

Coronavirus (COVID-19): Analysis

Coronavirus (COVID-19): modelling the epidemic in Scotland (Issue No. 7)

Background

This is an update on the Scottish Government modelling of the spread and level of Covid-19. This updates the previous publication on modelling the spread and level of Covid-19 in Scotland published on the 25 June 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 virus, e.g. to decide how many Intensive Care Beds (ICU) we need available for Covid patients.

Key Points

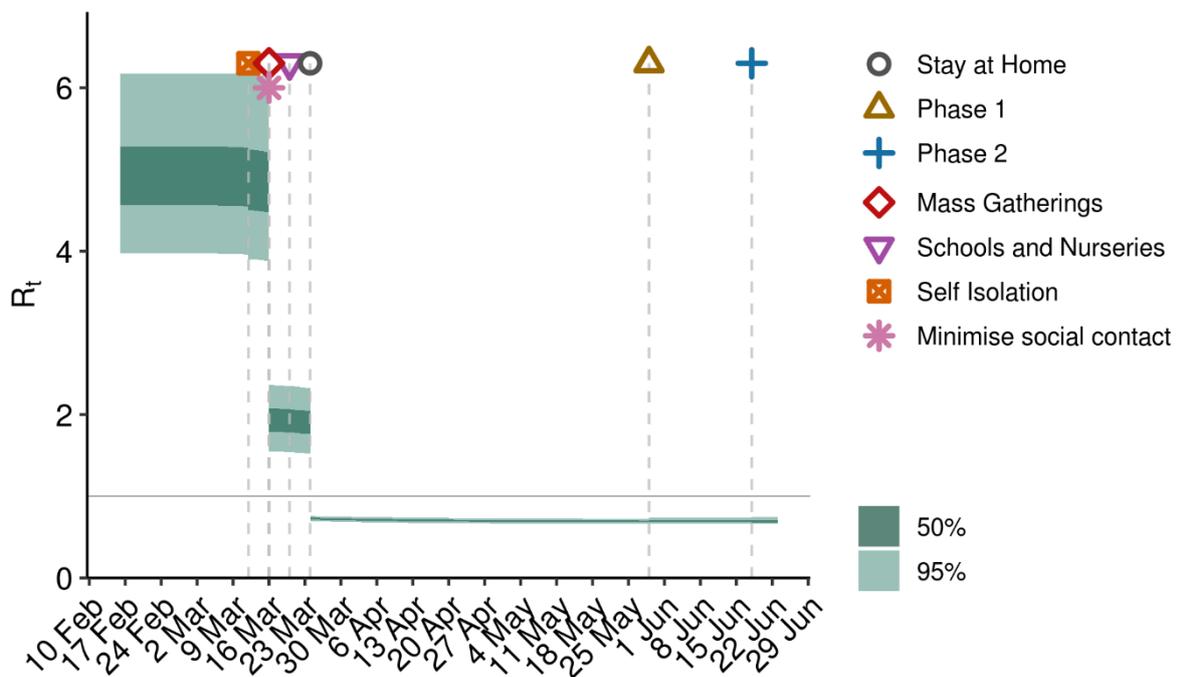
- Modelling of the epidemic in Scotland is undertaken to look at the progression of the epidemic and to inform logistical response required.
- This is done over two time periods. Short term, for the next two weeks, and longer term. Both these help the public sector in Scotland plan their response and helps determine if the measures in place are working.
- Modelling by the Scottish Government estimates that on 26 June there were around 120 new infections and 1,500 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 1 July, R in Scotland was estimated to be between 0.6 & 0.8, as it has been for 4 weeks.
- These forecasts were based on estimates of moving in to phase 2 guidance, implemented from 18 June. Changes associated with the move to phase 2 will not be seen for several weeks. 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 1 July, was that the value of R_t in Scotland was between 0.6 and 0.8.

Figure 2. Estimates of R_t for Scotland, as of the 1 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 26 June there were around 120 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 1,500 (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.

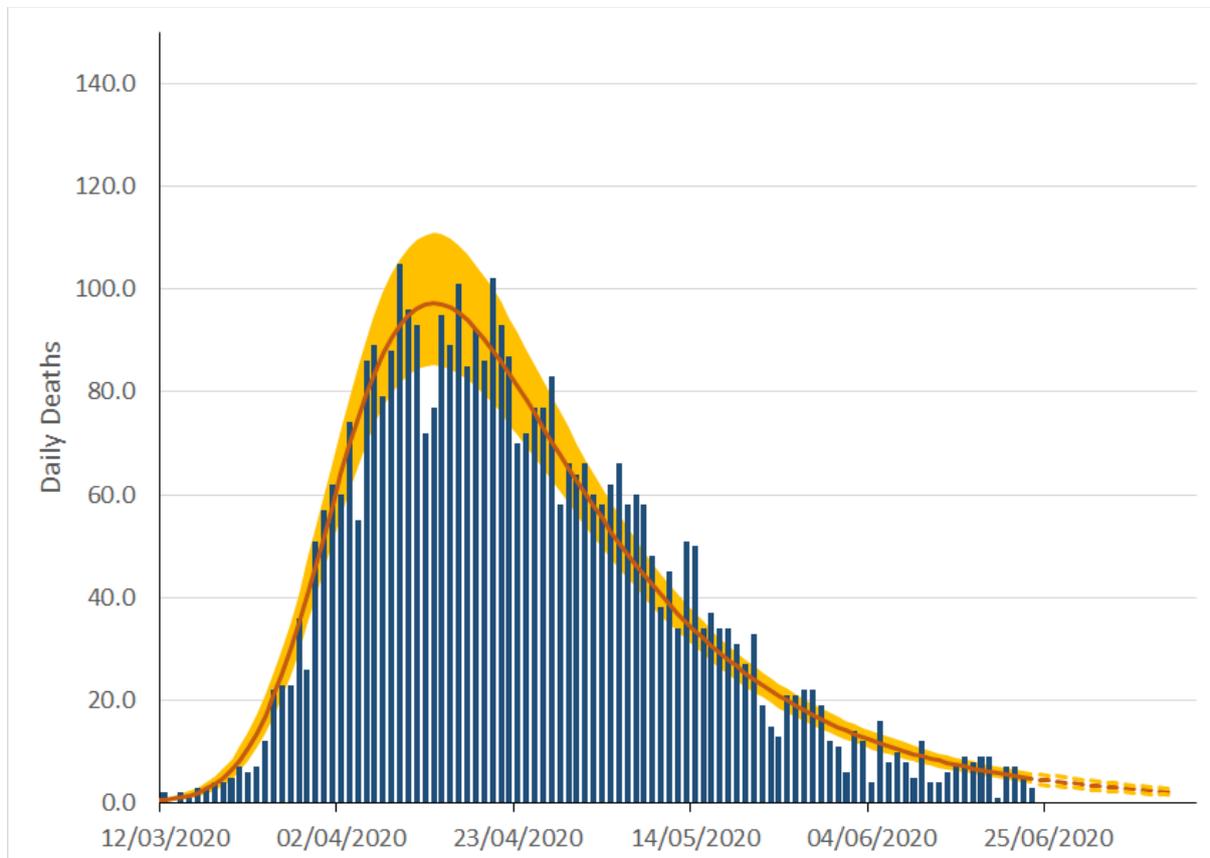
Estimated new daily infections			
Date	Mid	Lower	Upper
15 May	940	730	1,190
22 May	660	510	860
29 May	470	350	620
05 June	340	240	450
12 June	240	170	330
19 June	170	120	240
26 June	120	80	180
03 July	90	50	130
10 July	60	40	100

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

Estimated Infectious Pool				
Date	Mid	Lower	Upper	Percentage Weekly Change
15 May	11,800	9,400	14,800	-
22 May	8,400	6,500	10,700	-29%
29 May	5,900	4,500	7,700	-30%
05 June	4,200	3,100	5,600	-29%
12 June	3,000	2,100	4,100	-29%
19 June	2,100	1,500	3,000	-30%
26 June	1,500	1,000	2,200	-29%
03 July	1,100	700	1,600	-27%
10 July	800	500	1,200	-27%

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 (26 June).

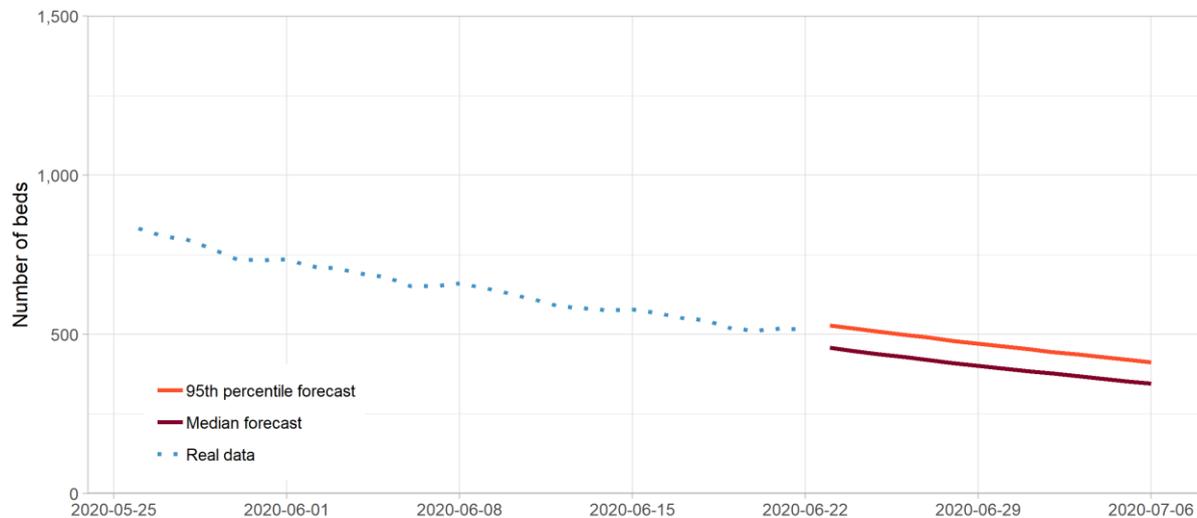


Source: Scottish Government modelled estimates using Imperial College model code,
Source: Actual data from <https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/vital-events/general-publications/weekly-and-monthly-data-on-births-and-deaths/deaths-involving-coronavirus-covid-19-in-scotland>

The short-term forecasts produced by SAGE suggest that the number of hospital beds occupied by Covid-19 patients in Scotland will continue to fall over the next two weeks (Figure 4). This is well within our Covid-19 hospital capacity of 4,250.

The short and 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 2 in our modelling until mid-July.

Figure 4. Short-term forecast of hospital bed occupancy in Scotland as produced by SAGE (25 June).



Source: This figure has been produced by the Scottish Government using the forecast data provided by SAGE.

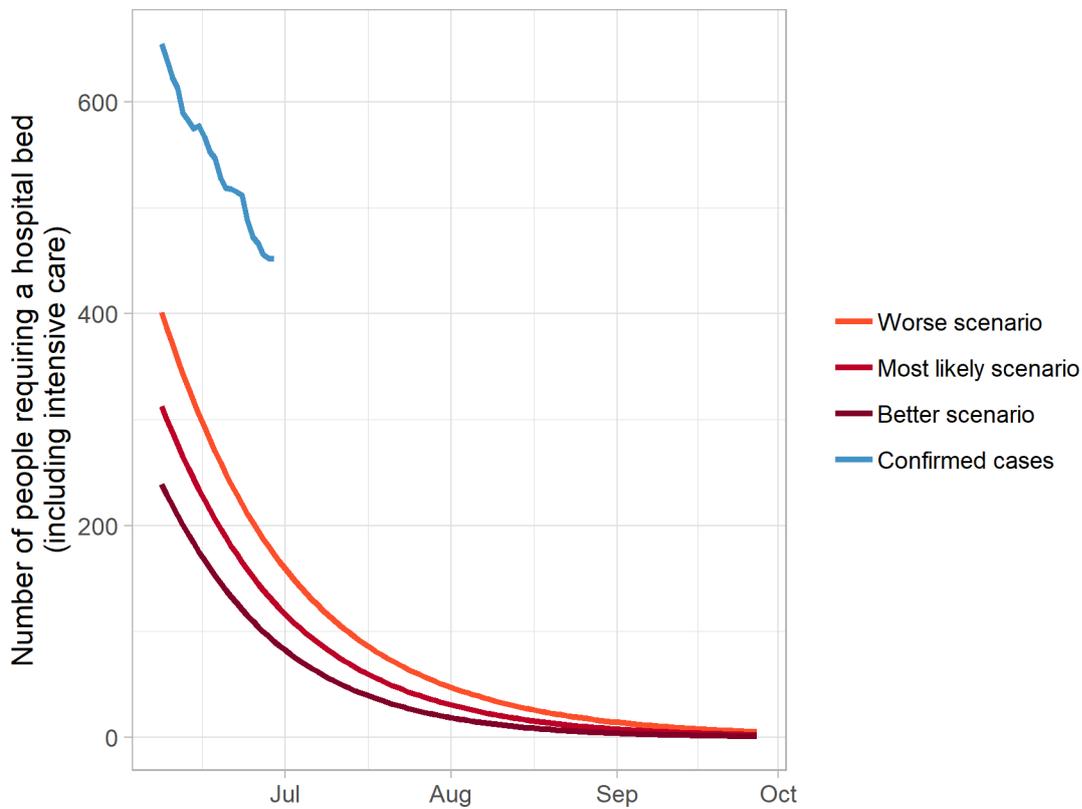
The medium-term forecasts produced by the Scottish Government (Figure 5) using the logistics model show a similar story with a steady decline in the number of people requiring a hospital bed from Covid-19. The logistical model also provides us with a medium term forecast of the number of ICU beds which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

The three scenarios presented in Figure 5 for hospital demand and Figure 6 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 scenario and Better scenario should not be considered an upper and lower bound. 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 demand forecast in Figure 6.

The number of hospital beds in use (Figure 5) is tracking above the worse scenario. This could be because patients are being kept in hospital for longer, particularly later in the epidemic, or actual cases are declining more slowly at this point in time.

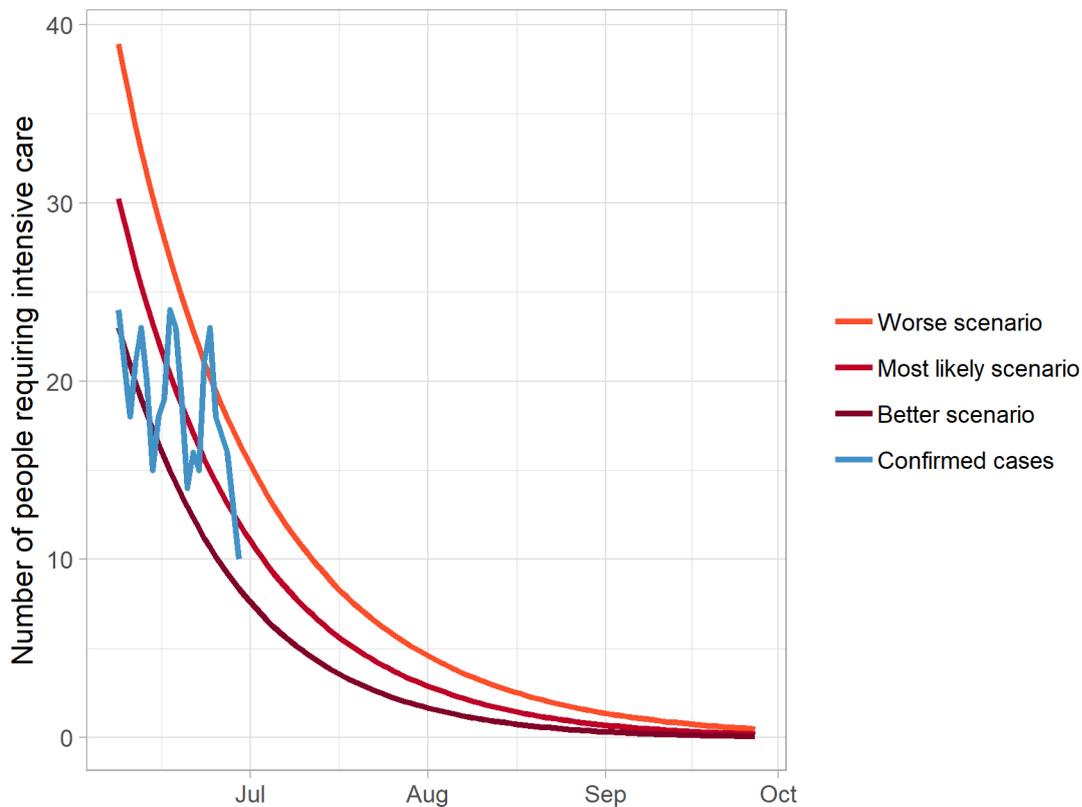
Figure 5: Logistical model medium term forecast of number of people requiring a hospital bed from Covid-19 in Scotland, 26 June. Capacity is around 4,000.



Source: Scottish Government modelled estimates using outputs from the Imperial College model code,

Source: Actual data from <https://www.gov.scot/publications/coronavirus-covid-19-trends-in-daily-data/>

Figure 6: Logistical model medium term forecast of number of people requiring an intensive care bed from Covid-19 in Scotland, 26 June. Capacity is around 700.



Source: Scottish Government modelled estimates using outputs from the Imperial College model code,

Source: Actual data from <https://www.gov.scot/publications/coronavirus-covid-19-trends-in-daily-data/>

What next?

The modelled estimates of hospital and ICU use, and of the reproduction number R_t will be published each week. Further information can be found at <https://www.gov.scot/coronavirus-covid-19>

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