

Coronavirus (COVID-19): Analysis

Coronavirus (COVID-19): modelling the epidemic in Scotland (Issue No. 9)

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 the 9 July 2020. The estimates in this document help the Scottish Government, the health service and the wider public sector plan and put in place what is needed to keep us safe and treat people who have the virus, e.g. to decide how many Intensive Care Beds (ICU) we need available for Covid patients.

Key Points

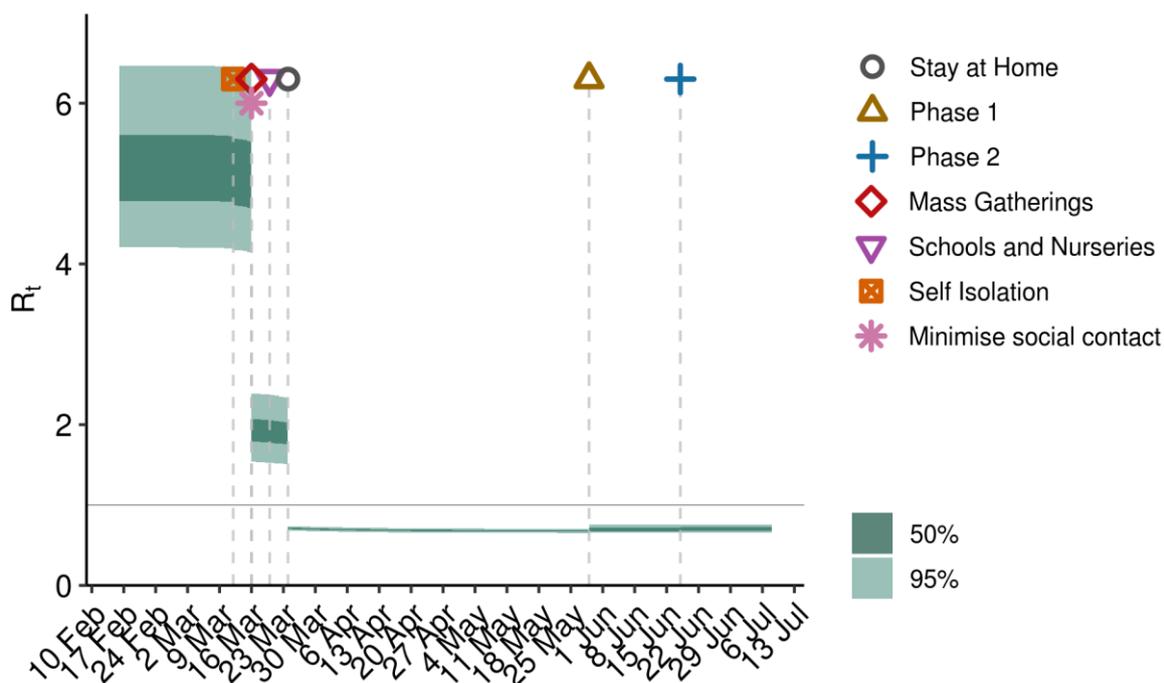
- Modelling is undertaken to look at the progression of the epidemic in Scotland and to inform the logistical response required.
- This is done over two time periods. Short term, for the next two weeks, and longer term. Both of these help the Scottish Government and wider public sector plan their response and help determine if the measures in place are working.
- Modelling by the Scottish Government estimates that on 10 July there were around 60 new infections and 700 people in Scotland who could be infectious with Covid-19. Both of these numbers have fallen significantly in the last week.
- The modelling forecasts that the number of infectious people, the number of cases, hospital and ICU use and deaths are all likely to continue to fall over the next two weeks.
- We currently use the value of R to talk about Covid-19 in Scotland. On 15 July, R in Scotland was estimated to be between 0.5 & 0.9.
- These forecasts were based on estimates of moving in to phase 2 guidance, implemented from 18 June. Changes associated with the move to phase 3 will not be fully seen until early August. The longer term forecasts will be closely monitored against actual cases over the next few weeks as the situation changes.

The Imperial College modelling code used by the Scottish Government to understand the progression of the epidemic in Scotland is driven by changes in the numbers of deaths occurring each day. We have reached a point where this number is very low. While this is really good news, it makes reporting of the R number less helpful in understanding how the epidemic is changing. A small, localised outbreak would result in a high R value, even though the number of cases would actually be very few. If the number of deaths drops further we will likely report trends in the numbers of new cases, the numbers of people who may be infectious, and the rate of change of these figures.

What the modelling tells us

Figure 1 shows how R_t has changed since February. Before the “stay at home” restrictions were put in place R_t was above 1, and most likely to have been between 4 and 6 before any interventions were put in place.

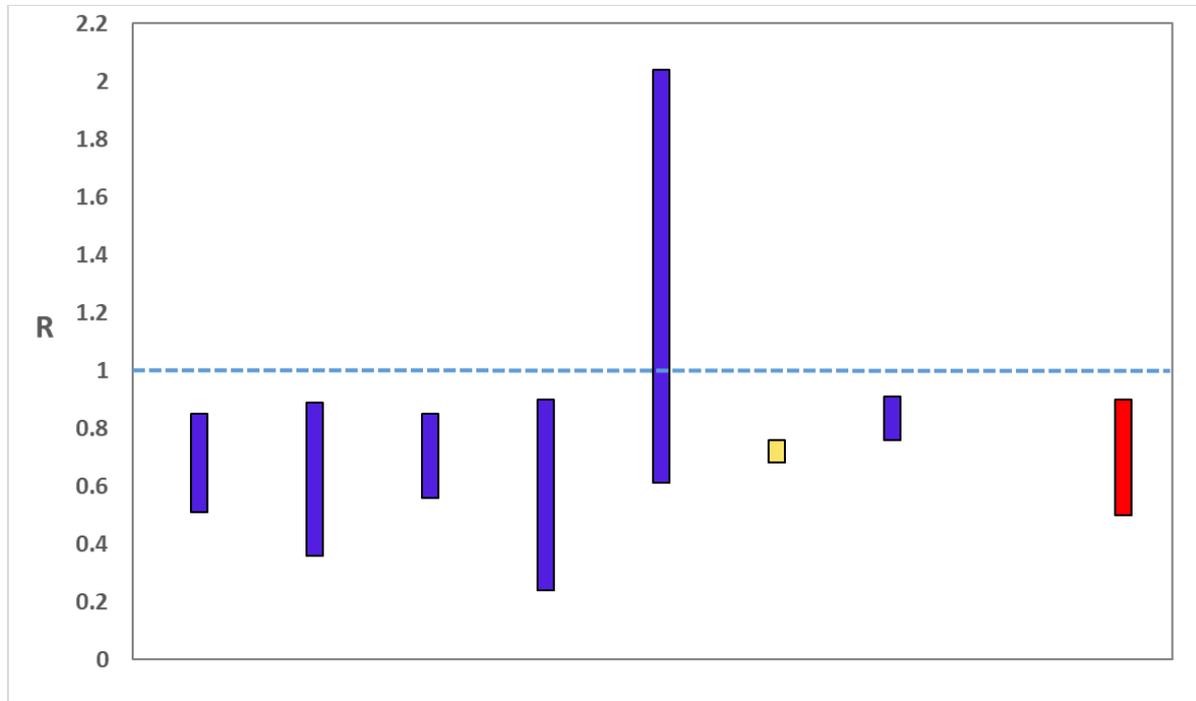
Figure 1: Trends in R_t for Scotland, 2020



Source: Scottish Government modelled estimates using Imperial College model code,
 Source: Actual data from <https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/vital-events/general-publications/weekly-and-monthly-data-on-births-and-deaths/deaths-involving-coronavirus-covid-19-in-scotland>

The R_t value estimated by the Scottish Government falls within the range of values estimated by other modelling groups and considered by SPI-M and SAGE (Figure 2). SAGE’s consensus view, as of 15 July, was that the value of R_t in Scotland was between 0.5 and 0.9.

Figure 2. Estimates of R_t for Scotland, as of 15 July, including 90% confidence intervals, produced by SAGE. The estimate produced by the Scottish Government is the 6th from left (yellow), while the SAGE consensus range is the right-most (red).



Source: Scientific Advisory Group for Emergencies (SAGE).

The Scottish Government's epidemiological model estimates that on 10 July there were around 60 new cases of Covid-19 in Scotland (see Table 1), while the number of people in Scotland who could be infectious on this date was around 700 (see Table 2). Our estimates indicate this number has been declining by around 30% each week, and will continue to decline at a similar rate over the next two weeks.

Table 1: Estimated daily number of new Covid-19 cases in Scotland.

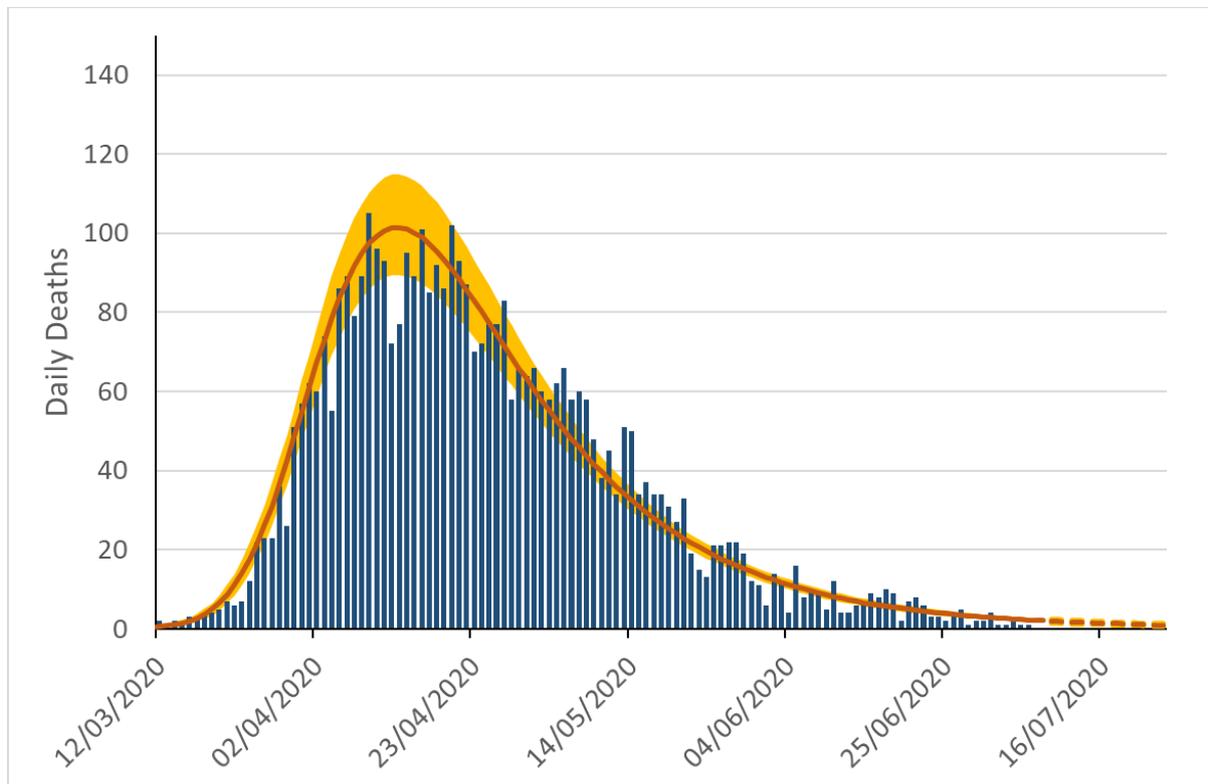
Estimated new daily infections			
Date	Mid	Lower	Upper
15 May	840	670	1,050
22 May	580	450	730
29 May	410	320	530
05 June	290	220	380
12 June	210	150	280
19 June	150	100	210
26 June	110	70	150
03 July	80	50	120
10 July	60	40	90
17 July	40	20	70
24 July	30	20	50

Table 2: Estimated number of people in Scotland who could be infectious.

Estimated Infectious Pool				
Date	Mid	Lower	Upper	Percentage Weekly Change
15 May	10,700	8,600	13,300	-
22 May	7,400	5,900	9,300	-30%
29 May	5,200	4,000	6,600	-30%
05 June	3,700	2,800	4,700	-29%
12 June	2,600	1,900	3,500	-29%
19 June	1,900	1,300	2,500	-29%
26 June	1,300	900	1,900	-28%
03 July	1,000	600	1,400	-28%
10 July	700	400	1,000	-28%
17 July	500	300	800	-26%
24 July	400	200	600	-26%

Figure 3 shows the epidemiological model forecasts produced by the Scottish Government, given the present set of interventions. This epidemic curve continues to show signs of reducing.

Figure 3: Scottish Government short-term forecast of the number of deaths from Covid-19 in Scotland, based on actual data (10 July).



Source: Scottish Government modelled estimates using Imperial College model code,
Source: Actual data from <https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/vital-events/general-publications/weekly-and-monthly-data-on-births-and-deaths/deaths-involving-coronavirus-covid-19-in-scotland>

The short-term forecast of hospital beds required by Covid 19 patients in Scotland over the next two weeks is not included this week, as the numbers have fallen to a low level. Should these numbers begin to rise significantly this forecast will be reintroduced.

The medium term forecasts presented here are fitted to trends in the historical data. Because it takes time for infected people to develop symptoms, require hospitalisation, and either die or recover, we will not fully see the effect of moving into phase 3 in our modelling until early August.

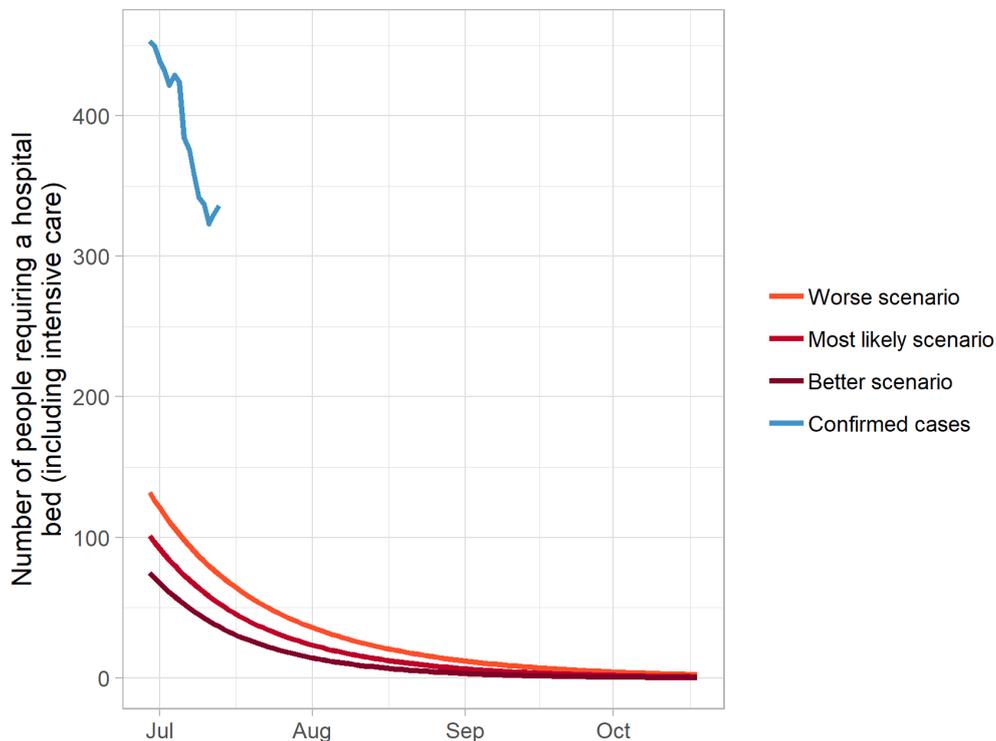
The medium-term forecasts produced by the Scottish Government (Figure 4 and 5) using the logistics model show a steady decline in the number of people requiring hospitalisation from Covid-19. The logistical model also provides us with a medium term forecast of the number of ICU beds which may be required (Figures 6 and 7).

The three scenarios presented in Figures 4 and 5 for hospital demand and Figure 6 and 7 for ICU demand are for different levels of daily infections. In each case, we translate these into logistical forecasts which are used for planning purposes.

The Worse and Better scenarios should not be considered an upper and lower bound respectively. It is important to note, in particular, that for planning reasons many of the assumptions used are deliberately precautionary, and so it is reassuring that actual case data are lower than the modelled estimate in the past, as is the case with the ICU admissions demand forecast in figures 5 and 7.

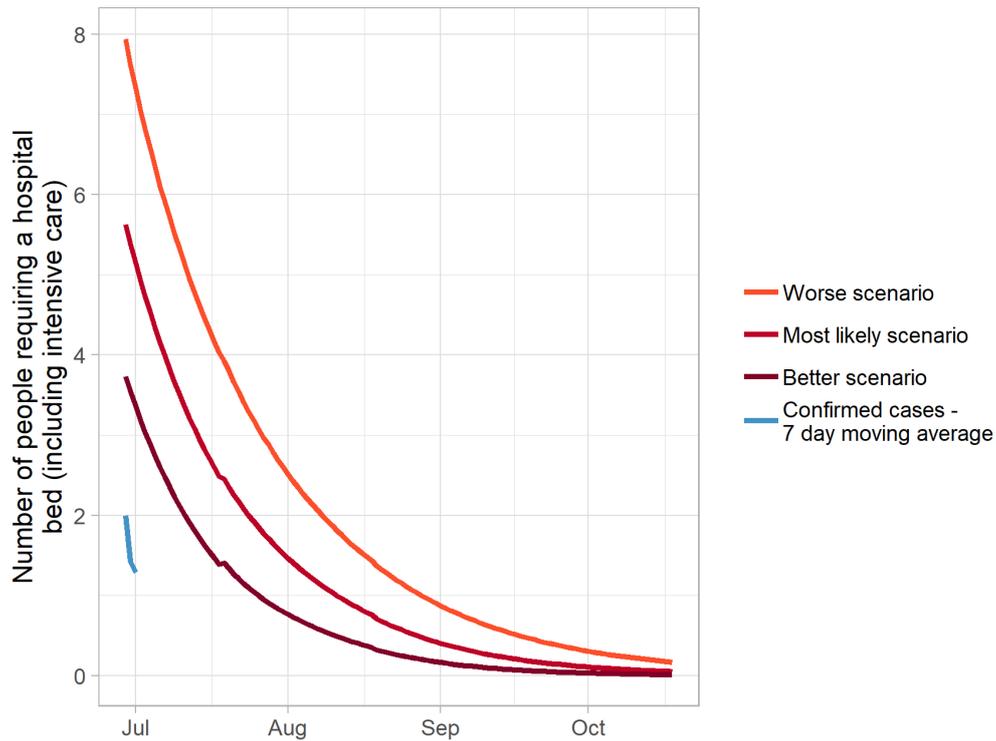
The number of hospital beds in use (Figure 4) is tracking above the worse scenario. This is likely to be due to Covid patients remaining in hospital for longer than expected.

Figure 4: Logistical model medium term forecast of the total number of people requiring a hospital bed from Covid-19 in Scotland, 10 July. Capacity is around 4,000.



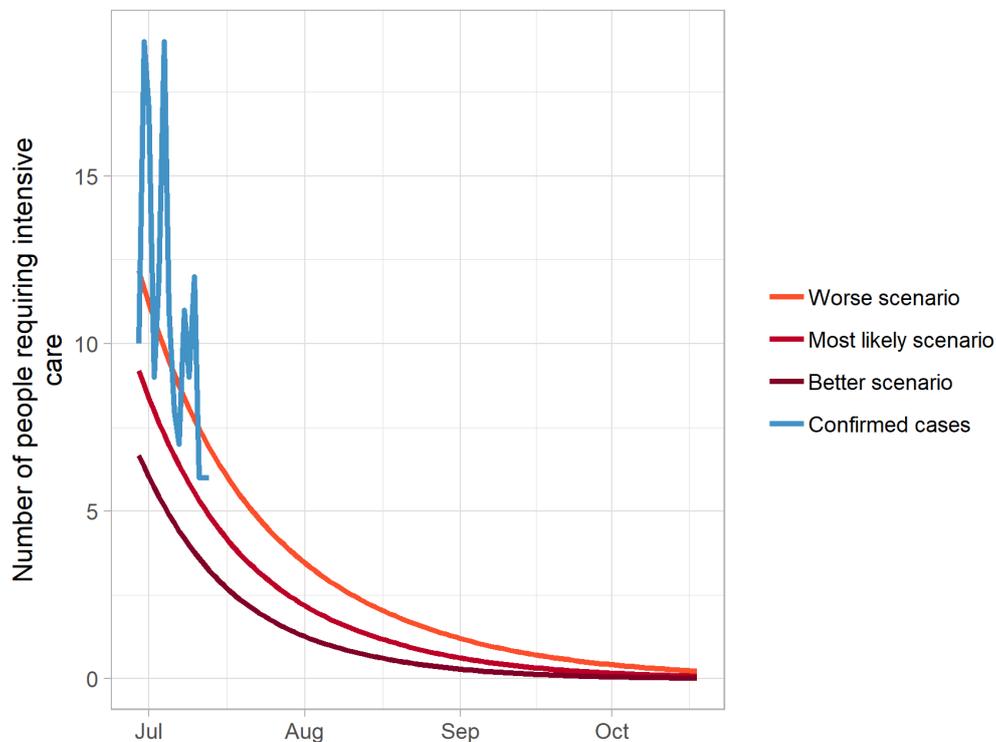
Source: Scottish Government modelled estimates using outputs from the Imperial College model code. Actual data from <https://www.gov.scot/publications/coronavirus-covid-19-trends-in-daily-data/>

Figure 5: Logistical model medium term forecast of admissions of people requiring a hospital bed from Covid-19 in Scotland, 10 July.



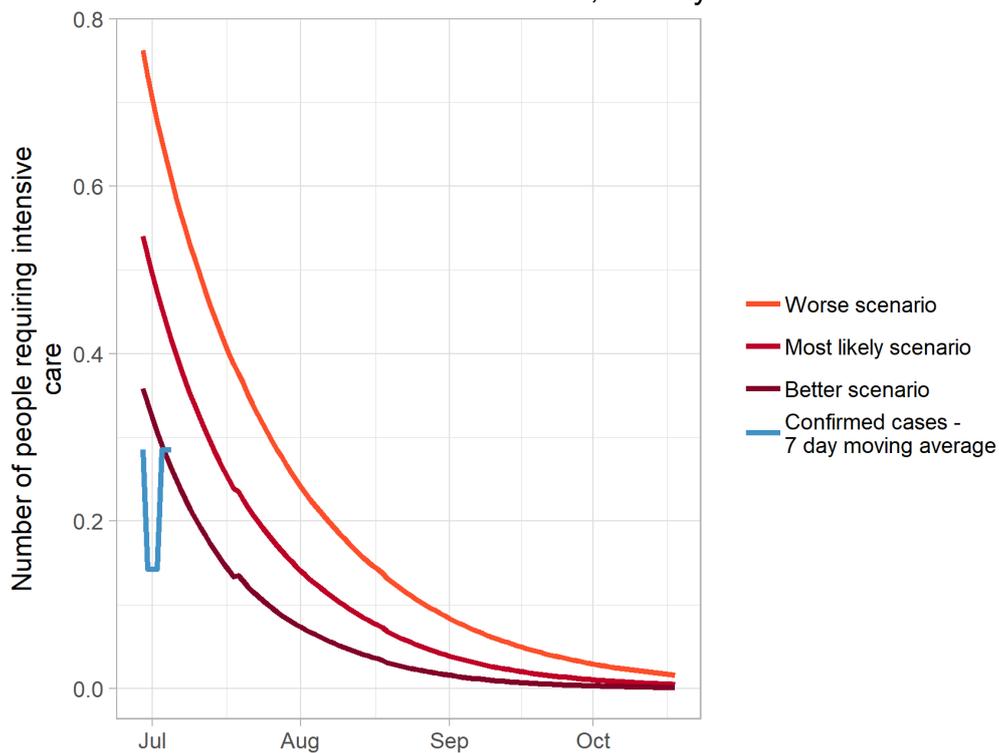
Source: Scottish Government modelled estimates using outputs from the Imperial College model code. Actual data from <https://www.gov.scot/publications/coronavirus-covid-19-trends-in-daily-data/>

Figure 6: Logistical model medium term forecast of total number of people requiring an intensive care bed from Covid-19 in Scotland, 10 July. Capacity is around 700.



Source: Scottish Government modelled estimates using outputs from the Imperial College model code. Actual data from <https://www.gov.scot/publications/coronavirus-covid-19-trends-in-daily-data/>

Figure 7: Logistical model medium term forecast of admissions of people requiring an intensive care bed from Covid-19 in Scotland, 10 July.



Source: Scottish Government modelled estimates using outputs from the Imperial College model code. Actual data from <https://www.gov.scot/publications/coronavirus-covid-19-trends-in-daily-data/>

What next?

The modelled estimates of the numbers of new cases and infectious people, along with how this relates to hospital and ICU requirements will be published each week. Where appropriate, R_t will also be provided. Further information can be found at <https://www.gov.scot/coronavirus-covid-19>

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EH1 3DG

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