Coronavirus (COVID-19): Analysis

Coronavirus (COVID-19): modelling the epidemic in Scotland (Issue No. 63)

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 30th July 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 0.7 and 0.9, with the growth rate between -5% and -2%, based on the period up to 2nd August.

The number of new cases in Scotland has been declining since the recent peak in early July (when there were over 400 per hundred thousand people). Last week the R number was below 1 for the first time since mid-May.

Hospital admissions have been declining slowly since mid-July and ICU admissions are now also beginning to decline. Acute bed occupancy has followed a similar trend, though ICU occupancy over the last few weeks is indicative of a plateau rather than a decline at this stage.

Key Points

- The reproduction rate R in Scotland is currently estimated as being between 0.7 and 0.9, based on the period up to 2nd August. The lower and upper limits have decreased since last week.
- The number of new daily infections for Scotland is estimated as being between 58 and 114, per 100,000 people, based on the period up to 2nd August.

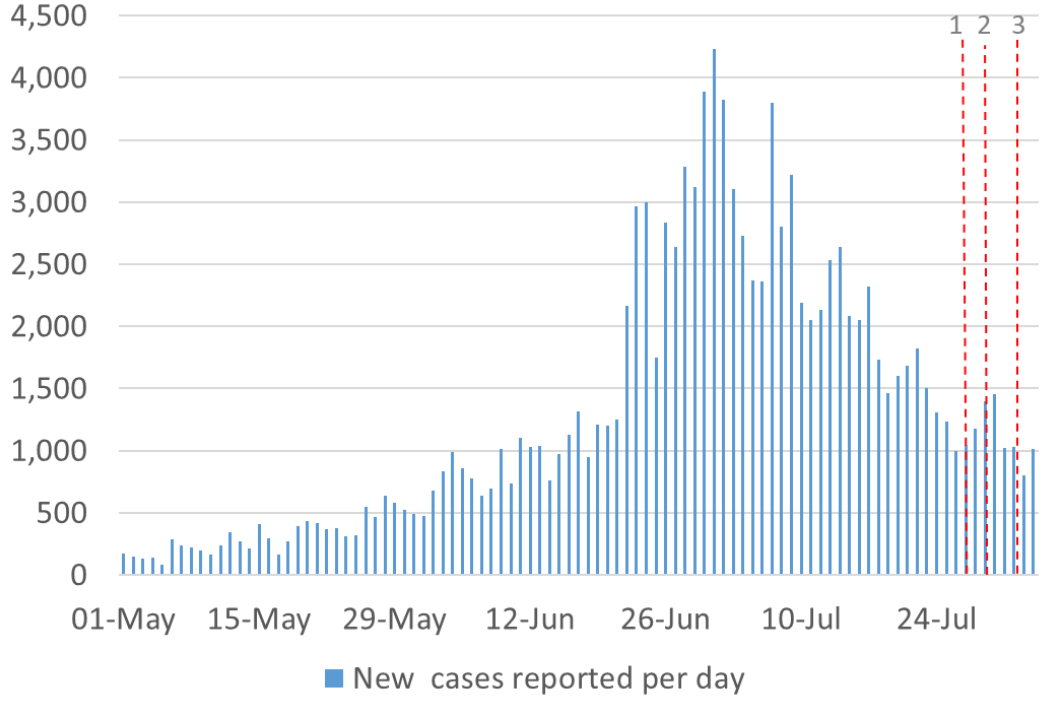
- The growth rate for Scotland is currently estimated as between -5% and -2%, based on the period up to 2nd August.
- Average contacts have remained at a similar level in the last two weeks (comparing surveys pertaining to 8th July - 14th July and 22nd July - 28th July) with a current level of 4.2 daily contacts.
- Mean contacts for those aged between 40-49 and 60-69 have shown an increase in comparison to two weeks prior. For individuals aged between 40-49 this is largely driven by a rise in contacts within the work place in contrast to those aged 60-69 where this increase is driven by a rise in contacts within the home and other setting (contacts had outside of the work, school and home).
- Interactions between those 18 and over with individuals under 18 have decreased in the last two weeks with the exception of those aged between 40-49 who have increased their interactions with this age group.
- The proportion of participants visiting different locations remains at similar levels across the majority of locations with those visiting another's home reporting the highest increase from 47% to 53% in the last two weeks.
- The proportion of contacts reported to have been indoors only has decreased within the last two weeks whereas the proportion of contacts occurring outside only has shown an increase over the same period.
- Hospitalisations have been declining from a peak in mid-July. Potential future changes in hospital occupancy and intensive care use depends on both current infection levels and the impact of the recent and upcoming relaxations of measures which will take a few weeks to become apparent.
- Modelled rates of positive tests per 100K using data to 2nd August indicate that, for the week commencing 15th August 2021, there are four local authorities with at least a 75% probability of exceeding 50 cases per 100k. These are Inverclyde, North Lanarkshire, South Lanarkshire and West Dunbartonshire. There are no local authorities which are expected to exceed 100 cases per 100k with at least a 75% probability.
- Nationwide, relative to last week's reported levels, wastewater Covid-19 RNA concentrations have fallen by around 20%. Compared to earlier in the year, the current levels of wastewater Covid are still in a similar range to late January/early February.
- All sites, besides Edinburgh, show wastewater Covid-19 levels continuing to be higher than would be expected given the current rate of new cases.

- The South Lanarkshire local authority overall wastewater Covid-19 level now is significantly above the national average, in contrast to the low levels of new cases observed.
- The Scottish Government is modelling the number of people likely to experience long Covid symptoms. This modelling estimates that, on 22nd August 2021, between 0.7% and 1.9% of the population are projected to experience symptoms for 12 weeks or more after their first suspected Covid infection in Scotland.

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 4th August 2021.



This report covers the period up to 28th July for contact patterns (indicated by dashed line 1). Wastewater data is provided to 30th July (dashed line 2). The estimates of R, incidence, growth rates, the modelled rates of positive tests per 100k, the medium term projections by the Scottish Government of infections, hospitalisations and ICU beds, and the long Covid analysis use data to 2nd 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[1] 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.

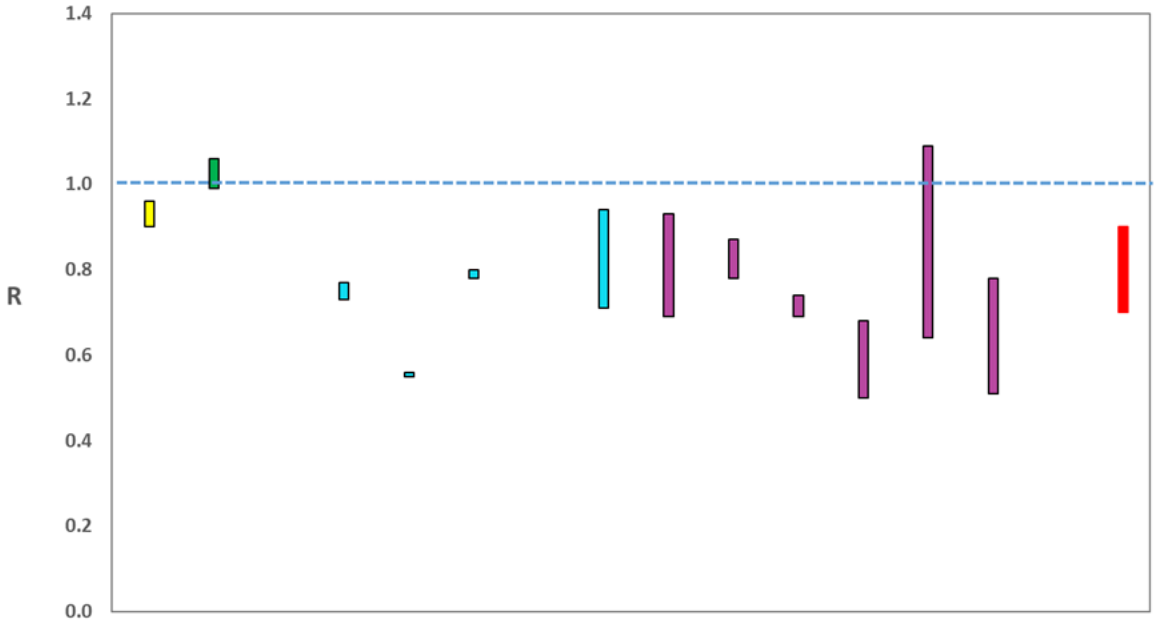
R is an indicator that lags by two to three weeks and therefore does not reflect any behavioural changes that have happened during this time.

[1] 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).

UKHSA's consensus view across these methods as of 4th August, using data to 2nd August, was that the value of R in Scotland was between 0.7 and 0.9 (see Figure 2)[2].

This week the Scottish Government presented two outputs to EMRG. The first uses confirmed cases as published by Public Health Scotland (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 4th August, including 90% confidence intervals, produced by EMRG[3]. Data to 2nd August.



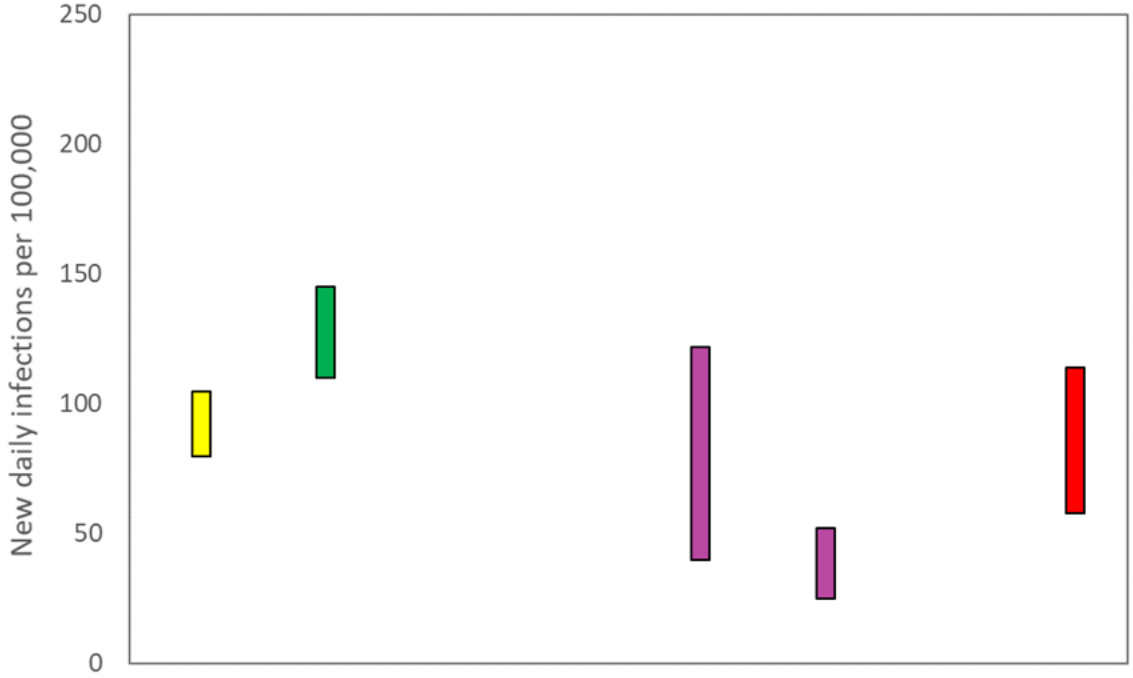
Source: EMRG

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 2nd August, was that the incidence of new daily infections in Scotland was between 58 and 114 new infections per 100,000. This equates to between 3,200 and 6,200 people becoming infected each day in Scotland.

[2] 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.

[3] 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 4th August, including 90% confidence intervals, produced by EMRG[2]. Data to 2nd August.



Source: EMRG

The consensus from UKHSA for this week is that the growth rate in Scotland is between -5% and -2% per day using data to 2nd August. The lower and upper limits have decreased 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 8th - 14th July and 22nd - 28th July) with a current level of 4.2 daily contacts as seen in Figure 4. Contacts across all settings have remained at similar levels compared to two weeks prior.

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

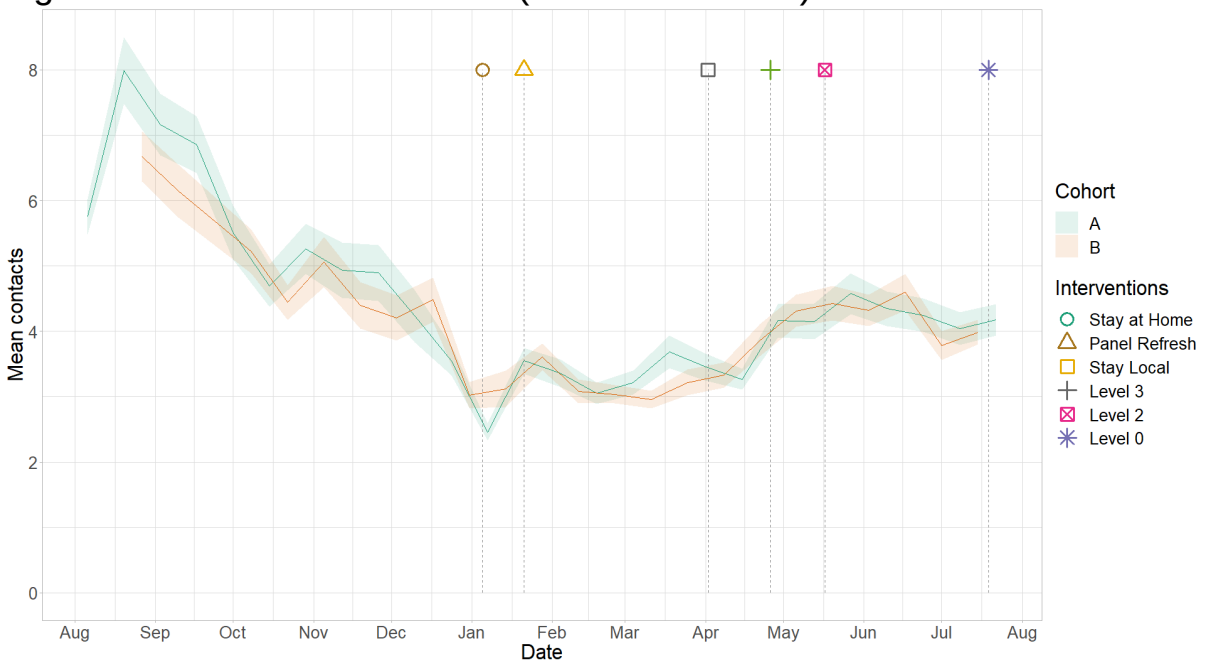
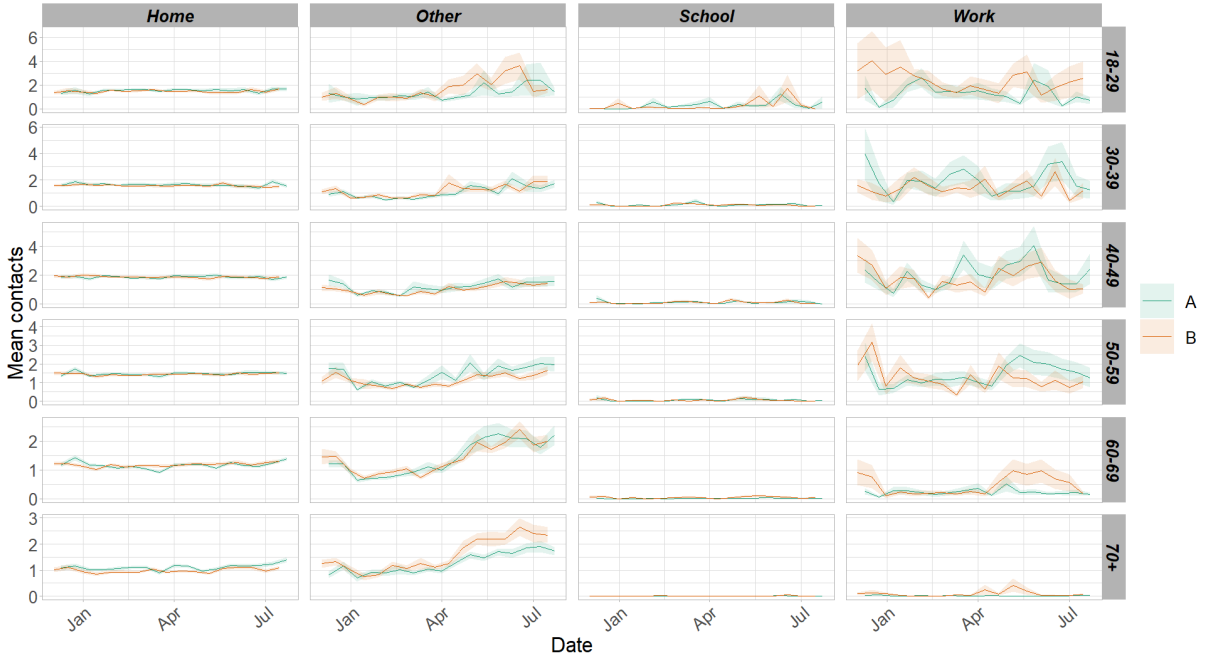


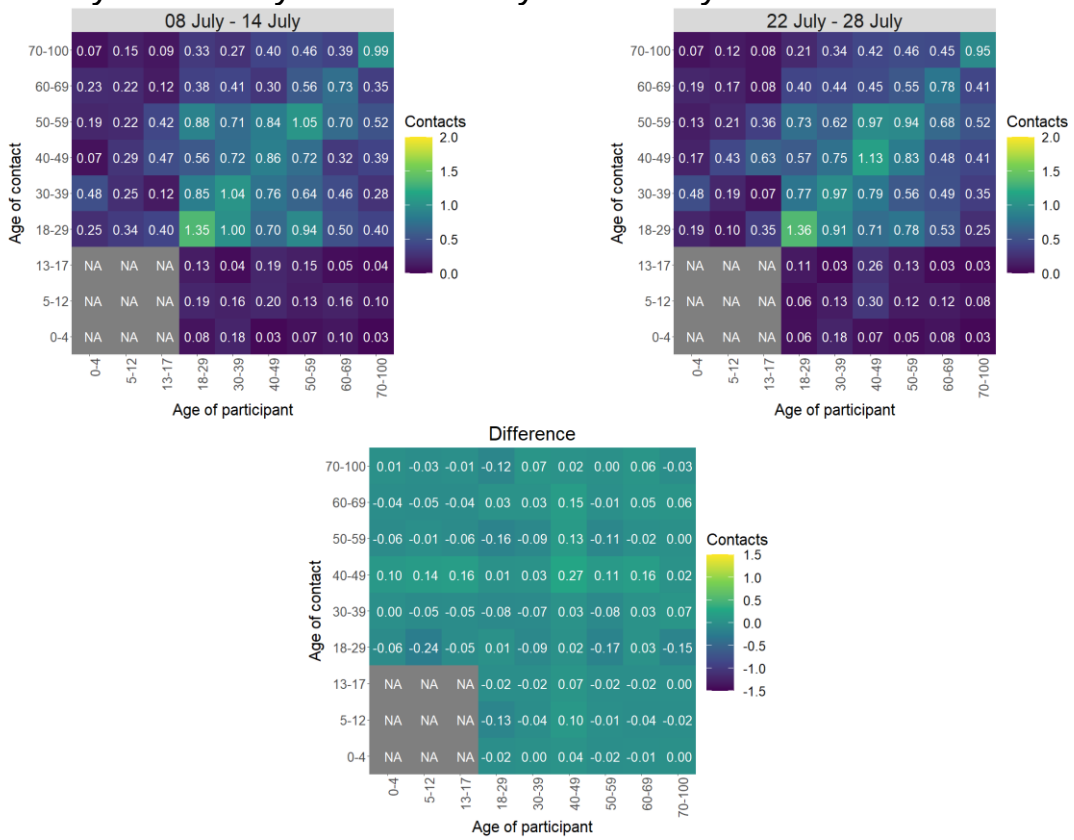
Figure 5 shows how contacts change across age group and setting. Mean contacts for those aged between 40-49 and 60-69 have shown an increase in comparison to two weeks prior. For individuals aged between 40-49 this is largely driven by a rise in contacts within the work place. For those aged 60-69 the increase is driven by a rise in contacts within the home and other setting (contacts had outside of the work, school and home).

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 8th July - 14th July and 22nd July - 28th July and the difference between these periods. Interactions between those 18 and over with individuals under 18 have decreased in the last two weeks with the exception of those aged between 40-49 who have increased their interactions with this age group.

Figure 6. Overall mean contacts by age group before the weeks relating to 8th July - 14th July and 22nd July - 28th July.



As seen in Figure 7, the proportion of participants visiting different locations remains at similar levels across the majority of locations, with those visiting someone else's home reporting the highest increase from 47% to 53% in the last two weeks.

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

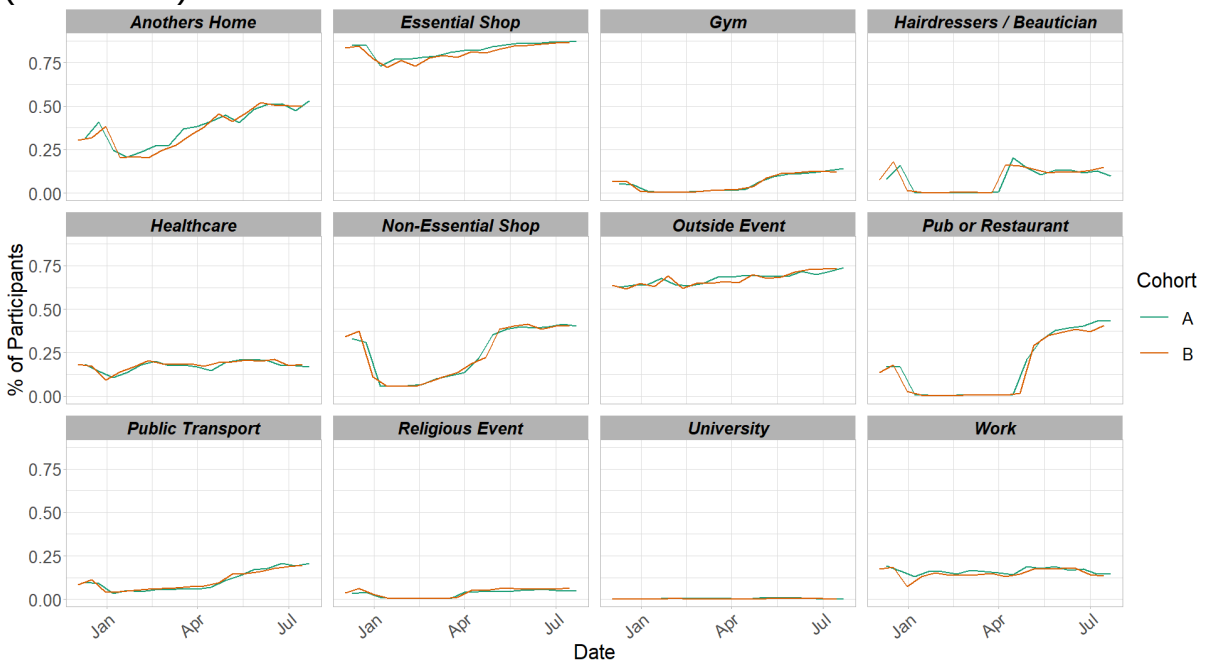
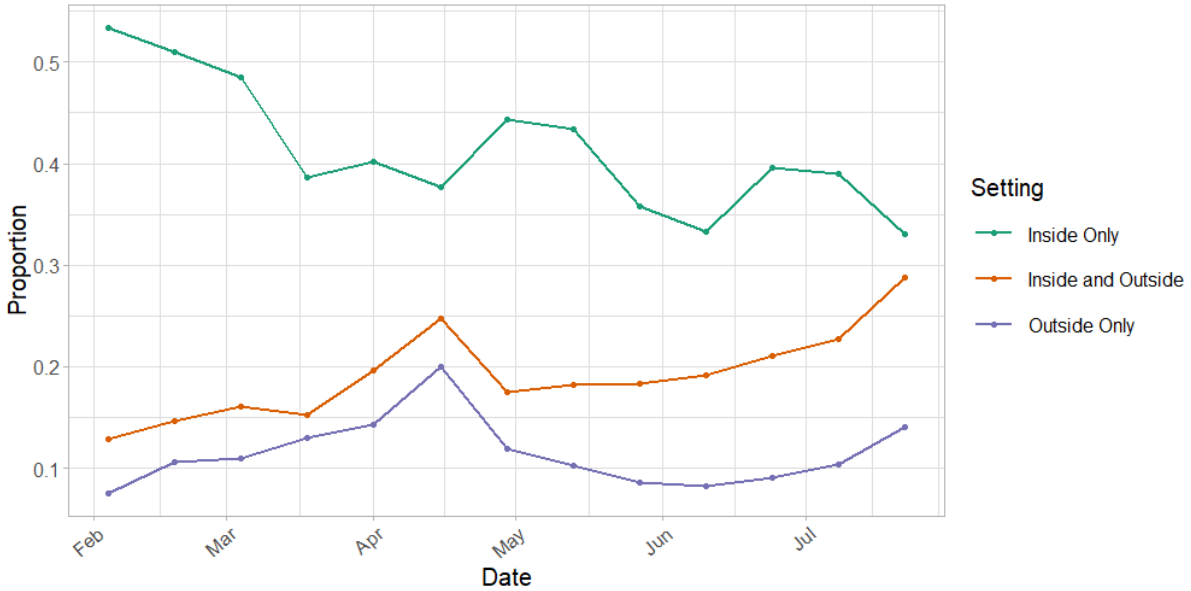


Figure 8 shows the proportion of participants that reported contacts had indoors and outdoors for contacts individually reported for panel A. A contact can be recorded as both indoor and outdoor. The graph also shows contacts reported as outside only and indoor only. The proportion of contacts reported to have been indoors only has decreased within the last two weeks whereas the proportion of contacts occurring outside only has shown an increase over the same period.

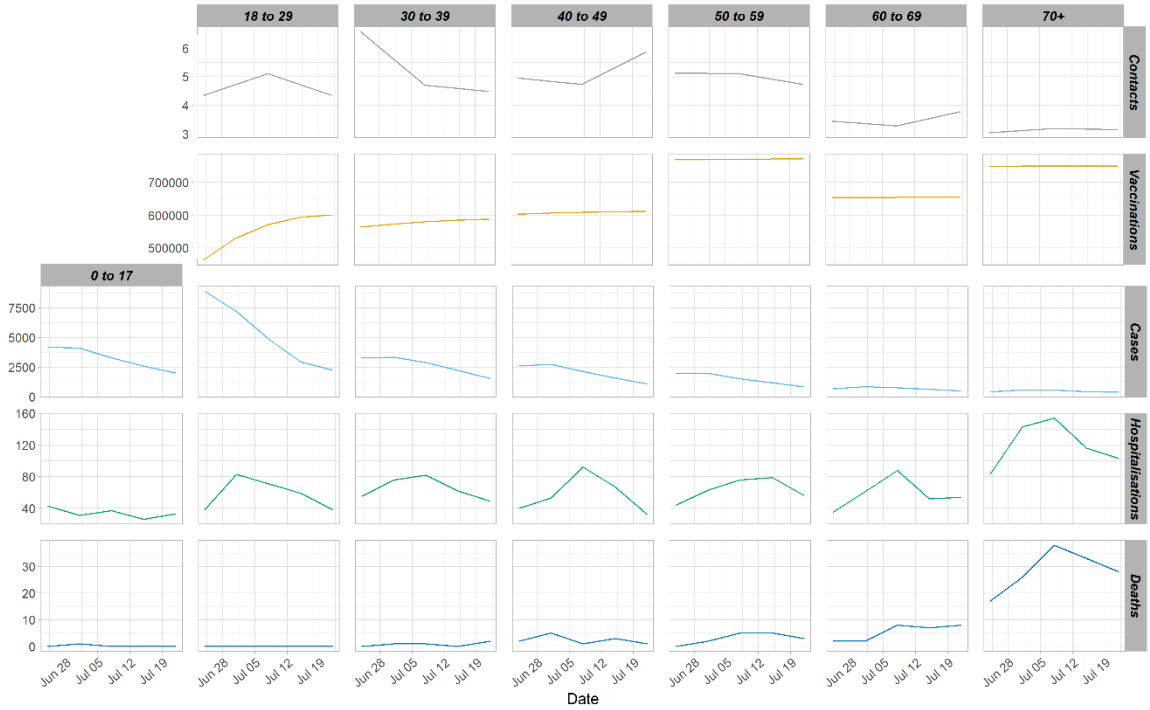
Figure 8. Proportion of participants reported indoors and outdoors for contacts individually reported for panel A.



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. Despite that, they have similar, or higher for the oldest age group, weekly 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[4] and cumulative vaccinations by age band[5]



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

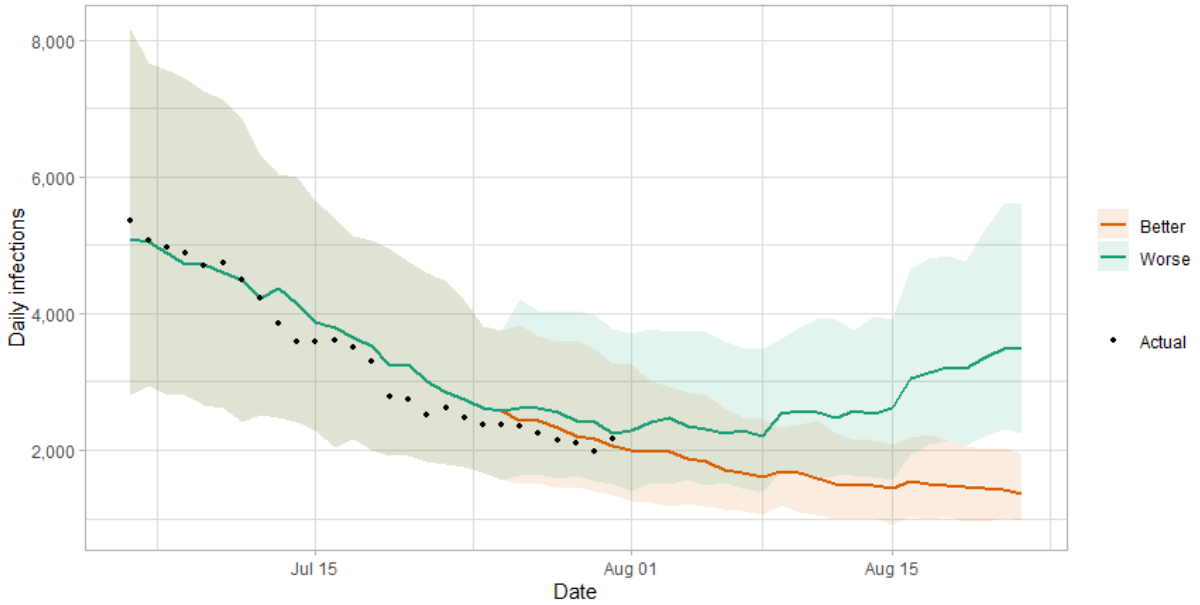
The Scottish Government assesses the impact of Covid-19 on the NHS in the next few weeks in terms of estimated number of infections. Figure 10 shows two projections.

'Worse' assumes a behaviour change over a two month period following the change in restrictions on the 19th July, and the upcoming changes on the 9th of August. 'Better' assumes this behavioural change happens

[4] Deaths, Cases and Hospitalisations from PHS COVID-19 daily cases in Scotland dashboard.
[5] 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.

more gradually over a five to six month period leading to lower transmission[6].

Figure 10. Medium term projections of modelled total new daily infections, adjusting positive tests[7] to account for asymptomatic and undetected infections, from Scottish Government modelling, based on positive test data reported up to 2nd August.



In comparison to last week, our confidence in the recent fall in infections has increased, so the 'Worse' projection now broadly follows that fall in infections. We have also assumed a less immediate impact from the relaxations on 19 July than was assumed last week for 'Worse'.

There is uncertainty as to whether infections will increase or decrease in coming weeks. This will drive whether hospital beds and intensive care beds also continue to 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 occupancy from the June increase in cases are 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.

[6] Both scenarios are based on current vaccine roll-out plans and efficacy assumptions.
[7] 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 2nd August.

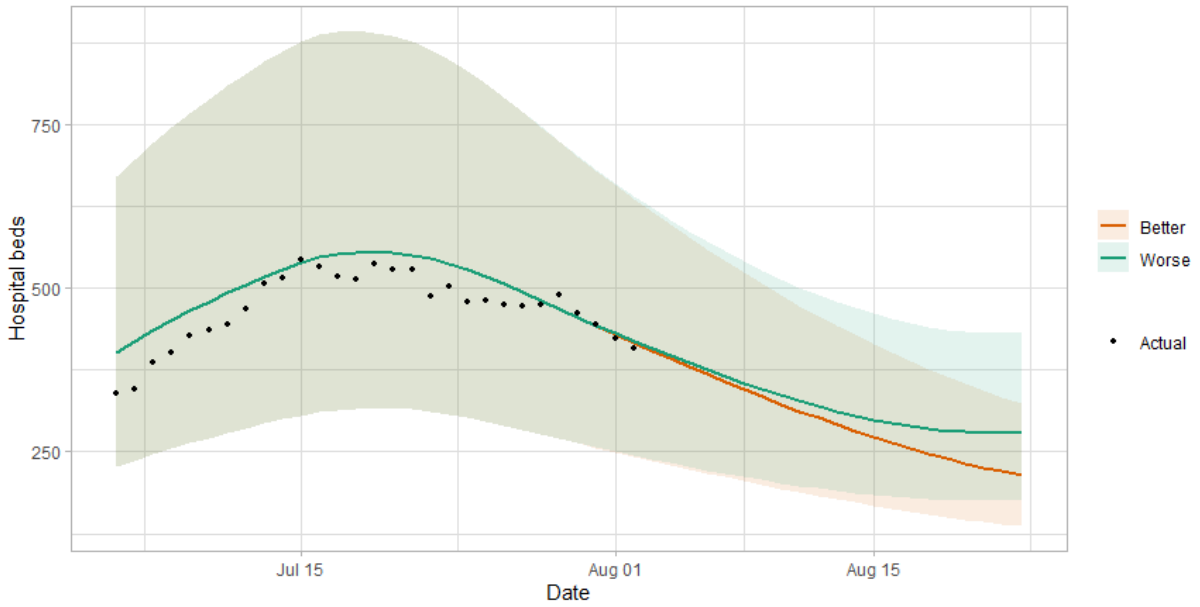
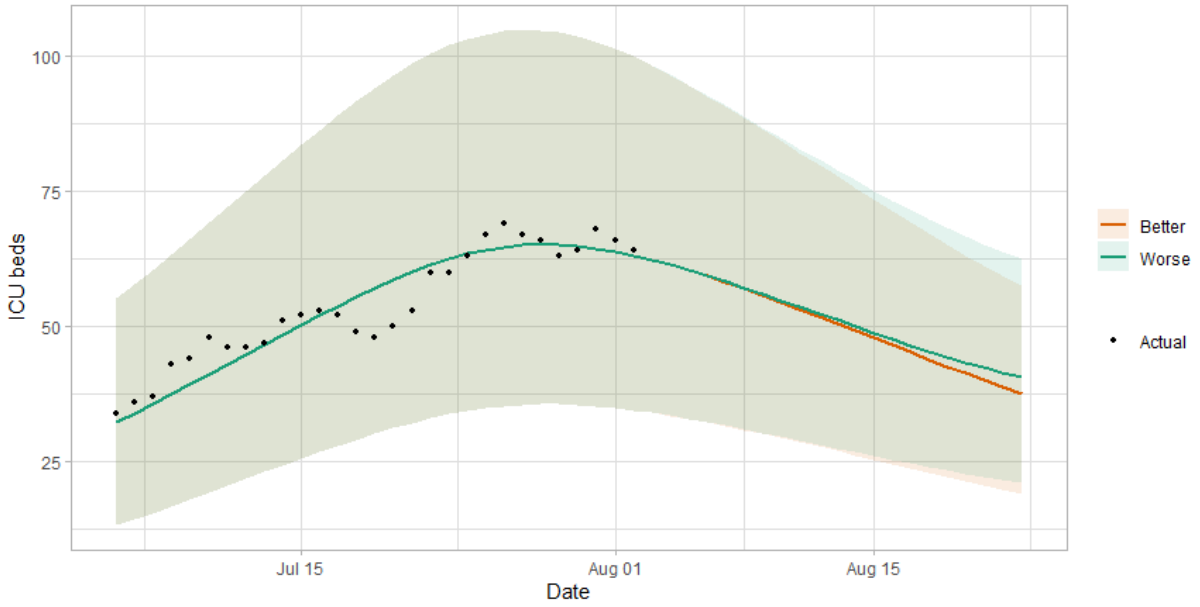


Figure 12 shows the impact of the projection on ICU bed demand.

Figure 12. Medium term projections of modelled ICU bed demand, from Scottish Government modelling[8], based on positive test data reported up to 2nd August.



[8] 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.

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

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

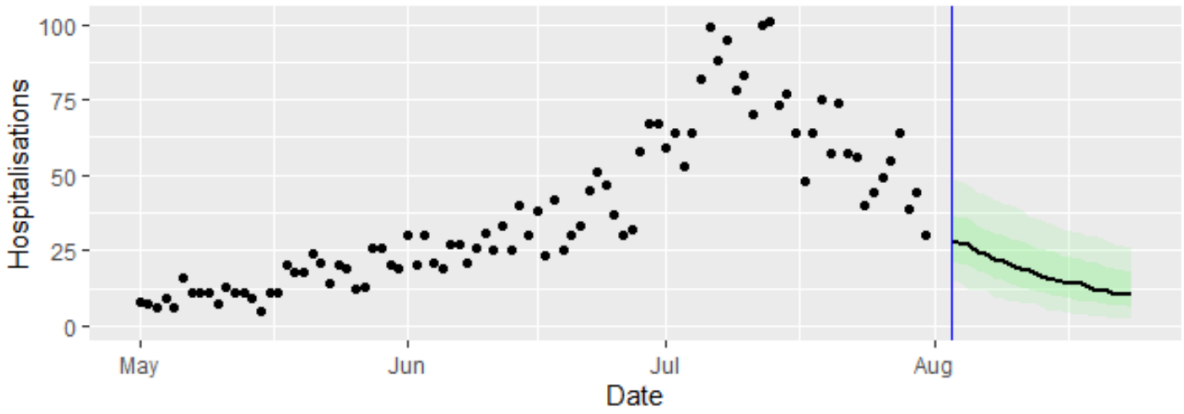
SPI-M produces projections of the epidemic[9] (Figure 13), combining estimates from several independent models (including the Scottish Government's logistics modelling, as shown in Figures 10-12). These projections are not forecasts or predictions. They represent a scenario in which the trajectory of the epidemic continues to follow the trends that were seen in the data up to 2nd 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 2nd 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 22nd August, 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.

[9] Four week projections are provided here: Scientific evidence supporting the government response to coronavirus (COVID-19) - GOV.UK (www.gov.uk)

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.

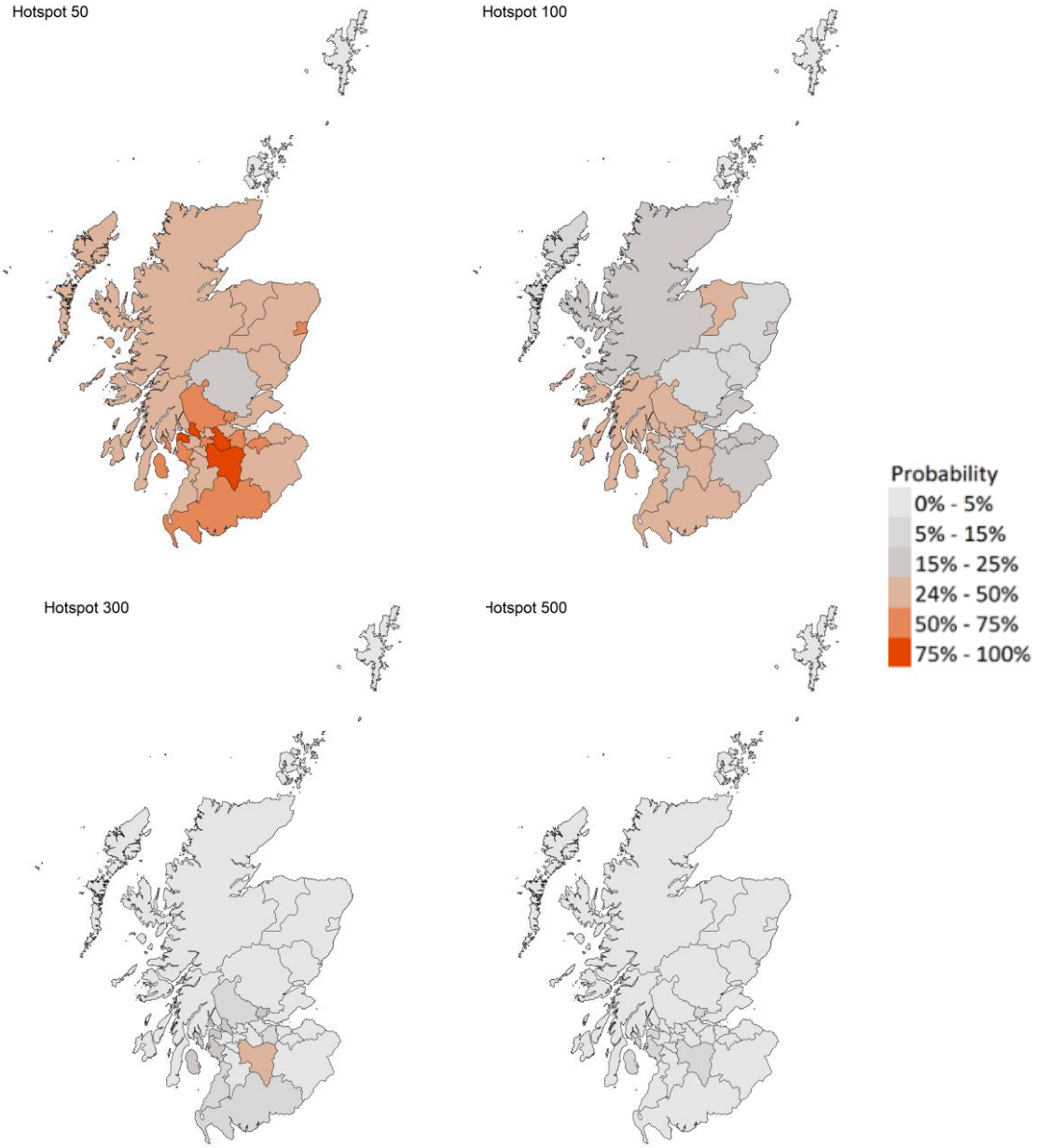
What we know about which local authorities are likely to experience high levels of Covid-19 in two weeks' time

We continue to use modelling based on Covid-19 cases and deaths using data to 19th July 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.

Modelled rates of positive tests per 100K using data to 2nd August (Figure 14) indicate that, for the week commencing 15th August 2021, there are four local authorities with at least a 75% probability of exceeding 50 cases per 100k. These are Inverclyde, North Lanarkshire, South Lanarkshire and West Dunbartonshire. There are no local authorities which are expected to exceed 100 cases per 100k with at least a 75% probability[10].

[10] Numbers are included in Table 1 in the Technical Annex.

Figure 14. Probability of local authority areas exceeding thresholds of cases per 100K (15th to 21st August 2021), data to 2nd August.



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

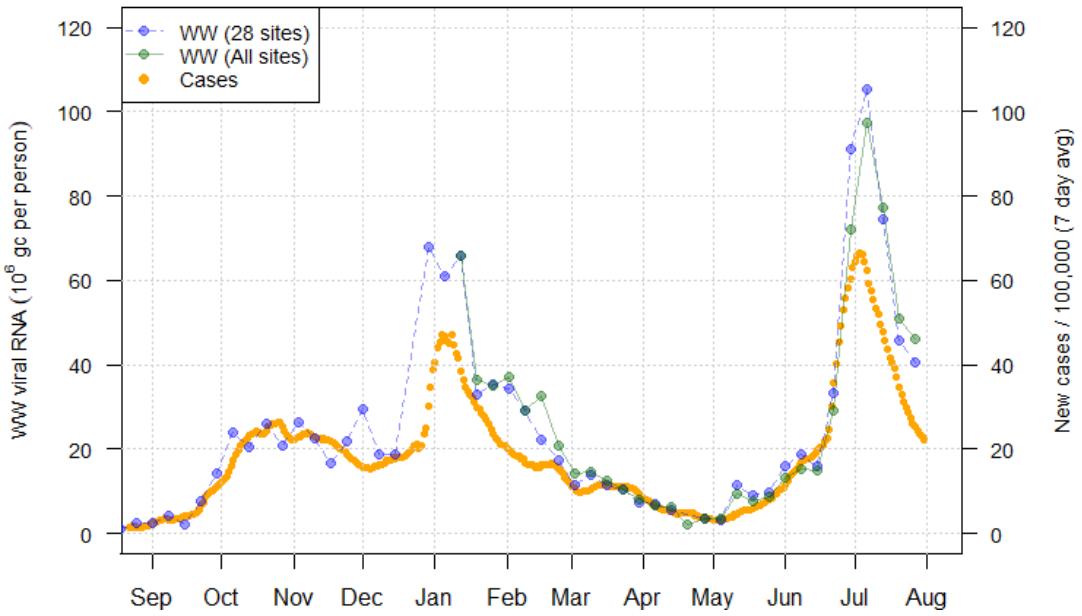
Levels of Covid-19 RNA in wastewater collected at a number of sites around Scotland are adjusted for population and local changes in intake flow rate and compared to 7-day average daily new case rates derived from Local Authority and Neighbourhood (Intermediate Zone) level aggregate data. See Technical Annex in Issue 34 of these Research Findings for the methodology.

Nationwide, the newest levels of wastewater Covid-19 averaged around 40-46 million gene copies per person per day, representing a decline of around 20% from last week.

The South Lanarkshire local authority overall wastewater Covid level is currently significantly above the national average, in contrast to the low levels of new cases observed there.

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[11].

Figure 15. National average trends in wastewater Covid-19 and daily new case rates (7 day moving average)[12].

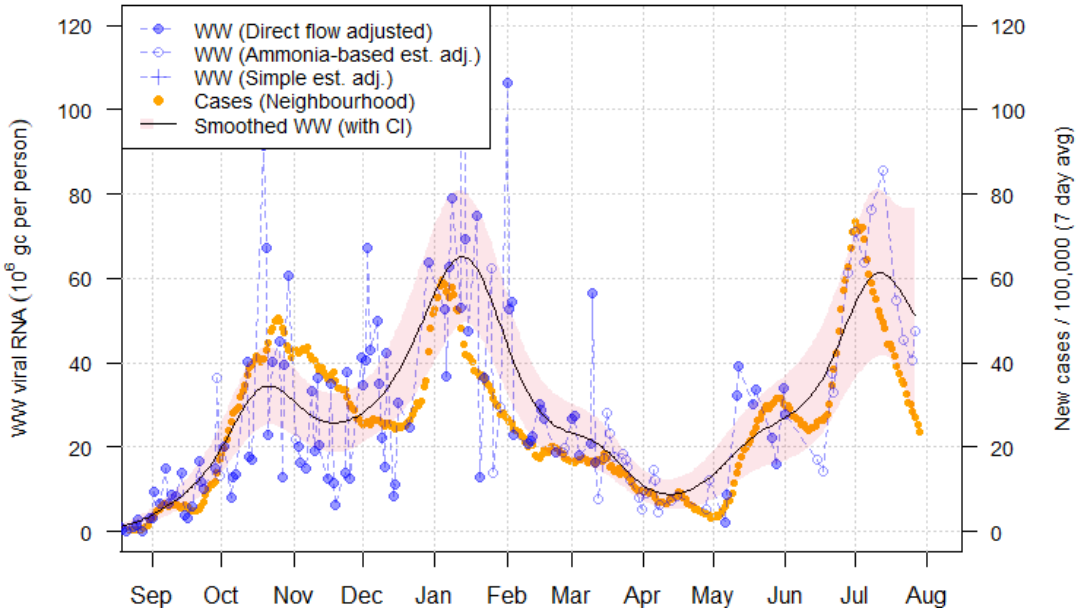


[11] Note that data in this report overlaps that shown in last week's publication.

[12] 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 shows Shieldhall (a site covering part of Glasgow), which gave a decline in weekly wastewater Covid levels similar to the national average. Dundee also showed a decline mirroring the national level. The Edinburgh site of Seafield is experiencing a decline which is steeper than seen nationally. In contrast, the Aberdeen site of Nigg shows no decline in wastewater Covid levels from the previous week

Figure 16. Wastewater Covid-19 and daily case rate (7 day moving average) for Shieldhall (covered pop: 377k) in Glasgow[13].

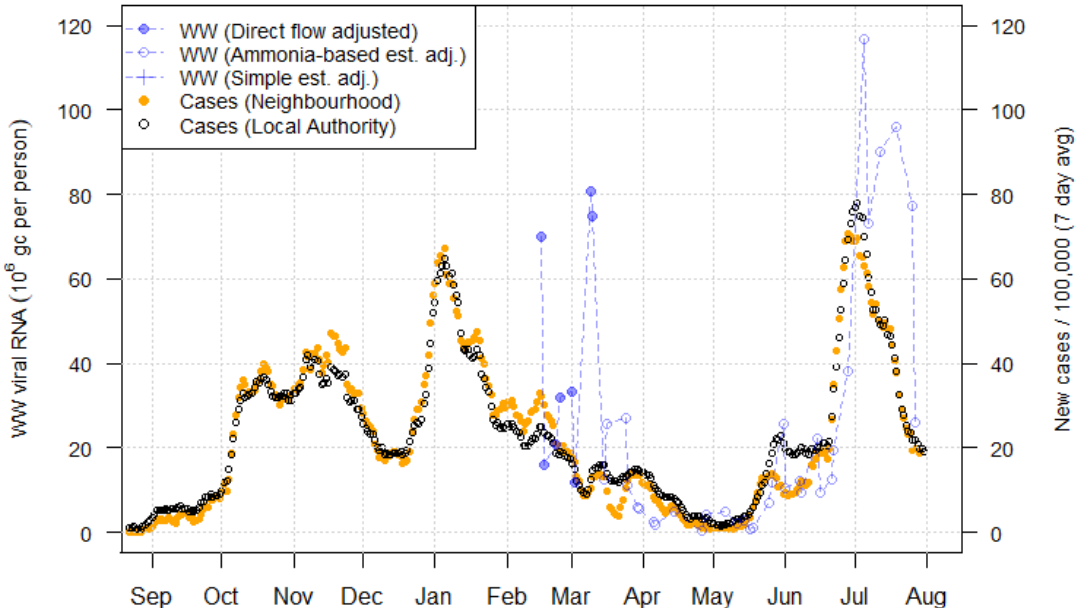


All sites, besides Edinburgh, show wastewater Covid levels continuing to be higher than would be expected given the current rate of new cases. To some extent wastewater Covid levels should reflect not just incidence but prevalence, as those infected may have a peak in shedding but continue to shed for some time. This may partially explain how the wastewater patterns seem to lag the decline in case rates. Nevertheless, these should be interpreted cautiously, given the rapid pace of current developments and inherent uncertainty in all measures.

Of the sites with a persistent high level of Covid-19 in wastewater, Paisley in Renfrewshire (Figure 17) and Daldowie in North Lanarkshire have now both registered a measurement with a large decline. However these represent single measurements and so there remains some uncertainty.

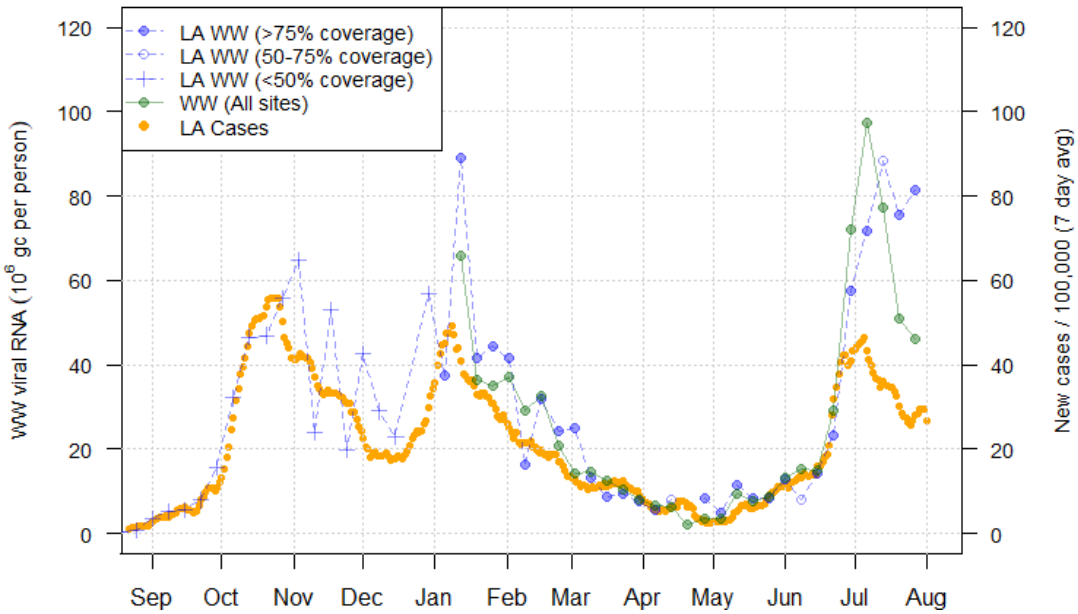
[13] The black line and red shaded area provide a smoothed curve and confidence interval for WW Covid-19 that is estimated from a generalised additive model based on a Tweedie distribution.

Figure 17. Wastewater Covid-19 and daily case rate (7 day moving average) for Paisley (covered pop: 82k) in Renfrewshire.



Across South Lanarkshire, many sites including Hamilton, Philipshill and Allers all show levels that either have not fallen or are rising. The South Lanarkshire local authority overall (as shown in Figure 18) now is significantly above the national average, in contrast to the low levels of new cases being observed there. A similar pattern, albeit to a lesser extent, is seen in Fife, driven by sites like Kirkcaldy, Dunfermline and Levenmouth, though the data there is more uncertain.

Figure 18. Average trends in wastewater Covid-19 and daily case rates (7 day moving average) in South Lanarkshire (covered pop: 325k).



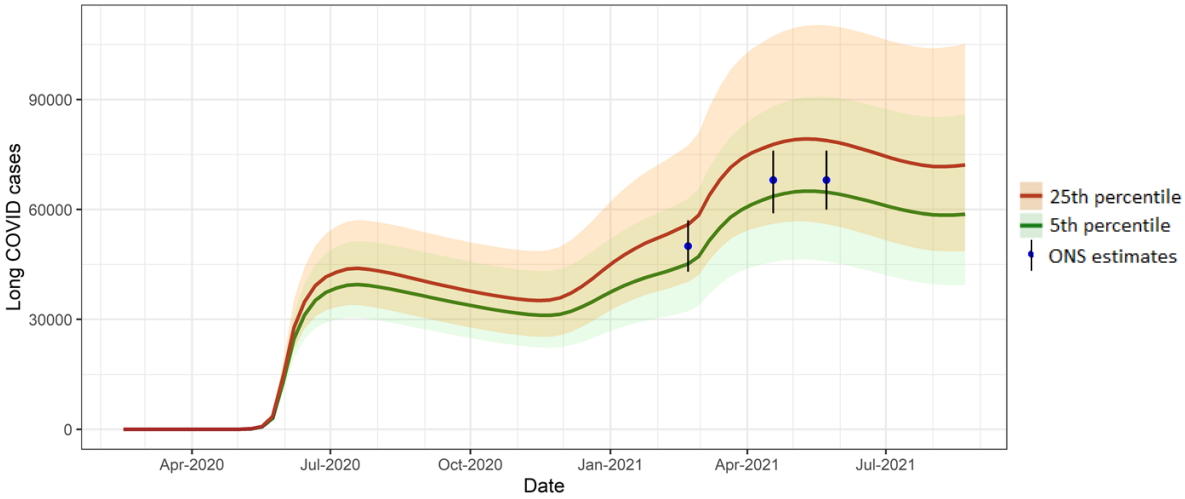
What estimates do we have of the number of people experiencing long Covid symptoms?

The Scottish Government has started to model the number of people likely to experience long Covid symptoms. This has then been projected forward to estimate long Covid rates in the future based on Scottish Government medium term projection modelling as set out in Figure 19.

This modelling estimates that, at 22nd August 2021, between 39,000 (0.7% of the population) and 105,000 (1.9%) people were projected to experience symptoms for 12 weeks or more after their first suspected Covid infection in Scotland.

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

Figure 19. Estimates of long Covid prevalence at 12 weeks from 16th February 2020 to 22nd August 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.

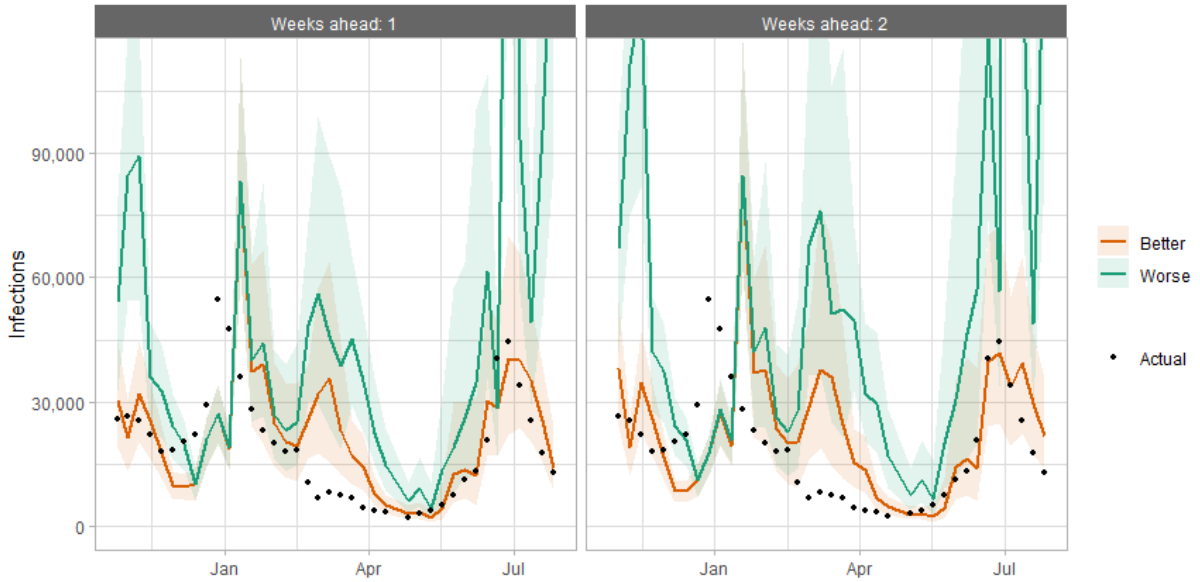
Modelling also allows us to make short-term forecasts of what may happen with a degree of uncertainty. These can be used in health care and other planning. The modelling in this research findings is undertaken using different types of data which going forward aims to both model the progress of the epidemic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

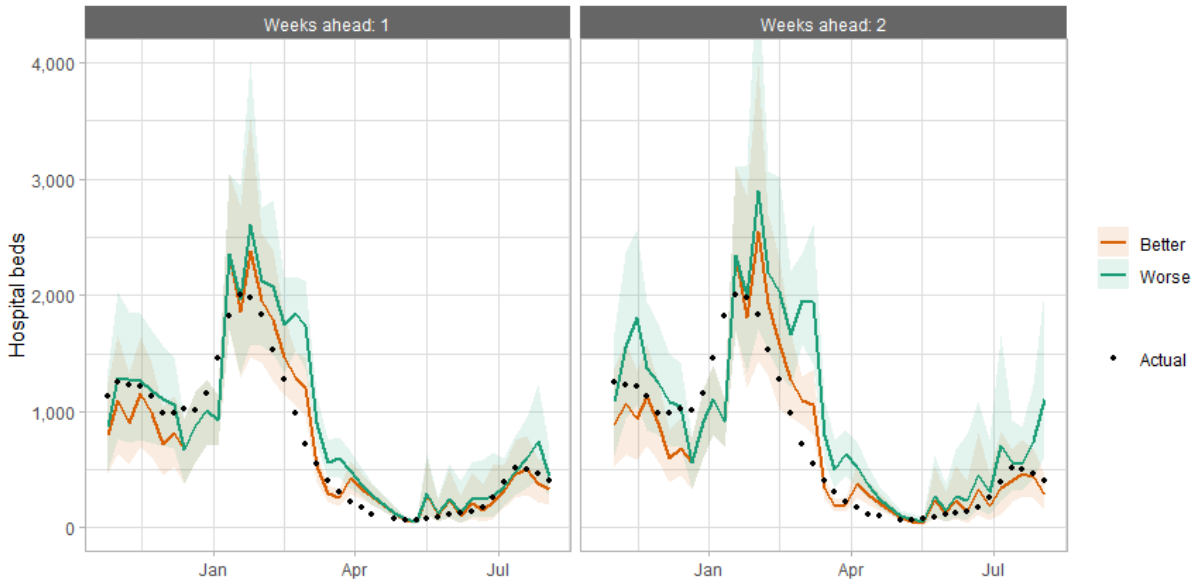
The following charts show the history of our modelling projections in comparison to estimates of the actual data. The infections projections were largely accurate during October to mid-December and from mid-January onward. During mid-December to mid-January, the projections underestimated the number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

Figure 20. 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 21. 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 22. ICU bed projections versus actuals, for historical projections published between one and two weeks before the actual data came in.

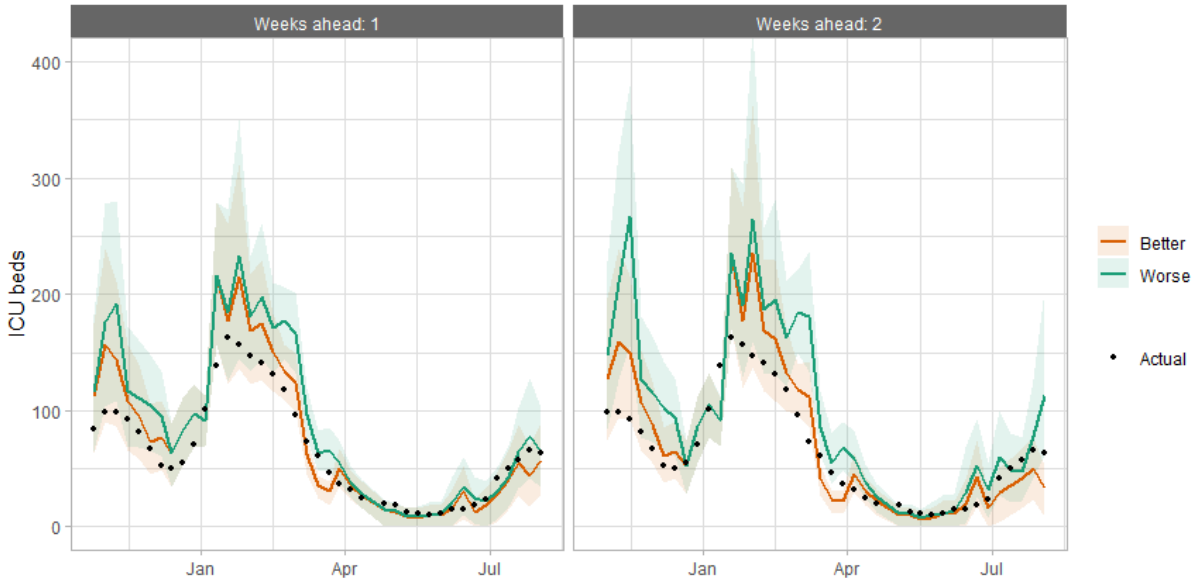


Table 1. Probability of local authority areas exceeding thresholds of cases per 100K (15th to 21st August 2021), data to 2nd August.

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

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 the 17th and 24th July, 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[14].

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[15]
	w/b 17th July	w/b 24th July	w/b 17th July	w/b 24th July	
Aberdeen City	44	35	44	35	80 %
Aberdeenshire	30	29	28	28	52 %
Angus	46	31	46	31	56 %
Argyll and Bute	24	15	24	15	18 %
City of Edinburgh	45	31	45	31	96 %
Clackmannanshire	53	49	37	49	23 %
Dumfries & Galloway	23	22	22	22	10 %
Dundee City	45	36	45	36	100 %
East Ayrshire	38	41	38	41	72 %
East Dunbartonshire	48	38	48	38	99 %
East Lothian	44	29	44	29	65 %
East Renfrewshire	50	43	50	43	95 %
Falkirk	33	27	33	27	69 %
Fife	58	55	58	48	50 %
Glasgow City	60	58	60	58	98 %
Highland	28	54	28	49	32 %
Inverclyde	22	44	22	44	92 %
Midlothian	45	33	45	33	88 %
Moray	22	25	22	25	56 %
Na h-Eileanan Siar	13	7	13	7	21 %
North Ayrshire	20	23	20	23	93 %
North Lanarkshire	95	72	95	72	94 %
Orkney Islands	6	11	6	11	34 %
Perth and Kinross	24	27	24	27	44 %
Renfrewshire	85	50	85	50	57 %
Scottish Borders	19	22	17	22	51 %
Shetland Islands	8	7	8	7	29 %
South Ayrshire	42	40	42	40	84 %
South Lanarkshire	75	82	55	82	90 %
Stirling	11	19	11	19	63 %
West Dunbartonshire	30	34	30	34	98 %
West Lothian	53	54	46	45	85 %

[14] 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.

[15] Coverage as at the week beginning 24th July 2021.

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The views expressed in this report are those of the researcher and do not necessarily represent those of the Scottish Government or Scottish Ministers.

This document is also available from our website at www.gov.scot.
ISBN: 978-1-80201-251-4

The Scottish Government
St Andrew's House
Edinburgh
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Produced for
the Scottish Government
by APS Group Scotland
PPDAS917466 (08/21)
Published by
the Scottish Government,
August 2021

ISBN 978-1-80201-251-4

Web Publication

PPDAS917466 (08/21)