

# Briefing for C19AG: Comparison of doubling times

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### Key points summary

We compare the size and rate of increase of the COVID-19 epidemic for Scotland, London and the rest of the UK except for London (rUKxL).

**The epidemic in Scotland is ~6 days behind London and is now growing at a faster rate.**

Based on deaths:

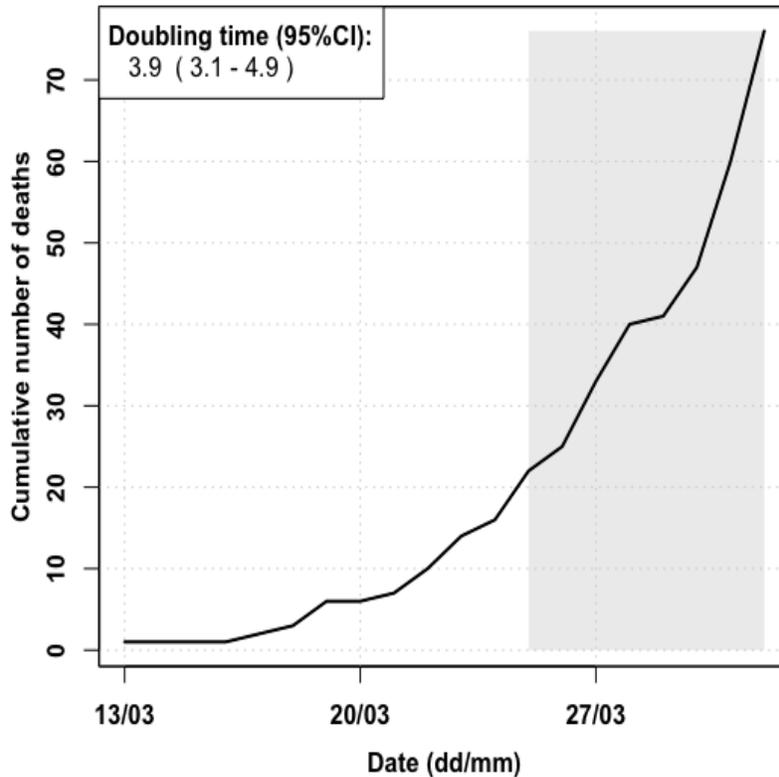
- The current doubling time for deaths in Scotland is 3.9 days (95% confidence interval: 3.1-4.9 days) (Figure 1).
- This is not significantly different from doubling time for previous 7 days (2.4 days; 95%CI: 1.6-3.7 days).

Based on case counts and case counts per 10,000 population available as of 01/04/2020:

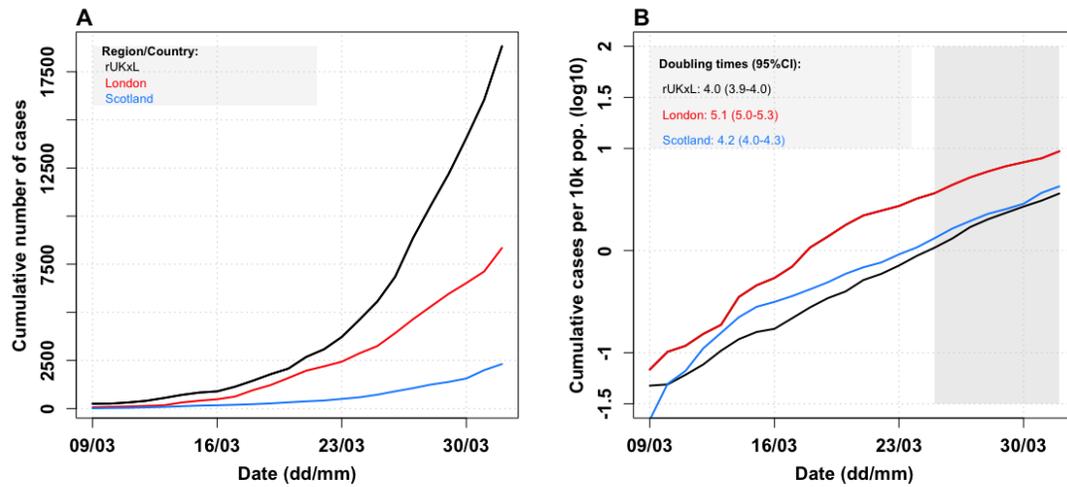
- The epidemic in Scotland is 6.2 days behind London and 1.1 days ahead of rUKxL (Figure 2).
- The current 7-day doubling time in Scotland is 4.2 days (95%CI: 4.0-4.3 days).
- This is very similar to doubling time for previous 7 days (4.2 days; 95%CI: 3.9-4.5 days).
- The current doubling time in Scotland is significantly faster than London (5.1 days, 95%CI: 5.0-5.3 days) and significantly slower than rUKxL (4.0 days, 95%CI: 3.9-4.0 days) over the same time period.

- Across Health Boards in Scotland there is variation in cumulative case incidence (1.7 to 7.5 per 10,000 population, Figures 3, 4) and doubling time (2.8 to 5.1 days, Figure 5).

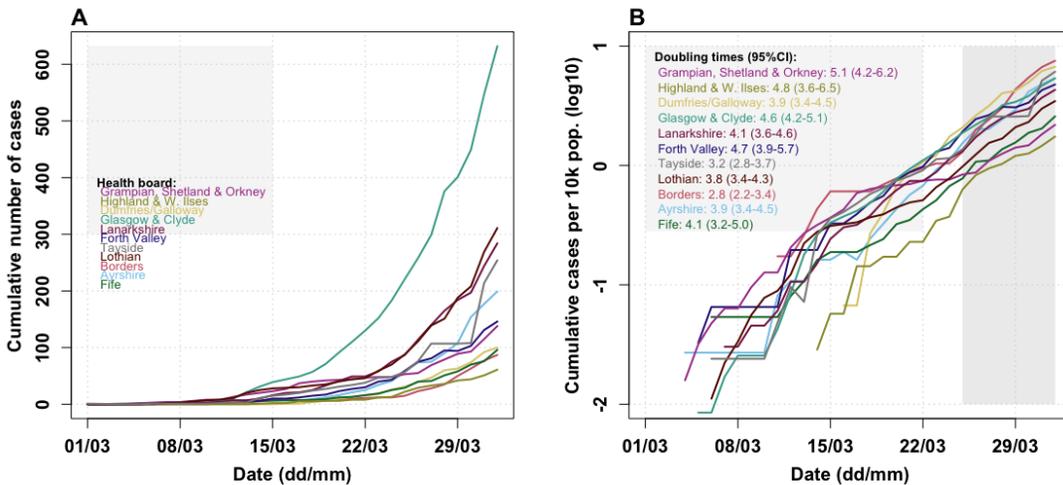
## Results



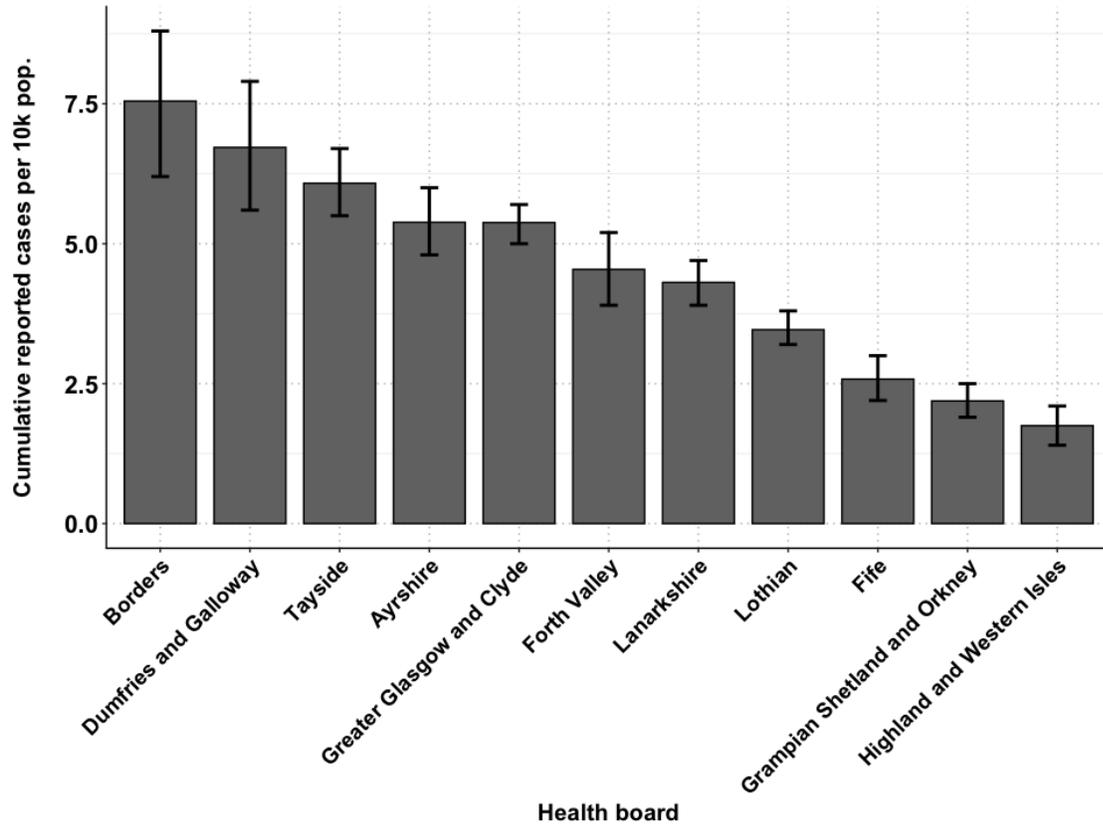
**Figure 1. Epidemic curve for Scotland based on deaths over time up to 01/04/2020.** Doubling time estimated over the past 7 days is 3.9 days (95%CI: 3.1-4.9 days).



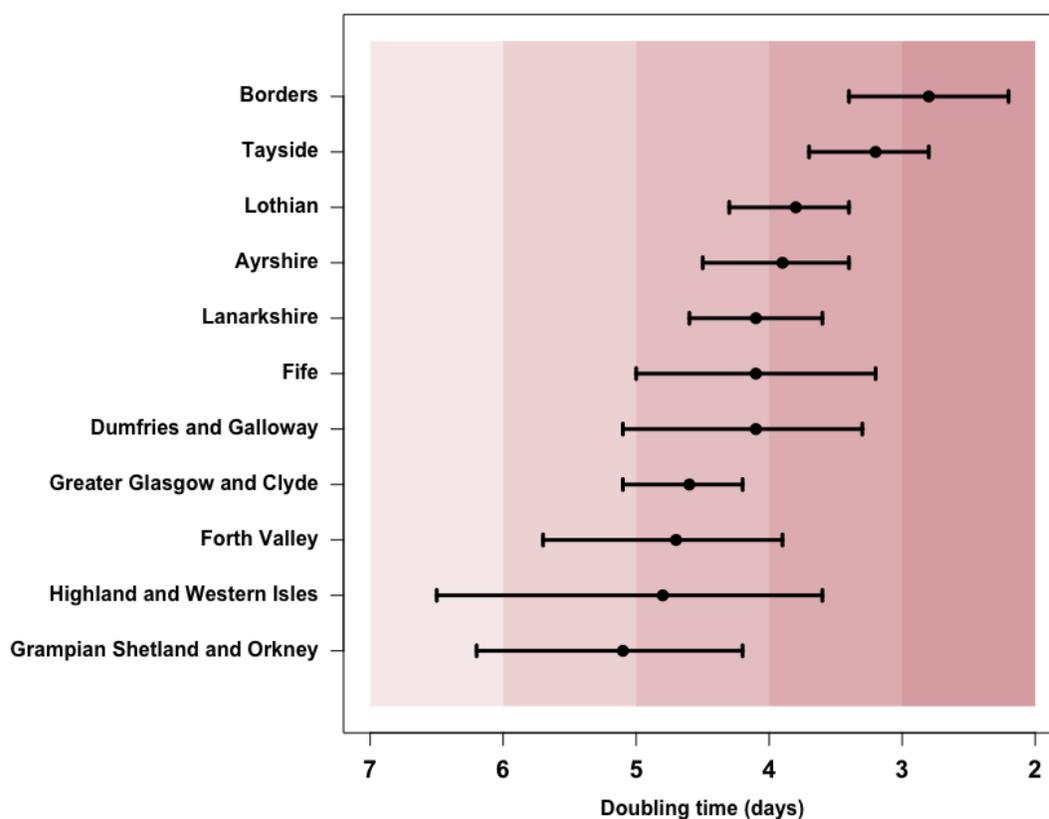
**Figure 2. Comparison of epidemic curves for Scotland, London and rUKxL up to 01/04/2020. A) Cumulative reported cases. B) Cumulative cases per 10,000 population on a log<sub>10</sub> scale. Inset shows corresponding doubling times (in days) over the past 7 days (with 95% confidence intervals).**



**Figure 3. Comparison of epidemic curves for all Scottish Health Boards up to 01/04/2020. A) Cumulative reported cases. B) Cumulative cases per 10,000 population on log<sub>10</sub> scale. Inset shows corresponding doubling times (in days) estimated over the past 7 days with 95% confidence intervals.**



**Figure 4. Cumulative incidence for all Scottish Health Boards up to 01/04/2020.** The error bars shows the 95%CI of the cumulative incidence per 10,000 population reached at last time point over the bootstrapped simulated datasets with Poisson error structure.



**Figure 5. Doubling time of cases.** Doubling times are calculated over a 7 day period up to 01/04/2020. Error bars indicate 95%CI.

## Data

- Case counts for Scotland and for Scottish HBs from <https://www.gov.scot/coronavirus-covid-19/> (accessed 1200 01/04/2020).
- Case counts for London and rUK except London from <https://www.arcgis.com/apps/opsdashboard/index.html#/f94c3c90da5b4e9f9a0b19484dd4bb14> (accessed 2000 01/04/2020).
- Death count for Scotland from <https://www.gov.scot/coronavirus-covid-19/> (accessed 1200 01/04/2020).
- Population counts from the Office of National Statistics (mid-year 2018).
  - UK: <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland>, Mid-2018, spreadsheet 'MYE2-all' (accessed 11400 26/03/20)

- Scotland Health Board Areas:  
<https://statistics.gov.scot/atlas/resource?uri=http://statistics.gov.scot/id/statistical-geography/S92000003> (accessed 1200 11/03/20).

## Doubling time calculations:

Calculated over prior 7 days using method described by *E. Vynnycky & R. White (2010) An Introduction to Infectious Disease Modelling*, page 74.

Confidence intervals calculated using bootstrapping of a simulated dataset with Poisson error structure, using method published here:

<https://doi.org/10.1101/2020.02.05.20020750>.

## Caveats

- Case count data are affected by any changes in testing strategy or testing effort over time and/or any variation in testing strategy or testing effort between regions.
- Case count data are likely a substantial under-representation of the true number of COVID-19 infections.
- Death data are considered more reliable but may lag behind case data by as much as 3 weeks.
- However, death data for London and rUKxL cannot be disaggregated. Nor can death data for Scottish Health Boards. Therefore more detailed analyses using death data are not currently possible.