MODELING THE DELTA VARIANT OF COVID-19

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Abstract – Academic paper.

In the preceding paper, Modeling and Battling COVID-19 we introduced a simple SIR model to understand how modelling the COVID-19 pandemic can be done. We also produced both a Python program and an Excel workbook that people could modify to create their own models. Recently, there has been a resurgence of COVID-19 because of the emergence of the Delta variant. In addition, the existence of vaccines has also complicated the modelling.

In this paper, we show how to extend the SIR model of the previous paper to account for the following additional factors:

1. The fact that some people are vaccinated, and others are not.
2. The fact that vaccinated people have breakthrough infections.
3. The fact that people who have been infected can be reinfected.
4. Vaccinated people are less likely to be infected by COVID-19 and are less likely to be hospitalized and die from COVID-19.

We handle this complexity, by subdividing the SIR compartments into sub-compartments and by extending the basic equations. We compare different models against US data to test various assumptions. As before, we provide Python programs and an Excel workbook so that interested people can do their own modelling and data analysis.

Keywords: COVID-19, epidemic model, Python, Excel, extended SIR-model, Delta variant

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