Office for National Statistics

Article

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

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

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1 . Main points

All findings are for the period 11 November 2020 to 16 May 2021, when the the Alpha variant (B.1.1.7) was the most dominant variant.

- The impact of age on the probability of testing positive differed between England and each of the devolved administrations.
- The effect of living in more urbanised areas on the probability of testing positive was similar for England and each of the devolved administrations.
- In Wales, there was no evidence of an association between household size and the likelihood of testing positive; in England, however, people who lived in larger households were more likely to test positive.
- In Northern Ireland, those who lived in larger households were more likely to test positive, similar to that seen in England.
- In Scotland, positivity increased with household size to a greater extent for non-White individuals and to a lesser extent for White individuals; compared with England, where positivity increased with household size regardless of ethnicity.
- In Scotland, those who lived in a deprived area and a multigenerational household were more likely to test positive than those who did not live in a multigenerational household; compared with England, where positivity increased with deprivation regardless of household type.

2 . Overview

About this article

This technical article presents the methods and results of analysis to identify characteristics of people who are more likely to test positive for coronavirus (COVID-19) in Wales, Northern Ireland, and Scotland. It screens the different characteristics of people sampled in our Coronavirus (COVID-19) Infection Survey (CIS) who have and have not tested positive for COVID-19 and uses a statistical model to assign risk to each of these characteristics.

In this article, analysis is focused on data from 11 November 2020 to 16 May 2021. This provides a snapshot of characteristics associated with testing positive for COVID-19 during the time when the Alpha variant (B.1.1.7) was identified as the most dominant variant. As such, characteristics may not have the same association with testing positive in analyses of previous or future weeks.

This article contains the technical details of the methods used and the interpretation of results.

About this analysis

This analysis used SARS-CoV-2 real-time reverse transcriptase polymerase chain reaction test (RT-PCR) results from nose and throat swabs of participants from the Office for National Statistics (ONS) Coronavirus (COVID-19) Infection Survey (CIS). The CIS is a large household survey monitoring current COVID-19 infections within the population living in private households in the UK. Therefore, it excludes those living in hospitals, care homes and /or other communal establishments. Participants were asked about demographics, living environment, behaviours, work and vaccination uptake. Further information on the study design can be found in COVID-19 Infection Survey: methods and further information.

This analysis used a separate logistic regression model for Wales, Northern Ireland and Scotland. Each model involved a set of core variables and followed the same processes for each country. This was to consider each devolved administration in isolation, fitting a model to predict the likelihood of ever testing positive during the Alpha wave of the pandemic (11 November 2020 to 16 May 2021). The core variables included in each model were:

- sex
- ethnicity
- age
- whether the household was multigenerational
- household size
- deprivation percentile
- urban and rural classification of postcode

We then looked at the effect of interactions between each variable on the likelihood of ever testing positive. A backwards elimination technique was used with a significance threshold of 0.05, with only significant interactions retained. Models included in the analysis were fit separately for Wales, Northern Ireland and Scotland, and covered all survey participant ages (two years and over).

Because of smaller sample sizes in the devolved administrations, the survey has less power to identify the factors that are associated with positivity. That is, we are less likely to detect relationships, even when they existed. Therefore, for each devolved administration, the model specification was run using a sample combining the devolved administration data with England data to bolster the sample. This allowed us to leverage the additional sample size in England to better detect the effects of variables overall and to identify where there were differences in these effects between each devolved administration and England.

In addition to the core variables and retained interactions from the devolved administration-only model, we included interactions between an indicator variable for “country” and each of these variables. This meant that each model term was included as a unique predictor and as part of an interaction term with country. This allowed us to identify whether the relationship between variables and the likelihood of testing positive differed between the devolved administration and England by testing whether the coefficients produced by the country interaction were different from zero and statistically significant at a threshold of 0.05.

In general, where there was no evidence of an effect when the sample contained the devolved administration alone, we presented findings from where the model was run using the combined sample as this model had more power to detect relationships where they exist. We also presented findings when there was evidence of a difference between the devolved administration and England from the combined model.

Where a significant interaction effect was observed in the combined model, the results were presented as predicted probabilities of testing positive. This allowed us to show both overall differences between England and the devolved administrations and the effect of each characteristic within each country. These probabilities are calculated at the reference category of the other variables. The reference categories of the variables were:

- White for ethnicity
- male for sex
- not being in a multigenerational household
- single person household
- the median deprivation score
- rural town for the urban and rural classification

The main comparison was how the predicted probability of testing positive for COVID-19 varied for each variable within the devolved administration when compared with England.

Findings for Wales, Northern Ireland and Scotland are presented in the following sections. All the data from our findings can be found in the accompanying dataset.

3 . Findings from the Wales analysis

Figure 1 presents the findings for Wales, which are based on results from 24,461 individuals, and the findings for England, which are based on 369,370 individuals. The findings for both Wales and England are from 11 November 2020 to 16 May 2021.

Main findings

- In both Wales and England, living in an urban city or town increased the likelihood of testing positive when compared to those living in a rural village.
- In England, a larger household size had a higher likelihood of testing positive but there was no evidence of this affect in Wales.
- We found no evidence of an effect of sex or living in a multigenerational household on positivity in Wales or in England.

Figure 1: In both Wales and England, living in an urban city or town increased the likelihood of testing positive when compared to those living in a rural village

The likelihood of ever testing positive for coronavirus (COVID-19) on nose and throat swabs by characteristic, Wales, 11 November 2020 to 16 May 2021

Notes:

1. Deprivation is based on the Index of Multiple Deprivation (IMD) score or equivalent scoring method for the devolved administrations. The score ranges from 1, which represents most deprived, up to 100, which represents least deprived. The odds ratio shows how a 10 unit increase in deprivation score is associated with the likelihood of testing positive for COVID-19.
2. An odds ratio indicates the likelihood of an individual testing positive for COVID-19 given a particular characteristic or variable. When a characteristic or variable has an odds ratio of one, this means there is neither an increase nor a decrease in the likelihood of testing positive for COVID-19 compared with the reference category. An odds ratio greater than one indicates an increased likelihood of testing positive for COVID-19 compared with the reference category. An odds ratio less than one indicates a decreased likelihood of testing positive for COVID-19 compared with the reference category.
3. For this analysis there are no areas in Wales that are considered major urban areas.
4. For household size, the odds ratio shows how having an additional person in the household is associated with the likelihood of testing positive.

Download the data

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Figure 2 presents the predicted probability of ever testing positive for coronavirus (COVID-19) by age for Wales and England from 11 November 2020 to 16 May 2021.

In Wales, age did not effect the the probability of testing positive until around age 60 years, when the probability of testing positive decreased. In contrast, in England, younger ages were markedly more likely to test positive than those from older ages.

Figure 2: In Wales, age did not effect the the probability of testing positive until around age 60 years, when the probability of testing positive decreased

The likelihood of ever testing positive for coronavirus (COVID-19) on nose and throat swabs by single year of age, Wales and England, 11 November 2020 to 16 May 2021

Notes:

1. Probabilities are subject to uncertainty, given that a sample is only part of the wider population. The model provides 95% confidence intervals around the probabilities.

2. These data should be used to compare trends by age within each country, not to estimate predicted probabilities, as probabilities are for a reference category.

Download the data

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Figure 3 presents the predicted probability of ever testing positive for COVID-19 by household size for Wales and England from 11 November 2020 to 16 May 2021.

In Wales, there is no evidence that household size was associated with the likelihood of testing positive. In contrast, in England, larger household size increased the likelihood of testing positive – a different pattern to that seen in Wales.

Figure 3: In Wales, there is no evidence that household size was associated with the likelihood of testing positive, in contrast, in England, larger household size increased the likelihood of testing positive

The likelihood of ever testing positive for coronavirus (COVID-19) on nose and throat swabs by household size, Wales and England, 11 November 2020 to 16 May 2021

Notes:

1. Probabilities are subject to uncertainty, given that a sample is only part of the wider population. The model provides 95% confidence intervals around the probabilities.

2. These data should be used to compare trends by household size within each country, not to estimate predicted probabilities, as probabilities are for a reference category.

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4 . Findings from the Northern Ireland analysis

Figure 4 presents the findings for Northern Ireland, which are based on results from 12,781 individuals, and the findings for England, which are based on 369,370 individuals. The findings for both Northern Ireland and England are from 11 November 2020 to 16 May 2021.

Main findings

- In Northern Ireland, those who lived in larger households were more likely to test positive, a similar relationship to that seen in England.
- In both Northern Ireland and England, living in an urban city or town, or rural town increased the likelihood of testing positive for coronavirus, when compared to those living in rural villages.
- Non-White individuals were more likely to test positive in England, but not in Northern Ireland.
- Individuals living in less deprived areas in England had a decreased risk of testing positive, but not in Northern Ireland.
- We found no evidence of an effect of sex or living in a multigenerational household on positivity in Northern Ireland or in England.

Figure 4: In Northern Ireland and England, those who lived in larger households were more likely to test positive and those in rural villages were less likely to test positive

The likelihood of ever testing positive for coronavirus (COVID-19) on nose and throat swabs by characteristic, Northern Ireland, 11 November 2020 to 16 May 2021

Notes:

1. Deprivation is based on the Index of Multiple Deprivation (IMD) score or equivalent scoring method for the devolved administrations. The score ranges from 1 which represents most deprived up to 100 which represents least deprived. The odds ratio shows how a 10 unit increase in deprivation score is associated with the likelihood of testing positive for COVID-19.
2. An odds ratio indicates the likelihood of an individual testing positive for COVID-19 given a particular characteristic or variable. When a characteristic or variable has an odds ratio of one, this means there is neither an increase nor a decrease in the likelihood of testing positive for COVID-19 compared with the reference category. An odds ratio greater than one indicates an increased likelihood of testing positive for COVID-19 compared with the reference category. An odds ratio less than one indicates a decreased likelihood of testing positive for COVID-19 compared with the reference category.
3. For household size, the odds ratio shows how having an additional person in the household is associated with the likelihood of testing positive.

Download the data

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Figure 5 presents the predicted probability of ever testing positive for coronavirus (COVID-19) by age for Northern Ireland and England from 11 November 2020 to 16 May 2021.

In Northern Ireland the likelihood of testing positive appeared to increase until mid-adulthood (around early 40s) and then decreased in older ages, however, confidence intervals are wide so trends should be interpreted with caution. This contrasts to England where younger ages were markedly more likely to test positive than those from older ages.

Figure 5: In Northern Ireland, the likelihood of testing positive appeared to increase until mid-adulthood and decreased among older ages, whereas in England younger ages were more likely to test positive than older ages

The likelihood of ever testing positive for coronavirus (COVID-19) on nose and throat swabs by single year of age, Northern Ireland and England, 11 November 2020 to 16 May 2021

Notes:

1. Probabilities are subject to uncertainty, given that a sample is only part of the wider population. The model provides 95% confidence intervals around the probabilities.

2. These data should be used to compare trends by age within each country, not to estimate predicted probabilities, as probabilities are for a reference category.

Download the data

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5 . Findings from the Scotland analysis

Figure 6 presents the findings for Scotland, which are based on results from 34,863 individuals, and the findings for England, which are based on 369,370 individuals. The findings for both Scotland and England are from 11 November 2020 to 16 May 2021.

Main findings

- In both Scotland and England, living in a major urban area, urban city or town, or rural town increased the likelihood of testing positive for coronavirus, when compared to those living in rural villages.

- There was no evidence of an effect of sex on positivity in Scotland or in England.

Figure 6: In Scotland and England, living in more urban areas increased the likelihood of testing positive

The likelihood of ever testing positive for coronavirus (COVID-19) on nose and throat swabs by characteristic, Scotland, 11 November 2020 to 16 May 2021

Notes:

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

2. We have not presented the main effects for: household size, ethnicity, multigenerational household and deprivation for Scotland. This is because the effect of household size varies by ethnicity and the effect of multigenerational household varies by deprivation. These interactions are explored in other charts.

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Figure 7 presents the predicted probability of ever testing positive for coronavirus (COVID-19) by age for Scotland and England from 11 November 2020 to 16 May 2021.

In Scotland, the risk of testing positive appeared to increase until mid-adulthood (around early 40s) and decreased thereafter. In contrast, in England, younger ages were markedly more likely to test positive than those from older ages.

Figure 7: In Scotland, the likelihood of testing positive increased until mid-adulthood and decreased thereafter, in contrast to England where younger ages were more likely to test positive than older ages

The likelihood of ever testing positive for coronavirus (COVID-19) on nose and throat swabs by single year of age, Scotland and England, 11 November 2020 to 16 May 2021

Notes:

1. Probabilities are subject to uncertainty, given that a sample is only part of the wider population. The model provides 95% confidence intervals around the probabilities.

2. These data should be used to compare trends by age within each country, not to estimate predicted probabilities, as probabilities are for a reference category.

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Figure 8 presents the predicted probability of ever testing positive for COVID-19 by household size and ethnicity for Scotland and England from 11 November 2020 to 16 May 2021.

The effect of household size varied by ethnicity in Scotland. In England, both White and non-White individuals in larger households had a higher likelihood of testing positive. In Scotland, household size was associated with an increased likelihood of testing positive to a greater extent for non-White individuals compared with England. White individuals in Scotland were equally as likely to test positive regardless of household size, compared with White individuals in England.

Figure 8: In Scotland, positivity increased with household size to a greater extent for non-White individuals compared withEngland

The likelihood of ever testing positive for coronavirus (COVID-19) on nose and throat swabs by household size and ethnicity, Scotland and England, 11 November 2020 to 16 May 2021

Notes:

1. Probabilities are subject to uncertainty, given that a sample is only part of the wider population. The model provides 95% confidence intervals around the probabilities.

2. These data should be used to compare trends by household size and ethnicity within each country, not to estimate predicted probabilities, as probabilities are for a reference category.

Download the data

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Figure 9 presents the predicted probability of ever testing positive for COVID-19 by deprivation and multigenerational household status for Scotland and England from 11 November 2020 to 16 May 2021.

In Scotland, higher deprivation was associated with increased likelihood of testing positive to a greater extent for those in a multigenerational household, and to a lesser extent for non-multigenerational households, compared with England. In England, higher deprivation was associated with increased likelihood of testing positive regardless of whether an individual lives in a multigenerational household.

Figure 9: In Scotland, those with higher deprivation living in multigenerational households had an increased likelihood of testing positive than those in non-multigenerational households, compared with England

The likelihood of ever testing positive for coronavirus (COVID-19) on nose and throat swabs by deprivation and multigenerational household, Scotland and England, 11 November 2020 to 16 May 2021

Notes:

1. Probabilities are subject to uncertainty, given that a sample is only part of the wider population. The model provides 95% confidence intervals around the probabilities.
2. These data should be used to compare trends by deprivation and multigenerational household within each country, not to estimate predicted probabilities, as probabilities are for a reference category.
3. Because of the way the deprivation measure has been constructed, a higher deprivation score implies lower deprivation.

Download the data

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6 . Coronavirus (COVID-19) Infection Survey data

The predictors of positivity across countries of the UK: technical data from the Coronavirus (COVID-19) Infection Survey Dataset | Released 28 October 2021 Technical data from the Coronavirus (COVID-19) Infection Survey on the predictors of positivity across countries of the UK.

7 . Collaboration

This 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. Of particular note are:

University of Oxford – Sarah Walker

8 . 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.

Odds ratio

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

Deprivation

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

Multigenerational household

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

9 . Measuring the data

Our methodology article provides further information around the survey design and how we process data.

10 . Strengths and limitations

More information on the strengths and limitations of the data, data uses and users is available in the Coronavirus (COVID-19) Infection Survey QMI and the Coronavirus (COVID-19) Infection Survey statistical bulletin.

11 . Related links

Coronavirus (COVID-19) Infection Survey, UK
Bulletin | Updated weekly
Estimates for England, Wales, Northern Ireland and Scotland. This survey is being delivered in partnership with the University of Oxford, University of Manchester, Public Health England and Wellcome Trust.

Coronavirus (COVID-19) Infection Survey: characteristics of people testing positive for COVID-19 in England
Bulletin | Updated fortnightly
Characteristics of people testing positive for COVID-19 from the Coronavirus (COVID-19) Infection Survey, including antibody data by UK country, and region and occupation for England. Antibodies data published before 3 February 2021 are available in this series.

Coronavirus (COVID-19) Infection Survey: antibody and vaccination data for the UK
Bulletin | 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 Infection Survey: methods and further information
Methodology article | Updated 24 August 2021
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) Infection Survey QMI
QMI | Released 16 July 2021
Quality and Methodology Information for the Coronavirus (COVID-19) Infection Survey (CIS), detailing the strengths and limitations of the data, methods used, and data and users.

Coronavirus (COVID-19) Infection Survey technical article: waves and lags of COVID-19 in England, June 2021
Technical article | Released 29 June 2021
Data about the waves and lags of coronavirus from the Coronavirus (COVID-19) Infection Survey. This analysis has been produced in partnership with the University of Oxford.

Coronavirus (COVID-19) Infection Survey technical article: analysis of reinfections of COVID-19: June 2021
Technical article | Released 29 June 2021
Data about reinfections from the Coronavirus (COVID-19) Infection Survey. This analysis has been produced in partnership with the University of Oxford.

Coronavirus (COVID-19) Infection Survey technical article: analysis of positivity after vaccination
Technical article | Released 17 June 2021 Data about positivity after vaccination from the Coronavirus (COVID-19) Infection Survey. This analysis has been produced in partnership with the University of Oxford.

Coronavirus (COVID-19) Infection Survey: characteristics of people testing positive for COVID-19 in England
Article | Released 20 May 2021
Characteristics of people testing positive for COVID-19 from the Coronavirus (COVID-19) Infection Survey, including antibody data by UK country, and region and occupation for England. Antibodies data published before 3 February 2021 are available in this series.

Coronavirus (COVID-19) Infection Survey technical article: impact of vaccination on testing positive in the UK: October 2021
Technical article | Released 18 October 2021
The reduction in risk of testing positive for COVID-19 associated with vaccination overall and by different vaccine types using data from the Coronavirus (COVID-19) Infection Survey. Two time periods were analysed; when the Alpha variant was dominant in the UK (1 December 2020 to 16 May 2021), and when the Delta variant was dominant (17 May to 14 August 2021).