

## Coronavirus (COVID-19): Analysis

### Coronavirus (COVID-19): modelling the epidemic in Scotland (Issue No. 65)

#### Background

This is a report on the Scottish Government modelling of the spread and level of Covid-19. This updates the previous publication on modelling of Covid-19 in Scotland published on 13th August 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.

In Scotland, the modelled estimate for R is between 0.8 and 1.1, with the growth rate between -3% and 1%, based on the period up to 16th August.

The number of new cases has been increasing over the last week, with a marked increase on the 18th and 19th August. The estimate of R has increased and now span one. However, admissions to hospital and ICU have continued to decline over the last week.

**R is an indicator that lags by two to three weeks and therefore should not be expected to reflect recent fluctuations, such as the increase in reported cases that has been seen in the last week.**

#### Key Points

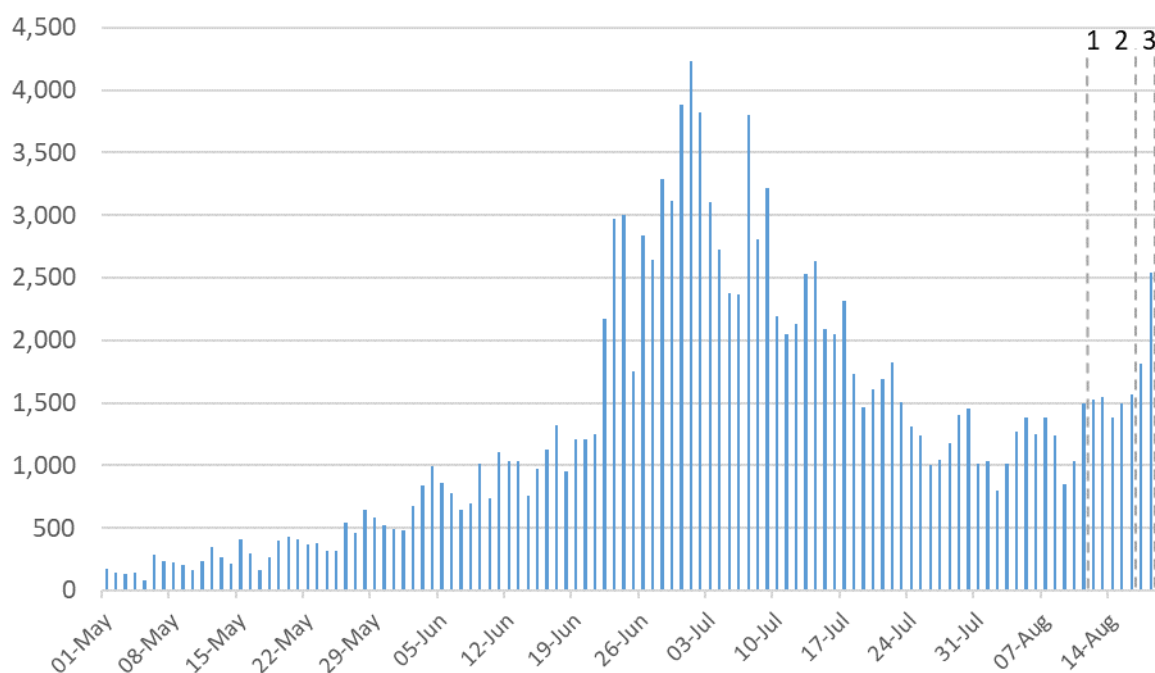
- The reproduction rate R in Scotland is currently estimated as being between 0.8 and 1.1, based on the period up to 16th August. This is an increase in the lower and upper limits from last week.
- The number of new daily infections for Scotland is estimated as being between 34 and 64, per 100,000 people, based on the period up to 16th August.

- The growth rate for Scotland is currently estimated as between -3% and 1%, based on the period up to 16th August.
- Average contacts have remained at a similar level in the last two weeks (comparing surveys pertaining to 22nd July - 28th July and 5th August - 11th August) with a current level of 4.1 daily contacts.
- Contacts within the work and home setting have decreased compared to two weeks prior, by 9% and 8% respectively, whereas contacts within the other setting (contacts outside of the work, school and home) have increased slightly by 5%.
- The biggest increase in interactions in the last two weeks is seen between those aged 18-29 with those under 18.
- Visits to a non-essential shop have increased from approximately 40% to 44% with individuals attending a hairdressers/beautician increasing from 10% to 14% in the last two weeks.
- The proportion of contacts reported to have been indoors only has increased within the last two weeks whereas the proportion of contacts occurring outside only has shown a decrease over the same period.
- Hospitalisations have been declining from a peak in mid-July, but have now levelled off. Potential future changes in hospital occupancy and intensive care use depend on both current infection levels and the impact of the recent relaxations of measures which will take a few weeks to become apparent.
- Modelled rates of positive tests per 100K using data to 16th August indicate that, for the week commencing 29th August 2021, 28 local authorities are expected to exceed 50 cases per 100k with at least 75% probability.
- Of these, 8 local authorities are expected to exceed 100 cases per 100k with at least 75% probability. These are Dumfries & Galloway, Fife, Glasgow, Inverclyde, North Ayrshire, North Lanarkshire, Renfrewshire and South Lanarkshire.
- Overall, wastewater (WW) Covid-19 RNA concentrations rose from the previous week similar to the observed rise in the rate of new cases. However, levels were rising substantially at the end of the period at many sites.
- Comparing the last two days of WW measurements (since 13th August) to measurements immediately prior, an increase in WW viral RNA is seen in 19 out of the 22 sites with available data. The increase is of a large magnitude, doubling or tripling the level in many sites.
- The number of people likely to experience long Covid symptoms on 5th September 2021 is estimated to be between 0.8% and 2.0% of the population, an increase since last week.

## Recent cases

Figure 1 shows the number of cases reported in Scotland between May and August 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 19th August 2021



This report covers the period up to 11th August for contact patterns (indicated by dashed line 1). The estimates of R, incidence, growth rates, the modelled rates of positive tests per 100k, wastewater analysis, and the long Covid analysis use data to 16th August (dashed line 2). The medium term projections by the Scottish Government of infections, hospitalisations and ICU beds uses data to 18th August (dashed line 3).

## 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 re-emergence of the epidemic and where in Scotland this might occur.

However modelling of Covid-19 deaths is an important measure of where Scotland lies in its epidemic as a whole. In addition, the modelling groups

that feed into the UK Health Security Agency (UKHSA) consensus<sup>1</sup> use a range of other data along with deaths in their estimates of R and the growth rate. These outputs are provided in this research findings. The type of data used in each model to estimate R is highlighted in Figure 2.

We use the Scottish Contact Survey (SCS) 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.

The logistical model utilises results from the epidemiological modelling, principally the number of new infections. The results are split down by age group, and the model is used to give a projection of the number of people that will go to hospital, and potentially to ICU. This will continue to be based on both what we know about how different age groups are affected by the disease and the vaccination rate for those groups.

### **What the modelling tells us about the epidemic as a whole**

The R value and growth rates are estimated by several independent modelling groups based in universities, Public Health England (PHE) and the Joint Biosecurity Centre. Estimates are considered, discussed and combined at the Epidemiology Modelling Review Group (EMRG), which sits within the UKHSA.

**R is an indicator that lags by two to three weeks<sup>2</sup> and therefore should not be expected to reflect recent fluctuations, such as the increase in reported cases that has been seen in the last week.**

UKHSA's consensus view across these methods as of 18th August, using data to 9th August, was that the value of R in Scotland was between 0.8 and 1.1 (see Figure 2)<sup>3</sup>.

This week the Scottish Government presented two outputs to EMRG. The first uses confirmed cases as published by Public Health Scotland

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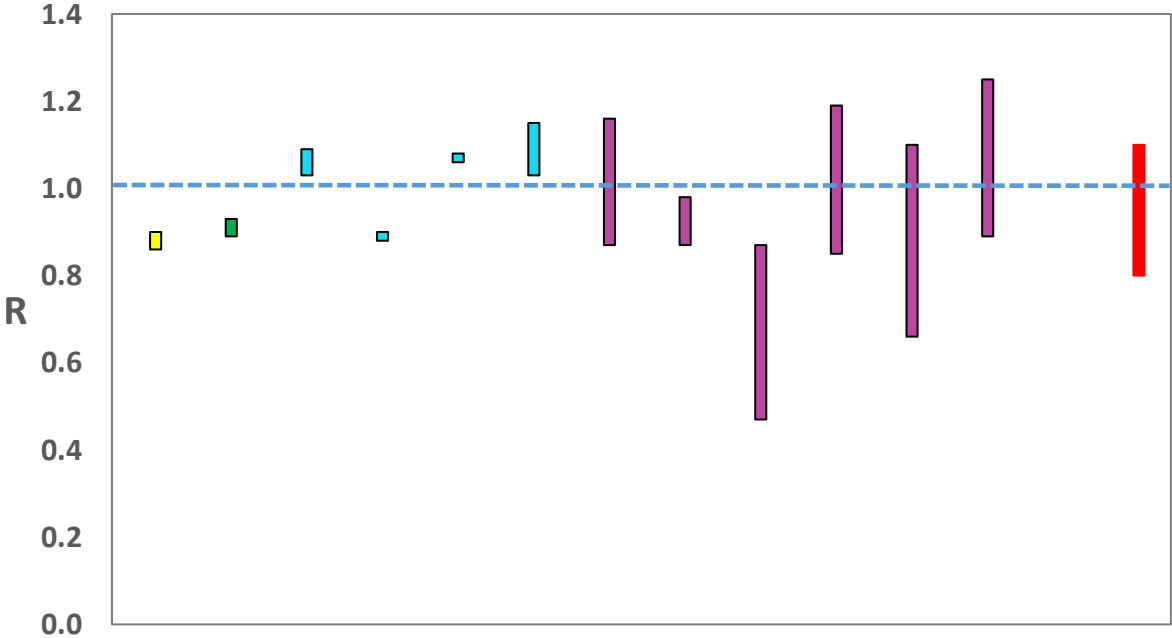
<sup>1</sup> UKHSA has now taken over the role of compiling the consensus from SAGE, based on models which feed into the Epidemiology Modelling Review Group (EMRG).

<sup>2</sup> Different data-streams and different models are expected to be lagged in their estimates by different amounts when compared with the true underlying epidemiological situation. This is due to multiple lags such as reporting and delays in the infection processes. However, the consensus combination generally reflects a 2-week lag.

<sup>3</sup> 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.

(PHS). The second uses instead wastewater data to estimate the number of cases. Both outputs are shown in Figures 2 and 3.

Figure 2. Estimates of  $R_t$  for Scotland, as of 18th August, including 90% confidence intervals, produced by EMRG<sup>4</sup>. Data to 16th August.



Source: EMRG

The various groups which report to the EMRG use different sources of data in their models to produce estimates of incidence (Figure 3). UKHSA’s consensus view across these methods, using data to 16th August, was that the incidence of new daily infections in Scotland was between 34 and 64 new infections per 100,000. This equates to between 1,900 and 3,500 people becoming infected each day in Scotland.

<sup>4</sup> 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; green uses wastewater data).The UKHSA consensus range is the right-most (red).

Figure 3. Estimates of incidence for Scotland, as of 18th August, including 90% confidence intervals, produced by EMRG<sup>2</sup>. Data to 16th August.



Source: EMRG

The consensus from UKHSA for this week is that the growth rate in Scotland is between -3% and 1% per day using data to 16th August. The lower and upper limits have increased since last week.

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

Average contacts have remained at a similar level in the last two weeks (comparing surveys pertaining to 22nd July - 28th July and 5th August - 11th August) with a current level of 4.1 daily contacts as seen in Figure 4. Contacts within the work and home setting have decreased compared to two weeks prior, by 9% and 8% respectively, whereas contacts within the other setting (contacts outside of the work, school and home) have increased slightly by 5%.

Figure 4: Mean Adult Contacts (truncated at 100) from SCS.

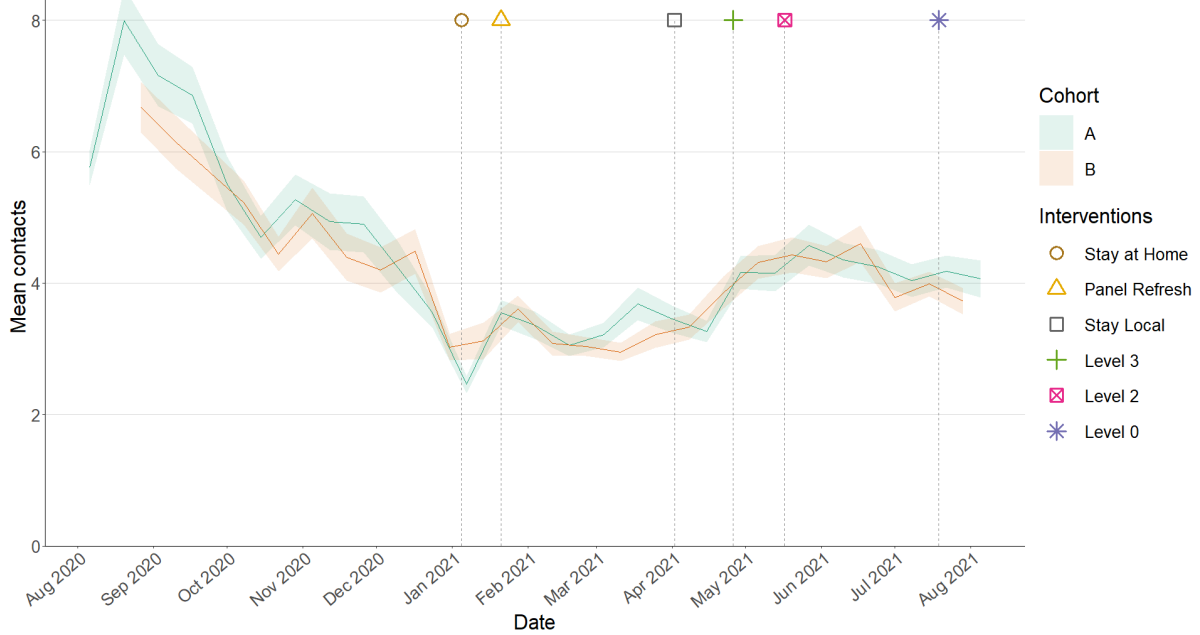
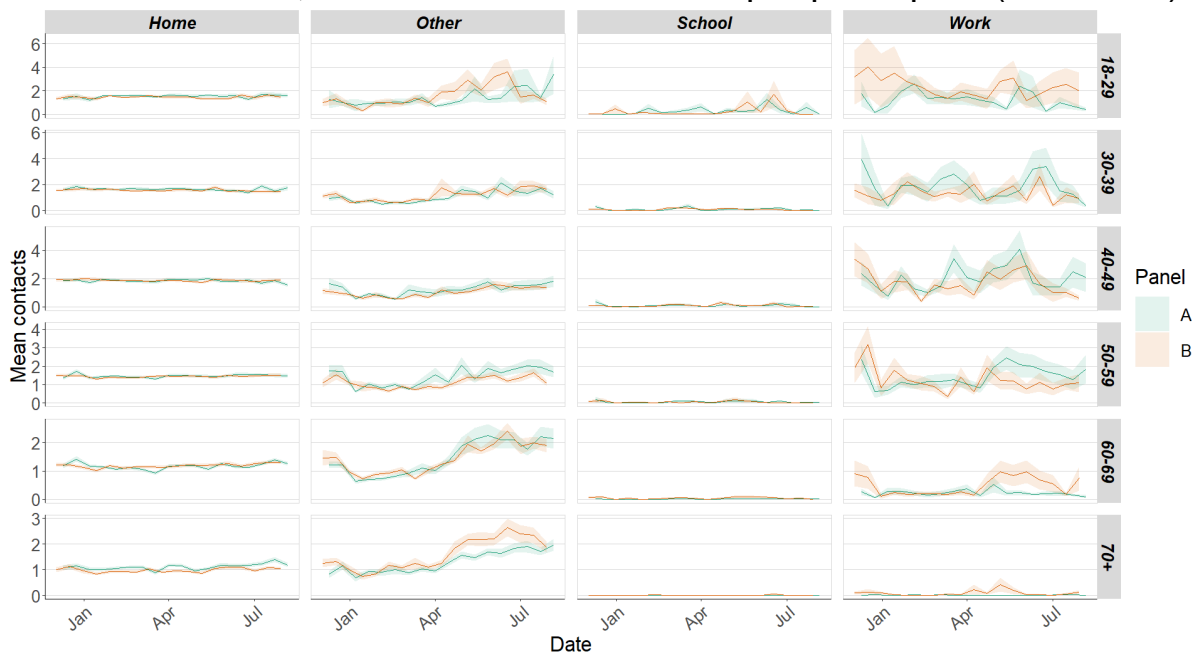


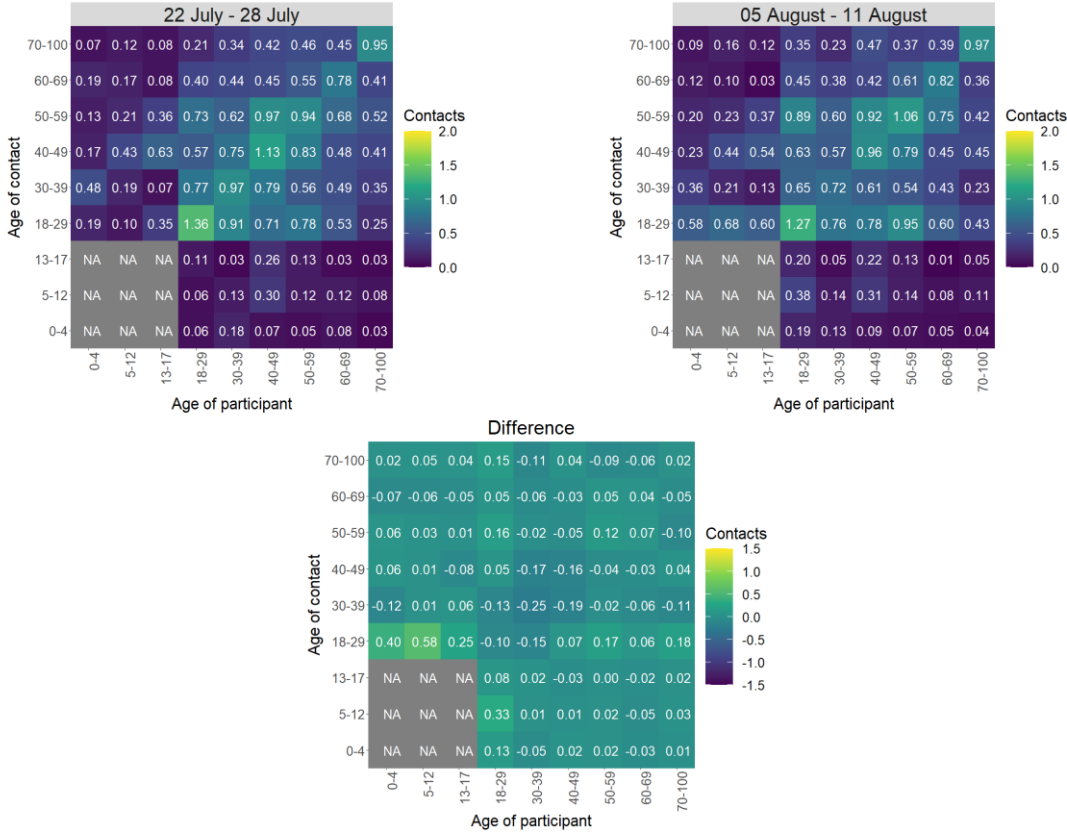
Figure 5 shows how contacts change across age group and setting. Those aged 18-29 have shown the biggest increase in contacts within the last two weeks, increasing by 25%, which is largely driven by a rise in contacts within the other setting. All remaining age groups have either had a reduction in overall contacts or remained at a similar level in comparison to two weeks prior.

Figure 5: 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 6 show the mean overall contacts between age groups for the weeks relating to 22nd July - 28th July and 5th August - 11th August and the difference between these periods. The biggest increase in interactions in the last two weeks is seen between those aged 18-29 with those under 18

Figure 6: Overall mean contacts by age group before for the weeks relating to 22nd July - 28th July and 5th August - 11th August.



As seen in Figure 7, the proportion of participants visiting different locations remains at similar levels across the majority of locations with those visiting a non-essential shop and also those visiting a hairdressers/beautician reporting the biggest increase in attendance. Visits to a non-essential shop have increased from approximately 40% to 44% with individuals attending a hairdressers/beautician increasing from 10% to 14% in the last two weeks.



Figure 7: Locations visited by participants at least once for panel A and B (from SCS).

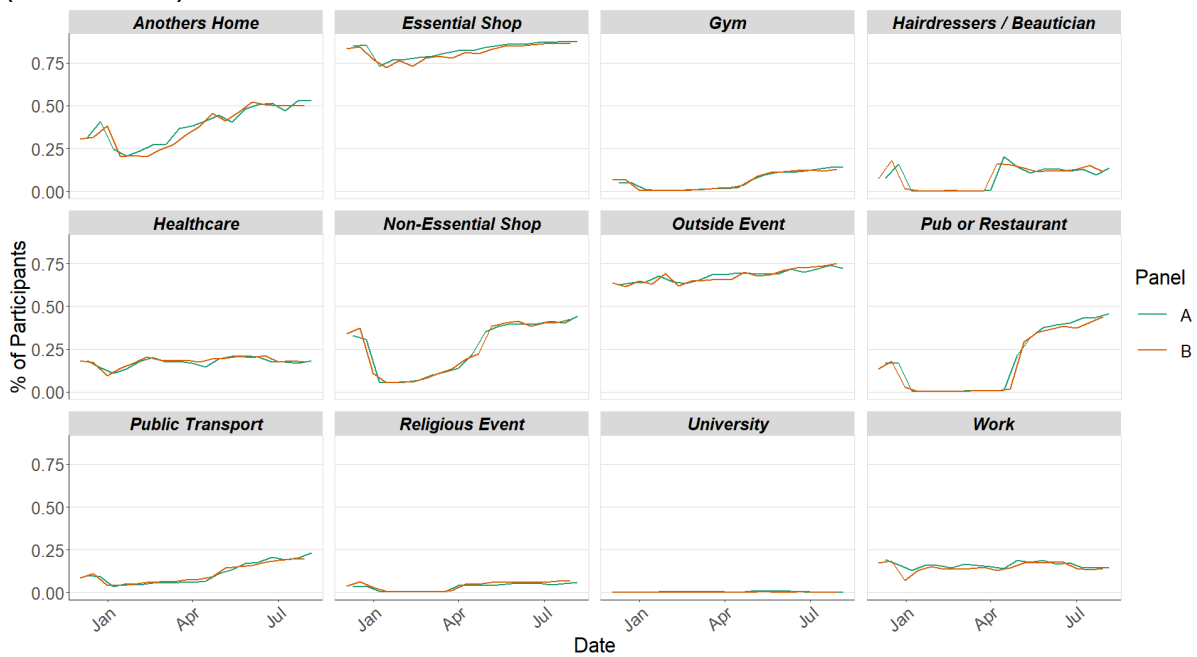
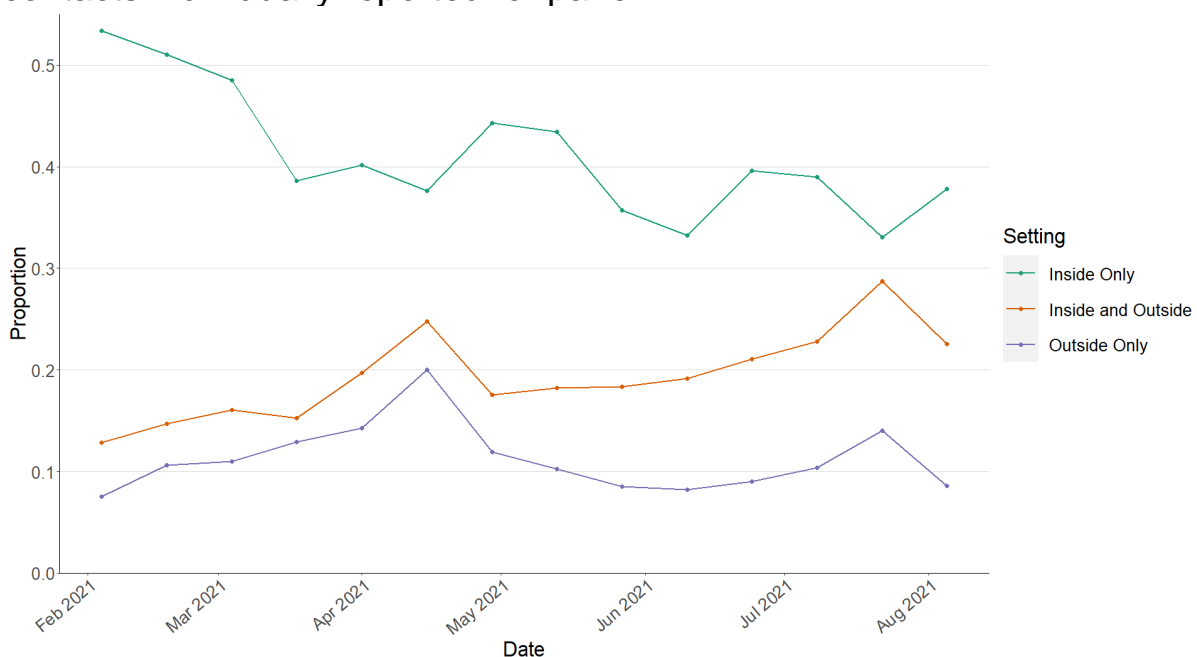


Figure 8 illustrates the proportion of all reported contacts that were indoors, outdoors or covered both settings. A contact can be recorded as both indoor and outdoor. The graph also shows contacts reported as outside only and indoor only. The proportion of contacts reported to have been indoors only has increased within the last two weeks whereas the proportion of contacts occurring outside only has shown a decrease over the same period.

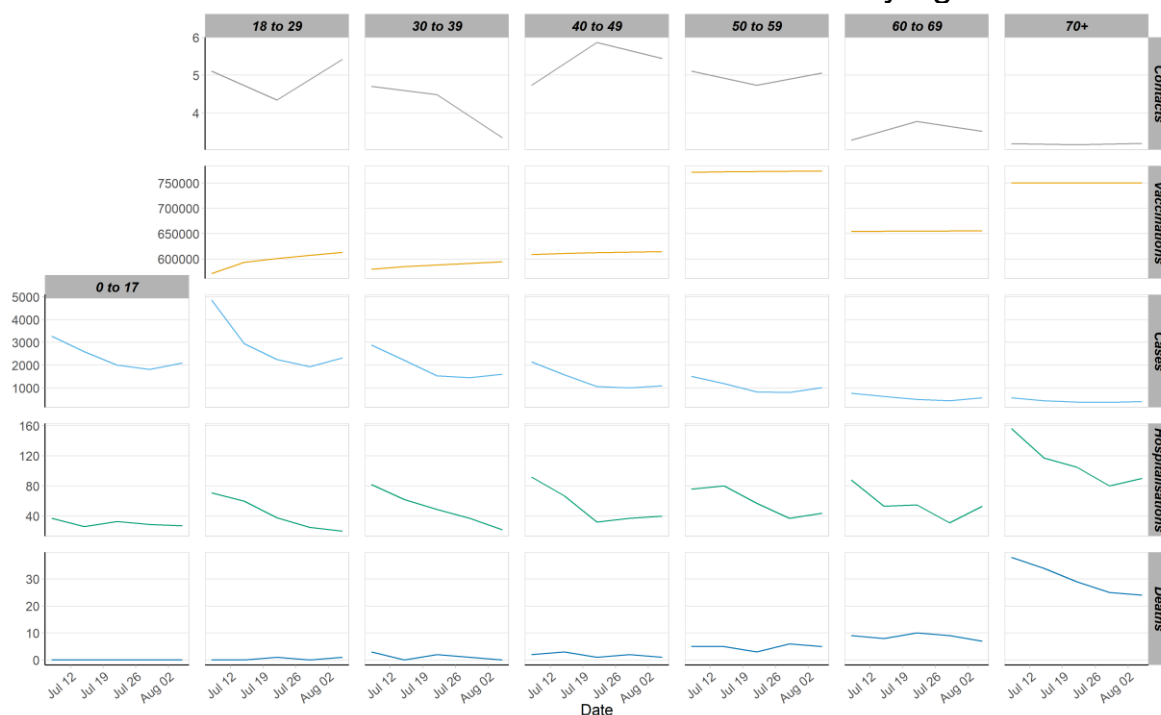
Figure 8: Proportion of participants reported indoors and outdoors for contacts individually reported for panel A.



## Vaccinations and contacts patterns

From Figure 9, it can be seen that the older age groups have fewer contacts and more vaccinations than the youngest age group, they also have the lowest weekly case number comparatively to the younger age groups which are currently rising. Despite this, the older age groups have similar or higher hospitalization levels and deaths to that seen with the younger age groups.

Figure 9: Average contacts for Panel A, weekly cases, covid-19 hospital admissions and deaths<sup>5</sup> and cumulative vaccinations by age band<sup>6</sup>



## What the modelling tells us about estimated infections as well as Hospital and ICU bed demand

The Scottish Government assesses the impact of Covid-19 on the NHS in the next few weeks in terms of estimated number of infections.

Figure 10 shows three projections over the three weeks to 5th September.

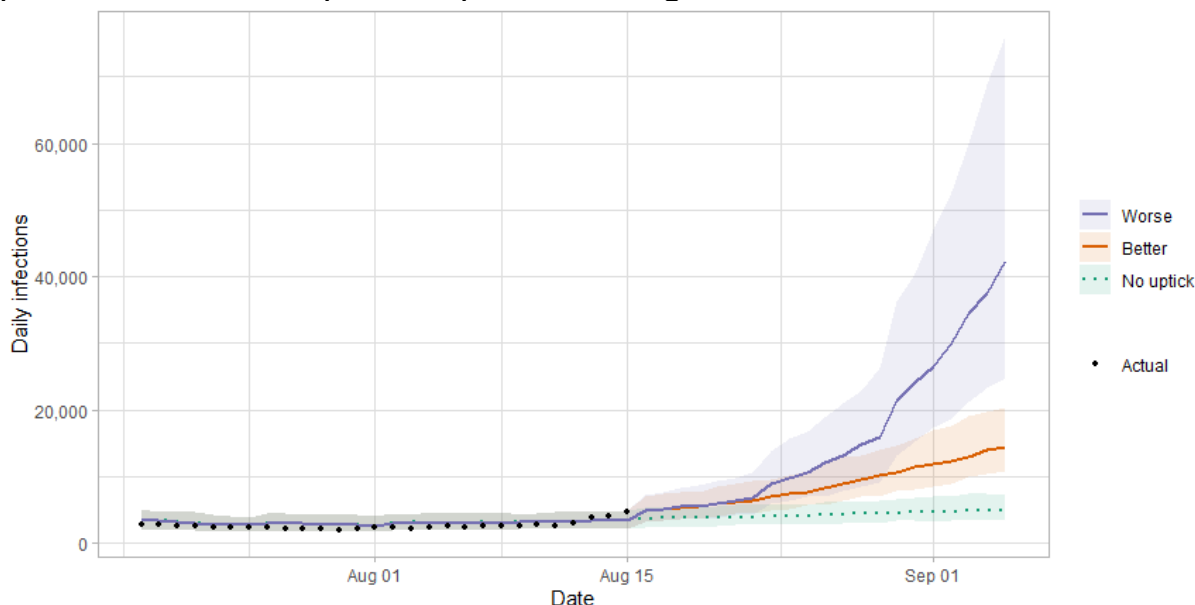
‘Worse’ assumes that increasing transmission continues for the next two weeks. ‘Better’ assumes transmission remains at the current level after

<sup>5</sup> Deaths, Cases and Hospitalisations from [PHS COVID-19 daily cases in Scotland dashboard](#).

<sup>6</sup> Vaccination and contact data for the 0-17 age cohort is not presented due to the vast majority of this age group not being offered vaccinations and the SCS excluding contacts between children.

the recent uptick in cases. 'No uptick' projects forward at the previous level of transmission from before the recent uptick<sup>7</sup>.

Figure 10. Medium term projections of modelled total new daily infections, adjusting positive tests<sup>8</sup> to account for asymptomatic and undetected infections, from Scottish Government modelling, based on positive test data reported up to 18th August.



There is uncertainty as to how much infections will increase in coming weeks. This will drive how much hospital beds and intensive care beds will rise.

Figure 11 shows the impact of the projections on the number of people in hospital. The modelling includes all hospital stays, whereas the actuals only include stays up to 28 days duration that are linked to Covid-19.

Hospital and ICU occupancies have stopped falling, and the future increase or decrease in hospital occupancy and intensive care use is highly uncertain, and depends on both current infection levels and the impact of the relaxation of restrictions.

<sup>7</sup> All scenarios are based on current vaccine roll-out plans and efficacy assumptions.

<sup>8</sup> The actual positive tests are adjusted to coincide with the estimated day of infection.

Figure 11. Medium term projections of modelled hospital bed demand, from Scottish Government modelling, based on positive test data reported up to 18th August.

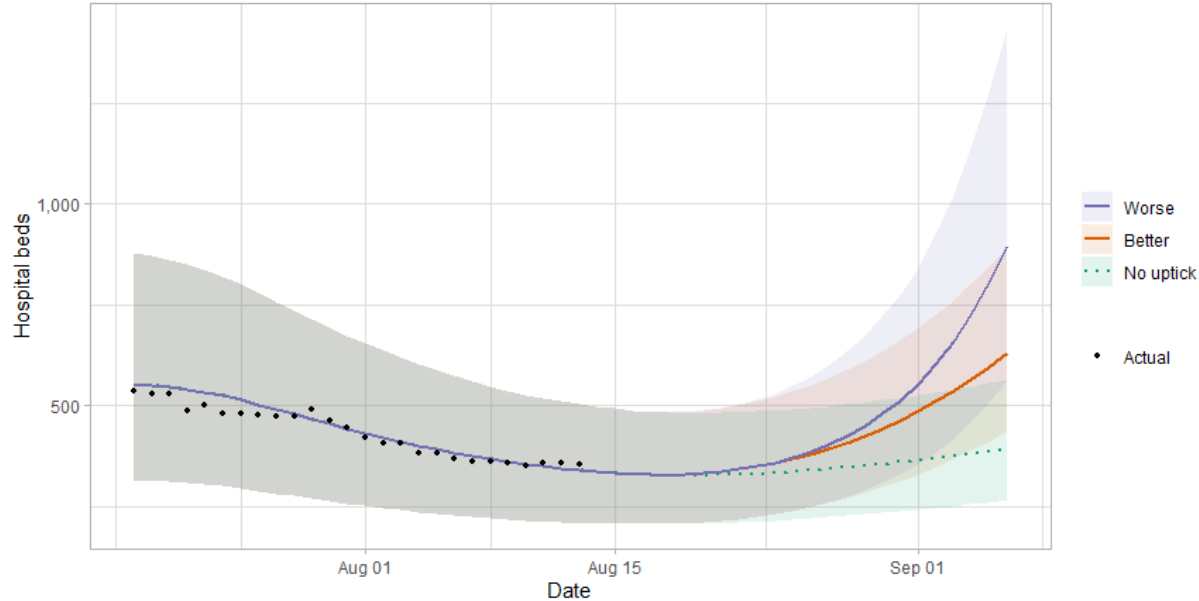
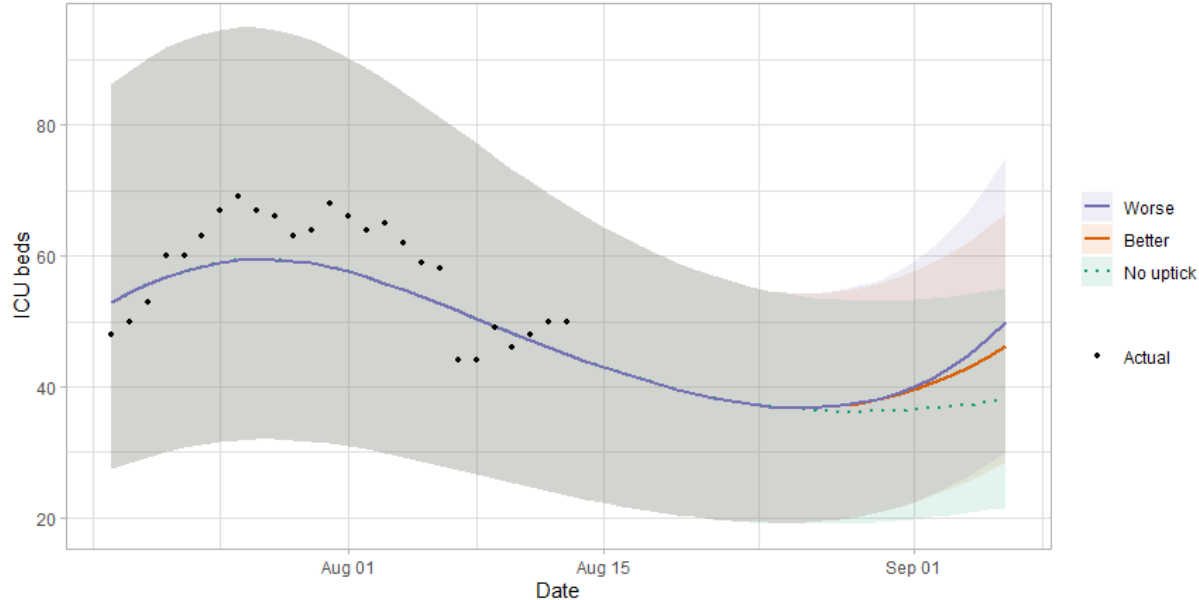


Figure 12 shows the impact of the projection on ICU bed demand.

Figure 12. Medium term projections of modelled ICU bed demand, from Scottish Government modelling<sup>9</sup>, based on positive test data reported up to 18th August.



A comparison of the actual data against historical projections is included in the Technical Annex.

<sup>9</sup> Actual data does not include full numbers of CPAP. ICU bed actuals include all ICU patients being treated for Covid-19 including those over 28 days.

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

SPI-M produces projections of the epidemic<sup>10</sup> (Figure 13), combining estimates from several independent models (including the Scottish Government's logistics modelling, as shown in Figures 10-12). These projections are not forecasts or predictions. They represent a scenario in which the trajectory of the epidemic continues to follow the trends that were seen in the data up to 16th August and **do not include the effects of any future policy or behavioural changes**.

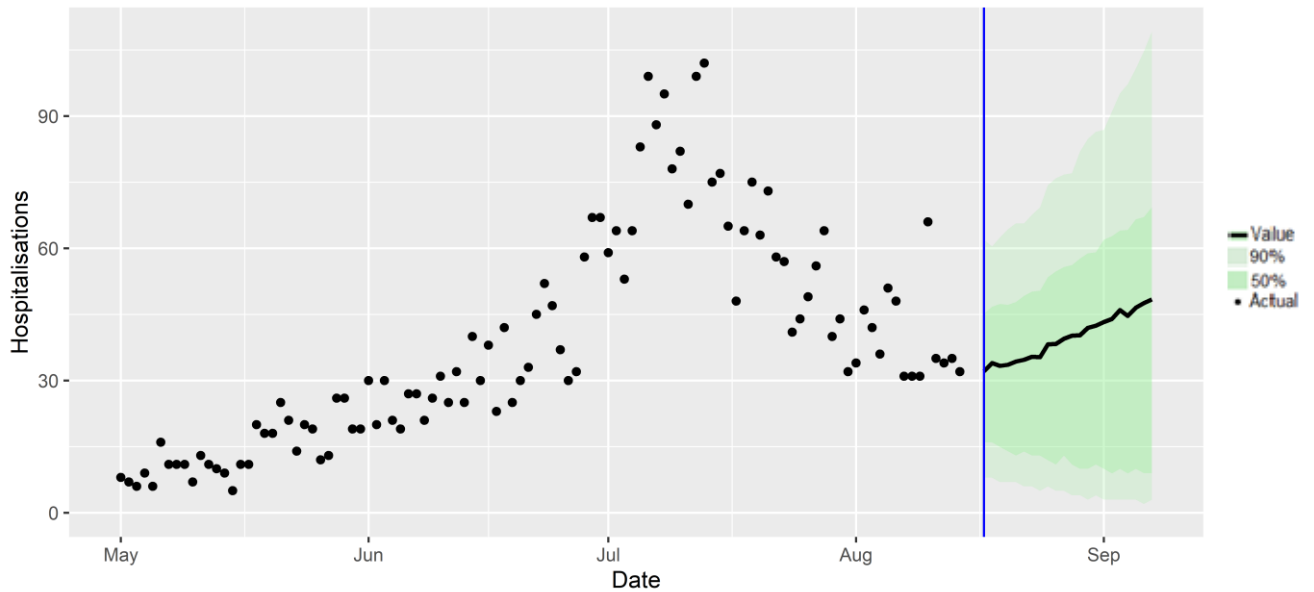
The delay between infection, developing symptoms, the need for hospital care, and death means they cannot fully reflect the impact of behaviour changes in the two to three weeks prior to 16th August. Projecting forwards is difficult when the numbers of admissions and deaths fall to very low levels, which can result in wider credible intervals reflecting greater uncertainty. The interquartile range can be used, with judgement, as the projection from which estimates may be derived until the 7th September, albeit at lower confidence than the 90% credible interval.

These projections include the potential impact of vaccinations over the next few weeks. Modelling groups have used their expert judgement and evidence from Public Health England, Scottish Universities & Public Health Scotland, and other published efficacy studies when making assumptions about vaccine effectiveness.

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<sup>10</sup> Four week projections are provided here: [Scientific evidence supporting the government response to coronavirus \(COVID-19\) - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/evidence/scientific-evidence-supporting-the-government-response-to-coronavirus-covid-19)

Figure 13. SPI-M medium-term projection of daily hospitalisations in Scotland, including 50% and 90% credible intervals.



We are not projecting the numbers of people expected to die with Covid-19 this week. The number of daily deaths has fallen to very low levels.

### **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 16th August 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 SPI-M 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.

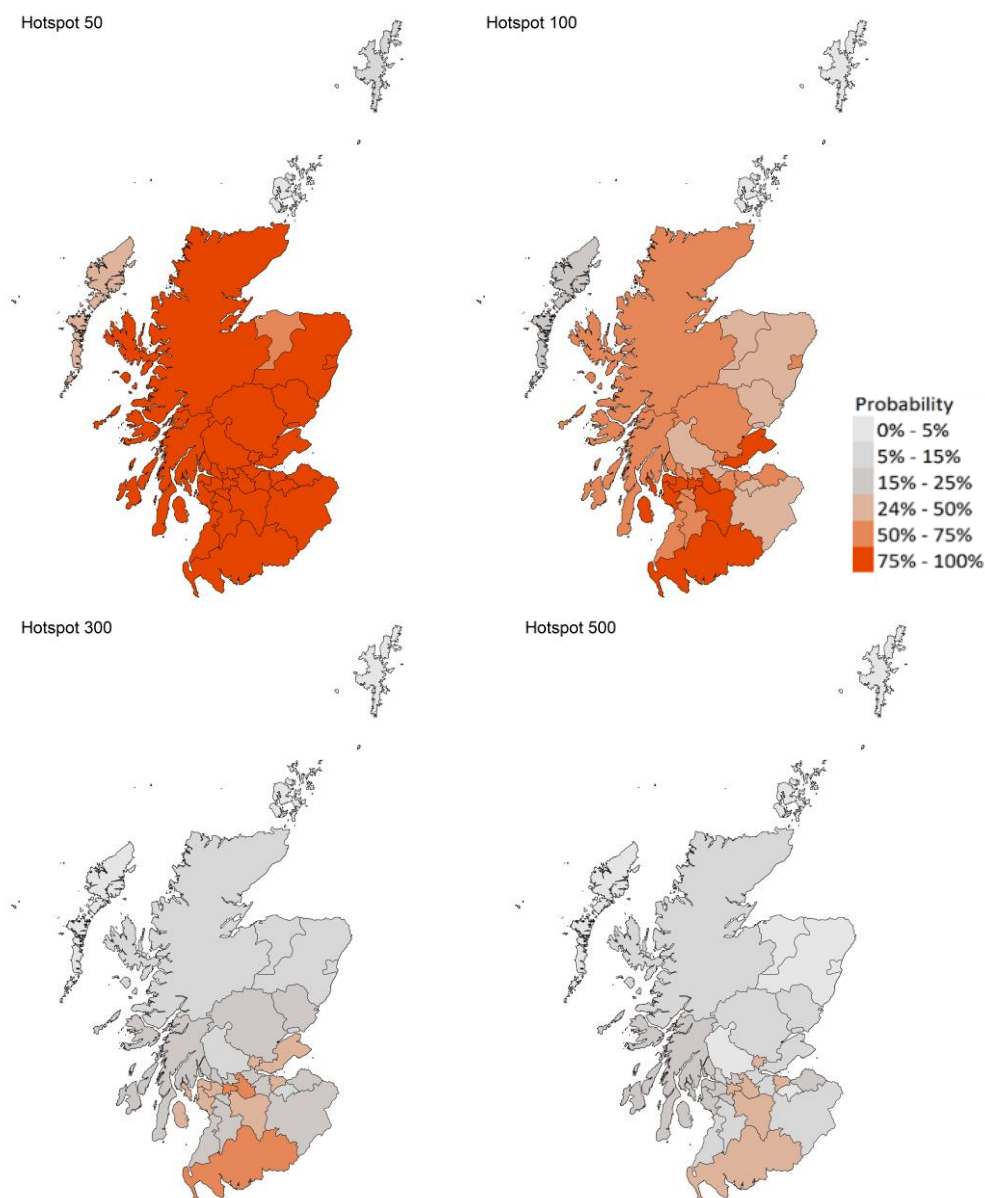
As noted, this week there has been an uptick in cases. The potential that this could be a strong and sudden uptick in the data, rather than statistical noise, is reflected in the very high upper bounds on the confidence intervals this week. It is therefore recommended that while the average projections remain low, there is an initial signal that case numbers may be rising rapidly and that the projections have yet to fully reflect this.

Modelled rates of positive tests per 100K using data to 16th August (Figure 14) indicate that, for the week commencing 29th August 2021,

there are 28 local authorities which are expected to exceed 50 cases per 100k with at least 75% probability<sup>11</sup>.

Of these, eight local authorities are expected to exceed 100 cases per 100k with at least 75% probability. These are Dumfries & Galloway, Fife, Glasgow, Inverclyde, North Ayrshire, North Lanarkshire, Renfrewshire and South Lanarkshire<sup>12</sup>.

Figure 14. Probability of local authority areas exceeding thresholds of cases per 100K (29th August to 4th September 2021), data to 16th August.



<sup>11</sup> The exceptions to this are Moray, Na h-Eileanan Siar, Orkney Islands and Shetland Islands.

<sup>12</sup> Numbers are included in Table 1 in the Technical Annex.

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

Levels of Covid-19 RNA in wastewater collected at a number of sites around Scotland are adjusted for population and local changes in intake flow rate 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, the latest levels of wastewater (WW) Covid-19 RNA averaged around 42 million gene copies per person per day (Mgc/p/d) for the week, representing a rise from last week. To note, levels were rising substantially at the end of the period at many sites.

Figure 15 shows the national weekly aggregate for the original 28 sites (sampled from August 2020, in blue) and, from January 2021, the aggregate for the full set of 110 sampled sites (in green), with a small number of unrealistically large outliers excluded. For this aggregate measure, nationally WW Covid-19 concentrations rose modestly from the previous week similar to the observed rise in the rate of new cases.

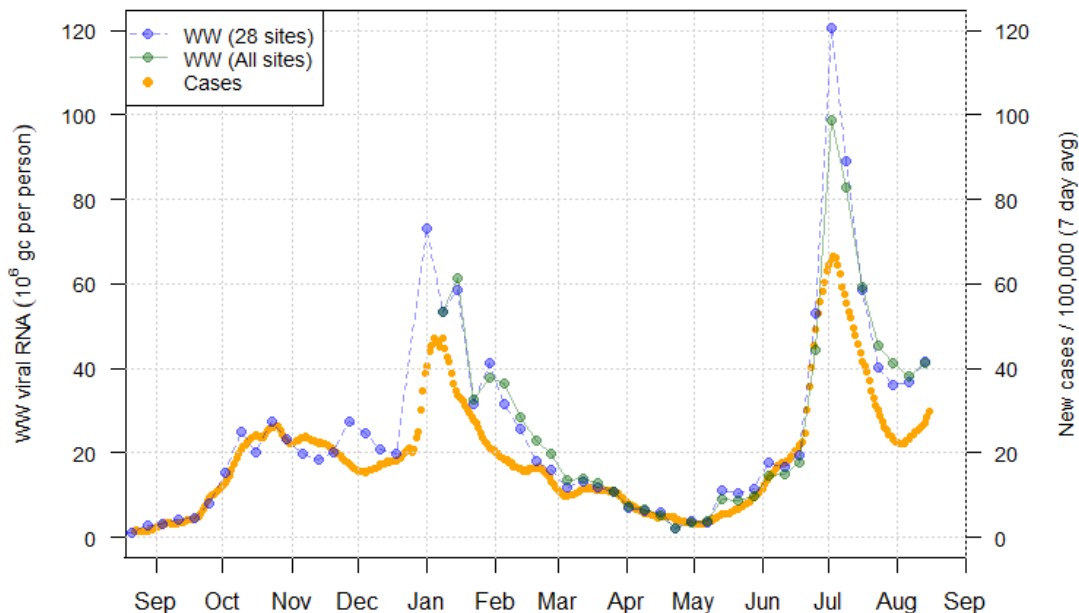
The temporary decrease in the number of samples tested continues this week, which impacts on the frequency of observations and the population covered by sampling, especially amongst smaller sites. This means there should be particular caution in interpreting the local authority results in Table 2 in the Technical Annex<sup>13</sup>.

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<sup>13</sup> Across NHS Lanarkshire, coverage fell from 80-90% to about 70%. In this area, the previously identified high level of wastewater Covid-19 fell to levels more similar to the national average (from around 70 to 50 Mgc/p/d), but this was primarily driven by a single low measurement taken at the large site of Daldowie.



Figure 15. National average trends in wastewater Covid-19 and daily new case rates (7 day moving average)<sup>14</sup>.



While the rise shown in Figure 15 is relatively modest, averaging over weeks masks the extent of increases in the most recent measurements. Comparing the last two days of WW measurements (since 13th August) to measurements immediately prior, an increase in WW viral Covid-19 is seen in 19 out of the 22 sites with available data. The increase is also large in magnitude, frequently doubling or tripling the level. While in many sites, there is only a single measurement available, at Seafield (covering the Edinburgh), shown in Figure 16, multiple measurements have been registered in the vicinity of 60 Mgc/p/d. At Shieldhall and Dalmuir in Glasgow, a similar recent rise was seen, though less data is currently available there.

While Seafield (Figure 16) has been quite variable in terms of WW levels in recent weeks, locations like Meadowhead (Figure 17) show a clearer increase over the same timescale. Several other sites give similar results.

Further measurements are required to establish whether this signal is sustained.

<sup>14</sup> 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.

Figure 16. Wastewater Covid-19 and daily case rate (7 day moving average) for Seafield (covered pop: 606k) in Edinburgh<sup>15</sup>.

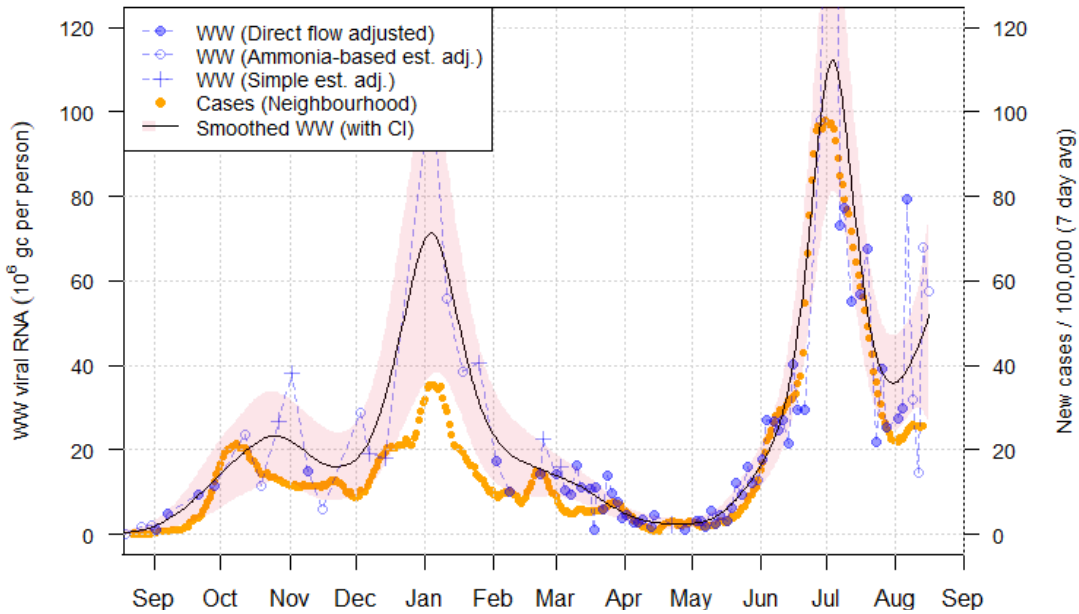
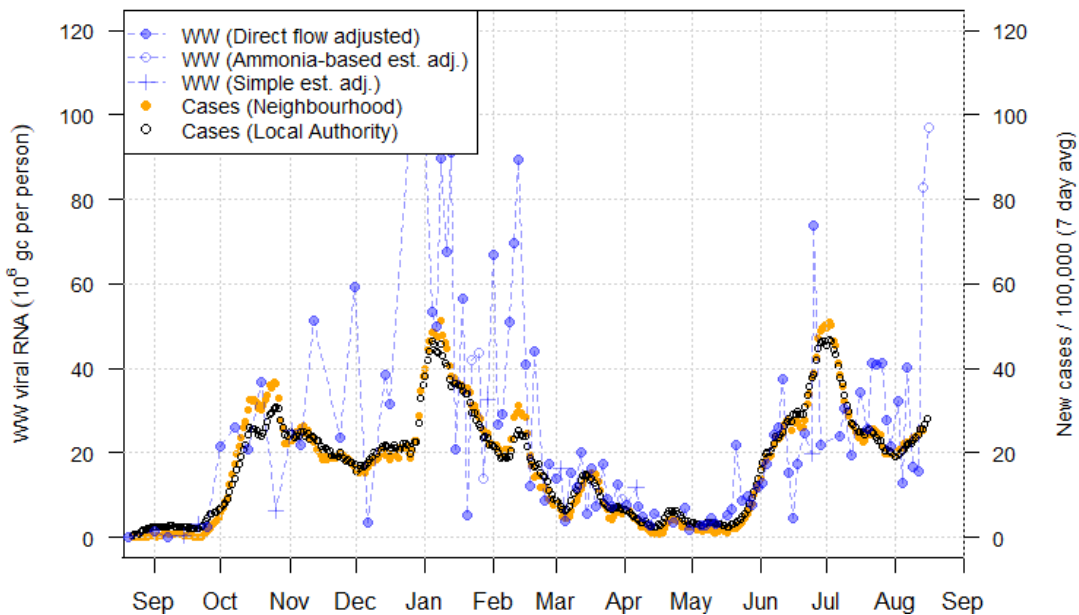


Figure 17. Wastewater Covid-19 and daily case rate (7 day moving average) for Meadowhead (covered pop: 191k) in South Ayrshire.



**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 has been projected to estimate

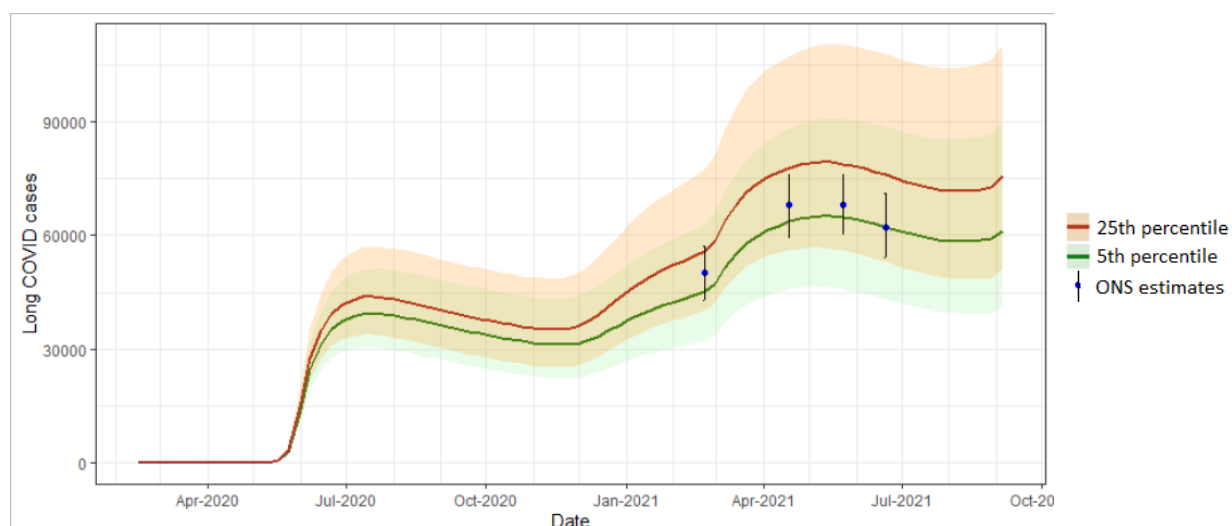
<sup>15</sup> The black line and red shaded area provide a smoothed curve and confidence interval for WW RNA that is estimated from a generalised additive model based on a Tweedie distribution.

long Covid rates in the future, based on Scottish Government medium term projection modelling, as set out in Figure 18.

This modelling estimates that at 5th September 2021 between 41,000 (0.7% of the population) and 110,000 (2.0%) people were projected to experience symptoms for 12 weeks or more after their first suspected Covid infection in Scotland. This is an increase since last week.

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

Figure 18: Estimates of long Covid prevalence at 12 weeks from 16th February 2020 to 5th September 2021 for the 5th and 25th percentile better long Covid rates (showing 95% confidence intervals). ONS estimates with range also shown.



## What next?

The modelled estimates of the numbers of new cases and infectious people will continue to be provided as measures of the epidemic as a whole, along with measures of the current point in the epidemic such as  $R_t$  and the growth rate. Further information can be found at <https://www.gov.scot/coronavirus-covid-19>.

We may report on exceedance in future weeks when the background levels of Covid-19 reduces so that it can be useful in identifying outbreaks.

## 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.

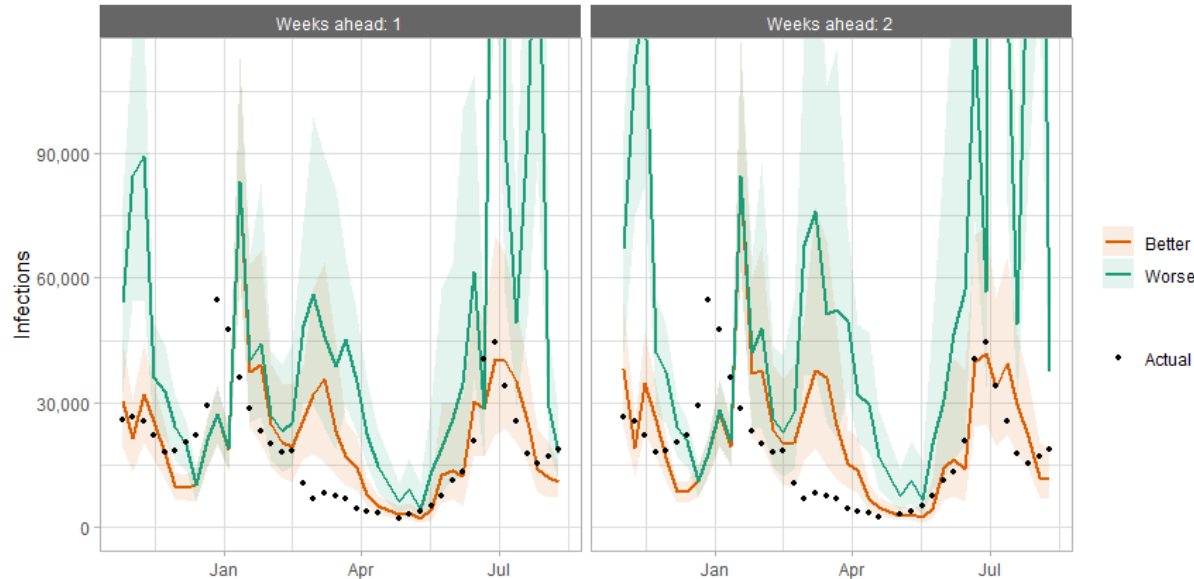
Modelling also allows us to make short-term forecasts of what may happen with a degree of uncertainty. These can be used in health care and other planning. The modelling in this research findings is undertaken using different types of data which going forward aims to both model the progress of the epidemic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

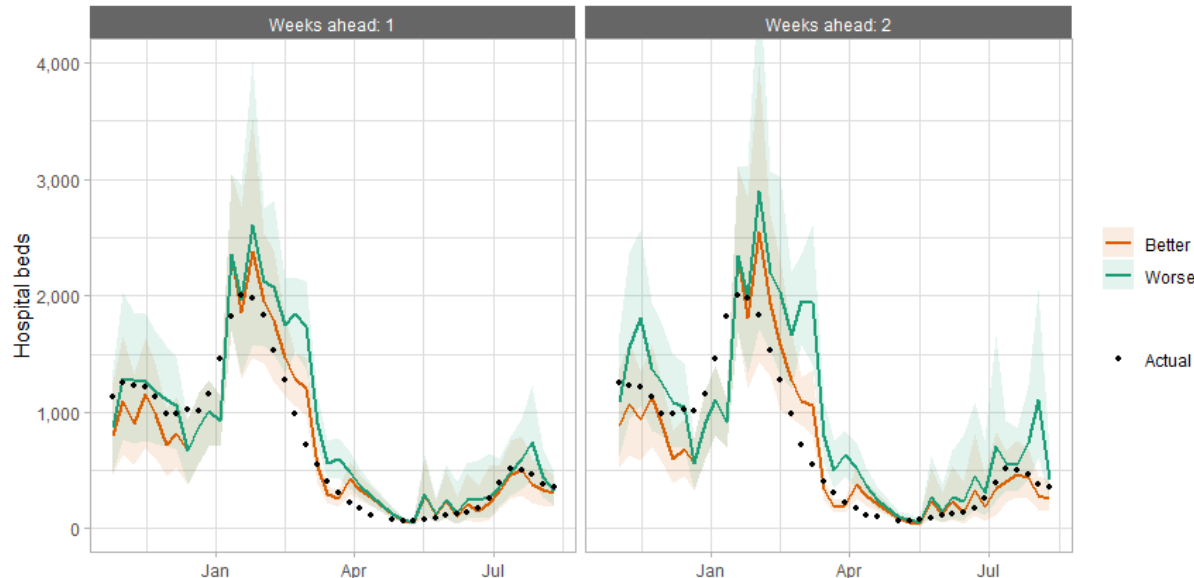
The following charts show the history of our modelling projections in comparison to estimates of the actual data. The infections projections were largely accurate during October to mid-December and from mid-January onward. During mid-December to mid-January, the projections underestimated the number of infections, due to the unforeseen effects of the new variant.

Figure 19. Infections projections versus actuals, for historical projections published between one and two weeks before the actual data came in.



Hospital bed projections have generally been more precise than infections estimates due to being partially based on already known information about numbers of current infections, and number of people already in hospital. The projections are for number of people in hospital due to Covid-19, which is slightly different to the actuals, which are number of people in hospital within 28 days of a positive Covid-19 test.

Figure 20. Hospital bed projections versus actuals, for historical projections published between one and two weeks before the actual data came in.



As with hospital beds, ICU bed projections have generally been more precise than infections. The projections are for number of people in ICU due to Covid-19. The actuals are number of people in ICU within 28 days

of a positive Covid-19 test up to 20 January, after which they include people in ICU over the 28 day limit.

Figure 21. ICU bed projections versus actuals, for historical projections published between one and two weeks before the actual data came in.

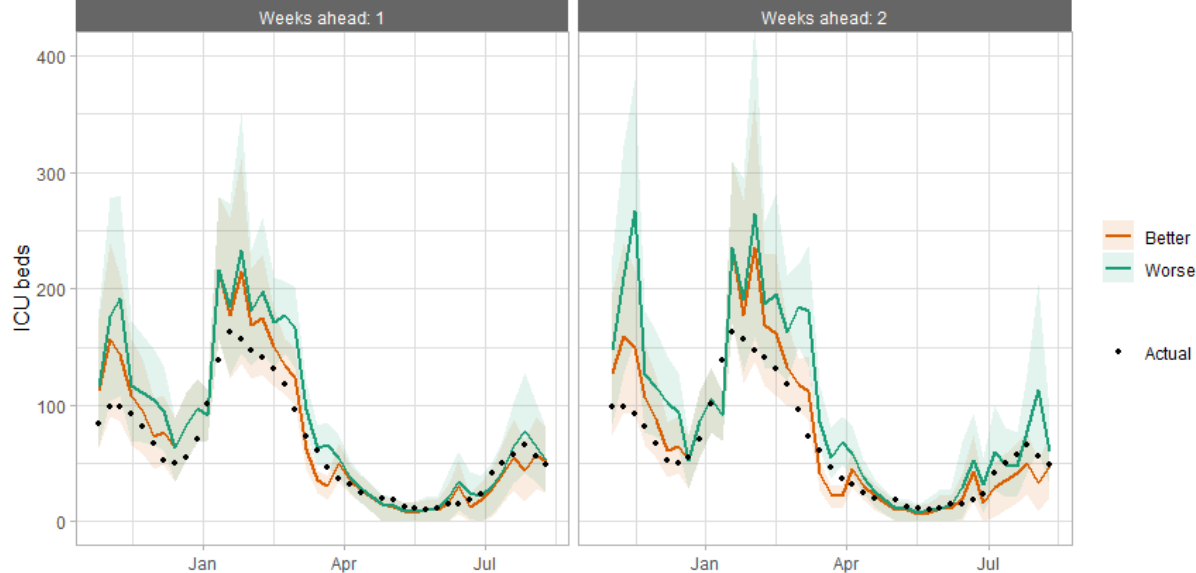


Table 1. Probability of local authority areas exceeding thresholds of cases per 100K (29th August to 4th September 2021), data to 16th August.

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

## What levels of Covid-19 are indicated by wastewater (WW) data?

Table 2 provides population weighted daily averages for normalised WW Covid-19 levels in the weeks beginning 3rd and 10th August, 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<sup>16</sup>.

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

Local authority (LA)	Average daily WW case estimate, with outliers included		Average daily WW case estimate, with outliers removed		Coverage <sup>17</sup>
	w/b 3rd August	w/b 10th August	w/b 3rd August	w/b 10th August	
Aberdeen City	25	22	25	22	80%
Aberdeenshire	18	18	16	18	27%
Angus	39	25	39	25	56%
Argyll and Bute	–	–	–	–	0%
City of Edinburgh	47	47	47	47	96%
Clackmannanshire	49	75	36	75	70%
Dumfries & Galloway	13	26	11	26	38%
Dundee City	49	32	49	32	100%
East Ayrshire	23	65	23	65	57%
East Dunbartonshire	38	36	38	36	99%
East Lothian	47	47	47	47	56%
East Renfrewshire	26	49	26	49	89%
Falkirk	25	49	25	49	43%
Fife	29	49	29	49	36%
Glasgow City	35	52	35	52	98%
Highland	21	24	21	24	31%
Inverclyde	–	23	–	23	92%
Midlothian	47	47	47	47	73%
Moray	19	23	13	23	42%
Na h-Eileanan Siar	–	–	–	–	0%
North Ayrshire	18	38	18	38	85%
North Lanarkshire	84	43	76	43	88%
Orkney Islands	9	3	9	3	34%
Perth and Kinross	–	–	–	–	3%
Renfrewshire	26	16	26	16	57%
Scottish Borders	31	16	28	16	40%
Shetland Islands	1	1	1	1	29%
South Ayrshire	23	60	23	60	84%
South Lanarkshire	48	62	48	62	52%
Stirling	17	11	17	11	53%
West Dunbartonshire	38	36	38	36	48%
West Lothian	24	24	24	24	55%

<sup>16</sup> 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 both with and without the outliers removed. See Technical Annex in Issue 60 of these Research Findings for further details.

<sup>17</sup> Coverage as at the week beginning 10th August 2021.



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