Supplementary Material

In [1] we presented a model simulating a quasi-worst scenario. Here we give a short discussion on how sensitive our model is with regards to the the reproduction rate and initial conditions. These are essential parameters that are estimated based on given data (the other parameters in the model have values taken from lab experiments in cited papers). To make our discussion concise we omit plots for the West Coast since similar trends will be obtained.

Reproduction Rate

The model presented in [1] is very sensitive to the reproduction rate (R). We will do three analyses.

Firstly, we can introduce Phase 4 in our model to account for recent events that have led to a surge in new cases (see Discussion in [1]). If we increase the R-value to 2 at Day 135, we will obtain a curve corresponding to a second peak about twice the value of the first. Figure I below illustrates the case for the East Coast.

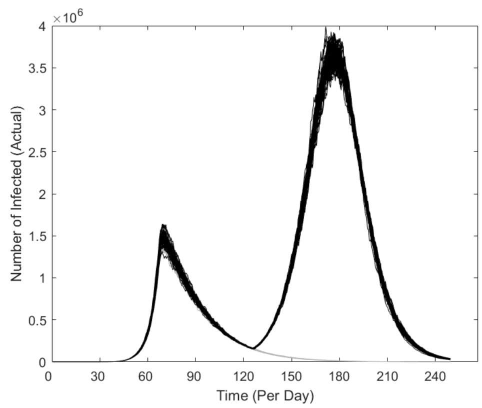


Figure I: Introducing a new Phase 4 with $R = 2$ at Day 135 produces a second spike of infections.

Secondly, we can also change the R-value of Phase 3. This measures government response and how well social distancing is practiced since the lockdown. Figure II shows some contrasts between different R-values at Phase 3 for the East Coast.

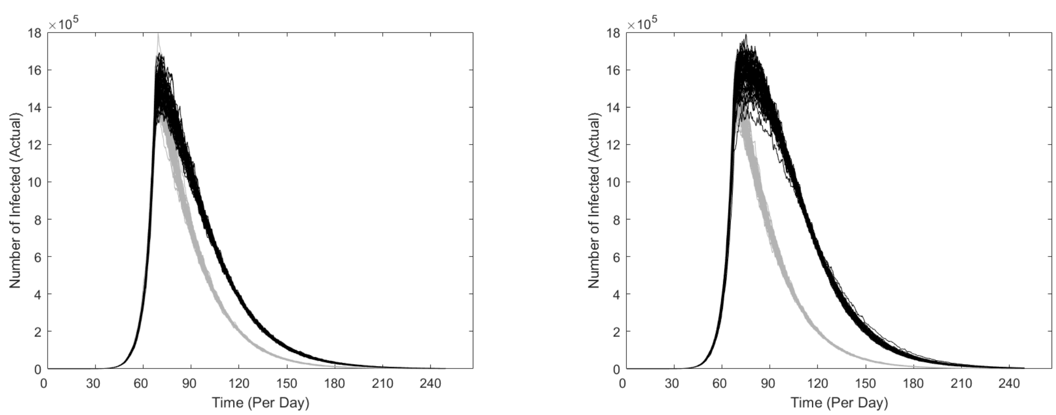


Figure II: The effects of changing the R-value in Phase 3 from 1 to to 1.1 (left) and 1.2 (right).

Another important factor that affects the R-value in our model is the reporting rate with regards to the change of phases. This will lead to an increase in the number of people infected with the virus, and not merely just a shift in the plots, due to delayed population action and government response. Again this can be captured by our simulation, and as an example Figure III illustrates the case when we increase the reporting rate for the East Coast by a week.

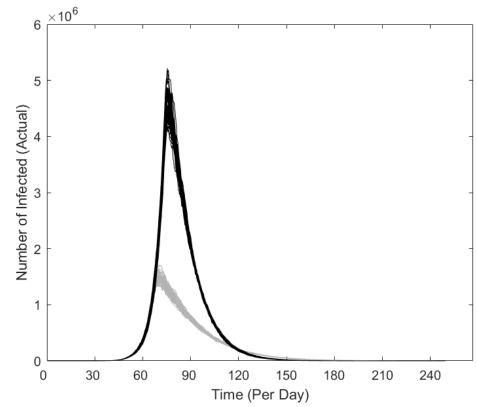


Figure III: The effects of delaying reporting rates by an additional week.

Initial Conditions

Our model is also quite sensitive to the initial conditions, in particular the infected community population (I_C). In Figure IV we see that a change in initial I_C from 1 to 3 greatly impacts the peak and total infected population in the East Coast.

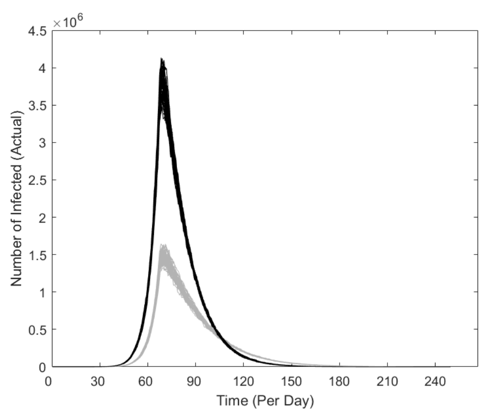
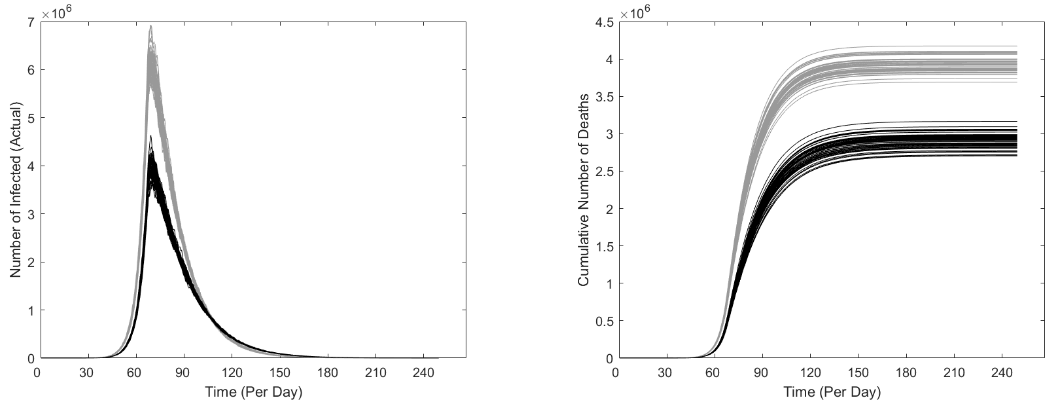
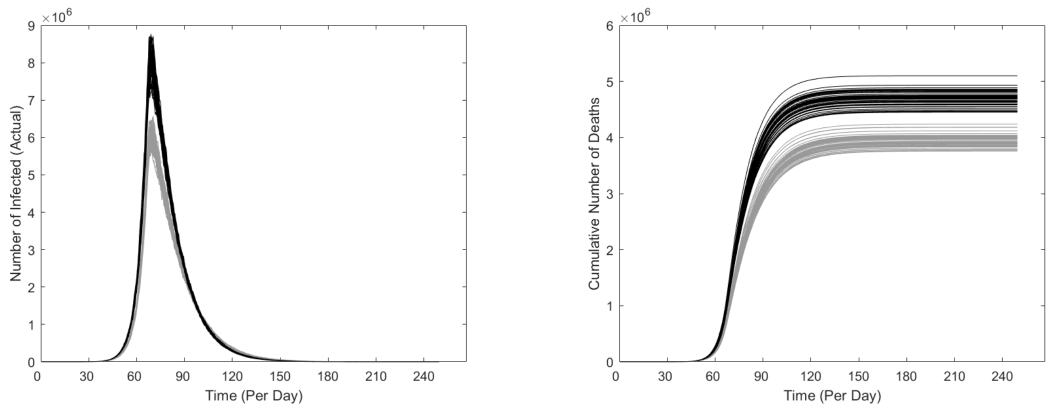


Figure IV: The effects of increasing I_C from 1 to 3.

Changing I_C in the hypothetical 25% infected worst-case scenario, and keeping everything the same, will also create a large variation in our results. In [1] the value of I_C in this hypothetical case is 5; Figure V shows that changing I_C to 3 (resp. 7) will result in around 17% (resp. 28%) infected.



(A)



(B)

Figure V: The effects of changing I_C in the hypothetical case from 5 to **(A)** 3 and **(B)** 7.

References

[1] Yao-Yu Yeo, Yao-Rui Yeo, and Wan-Jin Yeo (2020). A Computational Model for Estimating the Progression of COVID-19 Cases in the US West and East Coast Population Regions. *Experimental Results*, to appear.