**Use of Epidemiological Models During the COVID-19 Pandemic**

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Models help formalise assumptions about the way the world works and explore the consequences of those assumptions.

In studying infectious disease epidemics such as the current COVID-19 pandemic, models are often used to make short-term forecasts of case numbers and to evaluate the relative impact and effectiveness of potential options for intervention. Models are tools that help us formalise assumptions about the way the world works and explore the consequences of those assumptions.

SACEMA researchers collaborating with colleagues at the London School of Hygiene and Tropical Medicine have developed a simple projection model to evaluate the early spread of COVID-19 in African countries, based on the timing of the first cases identified in each country.

The model uses information estimated from other contexts, such as the average number of new infections produced by each infection in a susceptible population, and the timing between the onsets of linked cases. The model then projects how the early cases will spread through the population and predicts when countries will reach the level of 1 000 and 10 000 cases (in the absence of effective interventions).

Although the model is simple, it performed well when validated against data from countries that had already reached 1 000 cases.

The findings from the projections are concerning - we predict that most African countries will have 1 000 cases by the end of April 2020 and that, in the absence of interventions, many countries could have 10 000 cases a few weeks later. While the model has a substantial amount of uncertainty regarding the specific number of cases on a given day in a given country, the overall findings are robust and provide a strong caution for the consequences of inaction.

**Models of long-term COVID-19 dynamics indicate that we can use social distancing to flatten the curve**

Epidemiological models can also be used to investigate longer-term expectations; however, long-term predictions should be qualitative in nature, looking at the relative effects of different scenarios, rather than aiming to make precise statements about numbers and dates.

In this way, epidemiological modelling is similar to weather forecasting. While local weather forecasts are relatively good at telling us what is likely to happen today or tomorrow, we all know not to trust the forecast to tell us whether it will rain in 10 days’ time. This is because small uncertainties about the weather today or tomorrow propagate to create large uncertainties further in the future. As information about what happened today becomes available, the uncertainty is reduced and the resulting predictions can be refined.

On the other hand, long-term weather patterns do have some predictability, e.g. Cape Town is likely to be warmer in April than in July. These types of qualitative predictions are robust to small-scale variation and uncertainty.

Similarly, models of long-term COVID-19 dynamics indicate that we can use social distancing to flatten the curve – reducing the size of the peak in the number of cases and hospitalisations relative to an epidemic with no interventions. However, we should be sceptical of quantitative statements about how high the peak will be and when it will occur.

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