Report for Channel 4 – the effects of an early knockdown.

In brief, had her Majesty's government brought forward the lockdown from 23 March to a few days before the Cheltenham Festival—on 8 March—the peak death rates seen on 9 April of over 1000 would have been delayed by about four weeks, reducing the peak death rate to below 900. This effect is much like ‘flattening the curve’. This is important because ‘flattening the curve’ means mortality is dispersed and delayed in time. Practically, this means that the same number of people would have died after a sufficient period of time. In other words, one could have delayed and smoothed the first peak but would only have deferred the total number of lives lost. The analogy here would be like trying to hold back the tide—all one can do is redirect or defer the impending deluge.

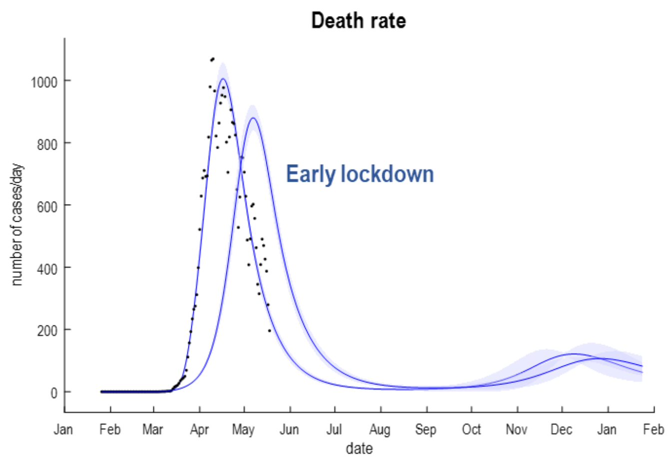

Figure 1: *Predicted fatality rates per day, under the lockdown and social distancing we witnessed and with an early lockdown. The blue lines correspond to the expected rates of death, while the shaded areas correspond to 90% Bayesian credible intervals. The dots show to recorded deaths.*

The underlying causes of the deaths depicted in Figure 1 are shown in Figure 2. The upper left panel reproduces the predicted and observed death rates (with dots and blue lines respectively), under the two knockdown scenarios. The equivalent cumulative lives lost are shown in the upper right panel. The latent causes of this mortality are shown in the lower panels, in terms of social distancing (*location* panel) and the proportion of people in various states of infection (*infection* panel).

For our purposes, we are interested in social distancing as reflected in the probability of leaving home (the blue lines in the *location* panel). One can see that social distancing took effect on 20 March, based upon the model parameters estimated from the observed data. The fictive scenario of lockdown on 8 March advances the social distancing by 12 days. The shift in the accompanying profiles of infection and population immunity are shown in the *infection* panel. Note again that the effect is to move these curves into the future. Interestingly, the cumulative deaths converge at about 36 weeks. After this, they diverge again with the emergence of a putative second wave. The mechanism behind the second wave rests on a slow loss of immunity—as shown by the yellow lines in the *infection* panel.

Note: the model assumptions and parameters upon which this report can be found in (Friston et al., 2020). In brief, this model uses something called dynamic causal modelling that is slightly more sophisticated than conventionally epidemiological models. In particular, it treats social distancing as both cause and consequence of the prevalence of infection. This means it is possible to predict future social distancing responses at a societal and institutional level. To model an early knockdown, we simply increased the sensitivity (i.e., decreased a soft threshold) to the prevalence of infection of the probability of leaving home.

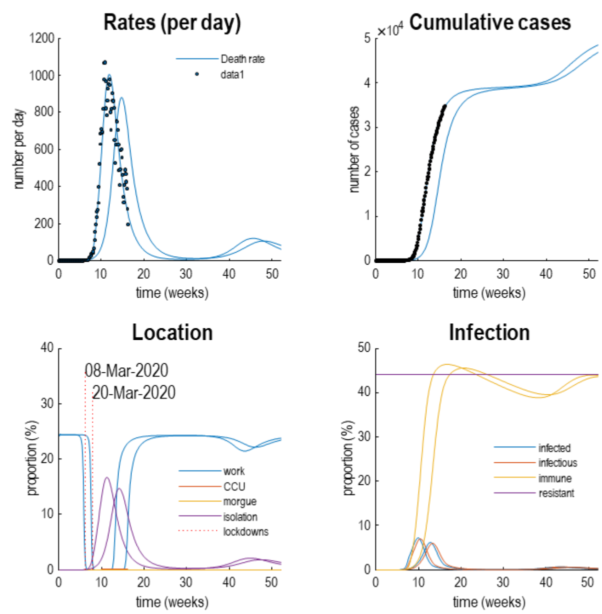

Figure 2*: expected deaths and underlying or latent causes. These causes are listed in the lower panels, in terms of where you are during the course of the pandemic (i.e., work, critical care, the morgue or in isolation. And in terms of how you have been affected; infected, infectious, or contagious, immune, or resistant). The pairs of coloured lines in each panel correspond to the predictions of the model under the two (early and late) lockdown scenarios.*

A similar picture emerges if we consider containment strategies in terms of testing, tracking, and tracing. Figure 3 shows what might have happened if the government had pursued its initial containment strategy. Here, this was modelled under the assumption that 50% of people who were asymptomatic but infected could have been identified and subsequently compelled to self-isolate. Here, we see a more profound delay and dispersion of the epidemic.

However, it is unlikely that this policy could have been implemented. This is evident in the lower panel, which shows the number of people that would have been tested or identified under an efficacious containment strategy. The dotted red line is a rough indication of the capacity for this testing or identification. It is immediately obvious that the number of people waiting for their results or testing positive each day far exceeds testing capacity (here, based upon hundred thousand tests per day for a population of 66 million).

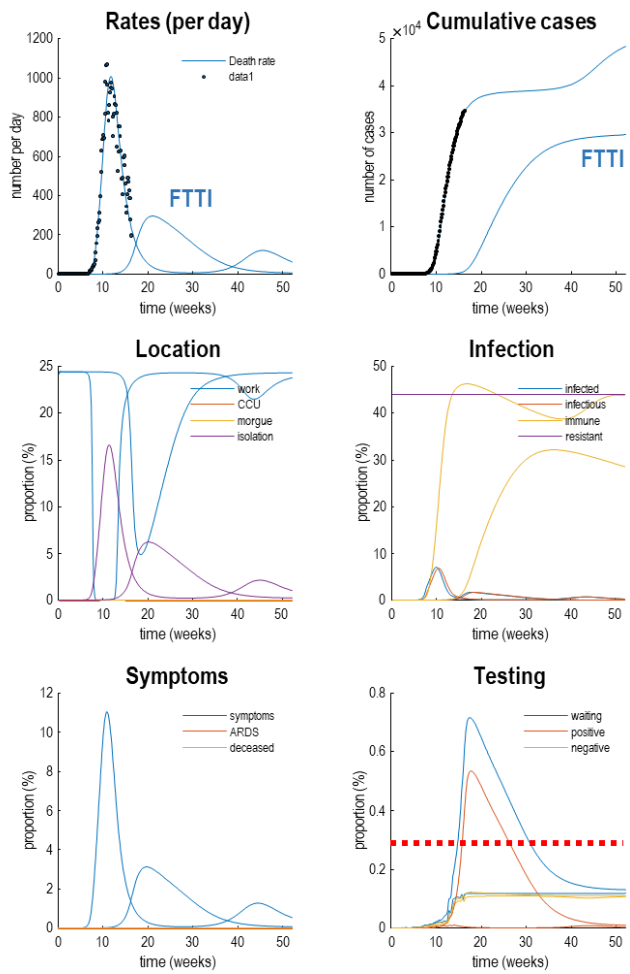

Figure 3*: this figure uses the same format as the previous figure. However, here, we have included two further latent causes; namely, symptoms and testing. The pairs of coloured lines correspond to the predictions under the two containment strategies—modelled in terms of the efficacy of identifying asymptomatic but infected individuals and compelling them to self-isolate.*

References

Friston, K.J., Parr, T., Zeidman, P., Razi, A., Flandin, G., Daunizeau, J., Hulme, O.J., Billig, A.J., Litvak, V., Price, C.J., Moran, R.J., Lambert, C., 2020. Tracking and tracing in the UK: a dynamic causal modelling study. arXiv e-prints, arXiv:2005.07994.