16.2% lower odds of long-term absence compared with pre-infection. Previously reporting long COVID and being at least 40 weeks beyond a first COVID-19 infection was also associated with lower risk of long-term absence compared with pre-infection.

Participants in employment and currently reporting long COVID 18 to 23 weeks or 24 to 29 weeks after a first COVID-19 infection were 40.4% and 45.2%, respectively, more likely to be absent from work compared with before they were infected. However, these higher odds of long-term absence did not persist for people reporting long COVID beyond 30 weeks post-infection. This finding may partly reflect people returning to work (with or without persistent illness) upon completion of the 28-week period of statutory sick pay. Also, participants who are most affected by long COVID may have already left employment by 30 weeks post-infection, and were therefore no longer in the study sample for this analysis.

The relationship between self-reported long COVID and long-term absence was strongest among people aged 50 to 64 years, peaking at a 103.4% increase in the odds of long-term absence, compared with pre-infection, for those reporting long COVID 24 to 29 weeks post-infection. Full modelling results by age group and sex can be found in our accompanying dataset.

Figure 4: People with self-reported long COVID 18 to 29 weeks after a first COVID-19 infection were more likely to experience long-term absence compared with the time before they were infected

Adjusted odds ratios for long-term absence from work among people aged 16 to 64 years and in employment, by time since first COVID-19 infection and self-reported long COVID-19 status compared with before COVID-19 infection, UK: 1 October 2021 to 30 September

Notes:

1. Long-term absence includes sickness leave for at least four weeks or any other reason for being away from work for an extended period, such as maternity or paternity leave.

2. Odds ratios estimated from a conditional logit model adjusted for calendar day of study assessment interacted with current age, sex, and self-reported health status at CIS enrolment.

Download the data

.xlsx

5 . Retirement among working-age people with and without self-reported long COVID

This section contrasts rates of retirement between 50,000 study participants with a positive test for coronavirus (COVID-19) who did or did not have self-reported long COVID 12 to 20 weeks after their first positive test. All participants were aged 16 to 64 years and in employment at the first study assessment within this 12- to 20-week interval (marking the start of follow-up).

Transition from employment to retirement for participants with self-reported long COVID occurred at a similar rate to that for participants who were infected with COVID-19 but did not report long COVID 12 to 20 weeks later. Participants with and without self-reported long COVID retired at rates of 30.2 (95% confidence interval: 23.1 to 38.8) and 25.2 (23.1 to 27.4) events per 1,000 person-years, respectively.

This finding still holds when restricting the sample to the age group most likely to retire, those aged 50 to 64 years, who accounted for 96.2% of all retirements during the study period. Among participants in this age group, retirement occurred at rates of 69.1 (52.6 to 89.2) and 68.4 (62.7 to 74.5) per 1,000 person-years for participants with and without self-reported long COVID, respectively.

After accounting for a range of socio-demographic factors that may be related to the likelihood of both self-reported long COVID and retirement (see Section 8, Measuring the data for details), 1.2% and 2.2% of participants with self-reported long COVID had retired by six months and one year of follow-up, respectively (Figure 5). Similar results were observed for participants without self-reported long COVID, with 1.4% and 2.3% of these participants retiring by six month and one year of follow-up, respectively.

After accounting for socio-demographic factors, 3.0% and 5.8% of participants aged 50 to 64 years with self-reported long COVID had retired by six months and one year of follow-up, respectively. Similar findings were observed for participants in this age group without self-reported long COVID (3.6% and 5.7%, respectively).

Figure 5: Working-age participants with and without self-reported long COVID 12 to 20 weeks after COVID-19 infection retired at similar rates

Weighted cumulative incidence of transition from employment to retirement among people aged 16 to 64 years and 50 to 64 years, by self-reported long COVID-19 status 12 to 20 weeks after a first COVID-19 infection, UK: 3 February 2021 to 30 September 2022

Notes:

1. Day 0 is the first study assessment in the interval 12 to 20 weeks after a first positive test for COVID-19 (the “index assessment”).

2. Nonparametric estimates of cumulative incidence were obtained after weighting the data by stabilised inverse-probability weights (SIPWs). The SIPWs accounted for calendar day, age, sex, ethnicity, country /region of residence, area deprivation quintile group, and self-reported health/disability status at the index assessment.

Download the data

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6 . Self-reported long COVID and labour market outcomes data

Self-reported long COVID and labour market outcomes Dataset | Released 5 December 2022 Estimates of associations between self-reported long COVID and labour market outcomes in the UK. Experimental Statistics.

7 . Glossary

Conditional logit regression

Conditional logit regression, also known as fixed effect logistic regression, is a statistical modelling technique for quantifying the strength of association between a dependent variable, such as economic inactivity, and one or more possible explanatory characteristics, such as self-reported long COVID. Unlike standard logistic regression, conditional logit regression estimates the association between dependent variables and explanatory characteristics within the same individuals over time, rather than between different individuals at a point in time. This means that we do not need to account for characteristics that do not change over time within individuals (including many demographic characteristics), and only characteristics that change over time within individuals (such as age) need to be considered in the model.

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 presence of SARS-CoV-2 with or without symptoms.

Economic inactivity

In official labour market statistics outputs, ONS defines the economically inactive population as being people aged 16 years and over without a job who have not looked for work in the last four weeks and/or are not available to start work in the next two weeks. This definition is consistent with international standards specified by the International Labour Organisation (ILO). The main inactive groups are students, people looking after family and home, long-term sick and disabled people, temporarily sick and disabled people, retired people and discouraged workers.

We used a similar, though slightly broader, definition for this analysis. COVID-19 Infection Survey (CIS) participants were classified as being inactive if they responded to the question "What is your current work, education or other status, that is, where you spend most of your time?" with any of the following:

- not in paid work and not looking for paid work
- retired
- attending college or other further education provider, including apprenticeships

Study participants not defined as being inactive may have responded with any of the following:

- employed or self-employed and currently working (including if on sick leave for less than four weeks)
- employed or self-employed and currently not working (including if on sick leave for four weeks or longer, or on maternity or paternity leave)
- looking for paid work and able to start

Long COVID

Long COVID is described in UK clinical guidelines, published on the National Institute for Health and Care Excellence (NICE) website, as "signs and symptoms that continue or develop after acute COVID19. It includes both ongoing symptomatic COVID19 (from 4 to 12 weeks) and postCOVID19 syndrome (12 weeks or more)." However, in this analysis, long COVID was self-reported according to the following CIS question, rather than being clinically diagnosed: "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?"

For our model-based analysis of economic inactivity (excluding retirement) and long-term absence, and the survival analysis of time to retirement, we aligned our definition of self-reported long COVID with that of postCOVID19 syndrome by ignoring responses to the long COVID question within the first 12 weeks of a COVID-19 infection.

Odds and odds ratios

Odds provide a measure of the likelihood of an event, such as economic inactivity. They describe how many more times the event is likely to occur than to not occur.

An odds ratio (OR) for a particular group (for example, people with self-reported long COVID) describes the relative difference in the odds of economic inactivity in that group compared with the odds in a reference group (for example, people not infected with COVID-19). An OR higher than 1 indicates a greater likelihood, while an OR less than 1 indicates a lower likelihood. If a characteristic (such as self-reported long COVID) exhibits marked differences in ORs between groups, the characteristic is said to be a "risk factor" for the outcome of interest (such as economic inactivity).

Person-years

Person-years take into account both the number of participants in a study and the amount of follow-up time each participant contributes to the study. For example, if a participant remains in the study for six months of follow-up, they have contributed 0.5 person-years to the analysis. The total person-years is then calculated as the sum of person-years contributed by all study participants included in the analysis. Analysis results are often presented as rates per 1,000 person years. This can be interpreted as the number of events that would occur among 1,000 people if they were each followed for one year, or 500 people if they were each followed for two years, or any other combination of people and follow-up time that multiply to 1,000 person-years.

8 . Measuring the data

Methodology for monthly time series of economic inactivity rates by self-reported long COVID status

This analysis was based on our UK Coronavirus (COVID-19) Infection Survey (CIS) data from 3 February 2021 (when the long COVID survey question was implemented) to 31 July 2022. The analysed sample comprised all CIS participants aged 16 to 64 years who responded to both the employment status and long COVID questions during the study period; monthly sample sizes are available in our accompanying dataset. In each month, the group with self-reported long COVID included all participants who responded positively to the survey question on long COVID, irrespective of whether participants had previously tested positive for COVID-19 or time since the first confirmed or suspected infection.

We produced repeated cross-sectional estimates of economic inactivity rates using weights reflecting the area-stratified design of the CIS sample, and that account for non-response in each month according to a range of demographic factors. The weights were calibrated to rolling three-monthly estimates of inactivity by age group and sex, derived from Labour Force Survey (LFS) data, which can be found in our Employment in the UK: October 2022 bulletin.

LFS participants respond to the survey on a quarterly basis, so official estimates of inactivity are published in rolling three-month intervals. However, CIS participants respond approximately monthly, so it was possible to produce monthly estimates of inactivity for this analysis. We therefore took the central month of each LFS three-month interval to be representative of the corresponding calendar month when calibrating the survey weights to published inactivity totals.

The numbers of inactive people by self-reported long COVID status estimated in this analysis sum to estimates of inactivity in the UK labour market, as published in our Employment in the UK: October 2022 bulletin. However, they do not sum to the estimates published in our Prevalence of ongoing symptoms following coronavirus (Covid-19) infection in the UK bulletin. This is because the latter are derived using separate survey weights that are appropriate for estimating the population prevalence of self-reported long COVID, but do not account for labour market status.

There are differences between the CIS and LFS sampling frames and target populations. The sampling frame for the CIS is UK private households, which does not include communal establishments such as hospitals, care homes, halls of residence and prisons. The LFS uses a similar sampling frame of private households but also includes NHS nurses' accommodation, and therefore accounts for this with an adjustment to the target population to which LFS respondents are weighted.

Students living in boarding schools or halls of residence during term time are included in the CIS sample if they were at their usual (non-term) address when the household was sampled, but are only eligible to respond to the survey each month when living at this address. However, in the LFS, students living in boarding schools or halls of residence during term time are always sampled via their usual (non-term) address.

Because the employment status of CIS respondents is determined by where they spend most of their time, full-time students are classified as being in education and therefore inactive, even if they have a part-time job. However, LFS respondents who are full-time students may be classified as being inactive, employed or unemployed, depending on their work status and availability. Because of these differences in how students are handled between the CIS and LFS, the estimates in Section 2, Monthly estimates of economic inactivity rates by self-reported long COVID status should be interpreted with caution, particularly for people aged 16 to 24 years.

The reported 95% confidence intervals account for the survey weights and the household-clustered design of the CIS sample. However, they do not account for the fact that the calibration totals are also estimated from a survey rather than being known quantities. Therefore, the reported confidence intervals are unlikely to fully reflect the uncertainty inherent in the estimates of inactivity. Confidence intervals for LFS estimates can be found in dataset A11: Labour Force Survey sampling variability accompanying our Labour market overview: October 2022.

Until June 2022, CIS data were collected via face-to-face interviews with study workers at participants' homes. Remote data collection was introduced in July and August 2022. Participants then completed the survey questionnaire online or by telephone and returned swab and blood sample kits through the post (or by courier for some participants), as explained in our article, The COVID-19 Infection Survey is changing. What does this mean for how the UK monitors the virus?

Methodology for the analysis of economic inactivity (excluding retirement) and long-term absence

This analysis used unweighted CIS data to 30 September 2022. We analysed monthly study assessments where participants responded to the long COVID question from 3 February 2021 (when the question was implemented on the survey), were aged 16 to 64 years and not in full-time education.

To ensure that a first positive swab test during the study period was likely to represent a first COVID-19 infection, and that we could fully observe participants' self-reported long COVID experience, we excluded participants with any of the following:

- a first positive swab test for COVID-19 (either a polymerase chain reaction (PCR) test via CIS study assessments or any swab test outside of the study, as self-reported by participants) before 11 November 2020, 12 weeks before the long COVID survey question was implemented (previous self-reported long COVID status could not be observed for participants infected before this)
- a first positive swab test for COVID-19 at CIS enrolment (the timing of infection could not be determined for these participants)
- a positive test for COVID-19 antibodies (based on CIS tests and self-reported results, excluding any tests after first receiving a COVID-19 vaccine) or suspected COVID-19 at least 14 days before a first positive swab test (the first observed positive test may have represented a reinfection for these participants)

The final analysed sample comprised 206,299 participants. When analysing long-term absence from work, we excluded study assessments before 1 October 2021 (when the furlough scheme was in operation in the UK) and those when participants were not employed, leaving 147,895 participants in the analysis.

We used conditional logit regression to estimate the association between each of the time-varying outcomes (inactivity excluding retirement and long-term absence) and the time-varying exposure (a composite of past COVID-19 infection status and current long COVID status). Because this modelling approach involves analysing multiple measurements for the same participant over time, each participant can contribute to the estimates for more than one time interval after COVID-19 infection.

To control for background labour market conditions over the study period, we adjusted for the calendar day of each assessment (modelled as a restricted cubic spline with boundary knots at the 10th and 90th percentiles and a single internal knot at the median of the time distribution) interacted with current age (restricted cubic spline), sex, and self-reported health status at CIS enrolment. We reported results as adjusted odds ratios (ORs) and 95% confidence intervals, with the pre-infection period being the reference group for comparison.

Methodology for the analysis of time to retirement

This analysis was based on a subset of 50,251 participants included in the analysis of economic inactivity (excluding retirement) who:

- had a positive swab test for COVID-19
- responded to the long COVID question at least once 12 to 20 weeks after their first positive swab test (the first of these responses was defined as the "index assessment")
- were aged 16 to 64 years and in employment at their index assessment
- responded to the CIS at least once after their index assessment

Of these participants, 18,727 were included in the analysis of people aged 50 to 64 years at the index assessment.

We right-censored follow-up at the earliest of several events if any of the following were reported at study assessments before the first transition to retirement:

- unemployment
- economic inactivity (excluding retirement)
- turning 65 years old
- the last observed study assessment

Follow-up time of participants who retired before a right-censoring event was assumed to be interval censored. This means that the retirement was assumed to have occurred at an unknown time between the last assessment at which the participant did not report being retired and the first assessment at which they did.

We estimated rates of retirement per 1,000 person-years of exposure time from start to end of follow-up (as defined above), stratified by self-reported long COVID status at the index assessment.

We then constructed stabilised inverse-probability weights (SIPWs) from logistic regression models relating self-reported long COVID status to participant characteristics at the index assessment: calendar day, age, sex, ethnicity, country/region of residence, area deprivation quintile group, and self-reported health/disability status. Continuous variables (calendar day and age) were modelled as restricted cubic splines. SIPWs were truncated at the 99th percentile of the distribution to avoid extreme weights. Nonparametric estimates of SIPW-weighted cumulative incidence curves for retirement were obtained using the Turnbull estimator.

Collaboration

This analysis was produced in collaboration with:

- Professor Kamlesh Khunti, University of Leicester
- Doctor Francesco Zaccardi, University of Leicester
- Professor Sarah Walker, University of Oxford
- Doctor Koen Pouwels, University of Oxford
- Professor Donald Houston, University of Portsmouth

9 . Strengths and limitations

Strengths

This analysis is based on data from the Coronavirus (COVID-19) Infection Survey (CIS), a large study that provides an important indicator of national COVID-19 positivity. All participants provide a nose-and-throat self-swab for polymerase chain reaction (PCR) testing at each study assessment, irrespective of symptoms or behaviours.

Selection bias is minimised by selecting households at random from national address lists. Prospective data collection means that survey responses are not affected by recall effects, such as participants overestimating the duration of their symptoms or approximating the timing of changes in employment status.

Limitations

All results of this analysis relate to statistical associations; causality cannot be inferred because we cannot rule out residual confounding by unmeasured time-varying factors. Bias may also be present if survey drop-out after COVID-19 infection is related to employment status. For example, if participants who are economically inactive the longest (perhaps because of ill-health) are also the most likely to drop out of the study, this could partly explain our finding of a weakening relationship between self-reported long COVID and inactivity for longer durations from infection.

We did not have data on working hours, so we were unable to investigate the relationship between self-reported long COVID and part-time work. It was not possible to split out long-term absence because of sickness from that for other reasons, for example maternity or paternity leave. However, the latter are unlikely to be influenced by past COVID-19 infection, so we expect the impact on the estimated relative risks of long-term absence by long COVID status to be small.

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

In July and August 2022, CIS participants were transitioned from face-to-face to remote data collection. For the latter, the survey can be completed online or by telephone, and swab and blood sample kits are sent through the post and returned by post (or by courier for some participants). In our analysis of the relationship between self-reported long COVID and economic inactivity (excluding retirement), we observed larger odds ratios in the interval 30 to 39 weeks post-infection when data were collected remotely (2.21) rather than in face-to-face interviews (1.21) (full results can be found in our accompanying dataset). The change in data collection mode may have led to differential exposure misclassification (CIS participants are 30% more likely to report long COVID if responding remotely rather than through face-to-face interview, as explained in our bulletin, Prevalence of ongoing symptoms following coronavirus (COVID-19) infection in the UK: 1 September 2022).

Long COVID is sometimes perceived as a stigmatized condition, as explained in this article published in the journal PLOS ONE. If the remote responses provide a more reliable measure of true long COVID status, the odds ratio for 30 to 39 weeks post-infection reported in the main analysis may be underestimated because most of the study data were collected in face-to-face assessments.

10 . Related links

Half a million more people are out of the labour force because of long-term sickness Article | Released 10 November 2022 Analysis of the rise in economic inactivity because of long-term sickness between 2019 and 2022.

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 COVID-19 Infection Survey data. Experimental Statistics.

COVID-19 Infection Survey: methods and further information Methodology article | Last updated 5 August 2022 Methodology providing information on the methods used to collect the data, process it, and calculate the statistics produced from the COVID-19 Infection Survey.

Coronavirus (COVID-19) Infection Survey quality report: August 2022 Report | Released 18 August 2022 Information on the COVID-19 Infection Survey data collection method change from study worker home visit to remote data collection.

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

11 . Cite this statistical bulletin

Office for National Statistics (ONS), released 5 December 2022, ONS website, statistical bulletin, Self-reported long COVID and labour market outcomes, UK: 2022