01/12/20

Modelling the COVID-19 epidemic; the Reproduction Number and other indicators

Current estimate of Rt (new positive tests): 0.9 – 1.1 (around 1)
Current estimate of Rt (hospital admissions): 0.7 – 0.9 (below 1)
Current estimate of Rt (ICU patients): 0.8 – 1.1 (around 1)
Average number of new positive tests per day last 7 days: 358 (down from 462)
7 day incidence based on new positive tests: 132 / 100k (down from 170)
14 day incidence based on new positive tests: 290 / 100k (down from 383)
7 day average of total positive tests (pillar 1 and 2) – 7.8% (down from 8.7%)
Tests per 7 days per 1000 population – 18.5 (down from 20.8)
Number of new positive tests in over 60s in last 7 days – 660 (down from 816)
Proportion total positive tests occurring in over 60s - 26.5% (unchanged from 26.7%)
First COVID +ve hospital admission in last week – 151 (down from 193)
Number of community acquired COVID inpatients – 338 (down from 386)
COVID +ve ICU patients – 38 (unchanged from 37)

Over the last week, the number of cases has reduced, including in the over 60s. There has been a decline in admissions and ICU occupancy. Rt is below 1 for hospital admissions, but has risen for cases over the last few days and is now around 1, and may be as high as 1.1. This is likely to reflect behaviours and interactions in the last week while cafes and close contact services were open. Providing that current restrictions are effective, we would expect Rt for cases to fall again from next week. Testing remains stable.

NI continues to have a lower incidence than England and Wales, though all indicators in NI remain high compared with ROI.

Hospital admissions have continued to decline over the last week. Hospital inpatients have fallen more slowly than admissions and remain at a relatively high level. In hospital deaths have declined somewhat from peak levels.

Given the current restrictions, we anticipate that numbers will decline slightly or remain stable until shortly before Christmas when they will begin to rise again. The rate of increase will depend on how much Rt increases following the 11th December. If Rt can be maintained at 1.6 or below then intervention would not be required until

the end of December / beginning January. However, if Rt were to rise as high as 1.8 then intervention would be required a few days earlier than this.

The Executive has previously determined that its policy is to keep Rt at or below 1.0. Any intervention will need a number of weeks to have maximum impact and therefore to influence the trajectory of the course of the epidemic.

Community transmission remains widespread, associated with multiple small clusters rather than a small number of larger outbreaks.

Regional variation in cases:

Incidence per LGD is shown over the last week in the table below. Incidence is falling in some LGDs and stable in others.

22-Nov	23-Nov	24-Nov	25-Nov	26-Nov	27-Nov	28-Nov	29-Nov	LGD
134.0	133.9	106.5	95.4	84.9	82.8	72.3	**75.8**	**Antrim and Newtownabbey**
78.9	78.9	67.1	78.9	83.3	97.0	98.2	**95.7**	**Ards and North Down**
173.8	174.1	148.8	139.2	134.5	129.4	127.5	**127.5**	**Armagh City, Banbridge and Craigavon**
153.3	153.6	128.1	114.4	119.0	123.1	107.6	**109.7**	**Belfast**
170.5	170.5	134.5	131.7	126.2	136.6	127.6	**128.9**	**Causeway Coast and Glens**
223.0	223.0	187.2	187.8	187.2	185.2	183.2	**191.8**	**Derry City and Strabane**
128.4	128.4	113.8	120.7	115.5	114.7	128.4	**141.2**	**Fermanagh and Omagh**
117.1	116.4	87.5	89.3	98.4	99.7	102.5	**95.6**	**Lisburn and Castlereagh**
157.1	157.3	126.3	131.9	140.5	141.2	139.1	**160.7**	**Mid and East Antrim**
228.0	227.8	194.5	205.6	201.5	192.7	192.0	**192.7**	**Mid Ulster**
105.0	104.9	82.7	85.5	93.3	98.3	102.8	**104.4**	**Newry, Mourne and Down**

Determining the value of Rt:

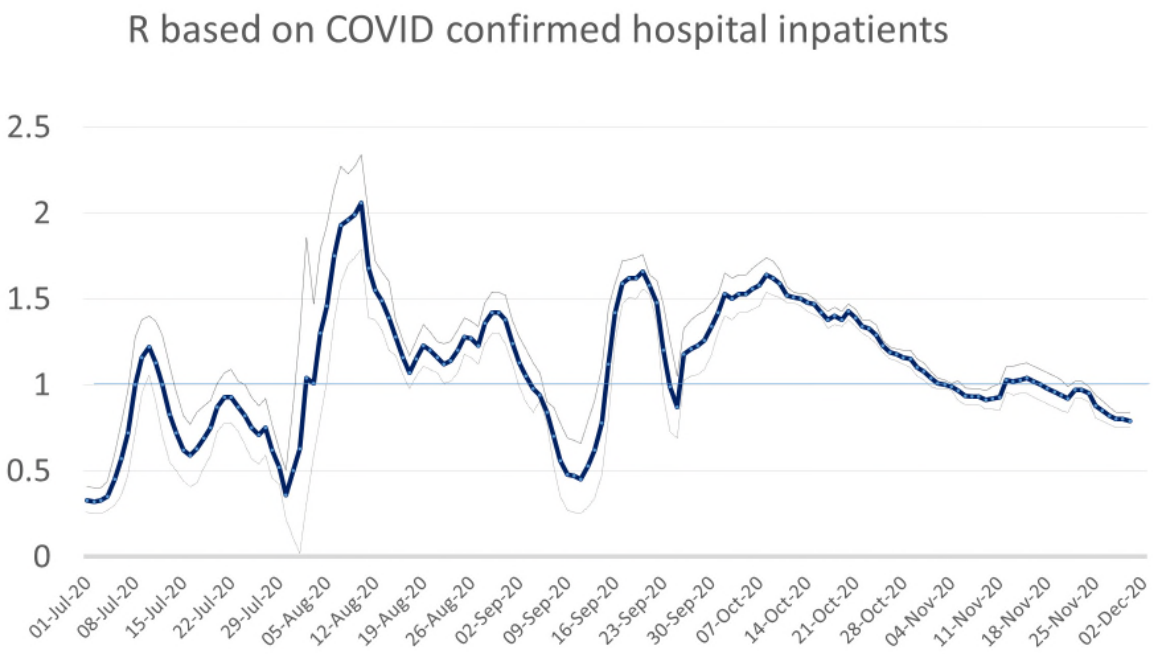
The most common approach to determining Rt during an epidemic is to use mathematical modelling, in particular a compartmental model using a SIR (susceptible-infectious-recovered) approach or a variation of it. Dozens of such models have been published and are in use throughout the world; there is no single standard model which everyone uses.

In addition to the impact of the mathematical model used, the calculated value of Rt is also influenced by the choice of input variable. Rt calculated for new COVID-19 cases will not be the same as Rt calculated for hospital admissions, or ICU occupancy, or deaths. There may be a significant lag (2-3 weeks) before a fall in Rt is apparent depending on the input variable(s) used.

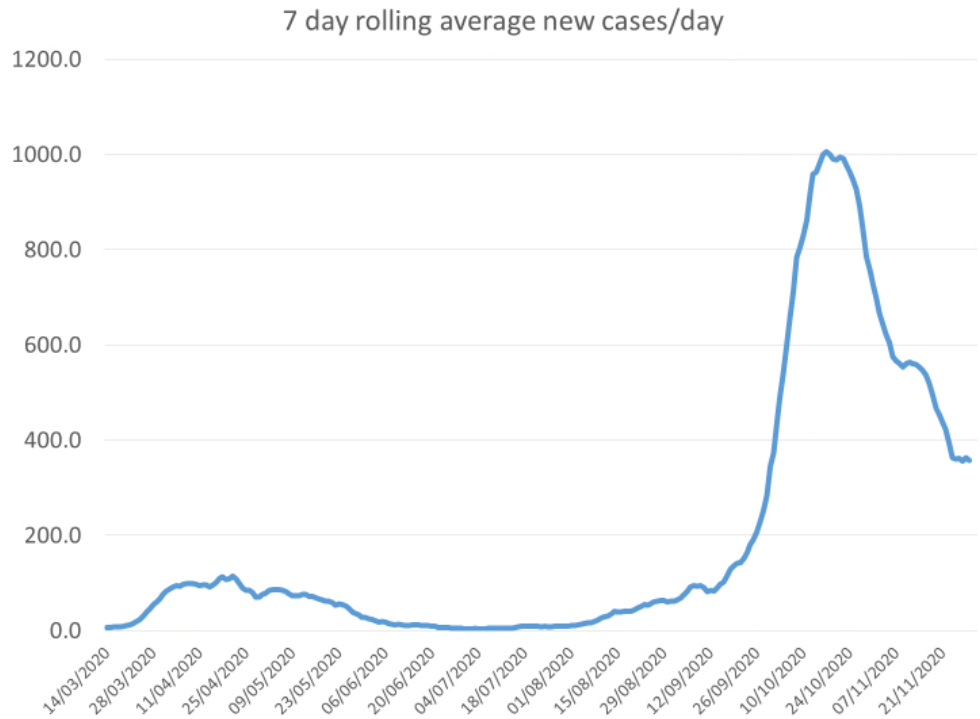
The modelling group determines Rt each day using a bespoke Northern Ireland SIR model. As its primary input the group uses hospital in-patient admissions with community acquired COVID-19, but also uses a range of other inputs. We therefore have several different values for Rt each day, each of which has a midpoint value and a lower and upper boundary (95% confidence intervals). In addition a number of academic groups, both in the UK and ROI, model the COVID-19 epidemic and we have access to their estimates of Rt for Northern Ireland. Rt can also be determined based on a contact matrix survey, and this approach may be more reliable when levels of community transmission are very low.

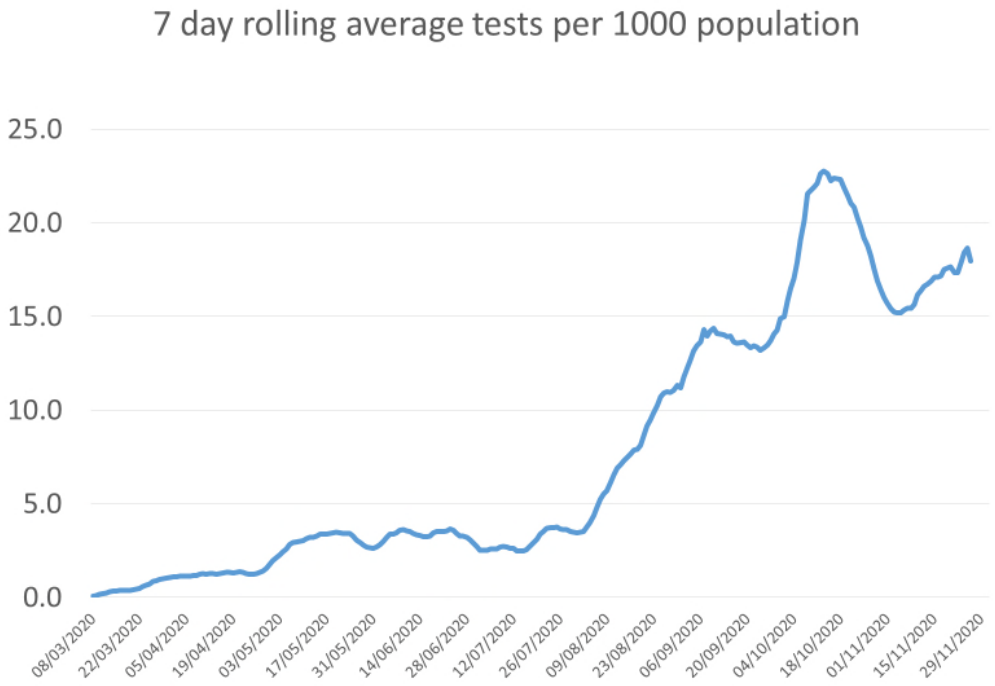
Trends for Northern Ireland:

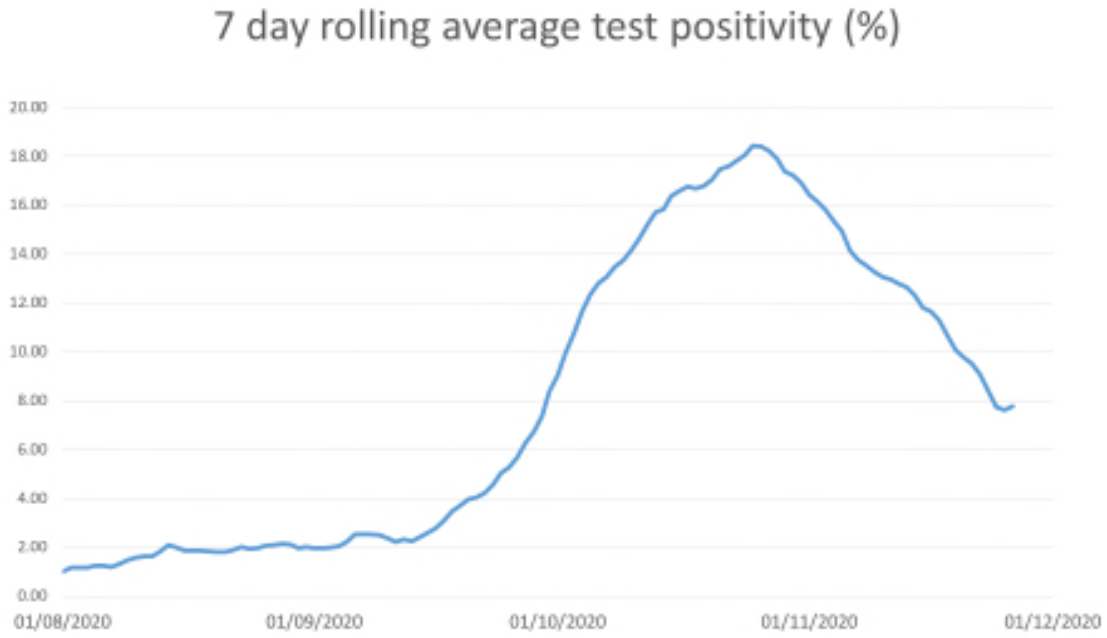
The graph below shows how Rt has changed over time during the course of the COVID-19 epidemic in Northern Ireland using hospital admissions with community acquired COVID-19 as an example. The value of Rt differs somewhat when other inputs are used, and is currently around 0.8 for hospital admissions and 1 for cases.



The graphs below shows that the number of new COVID 19 cases is declining slowly. Testing has increased, probably as a result of the opening of schools. There has been a modest decrease in test positivity.







The following graphs show first hospital admission of COVID +ve patients over a rolling 7 day period and the number of hospital inpatients. Admission numbers are declining, as are hospital inpatients, ICU patients and deaths are roughly stable at a high level.

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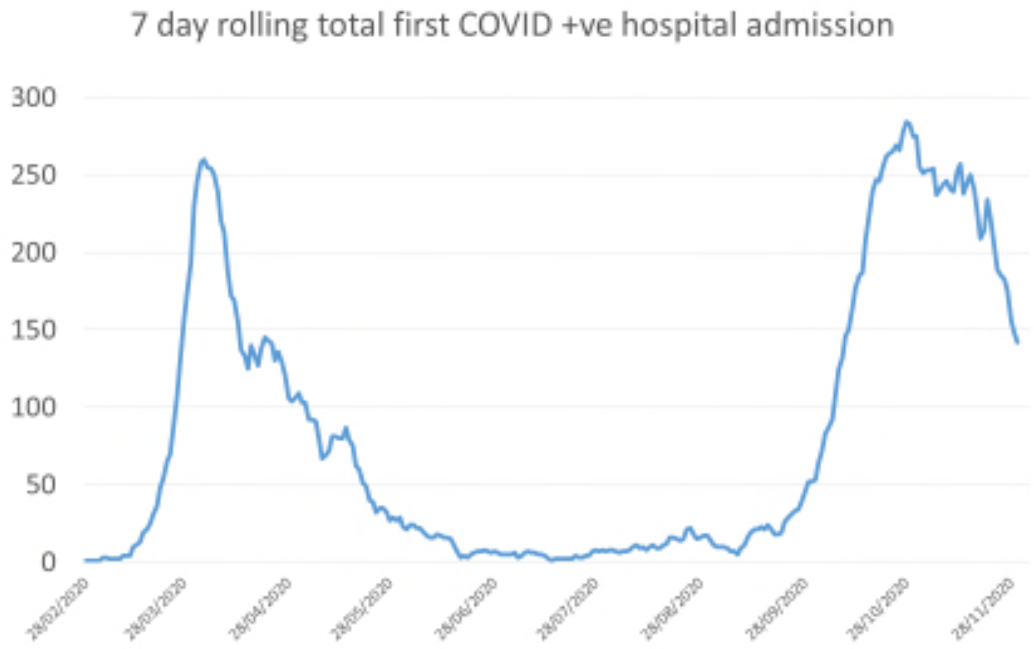
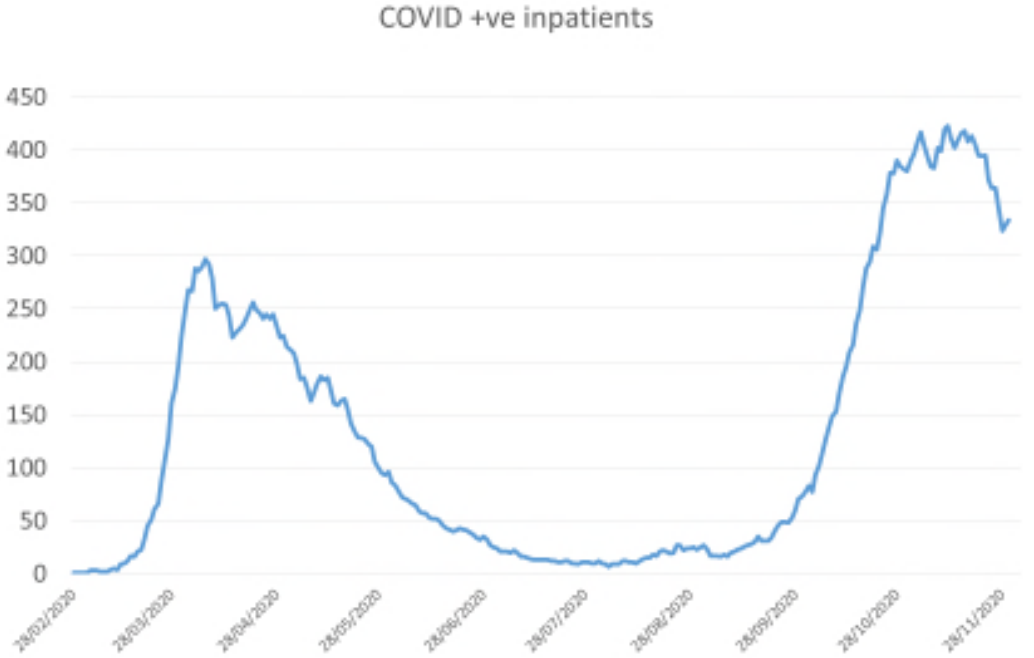
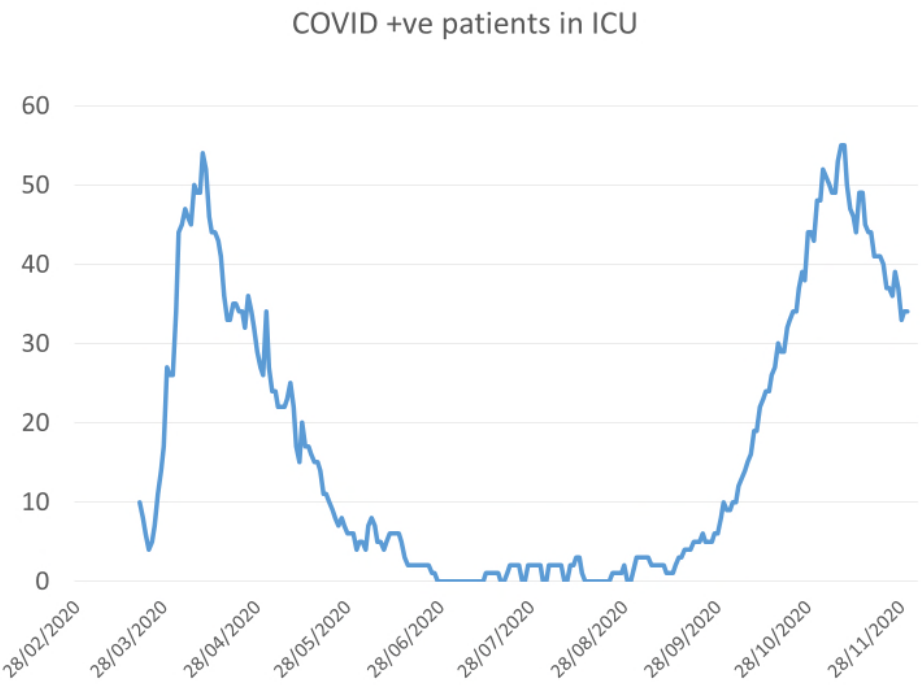

7 day rolling total first COVID +ve hospital admission
300
250
200
150
100
50
0
26/02/2020
26/03/2020
26/04/2020
26/05/2020
26/06/2020
26/07/2020
26/08/2020
26/09/2020
26/10/2020
26/11/2020

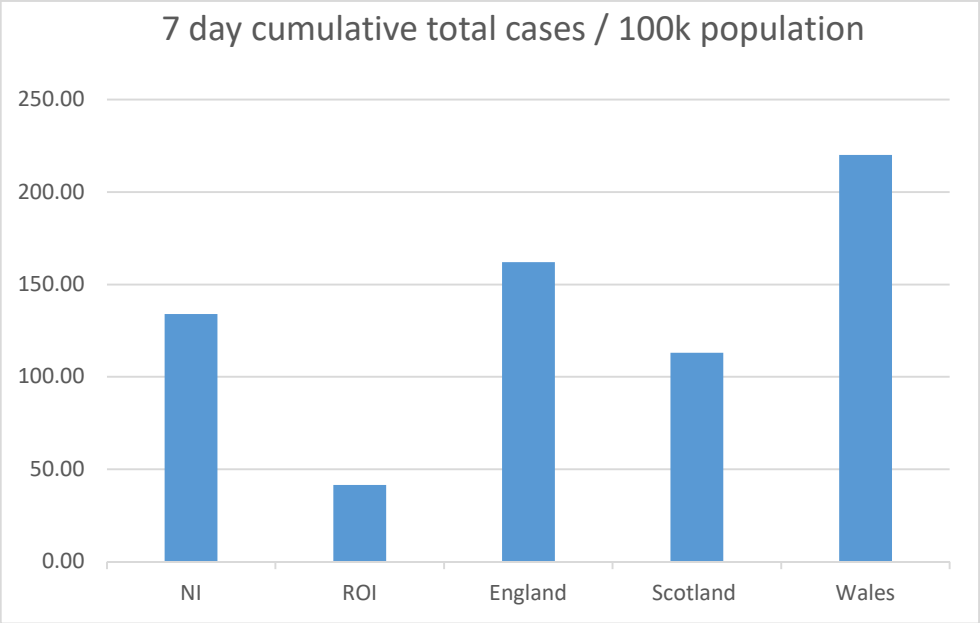

COVID +ve inpatients
450
400
350
300
250
200
150
100
50
0
26/02/2020
26/03/2020
26/04/2020
26/05/2020
26/06/2020
26/07/2020
26/08/2020
26/09/2020
26/10/2020
26/11/2020



NI, UK, ROI comparison:

The following chart shows cases per 7 days / 100 k population across the Common Travel Area. NI now has a lower incidence than either England or Wales, though significantly higher than ROI.

01/12/20


7 day cumulative total cases / 100k population
250.00
200.00
150.00
100.00
50.00
0.00
NI
ROI
England
Scotland
Wales