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Coronavirus (COVID-19): Analysis

Coronavirus (COVID-19): modelling the epidemic in Scotland (Issue No. 82)

Background

This is a report on the Scottish Government modelling of the spread and level of Covid-19 in Scotland. This updates the previous publication on modelling of Covid-19 in Scotland published on 10th December 2021. The estimates in this document help the Scottish Government, the health service and the wider public sector plan and put into place what is needed to keep us safe and treat people who have the virus.

This edition of the research findings focuses on the epidemic as a whole, looking at estimates of R, growth rate and incidence as well as local measures of change in the epidemic. It looks at both the impact of the Delta and Omicron variants. We will update on a weekly basis as we know more about the Omicron variant.

Key Points

Based on at point when the Delta variant made up the majority of cases

- The reproduction rate R in Scotland is currently estimated as being between 0.9 and 1.1, as of 30th November. This is unchanged since last week.
- The number of new daily infections for Scotland is estimated as being between 96 and 128 as at 30th November, per 100,000 people.
- The growth rate for Scotland is currently estimated as between -2% and 2% as at 30th November. The lower and upper limits have increased since last week.
- This report normally contains three elements: UKSHA consensus, Scottish Government projections and SPI-M projections. Due to uncertainty surrounding the Omicron variant and its increasing prevalence across the UK, SPI-M has been unable to produce consensus medium-term projections for hospital admissions and deaths this week.

- Modelled rates of positive tests per 100K using data to 13th December indicate that, for the week commencing 26th December 2021, 29 of the 32 local authorities are expected to exceed 50 cases per 100K with at least 75% probability. The exceptions are Na h-Eileanan Siar, Orkney Islands and Shetland Islands. These 29 local authorities are also expected to exceed 100 cases per 100K with at least 75% probability. Twelve local authorities are expected to exceed 300 cases per 100K with at least 75% probability. Only one local authority, East Ayrshire, is expected to exceed 500 cases per 100K with at least 75% probability. These models are based on a projection where the Delta variant makes up the majority of cases. Therefore it is likely that due to the Omicron variant, these are likely to be an underestimate.
- Modelling of long Covid estimates that on 2nd January 2022 between 1.5% and 3.2% of the population are projected to self-classify with long Covid for 12 weeks or more after their first suspected Covid infection in Scotland. The upper limit of the estimate of the proportion of the population with long Covid is higher than last week.
- Nationwide, wastewater Covid-19 RNA levels have shown a decrease of around 21% from the elevated levels seen in the last two weeks. The week ending 14th December saw levels of around 58 million gene copies per person per day (Mgc/p/d), down from around 74 Mgc/p/d in the previous week. It should be noted that this decrease is in the context of decreasing Delta variant and increasing Omicron variant.

Based on the Omicron variant

- Infections are rising and the number of infections are expected to continue to rise in the coming weeks as Omicron becomes more dominant. In three weeks' time we estimate that daily infections may be between 15,000 and 130,000.
- Using data to 14th December, we can estimate a doubling time for Scotland of between 2.36 – 2.48 days using S-gene target failure as a proxy for Omicron cases.
- Given this doubling time, it is likely that only a small percentage of infections will be of the Delta variant by January 2022.

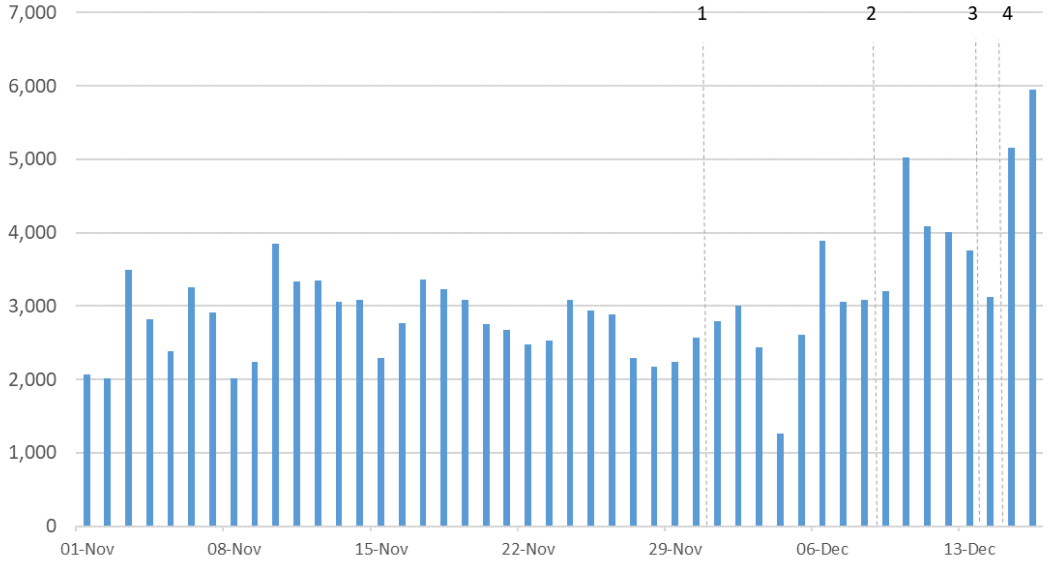
Other modelling

- Average contacts from the most recent Panel B cohort of the Scottish Contact Survey (week ending 8th December) indicate an average of 4.8 contacts.
- Mean contacts within the other setting (contacts outside home, school and work) have increased by 14% whereas work contacts have decreased by 12% in the last two weeks. Contacts within the home have remained at a similar level over the same period.
- Those aged 60 and over have increased their contacts within the last week with the majority of their contacts taking place within the other setting (contacts outside home, school and work). All remaining groups have reduced or have maintained a similar level of contacts over the same period.
- The highest interactions are reported between those 70 and over with each other. The biggest decrease in interactions is between the those under 18 with individuals within the 18-29 age group in the last two weeks.
- Visits to another's home decreased from approximately 49% to 45% and attending an outside event decreased from 71% to 68% in the last two weeks.
- Approximately 63% of individuals have taken at least one lateral flow test within the last 7 days for the survey pertaining to the 2nd – 8th December.
- The youngest and oldest age groups (18-29 and 70+) have reported the lowest proportions of individuals who have taken one or more lateral flows, with at most 54% taken at least one. In contrast, those aged between 30-59 report the highest proportion of individuals taking at least one lateral flow test within the last 7 days, with at least 70% taken at least one.

Recent cases

Figure 1 shows the number of Covid-19 cases reported in Scotland between November and December 2021. The vertical dashed lines indicate the cut off points for each of the modelling inputs; after these dates, the number of cases is not incorporated into the outputs.

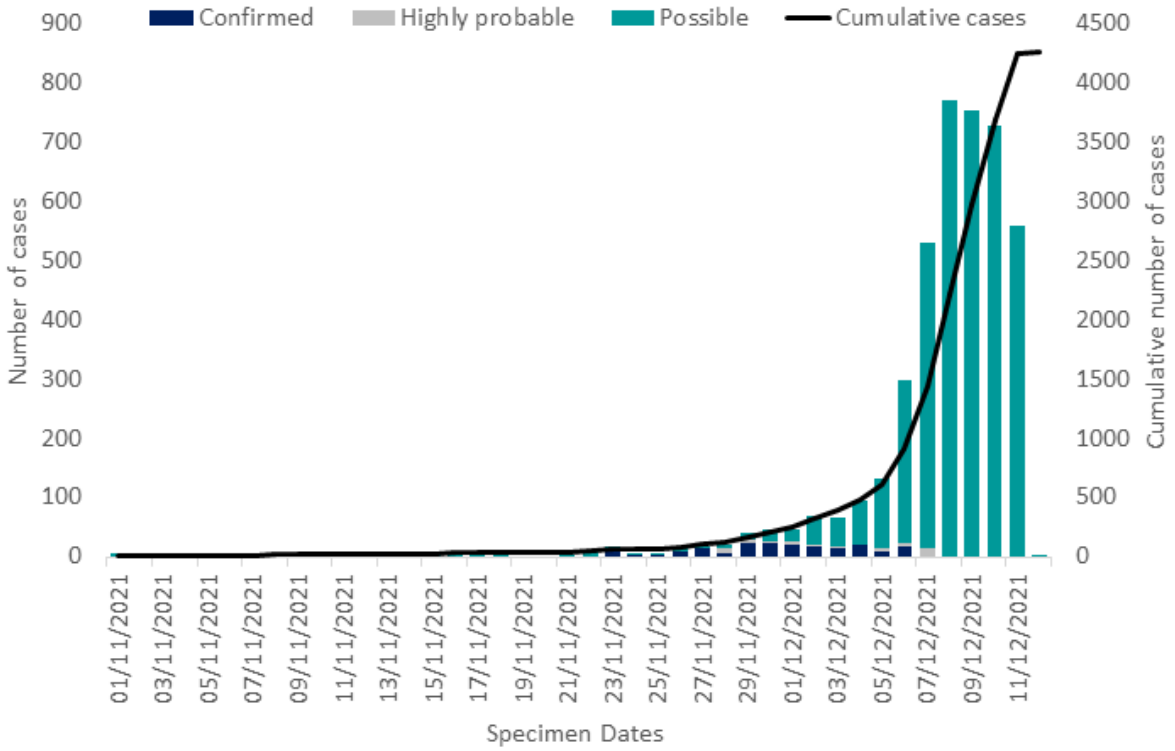
Figure 1: Cases reported in Scotland to 16th December 2021



R, growth rate and incidence are as of 30th November (dashed line 1). The Scottish Contact Survey uses data to 8th December (dashed line 2). The Scottish Government modelling of infections, hospitalisations and ICU beds, the long Covid analysis, and the modelled rates of positive tests per 100K use data to 13th December (dashed line 3). Wastewater analysis used data to 14th December (dashed line 4).

Figure 2 shows the number of confirmed Omicron cases and those cases that are under investigation. Note that data for 9th -12th December is lagged due to specimen processing times and these will be undercounted.

Figure 2: Confirmed Omicron variants and cases under investigation in Scotland, data to 12th December by specimen date[1]



Source: Public Health Scotland COVID-19 & Winter Statistical Report

Overview of Scottish Government Modelling

Modelling outputs are provided here on the current epidemic in Scotland as a whole, based on a range of methods. Because it takes a little over three weeks on average for a person who catches Covid-19 to show symptoms, become sick, and either die or recover, there is a time lag in what our model can tell us about any change in the epidemic, e.g. any impact of the Omicron variant. Therefore a new section has been included covering what we know of this variant.

The first section of this report covers a range of modelling from a point when the Delta variant made up the majority of cases:

- The UK Health Security Agency (UKHSA) consensus is shown, which uses a range of data in its estimates of R and the growth rate.

[1] The modelling in this report uses S-gene test data to 13th December only for medium term projections, and to 14th December for Omicron doubling times.

The second section of this report covers Omicron:

- Looking at estimates of the doubling time of this variant, using the data available for Scotland.
- It also projects this forward into the future to estimate the proportion of Omicron cases in the coming weeks.
- The logistical model has been updated to incorporate both Delta and Omicron. The results are split down by age group, and the model is used to give a projection of the number of people that will be infected.

We also include in this report other modelling:

- The Scottish Contact Survey (SCS) is used to inform a modelling technique based on the number of contacts between people. Over time, a greater proportion of the population will be vaccinated. This is likely to impact contact patterns and will become a greater part of the analysis going forwards.
- We also report on levels of Covid-19 RNA in wastewater around Scotland and compare it to the 7-day average daily new cases.

What the modelling tells us about the epidemic at a point in time when Delta made up the majority of cases

The R value and growth rates are estimated by several independent modelling groups based in universities and the UKHSA. Estimates are considered, discussed and combined at the Epidemiology Modelling Review Group (EMRG), which sits within the UKHSA. These are based on data to 13th December.

UKHSA's consensus view across these methods, was that the value of R as at 30th November[2] in Scotland was between 0.9 and 1.1 (see Figure 3)[3].

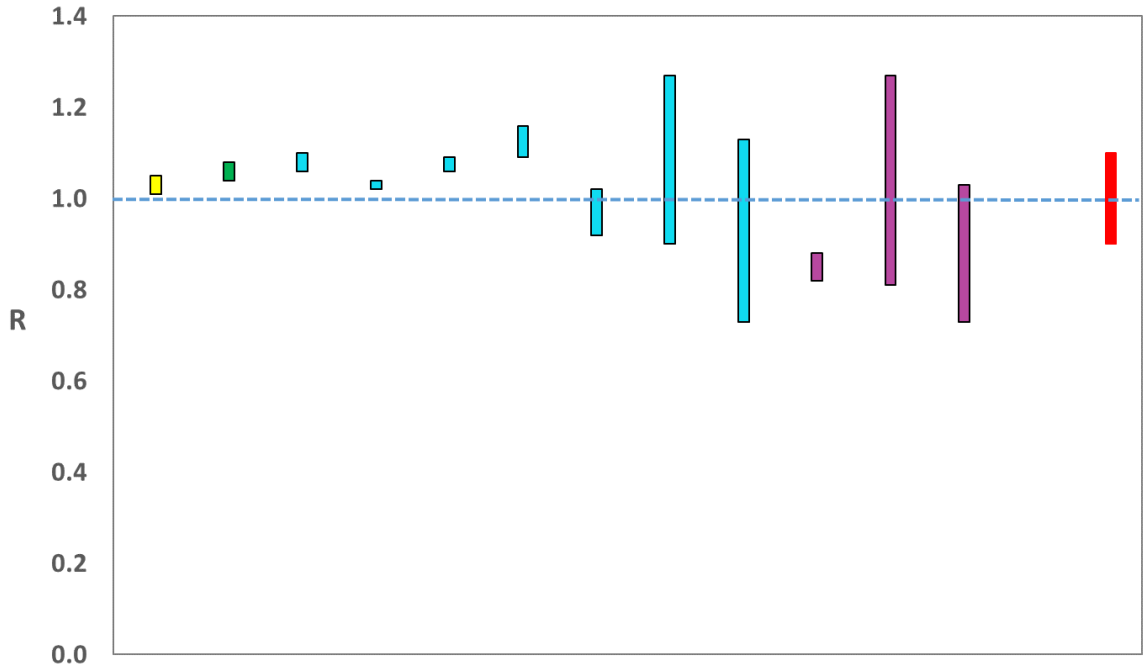
R is an indicator that lags by two to three weeks and therefore should not be expected to reflect recent fluctuations.

[2] Using data to 13th December 2021.

[3] Particular care should be taken when interpreting this estimate as it is based on low numbers of cases, hospitalisations, or deaths and / or dominated by clustered outbreaks. It should not be treated as robust enough to inform policy decisions alone.

This week the Scottish Government presented two outputs to EMRG. The first uses confirmed cases, as published by Public Health Scotland (PHS), and deaths from National Records Scotland (NRS). The second uses instead wastewater data to estimate the number of cases, and deaths from NRS. Both outputs are shown in Figures 3 and 4.

Figure 3. Estimates of R_t for Scotland, as of 30th November, including 90% confidence intervals, produced by EMRG[4].

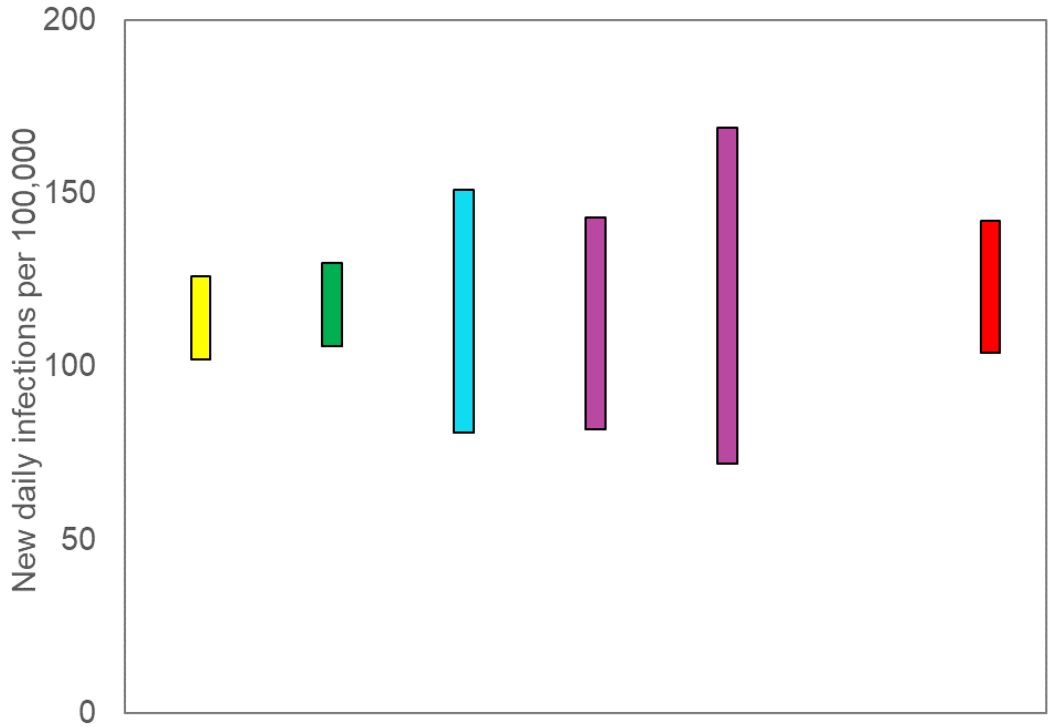


Source: EMRG

The various groups which report to the EMRG use different sources of data in their models to produce estimates of incidence (Figure 4). UKHSA's consensus view across these methods, as at 30th November, was that the incidence of new daily infections in Scotland was between 96 and 128 new infections per 100,000. This equates to between 5,200 and 7,000 people becoming infected each day in Scotland.

[4] The cyan bars use Covid-19 test data and purple bars use multiple sources of data. The estimates produced by the Scottish Government are the two on the left. (Yellow uses confirmed cases from PHS and deaths from NRS; green uses wastewater data).The UKHSA consensus range is the right-most (red). Data to 13th December. R, incidence and growth rate as of 30th November.

Figure 4. Estimates of incidence for Scotland, as at 30th November, including 90% confidence intervals, produced by EMRG[4].



Source: EMRG

The consensus from UKHSA for this week is that the growth rate in Scotland is between -2% and 2% per day as at 30th November. The lower and upper limits have increased since last week.

What we know about which local authorities are likely to experience high levels of Covid-19 in two weeks' time

We continue to use modelling based on Covid-19 cases and deaths using data to 13th December from several academic groups to give us an indication of whether a local authority is likely to experience high levels of Covid-19 in the future. This has been compiled via UKHSA into a consensus. In this an area is defined as a hotspot if the two week prediction of cases (positive tests) per 100K population is predicted to exceed a threshold, e.g. 500 cases.

There is uncertainty in regions with smaller populations, and hence lower test counts, in particular in regions such as Na h-Eileanan Siar, Orkney Islands and Shetland Islands. Models have varying degrees of responsiveness to sudden changes in case trends, therefore there is an

increased level of uncertainty in local authorities in which there have been recent sharp increases in case numbers.

Modelled rates of positive tests per 100K using data to 13th December (Figure 5) indicate that, for the week commencing 26th December 2021, 29 of the 32 local authorities are expected to exceed 50 cases per 100K with at least 75% probability. The exceptions are Na h-Eileanan Siar, Orkney Islands and Shetland Islands.

These 29 local authorities are also expected to exceed 100 cases per 100K with at least 75% probability.

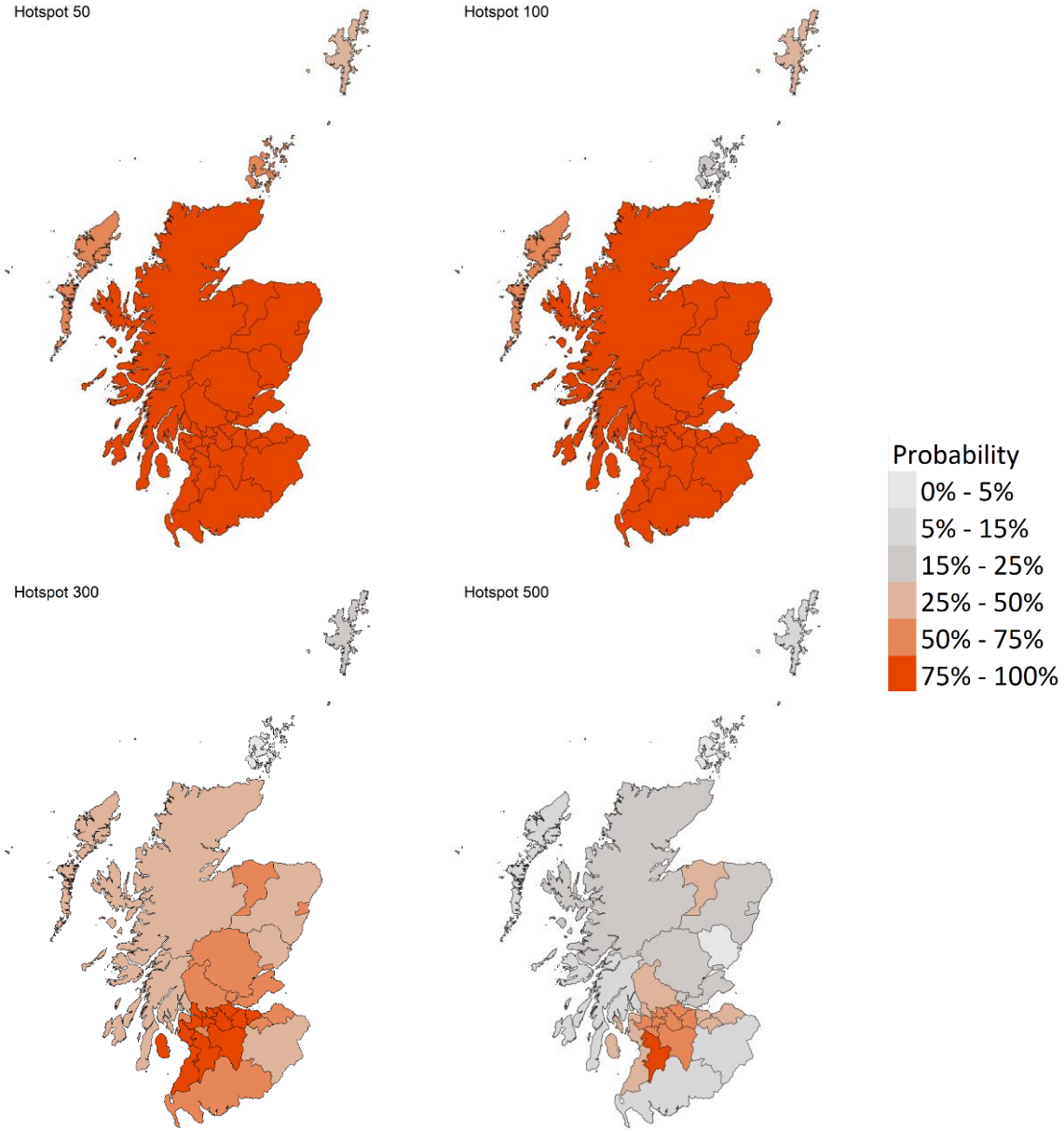
Twelve local authorities are expected to exceed 300 cases per 100K with at least 75% probability. These are Edinburgh, East Ayrshire, East Dunbartonshire, Falkirk, Glasgow, North Ayrshire, North Lanarkshire, Renfrewshire, South Ayrshire, South Lanarkshire, West Dunbartonshire and West Lothian.

Only one local authority, East Ayrshire, is expected to exceed 500 cases per 100K with at least 75% probability[5].

These models are based on a projection where the Delta variant makes up the majority of cases. Therefore it is likely that due to the Omicron variant, these are likely to be an underestimate.

[5] Values are included in Table 1 in the Technical Annex.

Figure 5. Probability of local authority areas exceeding thresholds of cases per 100K (26th December 2021 to 1st January 2022), data to 13th December.



What the modelling tells us about projections of hospitalisations and deaths in the medium term

Due to uncertainty surrounding the Omicron variant and its increasing prevalence across the UK, SPI-M-O has been unable to produce consensus medium-term projections for hospital admissions and deaths this week. The delay between infection, developing symptoms, the need for hospital care and death means the epidemiological data cannot fully reflect the recent rapid increase of the Omicron variant. SPI-M-O hopes

to produce medium-term projections again in the near future when the impact of Omicron is better reflected in the epidemiological data.

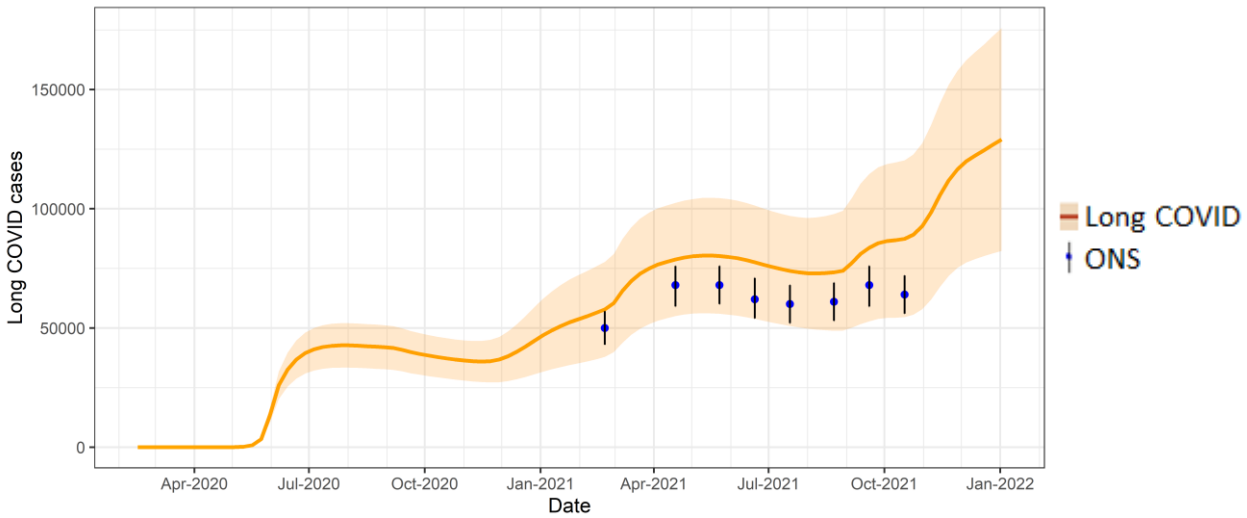
What estimates do we have of the number of people experiencing long Covid symptoms?

The Scottish Government is modelling the number of people likely to experience long Covid symptoms. This gives a projection of estimated self-reported long Covid rates in the future, based on Scottish Government medium term projection modelling, as set out in Figure 9.

This modelling estimates that at 2nd January 2022 between 82,000 (1.5% of the population) and 176,000 (3.2%) people are projected to self-classify with long Covid for 12 weeks or more after their first suspected Covid infection in Scotland. The upper limit of the estimate of the proportion of the population with long Covid is higher than last week.

These are preliminary results, further data on rates of long Covid and associated syndromes as research emerges are required.

Figure 6. Estimates of self-classified long Covid prevalence at 12 weeks from 16th February 2020 to 2nd January 2022 (showing 90% confidence interval). ONS estimates of self-reported long Covid with range also shown.



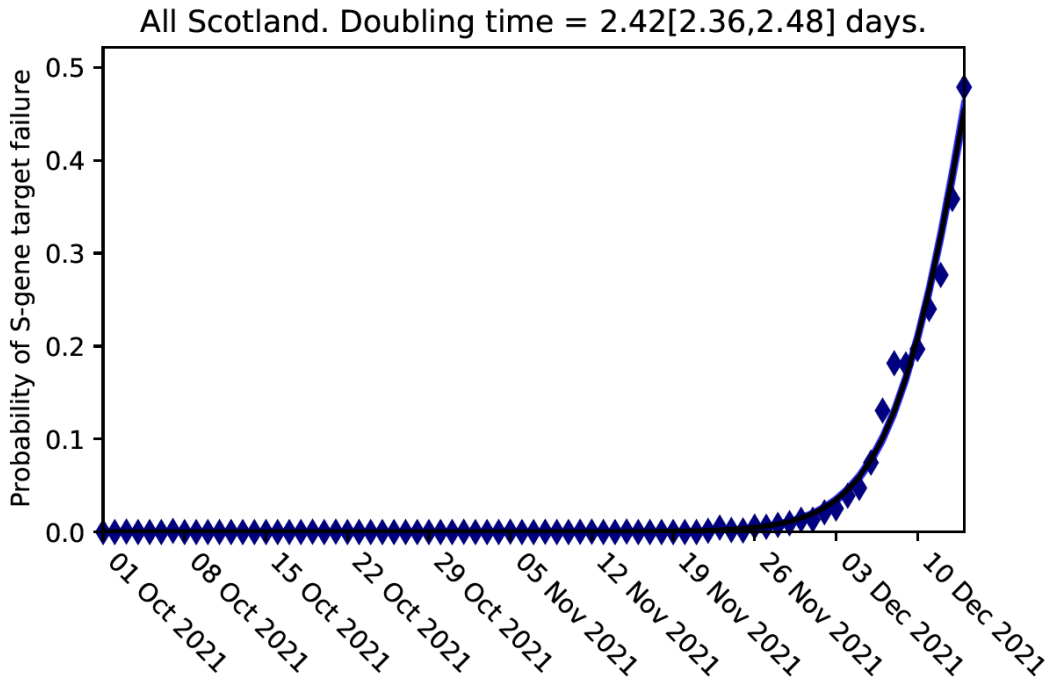
See the Technical Annex in issue 73 for information about the methodology.

What we know about the Omicron variant

As of 12th December 2021, a total of 4,252 cases have been reported, of which 186 (4.4%) were confirmed, 56 (1.3%) were highly probable and 4,010 (94.3%) were possible. Total cases are more than ten-fold higher than on 5th December, when there were 389[6].

Based on data to 14th December, we can estimate a doubling time for Scotland of between 2.36 – 2.48 days using S-gene target failure as a proxy for Omicron cases. We will continue to monitor the doubling times which may fluctuate or change over future days.

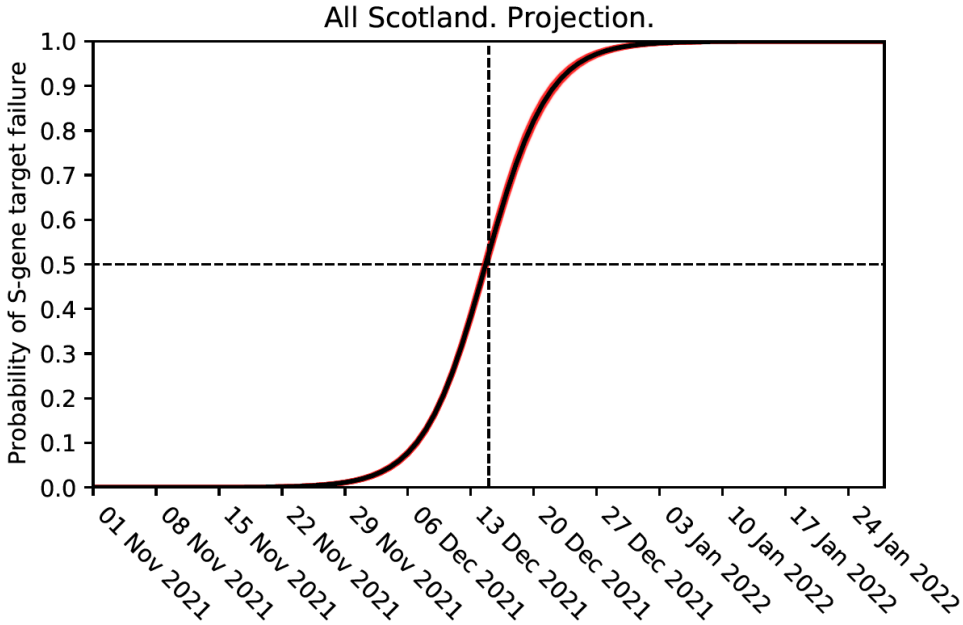
Figure 7: Estimated proportion of Omicron cases in Scotland based on S-gene target failure, data to 14th December



This curve is projected to estimate the proportion of Omicron cases in future weeks in Scotland.

[6] Public Health Scotland COVID-19 & Winter Statistical Report

Figure 8: Estimate of the proportion of Omicron cases in Scotland in the coming weeks



See the Technical Annex for information about the methodology.

What the modelling tells us about estimated infections

The Scottish Government assesses the impact of Covid-19 on the NHS in the next few weeks, in this research findings we focus on estimating the number of infections. Figures 9-11 show three projections over the three weeks to 2nd January, broken down by possible Omicron infections, Delta infections, and combined infections. We hope to be able to provide hospitalisation and ICU in future weeks which account for the Omicron variant as well as Delta.

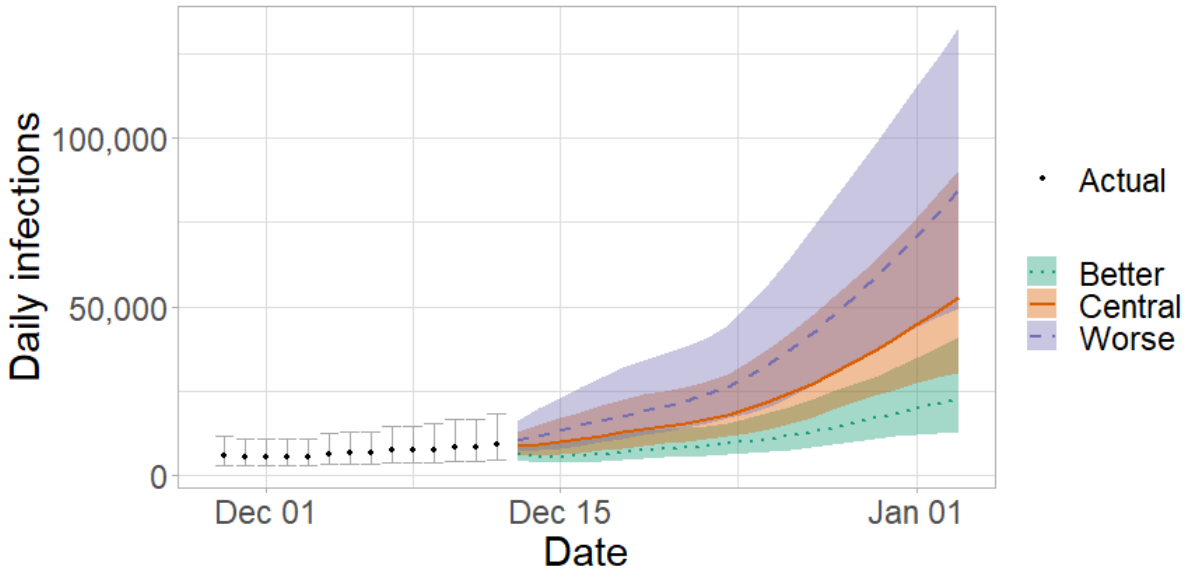
These projections include the effect of the new interventions announced on 14th December. 'Central' assumes a continuation of the current trend for Delta, and that Omicron is around three times more transmissible. 'Worse' assumes a higher transmissibility for both Delta and Omicron. 'Better' assumes a lower transmissibility for both variants. All projections also assume a lower vaccine effectiveness[7] for Omicron than for Delta[8].

[7] See Figure 6 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1041593/Vaccine-surveillance-report-week-50.pdf

[8] All projections are based on current vaccine roll-out plans and efficacy assumptions. Data to 13th December.

Delta infections are likely to fall over time, but those still being infected and already infected will still contribute to the numbers of people in hospital and ICU. Meanwhile the increase which we see in Omicron infections will continue. At the present time, due to the lag between infections and hospitalisations, only infections figures are provided in Figures 9-11. We hope to be able to provide hospital occupancy and ICU in future weeks.

Figure 9. Medium term projections of modelled total new combined daily infections in Scotland, adjusting positive tests[9] to account for asymptomatic and undetected infections, from Scottish Government modelling, based on positive test data reported up to 13th December



[9] The actual positive tests are adjusted to coincide with the estimated day of infection.

Figure 10. Medium term projections of modelled total new Delta daily infections in Scotland, adjusting positive tests to account for asymptomatic and undetected infections, from Scottish Government modelling, based on S-gene positive data reported up to 13th December

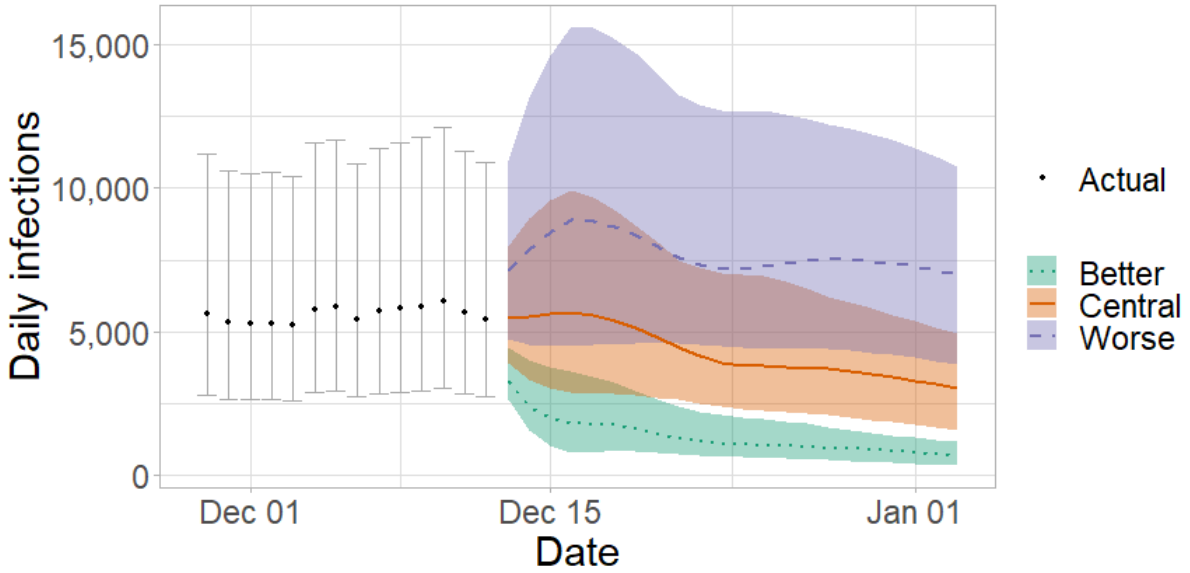
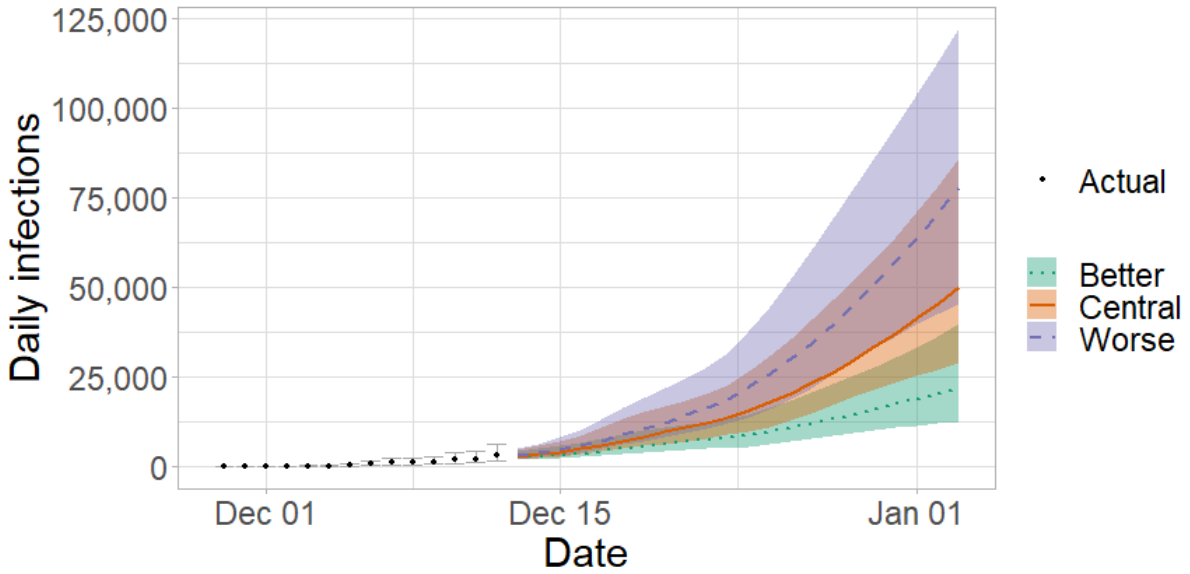


Figure 11. Medium term projections of modelled total new Omicron daily infections in Scotland, adjusting positive tests to account for asymptomatic and undetected infections, from Scottish Government modelling, based on S-gene negative data reported up to 13th December



The methodology for estimating projections is included in the Technical Annex.

Other modelling

This section covers some modelling outputs for which the methodology is not affected by which variant is dominant.

What we know about how people's contact patterns have changed

Average contacts from the most recent Panel B cohort of the Scottish Contact Survey (week ending 8th December) indicate an average of 4.8 contacts. This has decreased by 8% compared to the previous Panel B of the survey (week ending 24th November), as seen in Figure 12.

Mean contacts within the other setting (contacts outside home, school and work) have increased by 14% whereas work contacts have decreased by 12% in the last two weeks. Contacts within the home have remained at a similar level over the same period.

Figure 12: Mean Adult Contacts (truncated at 100) from SCS.

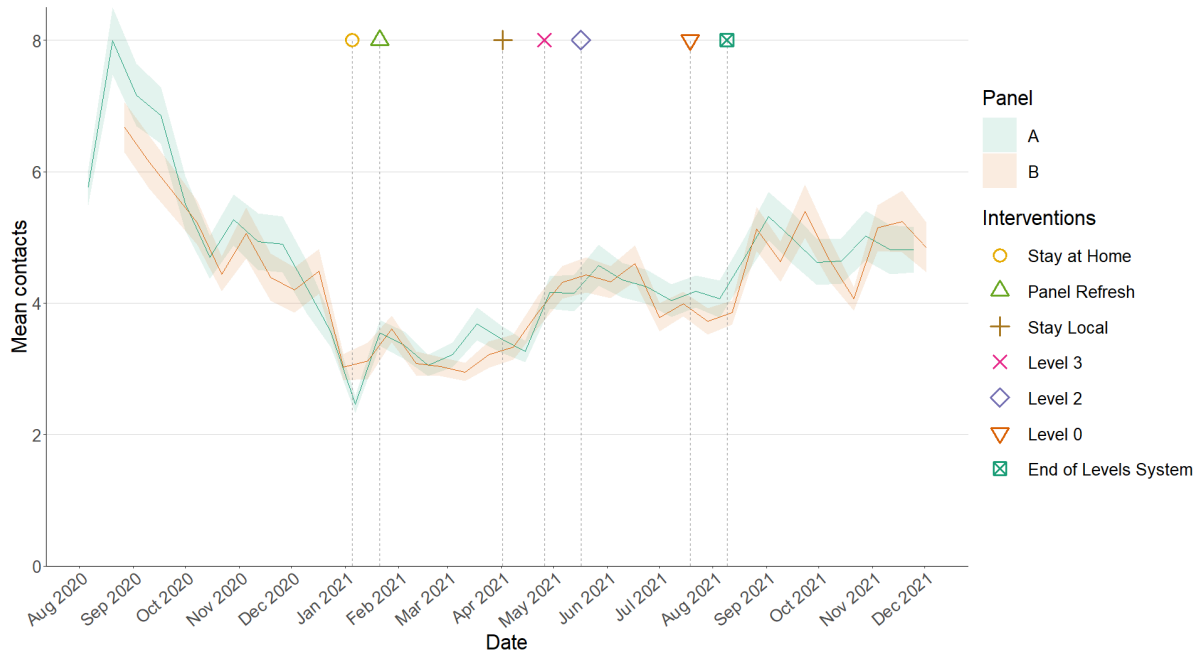
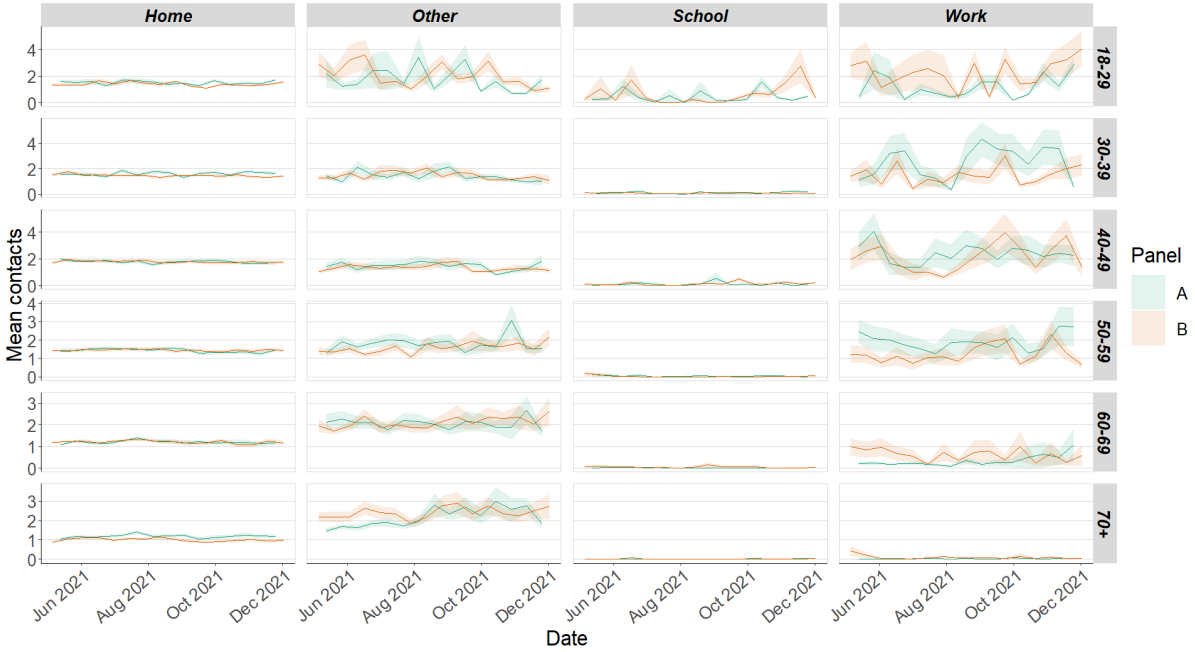


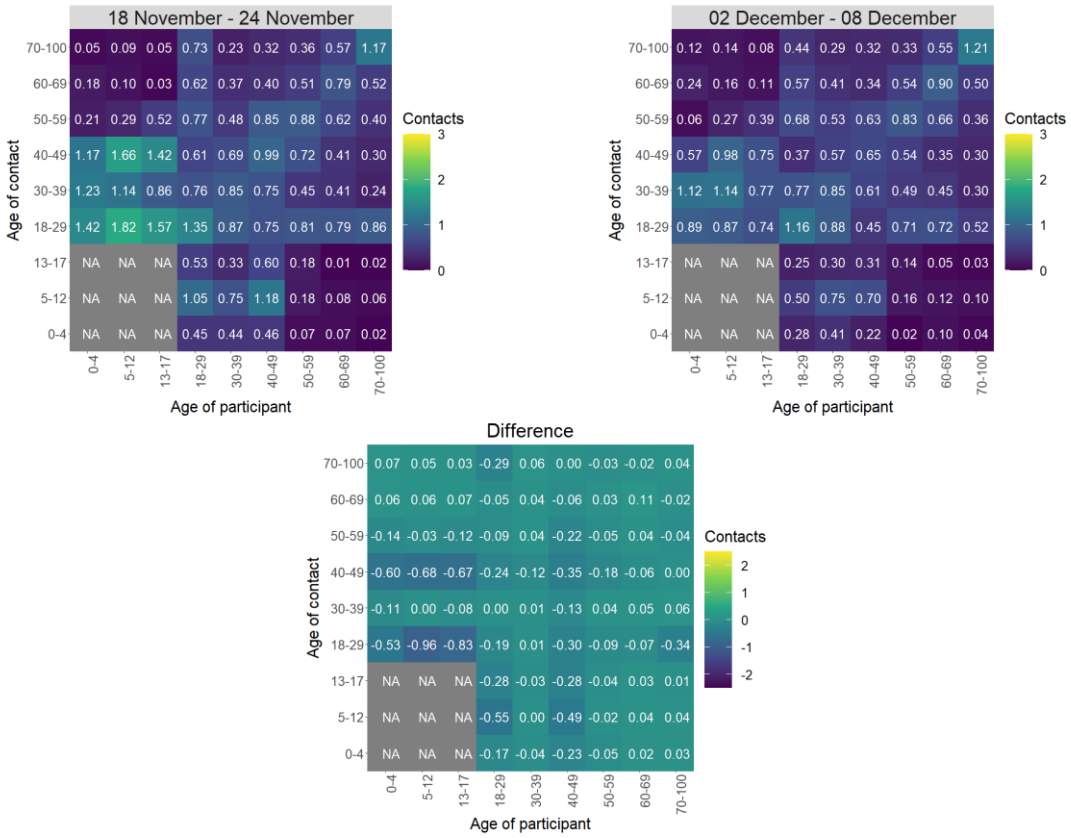
Figure 13 shows how contacts change across age group and setting. Those aged 60 and over have increased their contacts within the last week with the majority of their contacts taking place within the other setting (contacts outside home, school and work). All remaining groups have reduced or have maintained a similar level of contacts over the same period.

Figure 13: Average (mean) contacts for each panel per day by setting for adults in Scotland, truncated to 100 contacts per participant (from SCS).



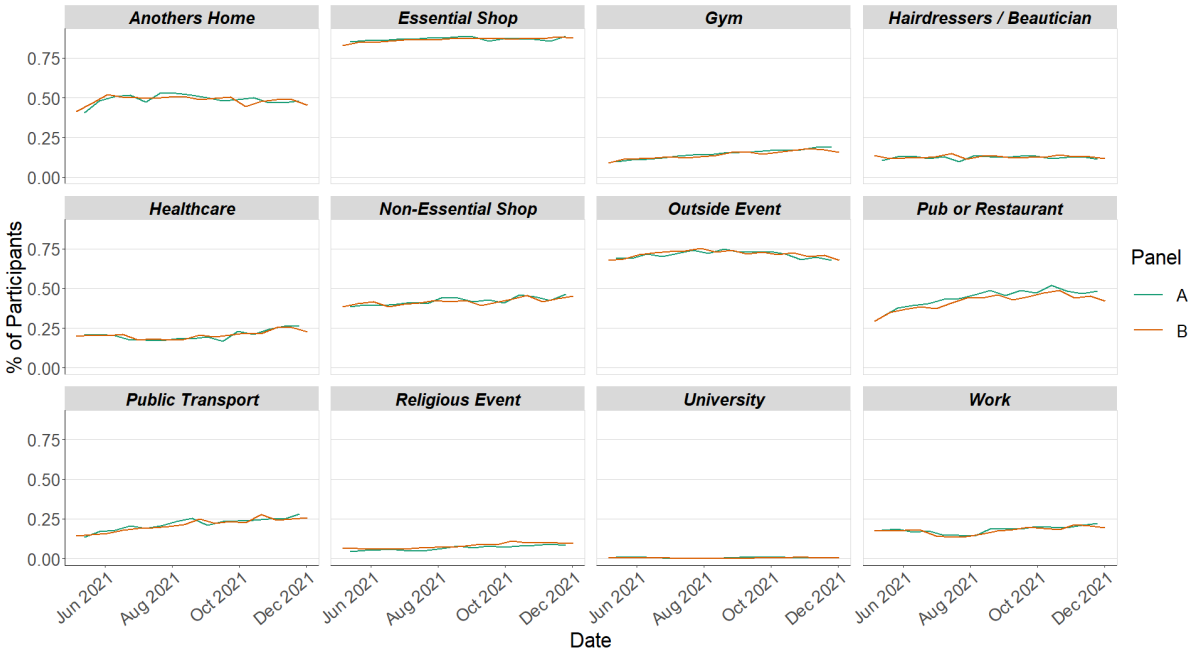
The heatmaps in Figure 14 show the mean overall contacts between age groups for the weeks relating to 18th November - 24th November and 2nd December - 8th December and the difference between these periods. The highest interactions are reported between those 70 and over with each other. In the last two weeks, the biggest decrease in interactions is between those under 18 with individuals within the 18-29 age group.

Figure 14: Overall mean contacts by age group before for the weeks relating to 18th November - 24th November and 2nd December - 8th December.



As shown in Figure 15, the biggest changes in the proportion of participants visiting different locations, though slight, is seen in those visiting another's home and attending an event outside. Visits to another's home decreased from approximately 49% to 45% and attending an outside event decreased from 71% to 68% in the last two weeks. A breakdown of this by age and gender is given in the Technical Annex.

Figure 15: Locations visited by participants at least once for panel A and B (from SCS).



Approximately 63% of individuals have taken at least one lateral flow test within the last 7 days for the survey pertaining to the 2nd – 8th December as shown in Figure 16. The youngest and oldest age groups (18-29 and 70+) have reported the lowest proportions of individuals who have taken one or more lateral flows, with at most 54% taken at least one. In contrast, those aged between 30-59 report the highest proportion of individuals taking at least one lateral flow test within the last 7 days, with at least 70% taken at least one.

Figure 16: Number of days participants taken a lateral flow in last 7 days

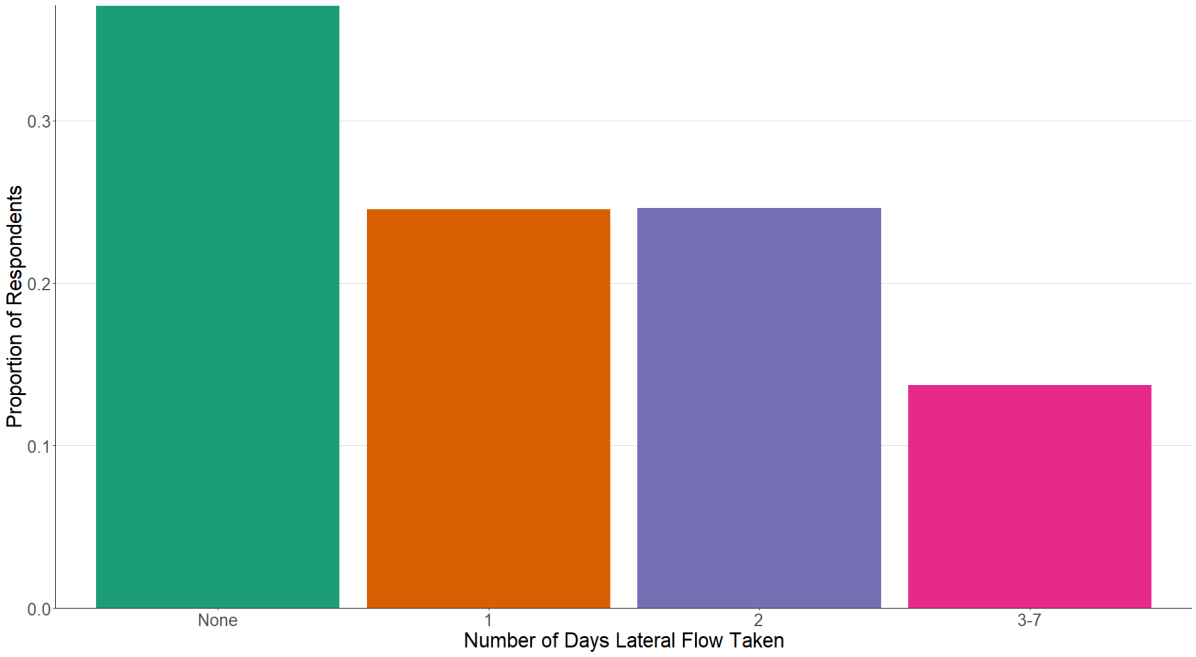
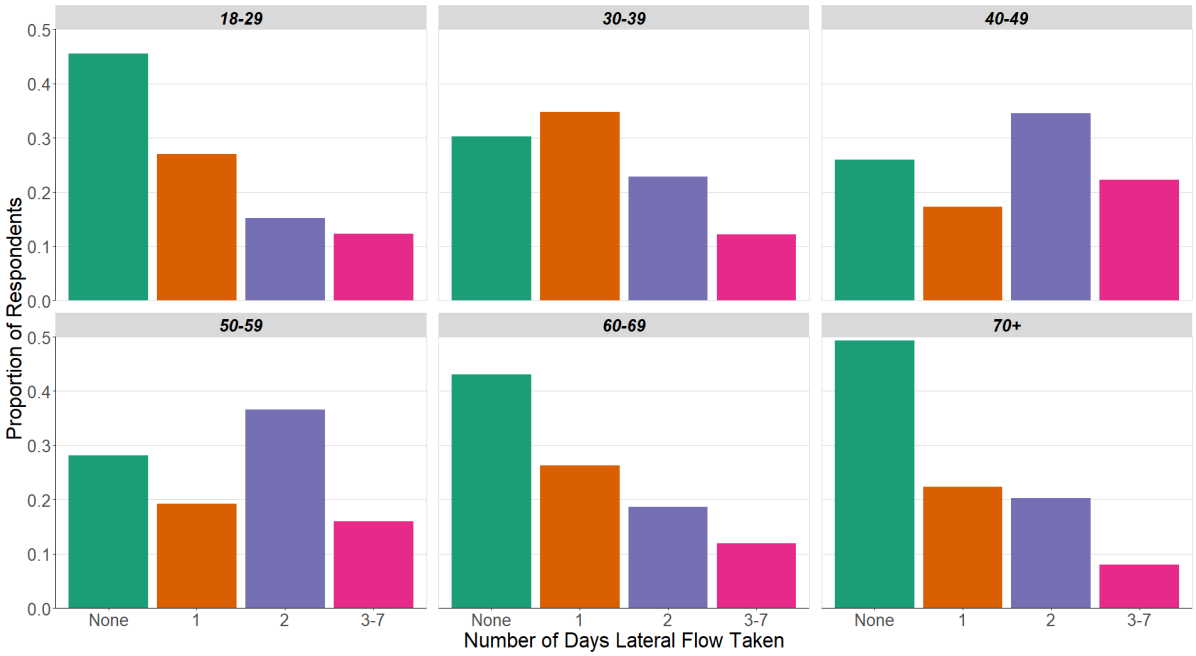


Figure 17: Number of days participants taken a lateral flow in last 7 days by age group



What can analysis of wastewater samples tell us about local outbreaks of Covid-19 infection?

Levels of Covid-19 RNA in wastewater (WW) collected at a number of sites around Scotland are adjusted for population and local changes in intake flow rate (or ammonia levels where flow is not available) and compared to 7-day average daily new case rates derived from Local Authority and Neighbourhood (Intermediate Zone) level aggregate data. See Technical Annex in Issue 34 of these Research Findings for the methodology.

Nationwide, wastewater Covid-19 levels have shown a decrease from the elevated levels seen in the last two weeks. The week ending on 14th December saw levels of around 58 million gene copies per person per day (Mgc/p/d), down from around 74 Mgc/p/d in the previous week (week ending 7th December), a decrease of 21%. It should be noted that this decrease is in the context of decreasing Delta variant and increasing Omicron variant. The Office of National Statistics' Coronavirus Infection Survey (CIS) has shown a similar recent drop, although data are only available up until 1st December. Case rates have continued their increase from last week.

Figure 18 shows the national running average trend (over a 7-day period) for the full set of sampled sites, with a small number of unrealistically large outliers excluded. WW Covid-19 levels have dropped slightly while an increase in case rates can be observed across almost all sites. This national trend is not representative for all sites

though: Figure 19 shows Dalmuir (covered pop: 428k) in Glasgow, where increases in both wastewater viral levels and case rates are seen.

Figure 18. National running average trends in wastewater Covid-19 and daily new case rates (7-day moving average) up until 10th December[10].

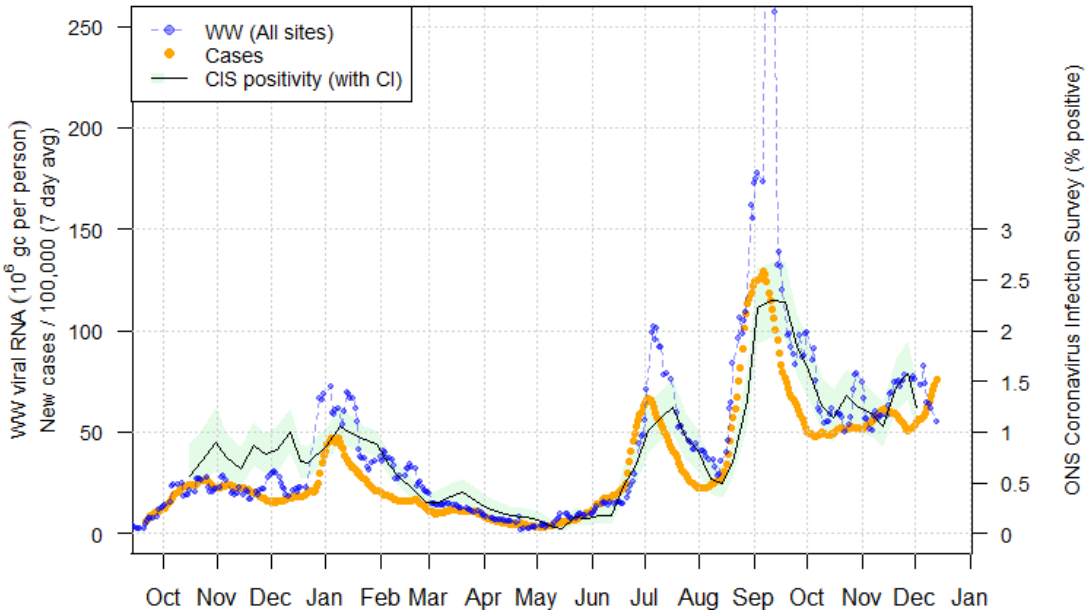
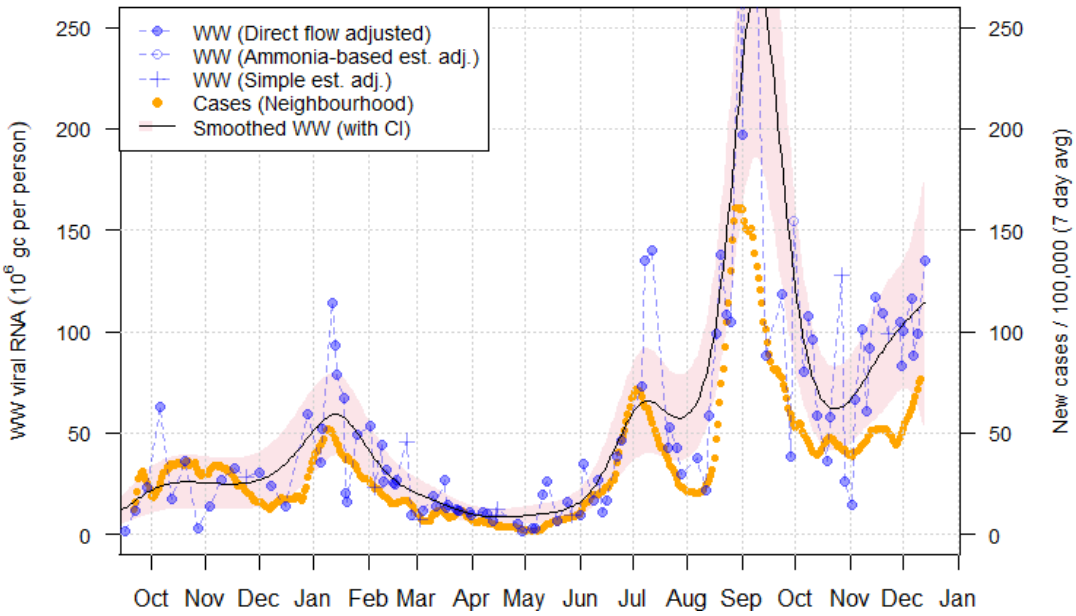


Figure 19. Wastewater Covid-19 and daily case rate (7 day moving average) for Dalmuir (covered pop: 428k) in Glasgow[11].



What next?

Modelling will be provided for both the Delta and Omicron variants where possible. As more information on Omicron becomes available this will be incorporated in the different models as and when it is appropriate to do so.

[10] Anomalously high values, one in Seafield (Edinburgh) in mid-February (see Issue 40), one in Dunblane in mid-June, and two in Daldowie in January, were removed. For this graph, a wastewater RNA average using the last 7-days of data is computed at every sampling date. Positivity estimates from the CIS are overlaid, with a scale chosen to approximately match the displayed peak of the survey percentage to the recent peaks in the rate of new cases.
[11] The black line and red shaded area provide a smoothed curve and confidence interval for WW Covid-19 that is estimated from a generalised additive model based on a Tweedie distribution.

Technical Annex

Epidemiology is the study of how diseases spread within populations. One way we do this is using our best understanding of the way the infection is passed on and how it affects people who catch it to create mathematical simulations. Because people who catch Covid-19 have a relatively long period in which they can pass it on to others before they begin to have symptoms, and the majority of people infected with the virus will experience mild symptoms, this “epidemiological modelling” provides insights into the epidemic that cannot easily be measured through testing e.g. of those with symptoms, as it estimates the total number of new daily infections and infectious people, including those who are asymptomatic or have mild symptoms.

Modelling also allows us to make short-term forecasts of what may happen with a degree of uncertainty. These can be used in health care and other planning. The modelling in this research findings is undertaken using different types of data which going forward aims to both model the progress of the epidemic in Scotland and provide early indications of where any changes are taking place.

The delivery of the vaccination programme will offer protection against severe disease and death. The modelling includes assumptions about compliance with restrictions and vaccine take-up. Work is still ongoing to understand how many vaccinated people might still spread the virus if infected. As Covid-19 is a new disease there remain uncertainties associated with vaccine effectiveness. Furthermore, there is a risk that new variants emerge for which immunisation is less effective.

How the modelling compares to the real data as it emerges

The method of producing the medium term projections (Figures 9 - 11) uses the published actual numbers of infections, rather than modelling them from the beginning of the epidemic. This means the projections begin from the point the published data ends.

There is no prediction interval around the actual infections in Figure 5 - 7 because there is no longer any uncertainty from simulating infections during this period. There is still uncertainty in the ascertainment rate, which is represented by the whiskers around the actual infections.

How do the locations visited by individuals vary between age and gender?

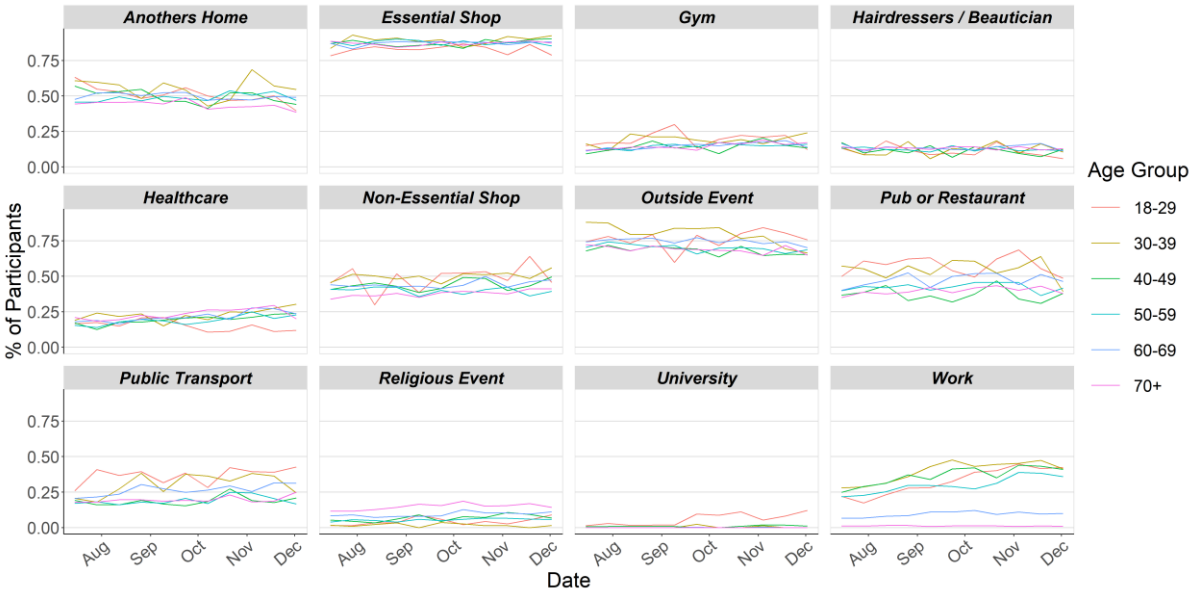
Figures 20 & 21 illustrate the proportion of individuals attending different locations by gender and age for Panel B.

Differences between the number of females and males visiting different locations are small where they occur. These show a higher proportion of females visiting another's home, a hairdresser/beautician, non-essential shop and work than males and a slightly higher proportion of males visiting the gym compared to females. The remaining locations are similar in proportions.

Figure 20: Locations visited by participants at least once for panel B by gender (from SCS).

In terms of age, the biggest difference is seen in attendance to a work setting. At most, 12% of participants 60 and over attend the workplace while a minimum of 17%, rising up to 48%, of the 18-59s attend the workplace during the same period.

Figure 21: Locations visited by participants at least once for panel B by age (from SCS).



How is the doubling time for the Omicron variant calculated?

In a recent WHO report[12] it was confirmed that in PCR tests one of the three target genes of the SARS-CoV-2 virus is not detected (called S-gene target failure, SGTF). This test can therefore be used as an indicator for the Omicron variant.

The number of total S-gene tests and the proportion which test positive for SGTF in Scotland are provided daily by PHS. Based on a methodology developed by academics at the University of Manchester, a statistical model is based on some underlying parameters of the Omicron variant. This is fitted against the actual number of S-gene test and the proportion of these which are positive for SGTF using maximum likelihood. This allows for a best estimate of the underlying parameters, including the relative growth advantage of the Omicron variant, which leads to an estimate of the doubling time of the variant.

The axis on the graph in Figure 8 is a proportion i.e. 0 = 0%, 1 = 100%. Therefore, the graph is showing an estimated proportion of Omicron cases, starting at 0% of cases in early November. The proportion is calculated as S-gene target failure cases as a proportion of all cases tested for the S-gene.

[12] Classification of Omicron (B.1.1.529): SARS-CoV-2 Variant of Concern (who.int)

To reflect the uncertainty the modelling has a random sampling element to the methodology. The red band represents the variance between these samples.

We have more information on Omicron but need more to confirm its characteristics, particularly around severity. As this becomes available we will refine the modelling.

Which local authorities are likely to experience high levels of Covid-19 in two weeks' time

Table 1. Probability of local authority areas exceeding thresholds of cases per 100K (26th December 2021 to 1st January 2022).
Data to 13th December.
This is based on the Delta variant being the majority of cases.

	Probability of exceeding (cases per 100K)			
Local Authority (LA)	50	100	300	500
Aberdeen City	75-100%	75-100%	50-75%	15-25%
Aberdeenshire	75-100%	75-100%	25-50%	15-25%
Angus	75-100%	75-100%	25-50%	0-5%
Argyll and Bute	75-100%	75-100%	25-50%	5-15%
City of Edinburgh	75-100%	75-100%	75-100%	25-50%
Clackmannanshire	75-100%	75-100%	50-75%	15-25%
Dumfries & Galloway	75-100%	75-100%	50-75%	5-15%
Dundee City	75-100%	75-100%	50-75%	15-25%
East Ayrshire	75-100%	75-100%	75-100%	75-100%
East Dunbartonshire	75-100%	75-100%	75-100%	50-75%
East Lothian	75-100%	75-100%	50-75%	25-50%
East Renfrewshire	75-100%	75-100%	50-75%	50-75%
Falkirk	75-100%	75-100%	75-100%	50-75%
Fife	75-100%	75-100%	50-75%	15-25%
Glasgow City	75-100%	75-100%	75-100%	50-75%
Highland	75-100%	75-100%	25-50%	15-25%
Inverclyde	75-100%	75-100%	50-75%	25-50%
Midlothian	75-100%	75-100%	50-75%	25-50%
Moray	75-100%	75-100%	50-75%	25-50%
Na h-Eileanan Siar	50-75%	50-75%	25-50%	5-15%
North Ayrshire	75-100%	75-100%	75-100%	25-50%
North Lanarkshire	75-100%	75-100%	75-100%	50-75%
Orkney Islands	50-75%	15-25%	0-5%	0-5%
Perth and Kinross	75-100%	75-100%	50-75%	15-25%
Renfrewshire	75-100%	75-100%	75-100%	50-75%
Scottish Borders	75-100%	75-100%	25-50%	5-15%
Shetland Islands	25-50%	25-50%	15-25%	5-15%
South Ayrshire	75-100%	75-100%	75-100%	25-50%
South Lanarkshire	75-100%	75-100%	75-100%	50-75%
Stirling	75-100%	75-100%	50-75%	25-50%
West Dunbartonshire	75-100%	75-100%	75-100%	25-50%
West Lothian	75-100%	75-100%	75-100%	50-75%

What levels of Covid-19 are indicated by wastewater data?

Table 2 provides population weighted daily averages for normalised WW Covid-19 levels in the weeks beginning 1st and 8th December 2021, with no estimate for error. This is given in Million gene copies per person, which approximately corresponds to new cases per 100,000 per day. Coverage is given as percentage of LA inhabitants covered by a wastewater Covid-19 sampling site delivering data during this period[13].

Table 2. Average daily cases per 100k as given by WW data[14].

Local authority (LA)	w/b 1st December	w/b 8th December	Coverage
Aberdeen City	49	37	99%
Aberdeenshire	37	32	34%
Angus	64	39	55%
Argyll and Bute	44	18	12%
City of Edinburgh	56	54	98%
Clackmannanshire	49	74	81%
Dumfries & Galloway	16	41	35%
Dundee City	78	39	100%
East Ayrshire	91	42	57%
East Dunbartonshire	102	117	99%
East Lothian	63	50	74%
East Renfrewshire	42	62	89%
Falkirk	120	84	79%
Fife	114	52	84%
Glasgow City	72	89	71%
Highland	68	13	36%
Inverclyde	62	51	98%
Midlothian	55	55	73%
Moray	52	27	28%
Na h-Eileanan Siar	–	–	0%
North Ayrshire	81	37	84%
North Lanarkshire	105	92	30%
Orkney Islands	18	8	34%
Perth and Kinross	77	24	38%
Renfrewshire	59	69	97%
Scottish Borders	42	27	58%
Shetland Islands	–	–	0%
South Ayrshire	94	45	84%
South Lanarkshire	60	82	57%
Stirling	33	10	53%
West Dunbartonshire	80	62	98%
West Lothian	128	41	76%

[13] Advancements in detection and interpretation practices allow us to identify when outlying results are anomalous rather than indicators of spikes in Covid-19 levels. Table 2 provides population weighted daily averages for normalised WW Covid-19 levels with the outliers removed. See Technical Annex in Issue 60 of these Research Findings for further details.

[14] Coverage as for week beginning 8th December 2021.

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