Projection of early spread of COVID-19 in South Africa

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This report investigates the expected timeframe for the first 1,000 and first 10,000 COVID-19 cases in South Africa, in the absence of additional mitigation efforts. Using a branching process model to simulate the growth of the epidemic, we find that the cumulative case count is likely to reach 1,000 cases between 28 March and 2 April (95% range: 25 March - 9 April), and that the cumulative case count is likely to reach 10,000 cases between 11 April and 16 April (95% range: 7 April - 25 April). Containment measures, including testing, contact tracing, isolation of cases, and quarantine of contacts are likely to slow, but not halt, the growth of the epidemic (Hellewell et al. 2020).
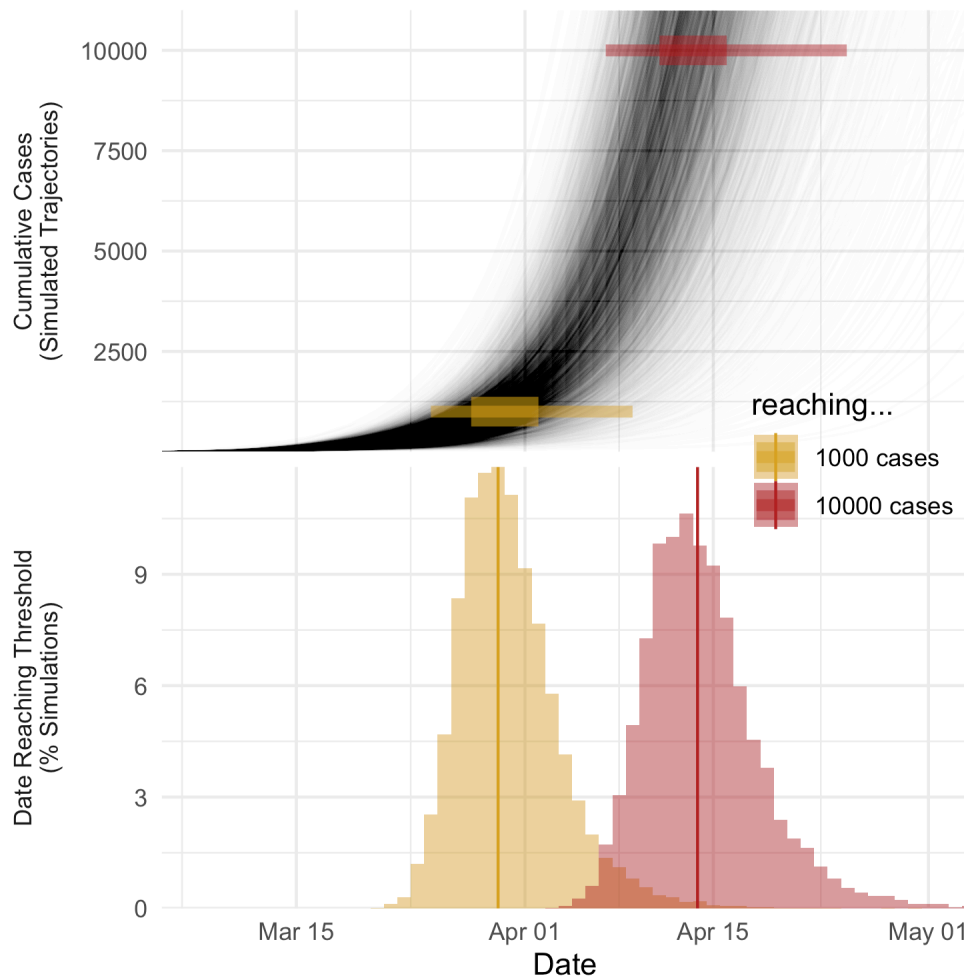

Figure 1: Distribution of times to 1,000 (yellow) and 10,000 (red) cases based on 10,000 model runs.

Assumptions and parameters

The model is initialized assuming that the epidemic was seeded by undetected cases occurring between 5 and 13 March, and makes the following additional assumptions:

- Any containment or mitigation efforts put into place during the early phase of the epidemic have no impact on undetected cases.
- The fraction of cases detected remains constant and is at least 50%.
- Each case produces an average of 2 additional cases (Abbot et al. 2020) (negative binomially distributed offspring distribution with mean 2 and dispersion parameter 0.38 (Bi et al. 2020)).
- The average time between the onset of a case and the onset of a subsequent case infected by that case (serial interval) is 4.7 days (log-normally distributed with mean 4.7 and standard deviation 2.9) (Nishiura, Linton, and Akhmetzhanov 2020).

The model was run 10,000 times and the full distribution of results is presented in the figure. The results are summarized using the middle 50% and 95% of the distribution for the time to reach the specified number of cases.

The model was built using the `bpmodels` package in the R statistical programming language (Funk 2020).

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References

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