

Article

COVID-19 Schools Infection Survey technical article estimating pupils testing positive for antibodies, England: November 2020 to July 2021

Experimental statistics providing estimates of pupils ever testing positive for SARS-CoV-2 antibodies from the COVID-19 Schools Infection Survey across a sample of schools, within selected local authority areas in England. This Schools Infection Survey is jointly led by the London School of Hygiene and Tropical Medicine, UK Health Security Agency and the Office for National Statistics.

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1 . Main points

- This article looks at how the proportion “ever testing” positive for SARS-CoV-2 antibodies can be calculated using the data available from the Schools Infection Survey (SIS) and seeks feedback on whether this is a useful measure; the methodology can be refined when more data is collected over the course of the coronavirus (COVID-19) pandemic.
- Calculating the proportion of pupils that “ever tested” positive for antibodies results in higher estimates of the proportion previously infected with coronavirus (COVID-19) in the local authorities sampled, compared with using just the results from the final [Round 6](#) tests carried out in SIS.
- Over the full duration of SIS, an estimated 15.30% (95% confidence intervals: 13.50% to 17.24%) of primary pupils and 17.29% (95% confidence intervals: 16.28% to 18.33%) of secondary pupils in the local authorities sampled had at least one test that recorded antibody levels above the limit of detection.
- For local authority estimates, confidence intervals are wide so should be interpreted with caution, but indicate a range in antibody levels around the country; in areas where community infection rates have been relatively low throughout the pandemic the percentage of pupils with antibody levels above the limit of detection is lower than areas that have had higher rates of infection.

Have you been asked to take part in the study?

For more information, please visit the SIS participant [guidance page](#).

If you have any further questions, please email the SIS operations team: Schools.Studies.Mailbox@ons.gov.uk.

Data from the School Infection Survey are not intended to be generally applicable to all schools in England. The study was originally designed to oversample schools in areas of England where COVID-19 infection was highest at the start of the academic year (September 2020). Further information can be found in the [methodology article](#).

The antibody tests used in this study detect antibodies produced following natural infection and not vaccination.

The estimates presented in this release are [experimental](#); these are statistics that are in the testing phase and not yet fully developed.

2 . Overview

Pupil antibody tests were collected periodically over the course of the 2020 to 2021 academic year in a sample of schools from 15 local authorities in England as part of the COVID-19 Schools Infection Survey (SIS). The pupil antibody test used in SIS was based on oral fluid collection - a non-invasive alternative to collecting blood and more suitable for self-administered use by children.

However, this test is less sensitive (estimated at 80%). Antibody levels are less concentrated in oral fluid samples compared to blood and may fall below the limit of detection for the oral fluid test more quickly, whereas they remain present in blood for longer. Therefore, some pupils who previously tested positive for SARS-CoV-2 antibodies will test negative in later rounds.

When new infections are low the net effect can lead to an apparent fall in antibody levels in the population. In the case of SIS the percent testing positive in [Round 6](#) was lower than in [Round 4](#). Therefore, the results cannot be used as a measure of prior COVID-19 infection over a long time period and, as the immune response does not rely on antibodies alone, these figures cannot be used as an indication of current immunity.

To try to provide a more comprehensive estimate of prior infection with COVID-19, the proportion “ever testing” positive for SARS-CoV-2 antibodies was calculated. This article looks at how the proportion “ever testing” positive can be calculated using the data available and seeks feedback on whether this is a useful measure.

3 . Pupils “ever testing” positive for coronavirus (COVID-19) antibodies

The main method (Method 1) involved taking the number of participants with at least one positive COVID-19 Schools Infection Survey (SIS) antibody test and dividing by the total number of participants that had at least one valid SIS antibody test result. The participants are weighted using our standard weighting procedure, which seeks to make the results representative of all pupils in the local authorities sampled based on their age, gender and ethnicity.

Over the full duration of SIS (November 2020 to July 2021), this method suggests that for those tested at least once, 15.30% (95% confidence intervals: 13.50% to 17.24%) of primary pupils and 17.29% (95% confidence intervals: 16.28% to 18.33%) of secondary pupils in the local authorities sampled had at least one test that recorded antibody levels above the limit of detection.

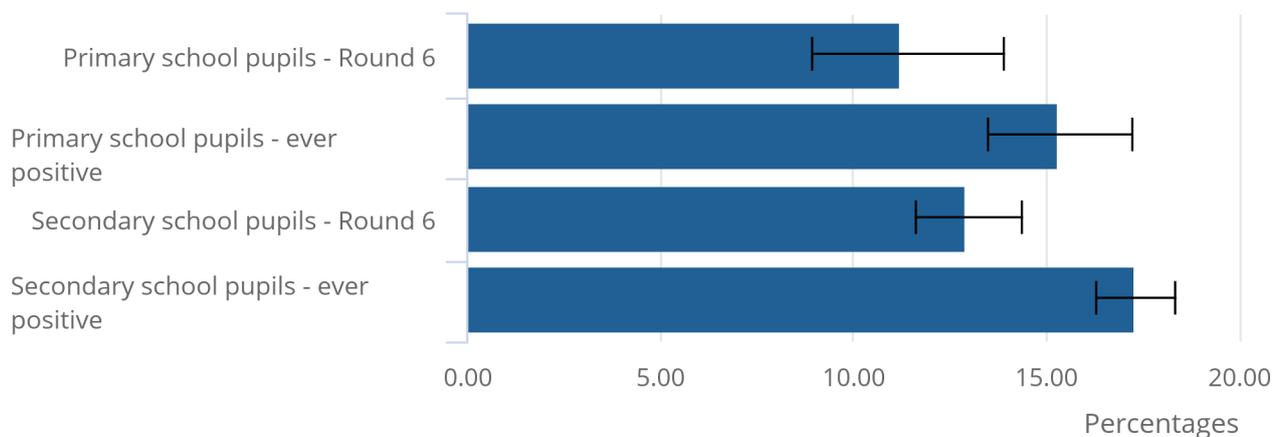
Figure 1 shows the estimates of “ever tested” positive compared to the standard prevalence estimate calculated using data from Round 6 only (published in [Round 6 bulletin](#)).

Figure 1: Pupils “ever testing” positive for antibodies

England, 03 November 2020 to 6 July 2021 (Round 1 to Round 6)

Figure 1: Pupils “ever testing” positive for antibodies

England, 03 November 2020 to 6 July 2021 (Round 1 to Round 6)



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

Notes:

1. Data from 14 local authorities; Bradford is not included as data were not available for both primary and secondary schools.
2. Round 6 (14 June to 6 July 2021) figures have been adjusted to account for the sensitivity and specificity of the antibody test.

Figure 2 shows the percentage of pupils “ever testing” positive for SARS-CoV-2 antibodies by local authority using this method. Confidence intervals are wide, so all estimates should be interpreted with caution; however, they indicate a wide range in antibody levels around the country.

In areas of the country where community infection rates have been relatively low throughout the pandemic (Bournemouth, Christchurch and Poole, and Norfolk) the percentage of pupils “ever testing” positive is lower than areas that have had higher rates of infection (Manchester, and Barking and Dagenham). The difference in infection rates around the country is more apparent when looking at the percent “ever tested” positive than seen when looking just at the Round 6 antibody test results (see [accompanying dataset](#) for Round 6 bulletin).

In 11 of the 14 local authorities sampled, a higher proportion of secondary school pupils tested positive for antibodies than primary school pupils. However, confidence intervals are wide and overlap for almost all local authorities sampled.

Figure 2: Pupils "ever testing" positive for antibodies to COVID-19 by local authorities

England, 03 November 2020 to 6 July 2021 (Round 1 to Round 6)

Notes:

1. Data from 14 local authorities; Bradford is not included as data were not available for both primary and secondary schools.

[Download this chart](#)

Limitations

This method will still underestimate exposure to COVID-19 because the first tests in SIS were carried out in November 2020, potentially missing infections from the beginning of the pandemic.

Additionally, not all pupils participated in each round (either because they joined the study part way through, dropped out, or missed a specific testing round), meaning the number of “opportunities” available to test positive varied for each participant. For example, if a participant joined the study in Round 4 and tested negative, it is possible that if they had been in the study from the start then the tests carried out in Round 1 or 2 could have returned a positive result.

Of the 14,300 participants tested at least once as part of SIS, only around 20% have test results from all four main testing rounds across the academic year. A large proportion of the sample joined between Rounds 2 and 4 when the sample was extended (over 25%). Table 1 shows the most common patterns of participation.

Table 1: Participation in antibody testing across rounds
England, 03 November 2020 to 6 July 2021 (Round 1 to Round 6)

Round 1	Round 2	Round 3	Round 4	Round 6	Number of pupils
X	X		X	X	2,789
			X	X	2,767
	X		X	X	1,454
				X	1,257
		X	X	X	1,053
			X		627
X	X		X		603
X	X				494
	X				468
X			X	X	384

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

Notes

1. “X” indicates participation in testing round.
2. Recruitment remained open over the survey and the sample was increased after Round 2.
3. Round 3 was scheduled for late January 2021, however it was cancelled because of restricted attendance in schools during the national lockdown, only new participants and those without an antibody test in Round 1 or 2 were invited to take a home test in Round 3.

4 . Alternative “ever tested” positive methods

As part of this analysis, we also considered two alternative methods for calculating those “ever testing” positive.

The first alternative method (Method 2) selected just those tested as part of Round 6 and counted previous positive tests if available for the participant. This method also has similar limitations to the preferred method (Method 1) (not all Round 6 participants have data from a previous round). Additionally, those who were not available or chose not to participate in Round 6 would also be excluded, despite having valid data from previous rounds.

Another alternative (Method 3) would be to only analyse those that had test results from each of the four main testing rounds to see what proportion had tested positive at least once. However, this method would result in a very small number of participants available for analysis (2,780), which means the data could not be weighted separately for primary and secondary pupils, and local authority estimates would also not be possible. Consequently, this method has been discounted. Table 2 shows the comparison between the adjusted estimate for Round 6 positivity (used in our [Round 6 bulletin](#)), the preferred method for “ever positive” (Method 1) and the first alternative method (Method 2).

Both methods of “ever tested” positive result in a significantly higher estimate of the proportion of secondary pupils infected with COVID-19. For primary pupils both methods are also higher, but the difference is not significant, partly because of the smaller number of primary pupils sampled, which results in wider confidence intervals.

In the future, by incorporating NHS Test and Trace data, it would also be possible to look at previous positive PCR test results, which would help fill in data gaps where a participant does not have a full years’ worth of antibody test results.

Table 2: Comparison of other “ever positive” methods
England, 03 November 2020 to 6 July 2021 (Round 1 to Round 6)

School Type	Round 6 (adjusted)			Method 1			Method 2		
	% Positive	Lower 95% confidence interval	Upper 95% confidence interval	% Positive	Lower 95% confidence interval	Upper 95% confidence interval	% Positive	Lower 95% confidence interval	Upper 95% confidence interval
Primary	11.25%	8.93%	13.90%	15.30%	13.50%	17.24%	14.89%	12.67%	17.33%
Secondary	12.95%	11.62%	14.37%	17.29%	16.28%	18.33%	18.14%	16.85%	19.49%

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

Notes

1. Round 6 (14 June to 6 July 2021) figures have been adjusted to account for the sensitivity and specificity of the antibody test.
2. All estimates of positivity have been weighted and are representative of the ethnicity, gender and age for all pupils in the sampled local authorities.

More about coronavirus

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

5 . COVID-19 Schools Infection Survey data

[COVID-19 Schools Infection Survey estimate of pupils ever testing positive for antibodies](#)

Dataset | Released 27 October 20

Experimental statistics providing estimates of pupils ever testing positive for SARS-CoV-2 antibodies from the COVID-19 Schools Infection Survey across a sample of schools, within selected local authority areas in England.

6 . Collaboration

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UK Health
Security
Agency

The Coronavirus (COVID-19) Schools Infection Survey analysis was produced by the Office for National Statistics (ONS) in collaboration with our research partners at the London School of Hygiene and Tropical Medicine and UK Health Security Agency.

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

Statistical significance

A result is said to be statistically significant if it is likely not caused by chance or the variable nature of the samples. For more information, see our methodology page on [statistical uncertainty](#).

8 . Data sources and quality

Data presented in this bulletin are from the COVID-19 Schools Infection Survey (SIS). These findings are for SARS-CoV-2 antibodies for pupils only.

Estimates have been weighted and are representative of the ethnicity, gender, and age for all pupils in the sampled local authorities.

Our [methodology article](#) provides further information about response rates, survey design, how we process data and how data are analysed.

Reference period

Antibody testing was carried out in schools on the following dates:

- between 3 and 20 November 2020 (referred to as Round 1)
- between 30 November and 11 December 2020 (referred to as Round 2)
- between 15 and 31 March 2021 (referred to as Round 4)
- between 14 June and 6 July 2021 (referred to as Round 6)

Round 3 was due to take place in late January 2021. Testing within schools for this round was cancelled because of restricted attendance in schools during the national lockdown; however, home antibody tests were carried out for new participants who joined the study after Round 2 and for those who did not receive a valid test result from Rounds 1 or 2.

Quality

More quality and methodology information on strengths, limitations, appropriate uses, and how the data were created is available in our [methodology article](#).

Data cleaning and quality assurance is being carried out on data collected as part of the study on an ongoing basis. All estimates presented in this bulletin are provisional results and presented as experimental statistics while we seek feedback on the methods used. Estimates may therefore be revised in future publications.

Strengths and limitations

Please refer to the [strengths and limitations](#) section of the COVID-19 Schools Infection Survey, Round 2 bulletin.

9 . Related links

[COVID-19 Schools Infection Survey, England: Round 6, June 2021](#)

Bulletin | Released 11 August 2021

Initial estimates of staff and pupils testing positive for coronavirus (COVID-19) from the COVID-19 Schools Infection Survey across a sample of schools, within selected local authority areas in England. This Schools Infection Survey (SIS) is jointly led by the London School of Hygiene & Tropical Medicine, Public Health England and the Office for National Statistics.

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

Article | Updated fortnightly

Antibody and vaccination data by UK country and English regions from the Coronavirus (COVID-19) Infection Survey. This survey is being delivered in partnership with the University of Oxford, University of Manchester, Public Health England and Wellcome Trust.

[COVID-19 Schools Infection Survey, England: Round 6, pupil antibody data, June 2021](#)

Bulletin | Released 27 October 2021

Initial estimates of pupils testing positive for SARS-CoV-2 antibodies from the COVID-19 Schools Infection Survey across a sample of schools, within selected local authority areas in England. This Schools Infection Survey (SIS) is jointly led by the London School of Hygiene & Tropical Medicine, UK Health Security Agency and the Office for National Statistics.