Briefing for C19AG: Comparison of doubling times

NOT FOR DISTRIBUTION

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06/04/2020

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 ~7 days behind London and is now growing at a faster rate but may be slowing.

Based on deaths:

- The current doubling time for deaths in Scotland is 2.9 days (95% confidence interval (CI): 2.5 - 3.3 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)..
- NOTE: Due to a delay in reporting over weekends, we expect to see an increase in the number of cases and the number of deaths reported in the coming days. Doubling time estimates are therefore subject to change and current estimates may not be an accurate reflection of the situation on the frontline.

Based on case counts per 10,000 population available as of 05/04/2020:

- The epidemic in Scotland is 6.8 days behind London and 1 days ahead of rUKxL (Figure 2, Figure 3).
- The current 7-day doubling time in Scotland is 4.9 days (95%CI: 4.7 - 5.1 days).
- This is slower than the doubling time for previous 7 days (4.0 days; 95%CI: 3.8 - 4.3 days).
- The current doubling time in Scotland is significantly faster than London (6.9 days, 95%CI: 6.8 - 7.1 days) and is not significantly different to rUKxL (5.0 days, 95%CI: 4.9 - 5.1 days) over the same time period.
- Across Health Boards in Scotland there is variation in cumulative case incidence (3.0 to 11.3 per 10,000 population, Figures 4, 5) and doubling time (3.3 to 6.0 days, Figure 6).

Results

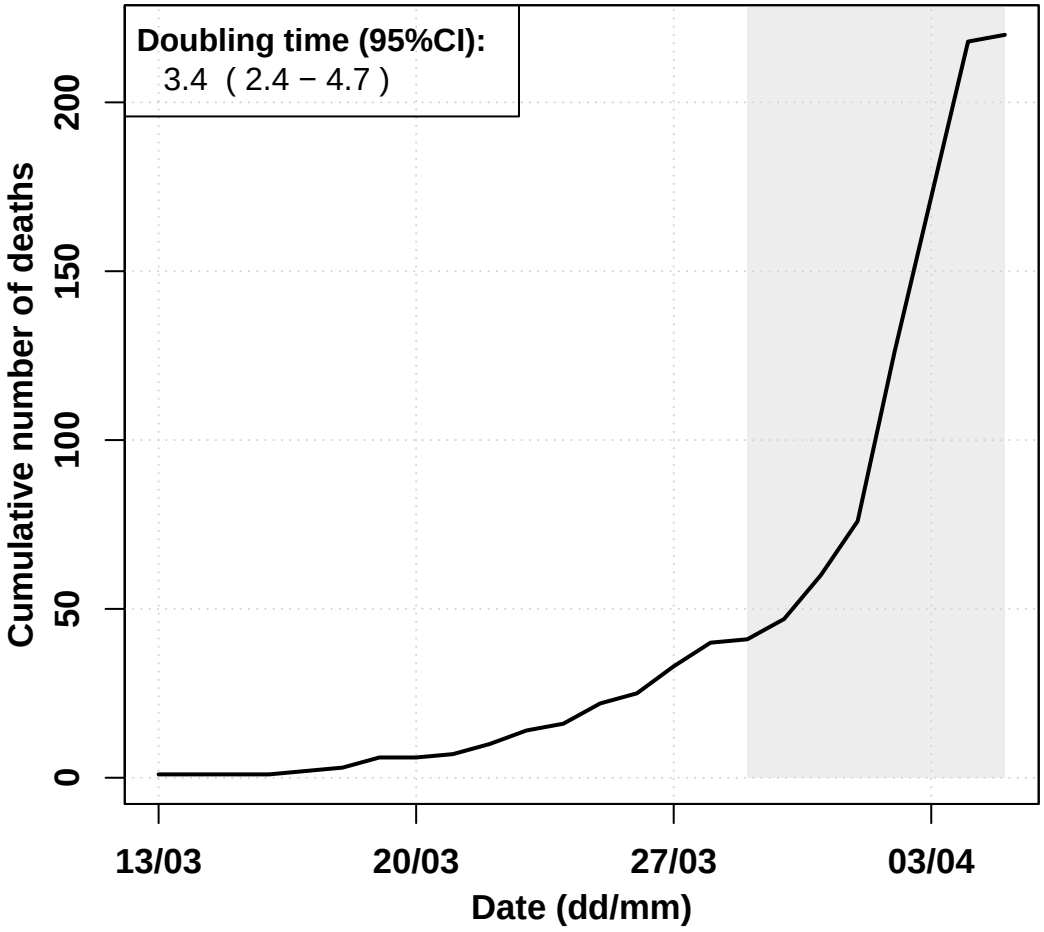

Figure 1. Epidemic curve for Scotland based on deaths over time up to 05/04/2020. Doubling time estimated over the past 7 days is 2.9 days (95% confidence interval (CI): 2.5-3.3 days).

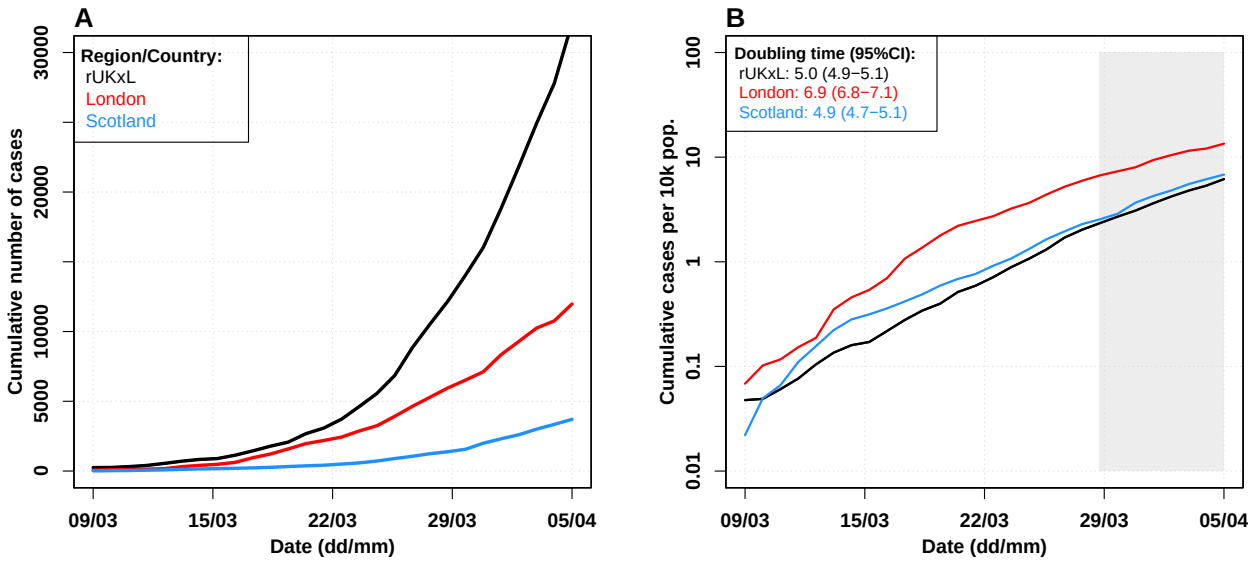

Figure 2. Comparison of epidemic curves for Scotland, London and rUKxL up to 05/04/2020. **A)** Cumulative reported cases. **B)** Cumulative cases per 10,000 population on a log10 scale. Inset shows corresponding doubling times (in days) over the past 7 days (with 95% CIs).

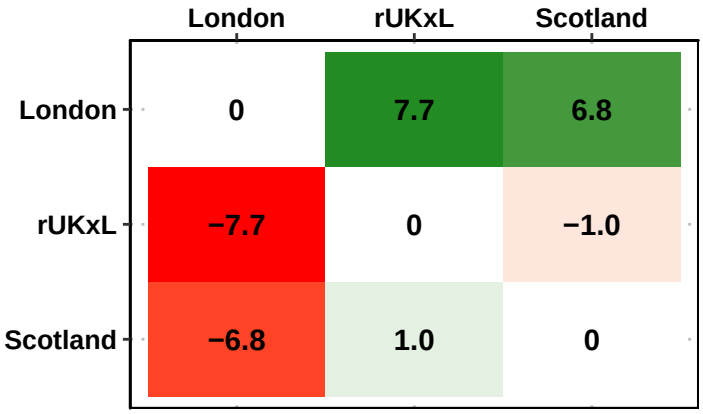

Figure 3. Pairwise epidemic progression comparison. The reported numbers are the numbers of days ahead (positive numbers, green) or behind (negative numbers, red) the regions in horizontal entries are relative to the regions in vertical entries.

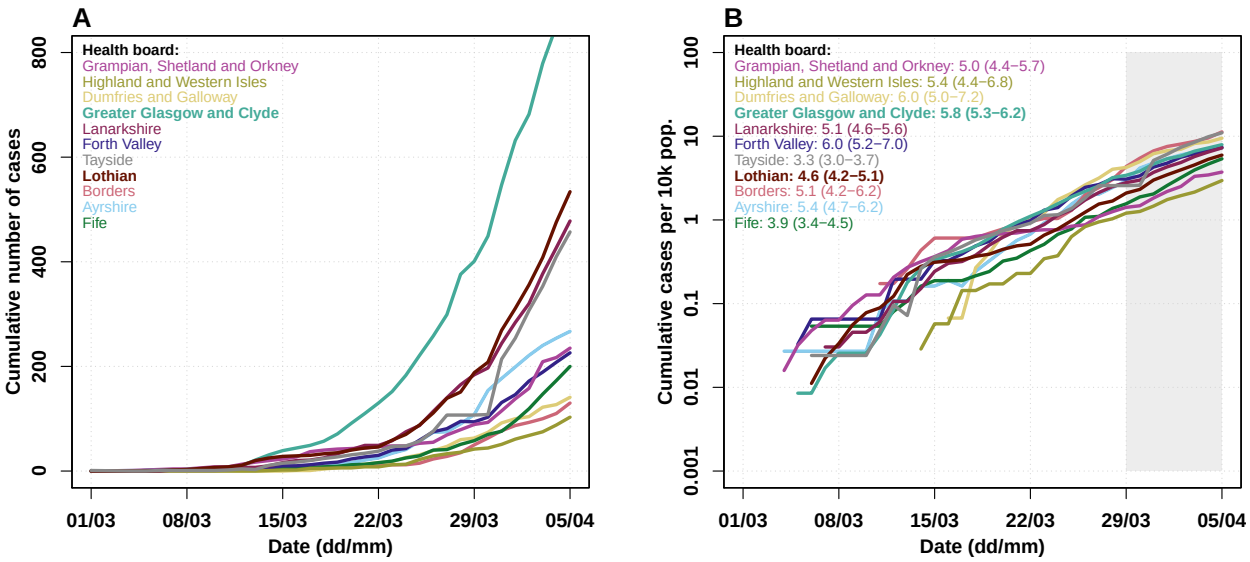

Figure 4. Comparison of epidemic curves for all Scottish Health Boards up to 05/04/2020. **A)** Cumulative reported cases. **B)** Cumulative cases per 10,000 population on log10 scale. Inset shows corresponding doubling times (in days) estimated over the past 7 days with 95% CIs.

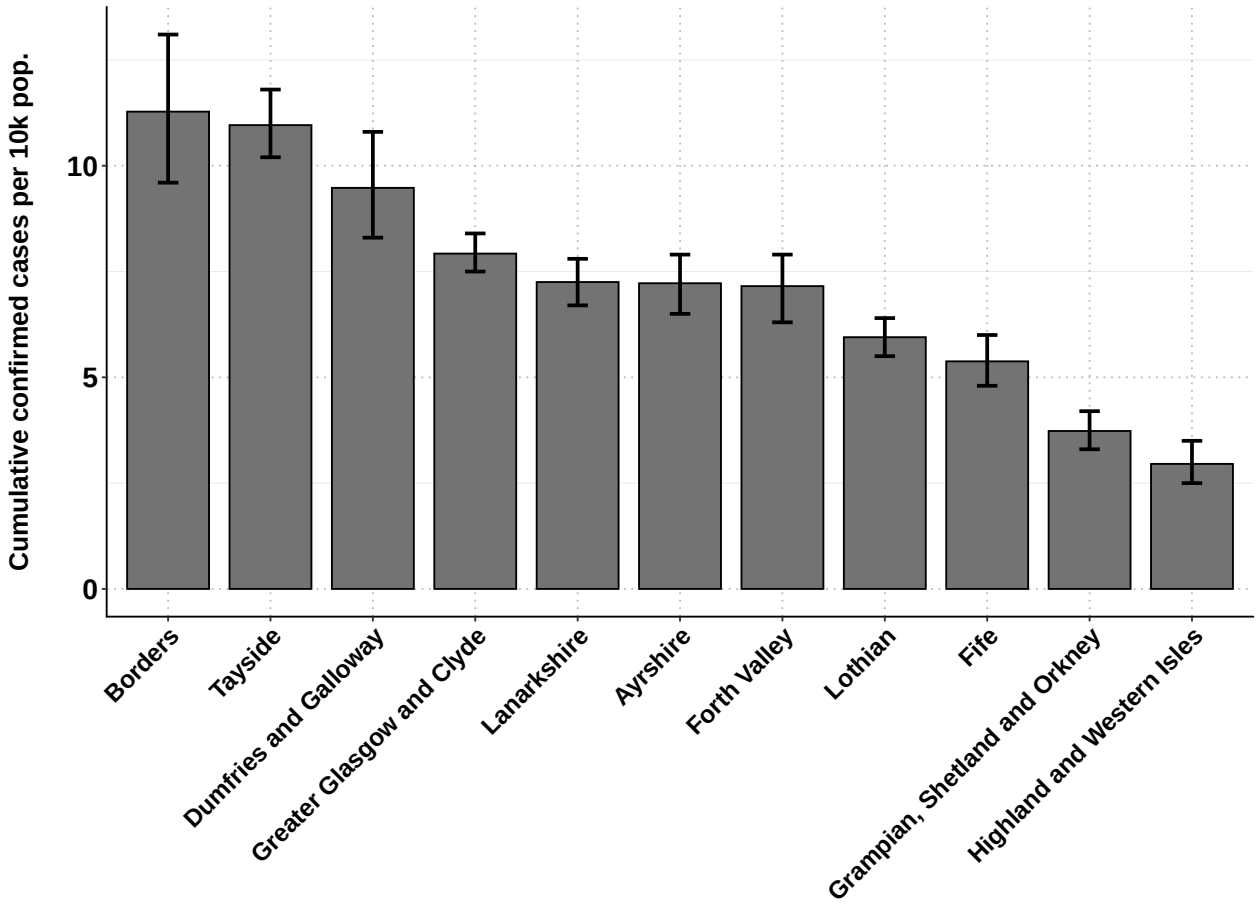

Figure 5. Cumulative incidence for all Scottish Health Boards up to 05/04/2020. The error bars show the 95%CI of the cumulative incidence per 10,000 population reached at last time point over the bootstrapped simulated datasets with Poisson error structure.

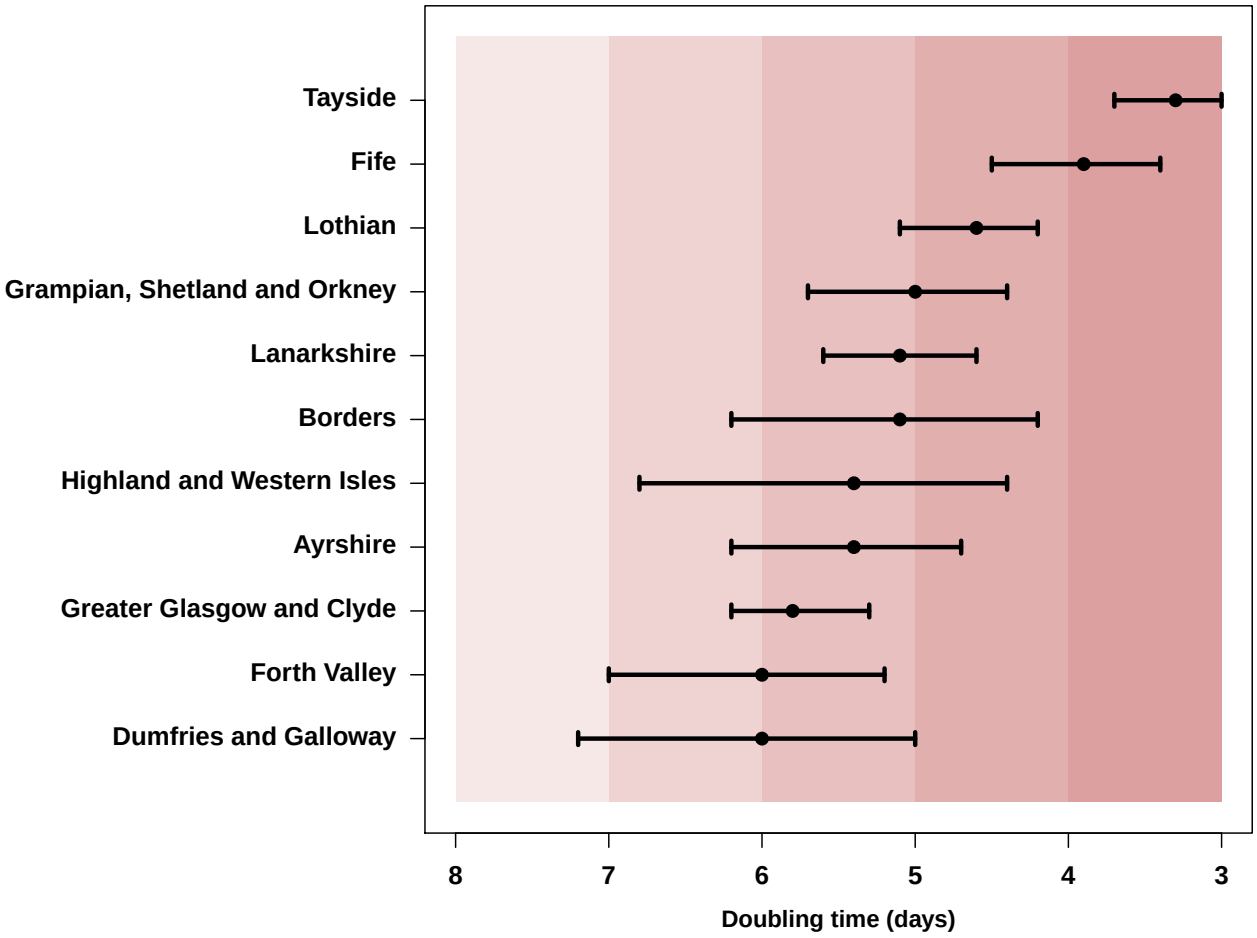

Figure 6. Doubling time of cases. Doubling times are calculated over a 7 day period up to 05/04/2020. Error bars indicate 95% CIs.

Region/Health board	Measure	Doubling time	95%CI lower	95%CI upper
Scotland	death	2.9	2.5	3.3
London	cases	6.9	6.8	7.1
Scotland	cases	4.9	4.7	5.1
Rest of UK	cases	5.0	4.9	5.1
Ayrshire	cases	5.4	4.7	6.2
Borders	cases	5.1	4.2	6.2
Dumfries and Galloway	cases	6.0	5.0	7.2
Fife	cases	3.9	3.4	4.5
Forth Valley	cases	6.0	5.2	7.0
Grampian Shetland and Orkney	cases	5.0	4.4	5.7
Greater Glasgow and Clyde	cases	5.8	5.3	6.2
Highland and Western Isles	cases	5.4	4.4	6.8
Lanarkshire	cases	5.1	4.6	5.6
Lothian	cases	4.6	4.2	5.1
Tayside	cases	3.3	3.0	3.7

Table 1. Summary of all doubling times and their 95% CIs reported in the above figures.

Data

- Case counts for Scotland and for Scottish HBs from https://www.gov.scot/coronavirus-covid-19/ (accessed 1400 05/04/2020).

- Case counts for London and rUK except London from https://www.arcgis.com/apps/opsdashboard/index.html#/f94c3c90da5b4e9f9a0b19484dd4bb14 (accessed 2000 05/04/2020).

- Death count for Scotland from https://www.gov.scot/coronavirus-covid-19/ (accessed 1400 05/04/2020).

- 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 1140 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.