

Coronavirus (COVID-19): Analysis

Coronavirus (COVID-19): modelling the epidemic in Scotland (Issue No. 5)

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 11 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.

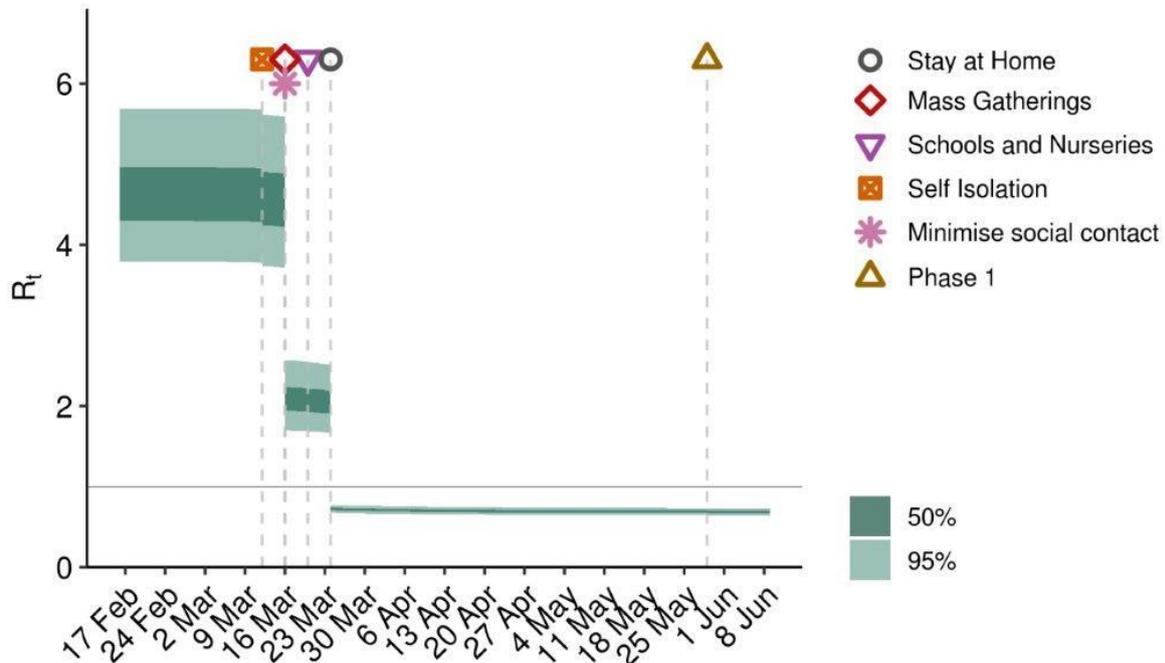
Key Points

- 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 to forecast Covid-19, which helps the public sector in Scotland plan their response and helps determine if the measures in place are working.
- We use the value of R to talk about Covid-19 in Scotland. Up to the 17 June, R in Scotland was estimated to be between 0.6 & 0.8.
- The modelling shows 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.
- These forecasts were based on estimates of moving in to phase 1 guidance implemented from 29 May. However, due to the time associated with disease progression data used for the forecasting the data do not yet fully reflect changes associated with moving in to phase 1. The longer term forecasts will be closely monitored against actual cases over the next few weeks as the situation changes.

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.

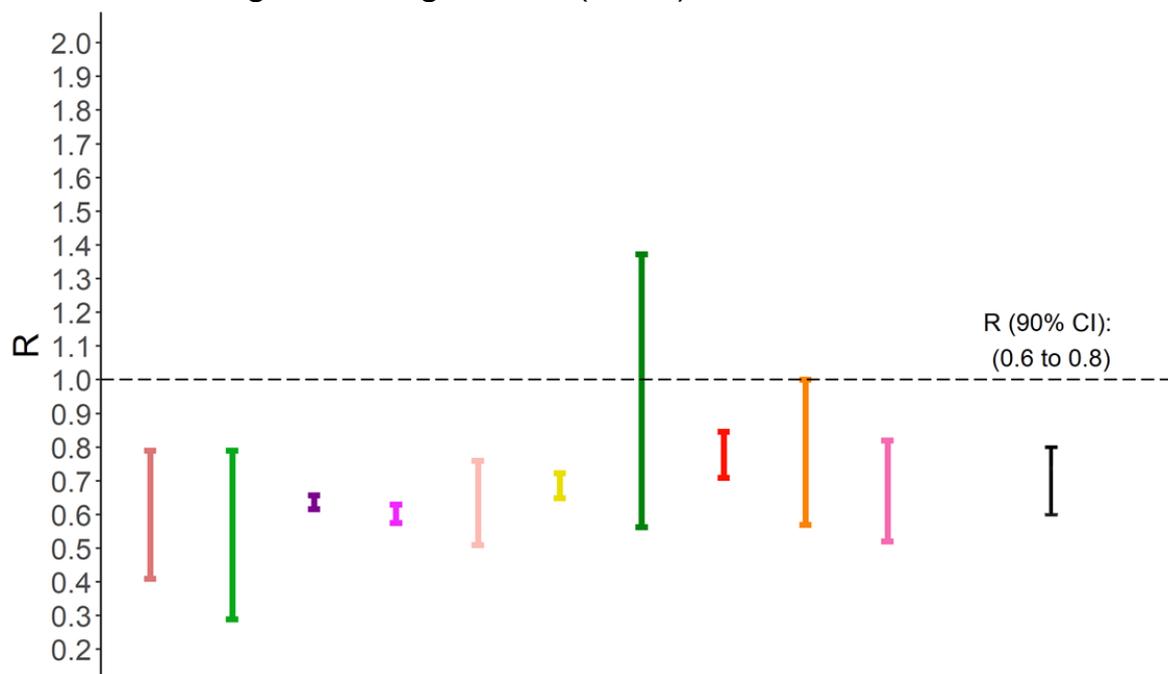
Figure 1: Trends in R_t for Scotland, 2020



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 17 June, 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 17 June, including 90% confidence intervals, produced by SAGE. The estimate produced by the Scottish Government is the 6 from left (yellow), while the SAGE consensus range is the right-most (black).



Source: Scientific Advisory Group for Emergencies (SAGE).

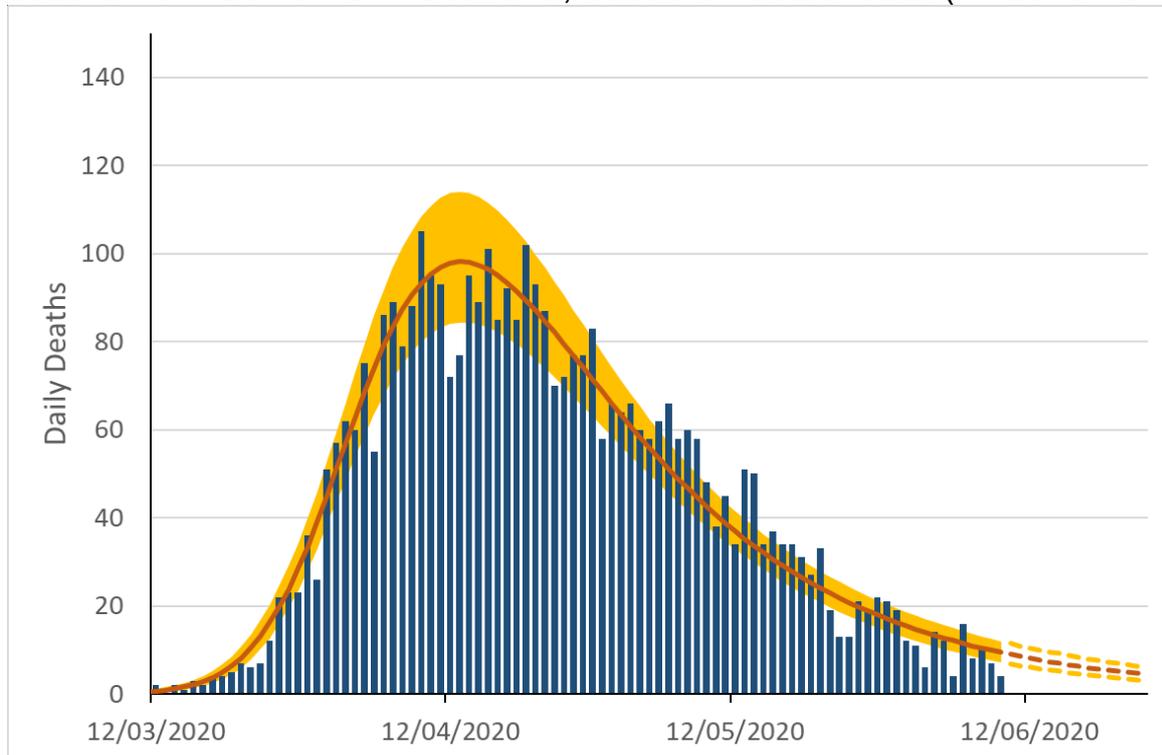
The Scottish Government’s epidemiological model estimates the number of infectious people in Scotland on 12 June to be around 2,900 (see Table 1). Forecasts indicate this number will decline over the following two weeks, and are promising, but is still at a level that could cause risk to the health service if onwards transmission rose rapidly. This figure is lower than was forecast previously, and reflects the fact that the number of deaths last week was lower than previously forecasted.

Table 1: Estimated number of infectious people in Scotland

Estimated Infectious Pool			
Date	Mid	Lower	Upper
15 May	11,600	8,600	15,400
22 May	8,200	5,900	11,100
29 May	5,800	4,000	8,200
05 June	4,100	2,700	5,900
12 June	2,900	1,800	4,300
19 June	2,000	1,200	3,200
26 June	1,400	800	2,300

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 (12 June 2020).

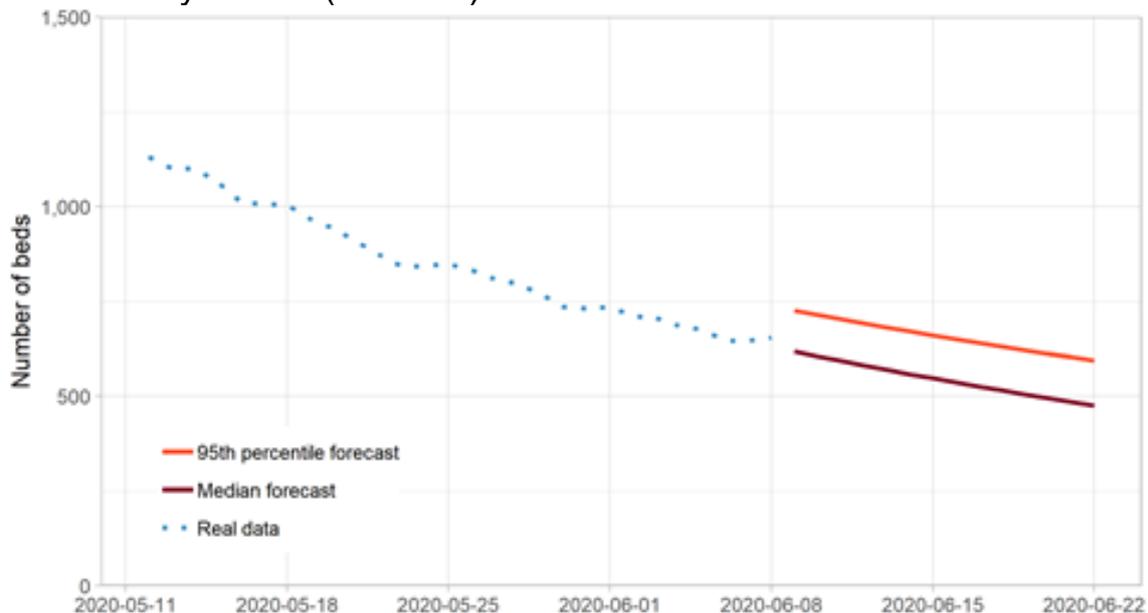


Source: Scottish Government modelled estimates using Imperial College model code,
Source: Actual data from <https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/vital-events/general-publications/weekly-and-monthly-data-on-births-and-deaths/deaths-involving-coronavirus-covid-19-in-scotland>

The 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.

These short-term forecasts 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 to phase 1 in our modelling until late June or early July.

Figure 4. Short-term forecast of hospital bed occupancy in Scotland as produced by SAGE (10 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 over the next few months, 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).

These forecasts are based on the measures implemented under Phase 1 of Scotland's route map, which were implemented on 29 May. We will not be able to fully measure the effects of this change until late June. Instead, the medium term forecasts are based on observations from other European countries which have enacted measures similar to those within our Phase 1 measures. We will monitor the impact of these changes in the coming weeks, and how this will affect hospital demand.

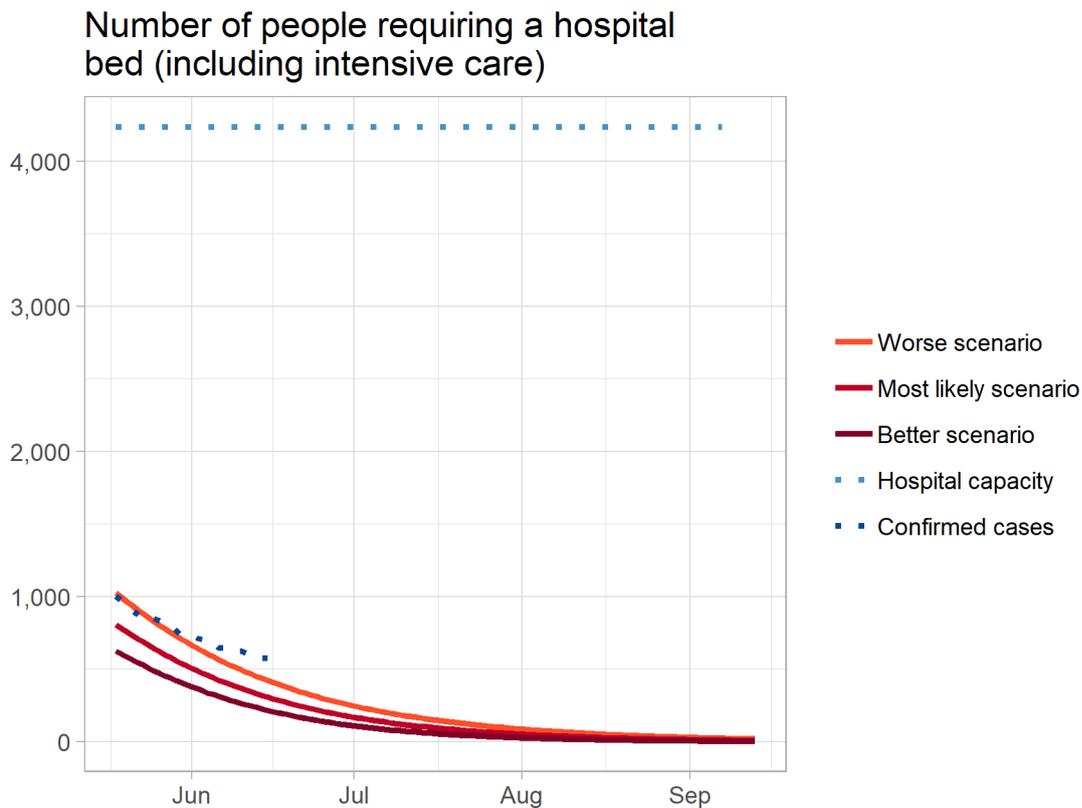
The three scenarios presented in Figure 5 for hospital demand and Figure 6 for ICU demand are for different levels of daily infections. In each case, we translate these into logistical forecasts which are used for planning purposes.

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.

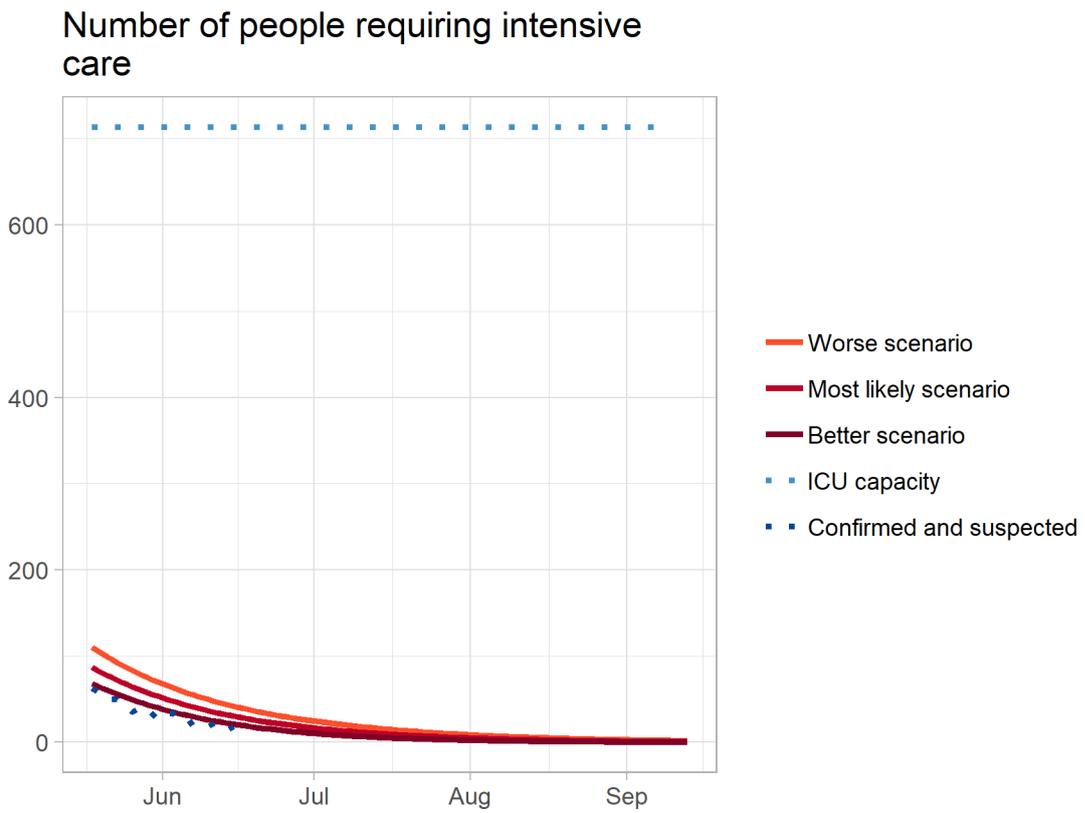
Figure 5: Logistical model medium term forecast of number of people requiring a hospital bed from Covid-19 in Scotland, 2020



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 from Covid-19 in Scotland, 2020



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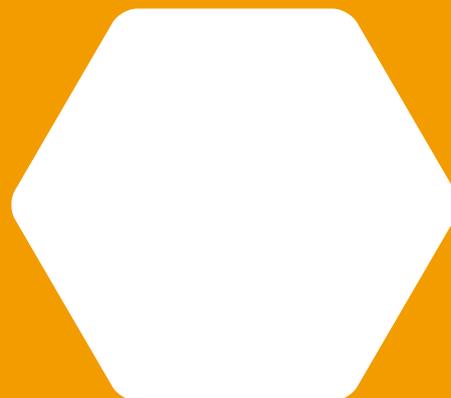
The views expressed in this report are those of the researcher and do not necessarily represent those of the Scottish Government or Scottish Ministers.

This document is also available from our website at www.gov.scot.

ISBN: 978-1-83960-844-5

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St Andrew's House
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Produced for
the Scottish Government
by APS Group Scotland
PPDAS742306 (06/20)
Published by
the Scottish Government,
June 2020



ISBN 978-1-83960-844-5

Web Publication

PPDAS742306 (06/20)