

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

Current estimate of R (ICU patients): 1.2 – 1.4 (definitely above 1)

Current estimate of R (hospital inpatients): 0.9 – 1.1 (around 1)

Current estimate of R (new positive tests): 0.6 – 0.9 (definitely below 1)

Average number of new positive tests per day last 7 days: 790 (down from 1003)

7 day incidence based on new positive tests: 291 / 100k (down from 369)

14 day incidence based on new positive tests: 663 / 100k (down from 753)

7 day average of total tests (pillar 1 and 2) which are positive – 13.9% (down from 14.5%)

Tests per 7 days per 1000 population – 21.8 (down from 26.0)

Number of new positive tests in over 60s in last 7 days – 1044 (down from 1148)

Proportion of total positive tests occurring in over 60s - 21.1% (up from 17.6%)

First COVID +ve hospital admission in last week – 242 (down from 258)

Number of community acquired COVID inpatients – 377 (up from 314)

COVID +ve ICU patients – 52 (up from 38)

Over the last week, the number of cases has declined, with R falling overall in NI to a little above 0.7. There is significant variation in different LGDs, with the greatest falls in areas with major urban centres. Testing has also decreased over the last week – this may be attributable to reduced testing demand as a result of the closure of schools. Test positivity has fallen slightly, but not as quickly as case numbers. It is therefore possible that the fall in cases numbers in the context of reduced testing may over-estimate the reduction in community transmission.

Hospital admissions have begun to decline slowly over the last week but remain at a relatively high level. COVID hospital patients have continued to rise slowly or plateau and remain at a high level. They should begin to decline in the next week. The rate of decline is likely to be slow and will depend on time to hospital discharge. ICU inpatients and deaths continue to rise. Anecdotal evidence suggests that improved treatments may be improving survival but increasing length of stay compared with wave 1, and we are currently exploring this further.

R is definitely below 1 for cases, around 1 for admissions and likely to be above one for hospital inpatients and ICU occupancy. This is likely to reflect the initial impact of the NI wide restrictions.

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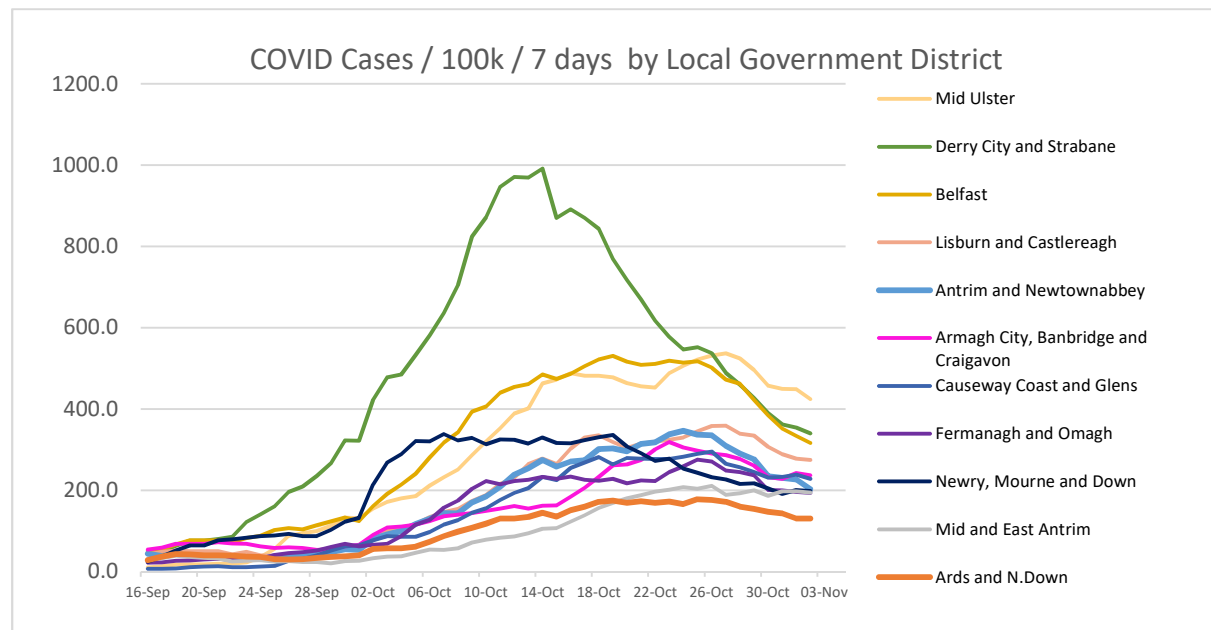
The number of cases in individuals aged >60 yrs has fallen modestly in terms of absolute numbers but increased as a % of positive tests; this is likely to reflect reduced testing and cases in younger people as a result of restrictions on schools and universities.

Absolute incidence and prevalence remain relatively high in European terms, and the highest of any of the nations of the UK / ROI. **Modelling continues to suggest that if our initial assumptions about R are met, there will be over 300 inpatients at the end of the current 4 week period of restrictions.** We will keep this under review and the picture will be clearer by next week.

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

Regional variation in cases:

There is considerable variation in COVID cases in Local Government Districts, but all remain now over 100/100k over the last 7 days. Mid Ulster has the highest incidence of cases. Cases are falling in all LGDs with the exception of Mid and East Antrim.



Determining the value of R:

The most common approach to determining R 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 R is also influenced by the choice of input variable. R calculated for new COVID-19 cases will not be the same as R calculated for hospital admissions, or ICU occupancy, or deaths. There may be a significant lag (2-3 weeks) before a fall in R is apparent depending on the input variable(s) used.

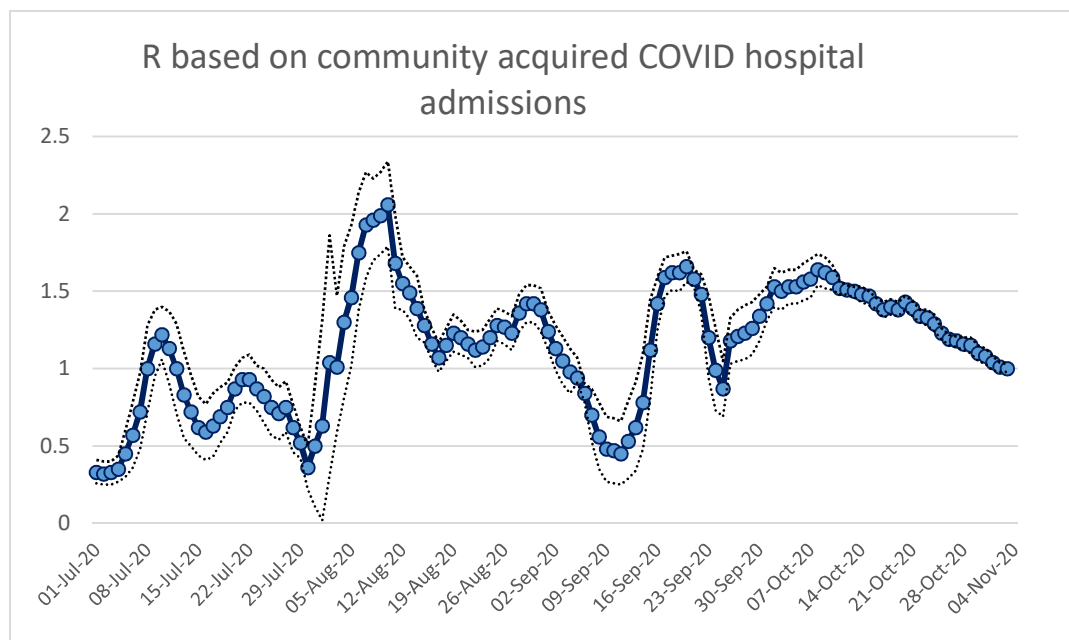
Once the activity of the epidemic is at a low level (as at present) marked fluctuations in R may be observed over short periods of time as a result of localised outbreaks or clusters. Local measures to address the cluster or outbreak will represent the most appropriate response in those circumstances, rather than general measures which are more appropriate when there is widespread community transmission.

The modelling group determines R each day using a bespoke Northern Ireland SIR model. As its primary input the group uses hospital in-patients with community acquired COVID-19, but also uses a range of other inputs. We therefore have several different values for R 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 R for Northern Ireland. R 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.

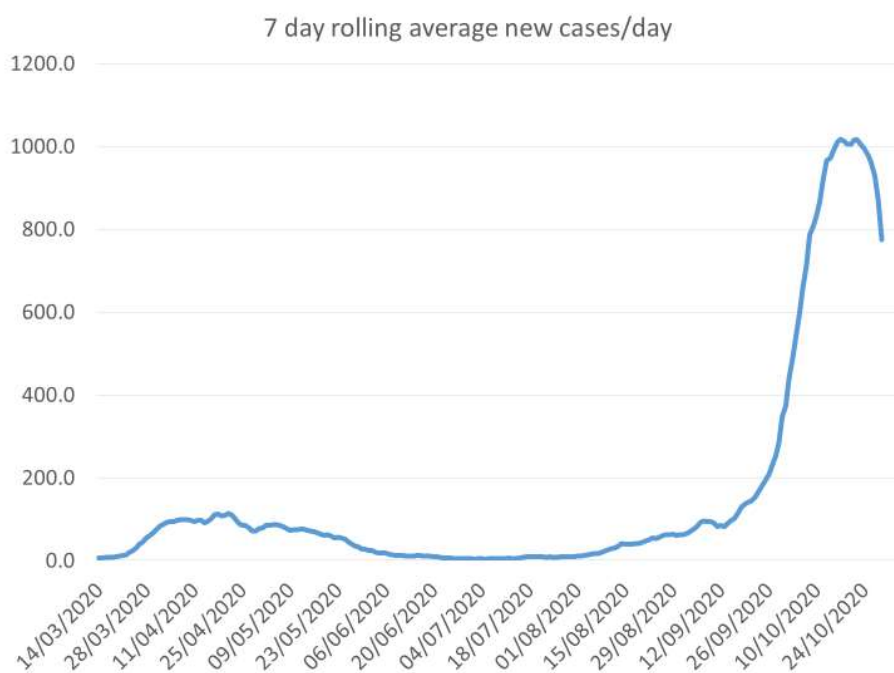
Trends for Northern Ireland:

The graph below shows how R_t 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 R_t differs somewhat when other inputs are used, and is currently below 1 for cases (around 0.7), around 1 for hospital admissions and above 1 for ICU patients.

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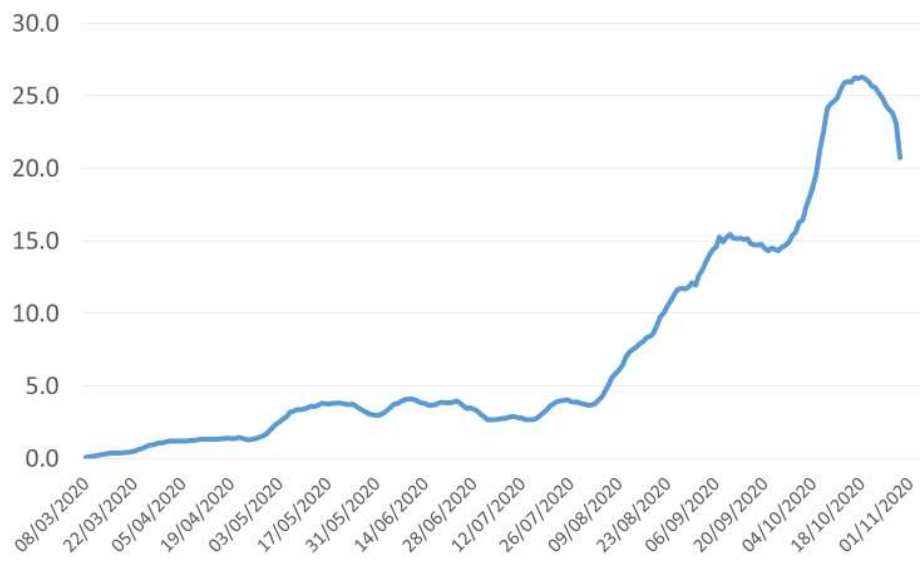


The graphs below shows that the number of new COVID 19 cases is now declining. Testing has also declined, as a consequence of reduced demand in the context of adequate supply. This may be due to the closure of schools, and the picture should become clearer in the next two weeks. There has been a modest decrease in test positivity, but this is falling more slowly than cases.

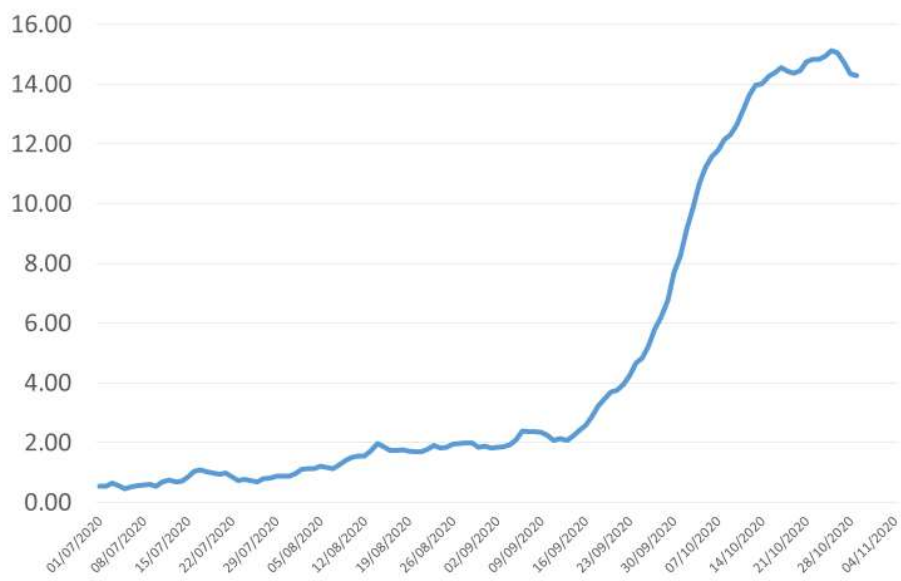


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7 day rolling average tests per 1000 population

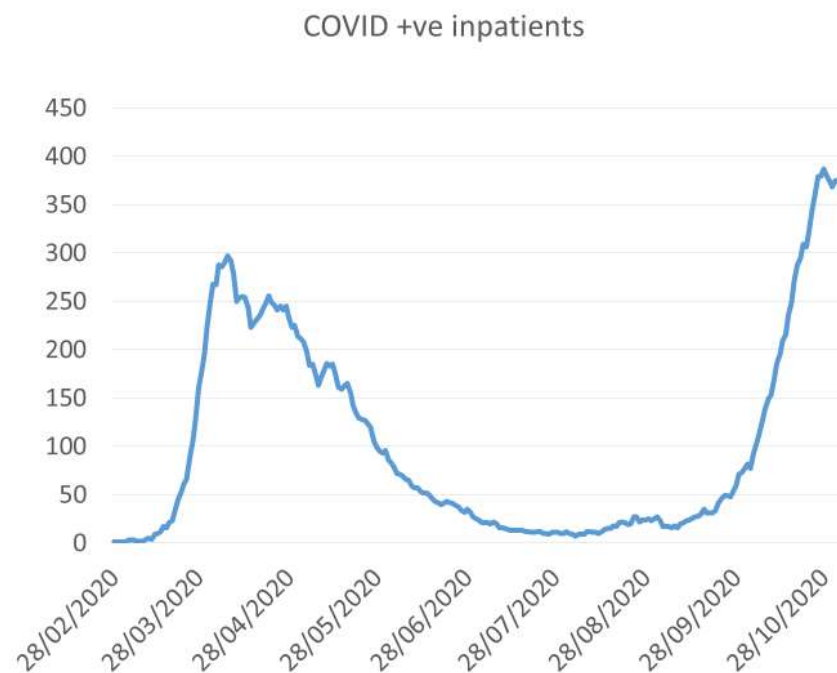
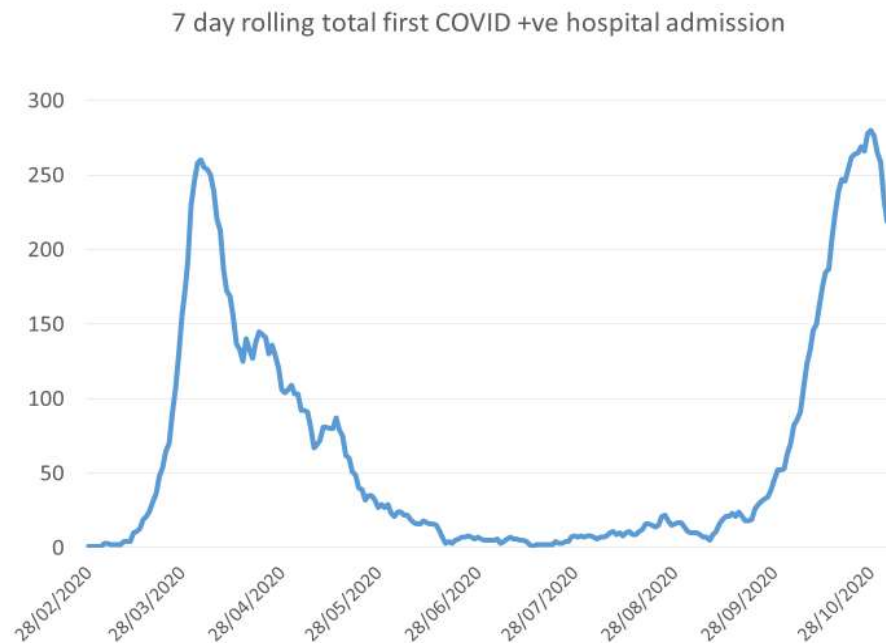


7 day rolling average test positivity (%)

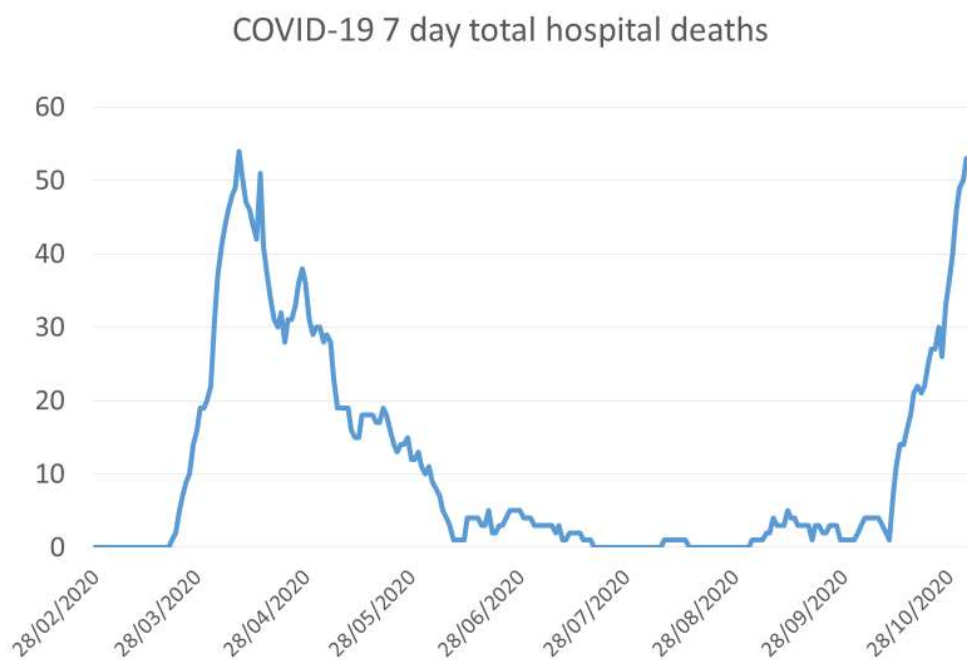
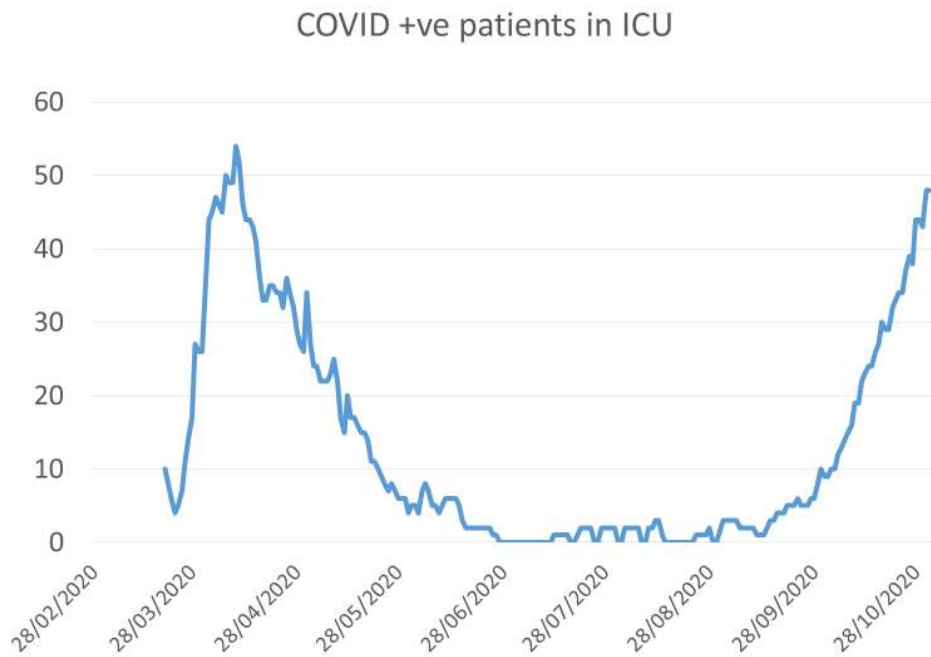


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The following graphs show first hospital admission of COVID +ve patients over a rolling 7 day period and the number of hospital inpatients. Admission numbers are beginning to decline. Hospital inpatients remain plateaued around peak, higher than wave 1. This is likely to reflect longer hospital stays due to more effective treatments which reduce mortality. ICU patients and deaths continue to rise.



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NI, UK, ROI comparison:

The following chart shows cases per 7 days / 100 k population across the Common Travel Area. Testing in ROI is currently around 18 / 1000 / 7 days compared with 22 in NI. NI

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remains the highest of the UK countries, though the gap between NI and Wales has narrowed considerably.

