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 ~7 days behind London and is now growing at a faster rate.

Based on deaths:

- The current doubling time for deaths in Scotland is 2.9 days (95% confidence interval: 2.6 - 3.2 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 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).
- The current 7-day doubling time in Scotland is 4.9 days (95%CI: 4.7 - 5.1 days).
- This is very similar to the 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 (6.9 days, 95%CI: 6.8 - 7.1 days) and significantly slower than rUKxL (5.0 days, 95%CI: 5.0 - 5.1 days) over the same time period.
- Across Health Boards in Scotland there is variation in cumulative case incidence (3 to 11.3 per 10,000 population, Figures 3, 4) and doubling time (2.9 to 6.9 days, Figure 5).

Results

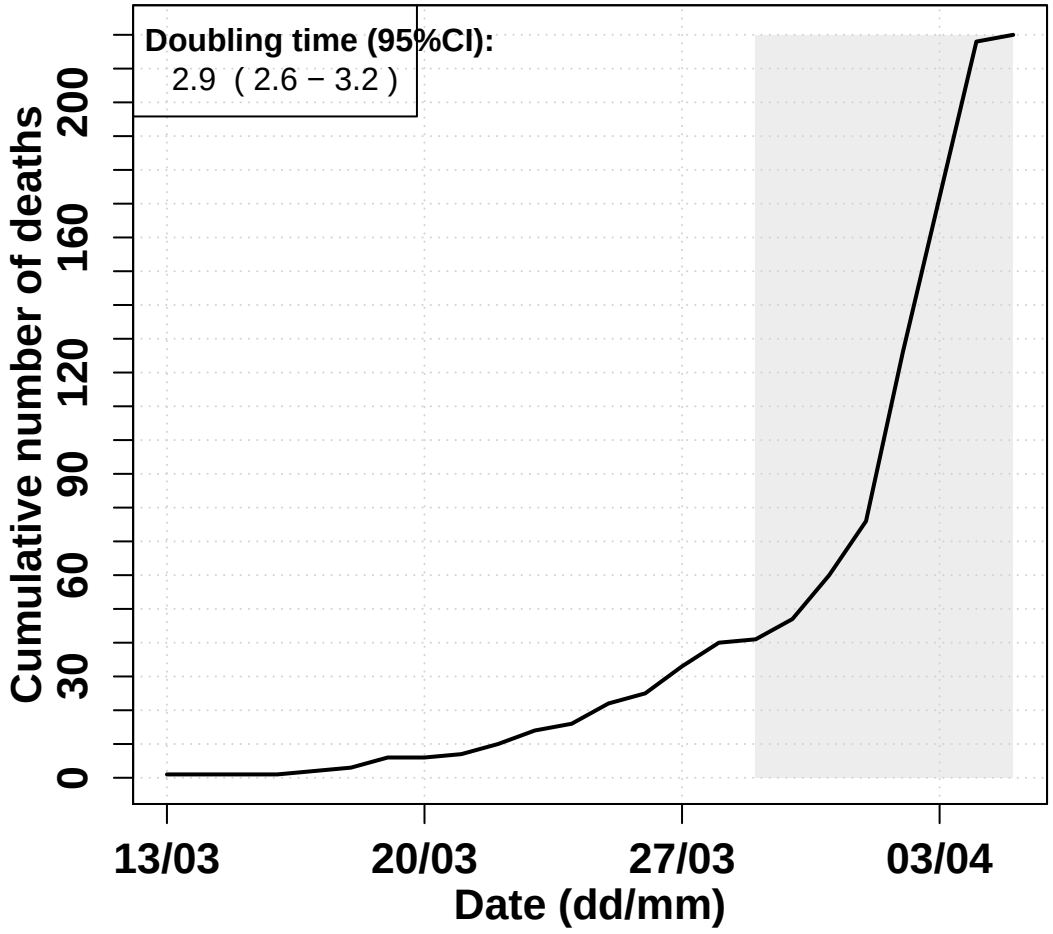

Figure 1. Epidemic curve for Scotland based on deaths over time up to 05/04/2020. Doubling time estimated over the past 7 days is 2.9 days (95%CI: `Td.report[1,'ci.low']-Td.report[1,'ci.upp']` days).

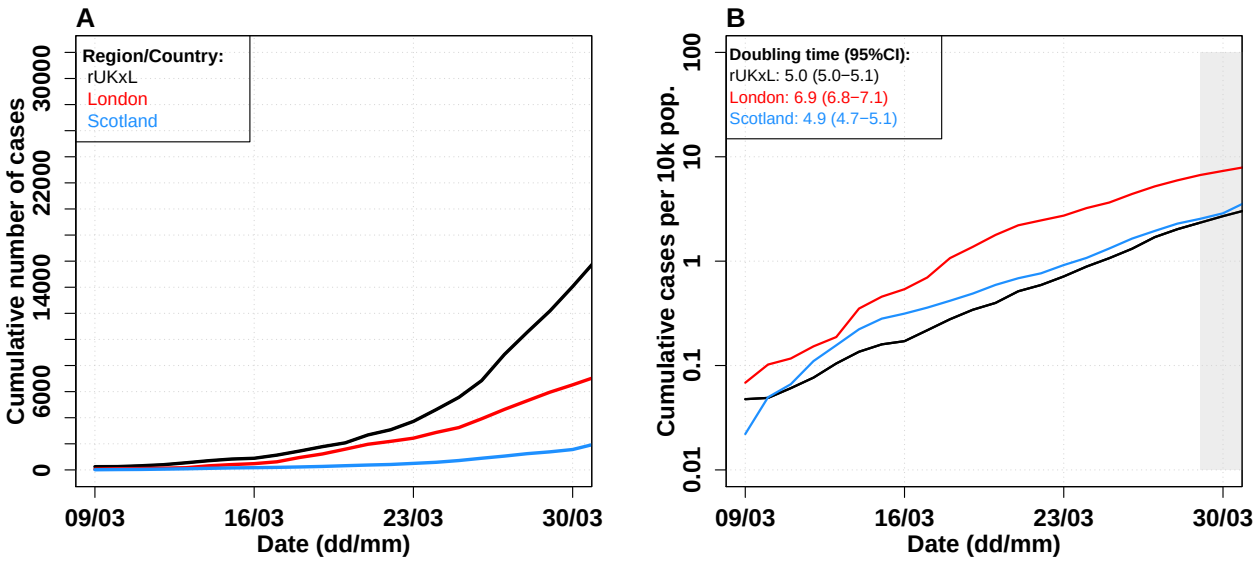

Figure 2. Comparison of epidemic curves for Scotland, London and rUKxL up to 05/04/2020. **A)** Cumulative reported cases. **B)** Cumulative cases per 10,000 population on a log10 scale. Inset shows corresponding doubling times (in days) over the past 7 days (with 95% confidence intervals).

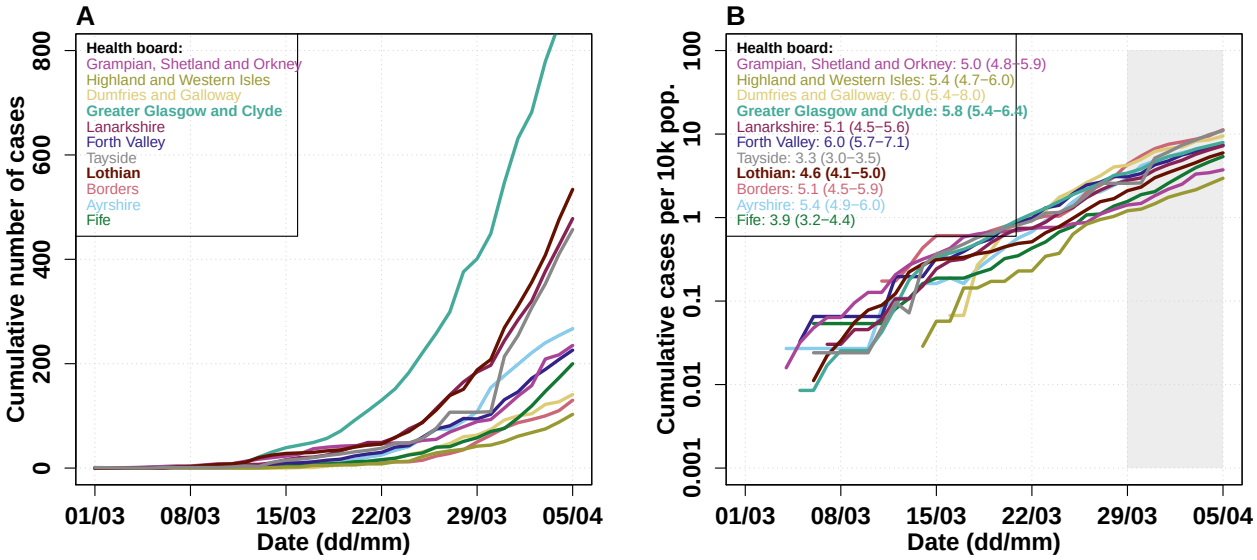

Figure 3. Comparison of epidemic curves for all Scottish Health Boards up to 05/04/2020. **A)** Cumulative reported cases. **B)** Cumulative cases per 10,000 population on log10 scale. Inset shows corresponding doubling times (in days) estimated over the past 7 days with 95% confidence intervals.

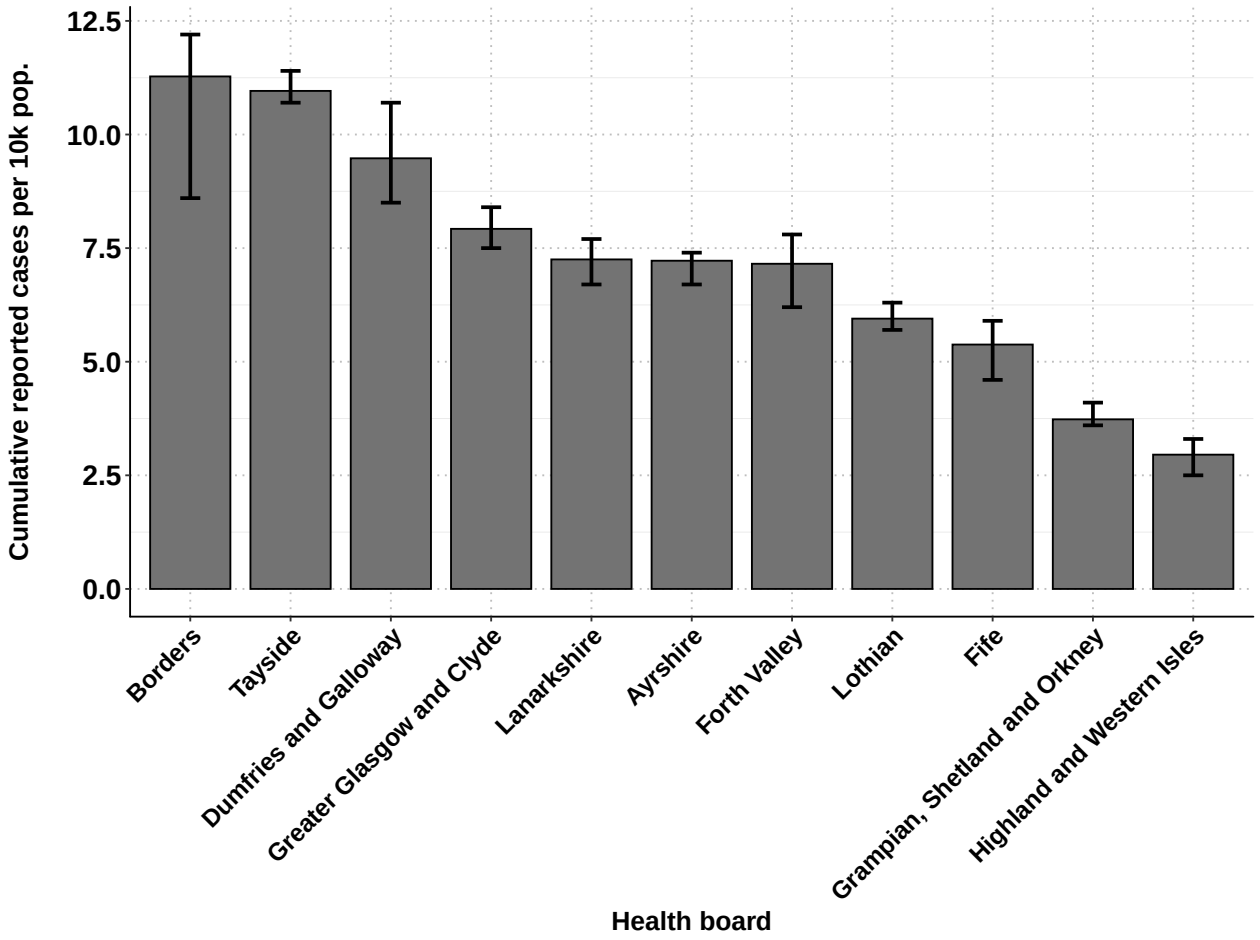

Figure 4. Cumulative incidence for all Scottish Health Boards up to 05/04/2020. The error bars show the 95%CI of the cumulative incidence per 10,000 population reached at last time point over the bootstrapped simulated datasets with Poisson error structure.

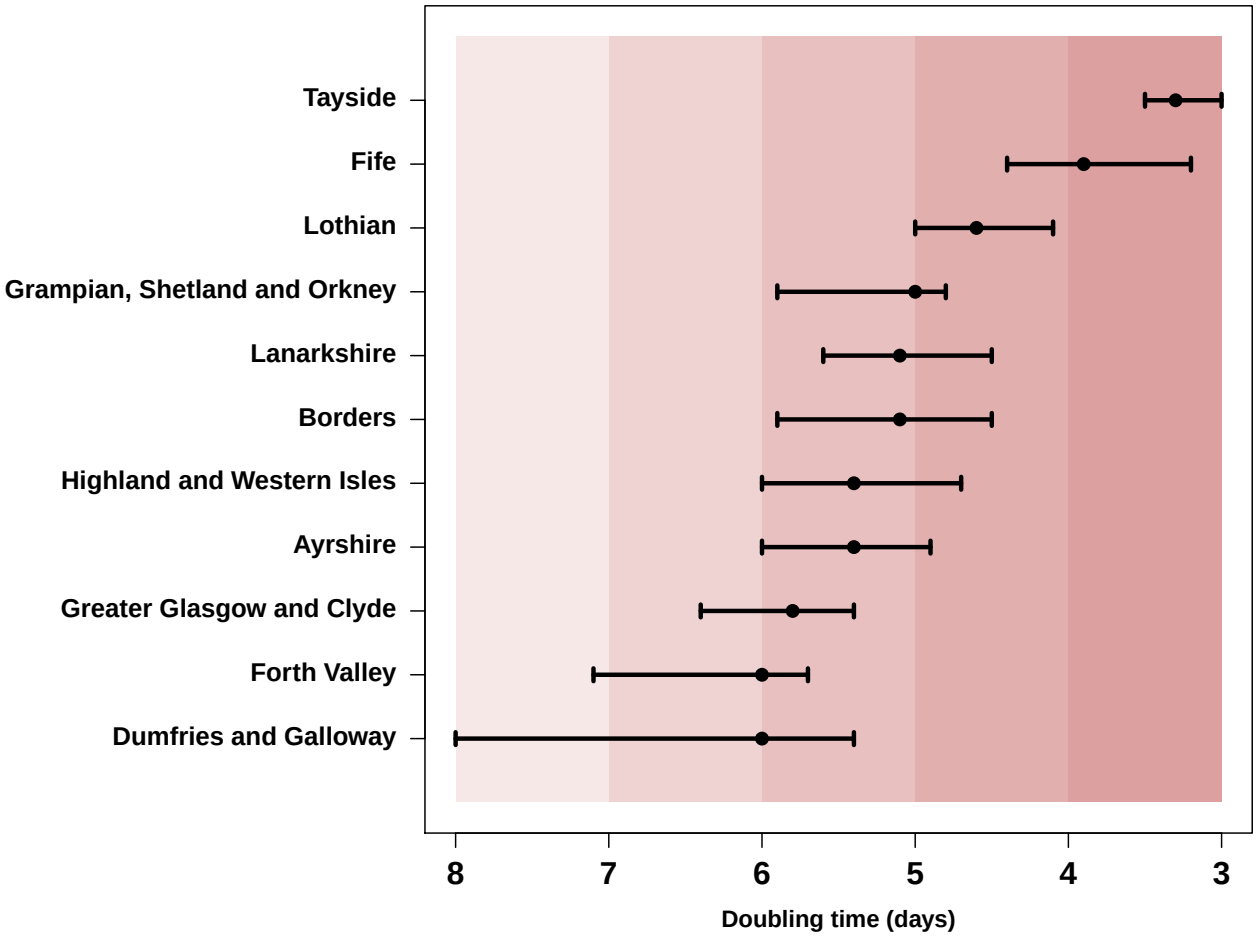

Figure 5. Doubling time of cases. Doubling times are calculated over a 7 day period up to 05/04/2020 Error bars indicate 95%CI.

Figure 6. Pairwise epidemic progression comparison.

variable	Td.obs	ci.low	ci.upp	t1	t2
Scotland death	2.9	2.6	3.2	2020-03-29	2020-04-05
London cases	6.9	6.8	7.1	2020-03-29	2020-04-05
Scotland cases	4.9	4.7	5.1	2020-03-29	2020-04-05
Rest of UK cases	5.0	5.0	5.1	2020-03-29	2020-04-05
Ayrshire cases	5.4	4.9	6.0	2020-03-29	2020-04-05
Borders cases	5.1	4.5	5.9	2020-03-29	2020-04-05
Dumfries and Galloway cases	6.0	5.4	8.0	2020-03-29	2020-04-05
Fife cases	3.9	3.2	4.4	2020-03-29	2020-04-05
Forth Valley cases	6.0	5.7	7.1	2020-03-28	2020-04-05
Grampian Shetland and Orkney cases	5.0	4.8	5.9	2020-03-29	2020-04-05
Greater Glasgow and Clyde cases	5.8	5.4	6.4	2020-03-29	2020-04-05
Highland and Western Isles cases	5.4	4.7	6.0	2020-03-29	2020-04-05
Lanarkshire cases	5.1	4.5	5.6	2020-03-29	2020-04-05
Lothian cases	4.6	4.1	5.0	2020-03-29	2020-04-05
Tayside cases	3.3	3.0	3.5	2020-03-29	2020-04-05

Data

- Case counts for Scotland and for Scottish HBs from https://www.gov.scot/coronavirus-covid-19/ (accessed 1200 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 1200 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.