


# Mathematics 747 Assignment 2

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The following assignment was completed using the `McMasterPandemic`  package.

## 1 McMasterPandemic shiny Improvements

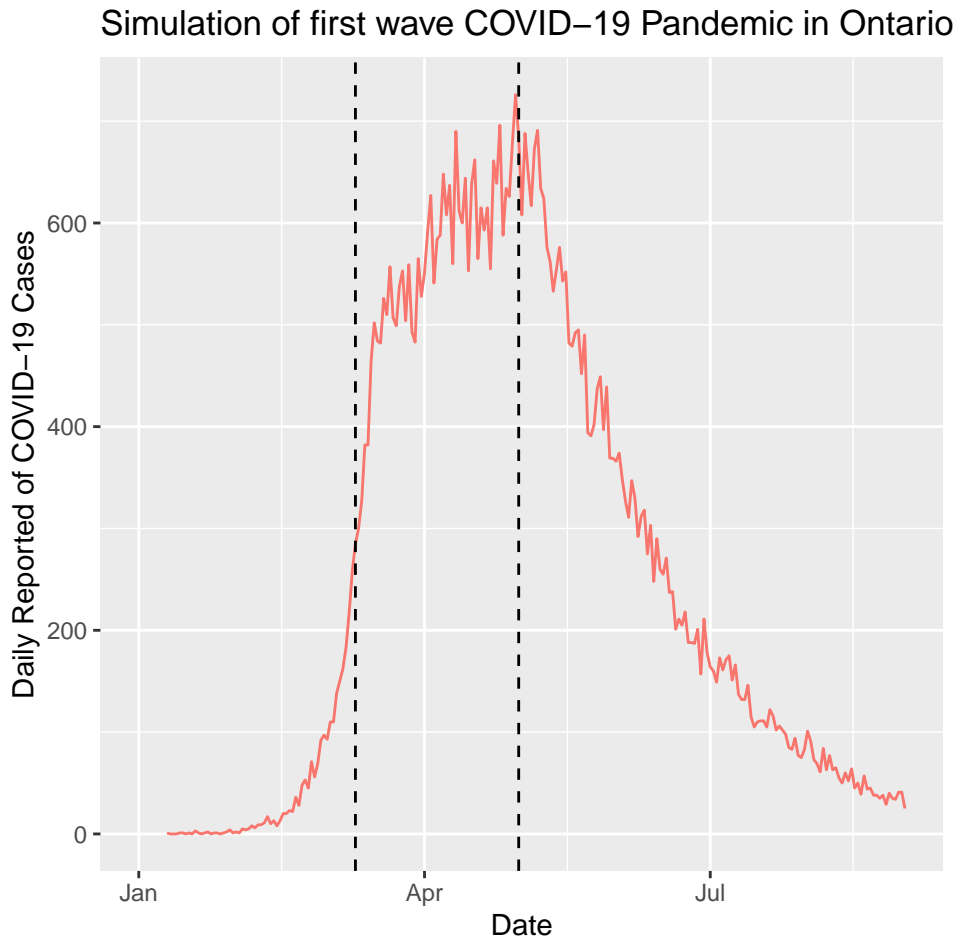
I implemented the following bug fixes for the Shiny:

- Fixed a bug (at Luka and Vlad's suggestion) where setting the population size (and several other parameters) explicitly by typing into the box would force the slider and the text input box out of sync.
- Fixed a bug (at Aigerim's suggestion) where time varying transmission rates could not be implemented after noise had been added to the graph.

Parts two and three were already complete.

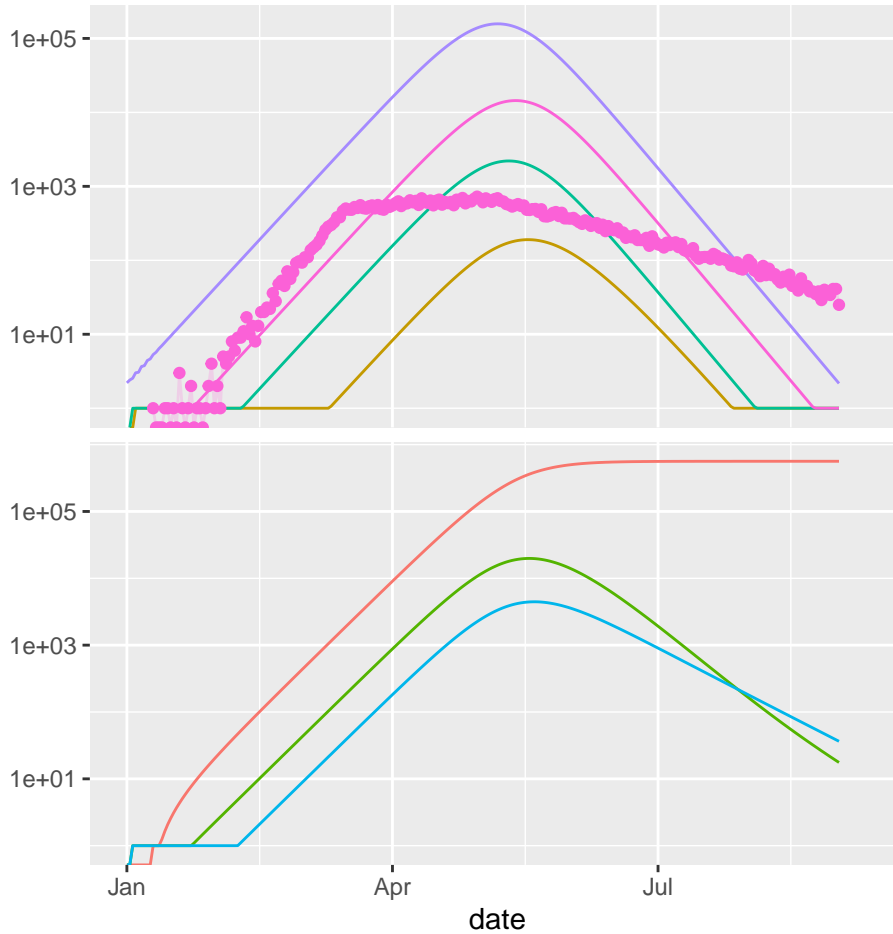
## 2 Part four: Simulating an epidemic

I spent many hours trying to find parameter settings to make the first wave of COVID-19 in Ontario. I first spent a very long time trying to do so without implementing time-varying transmission rates, and could not come up with a simulation that was even remotely close to the first wave of reported cases in Ontario. Eventually, I had to implement two time-varying changes for `beta0`, the baseline transmission rate across categories. I tried to find a match between the `report` column of the simulation and daily reported case counts of COVID-19 in Ontario. Below, please find my result.



### 3 Part five: parameter fitting

Now, assuming that my simulation of the first wave in Ontario is correct, we will use the fitting machinery in `McMasterPandemic`, namely the method `calibrate` to estimate the model parameter for `beta0` that we started with. Then, we will plot the result.



Visual inspection of the plot confirms that we have a decent model fit. If we compare the estimated parameters with the known ones that we used to generate the simulation, we see a somewhat reasonable match as well.

beta0 initial values	beta0 first time change	beta0 second time change
0.929400	0.7671000	0.7261000
0.892804	0.6256154	0.8225528

```
## $params
## $params$beta0
## [1] 0.892804
##
##
## $rel_beta0
## [1] 0.6256154 0.8225528
```

We hypothesize that including both process error and observation error does worsened our parameter estimates significantly. However, we conclude our section with some feedback on the `McMasterPandemic` package.

## 4 Part six: Feedback on McMasterPandemic

Overall, I really enjoyed working with the `McMasterPandemic` package.