Virus Network Parameter Analysis

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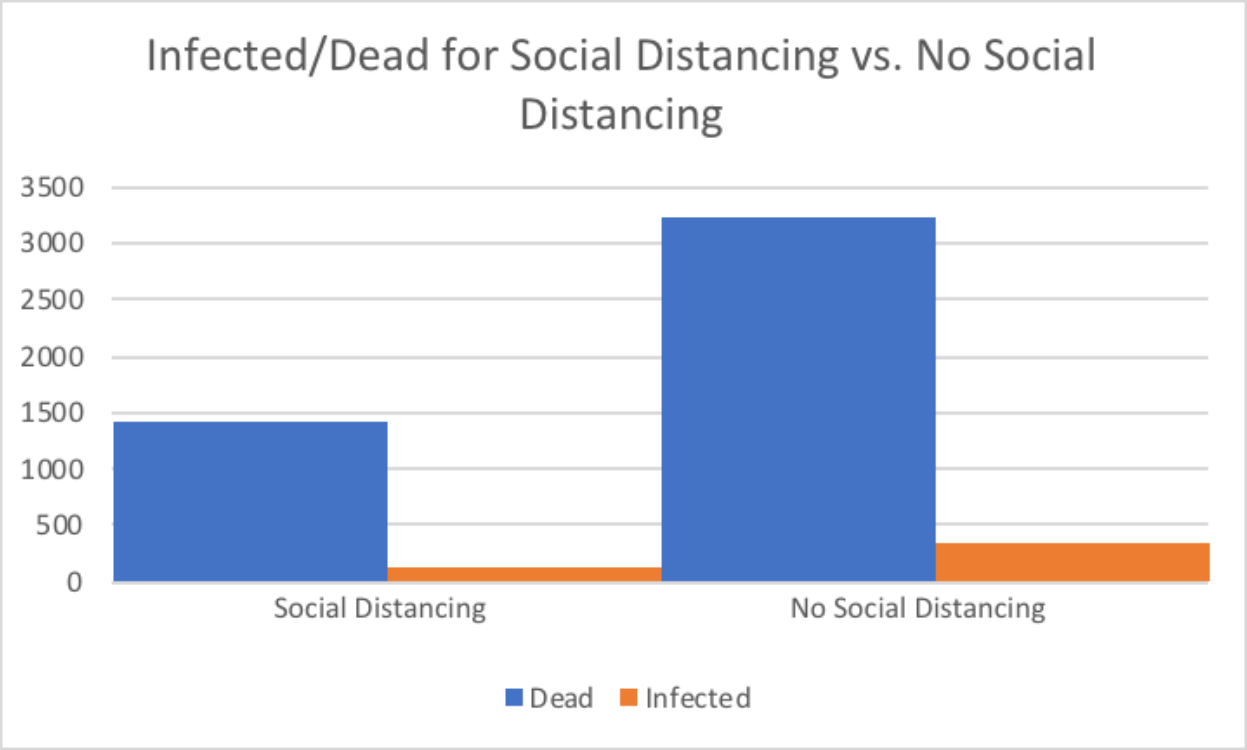
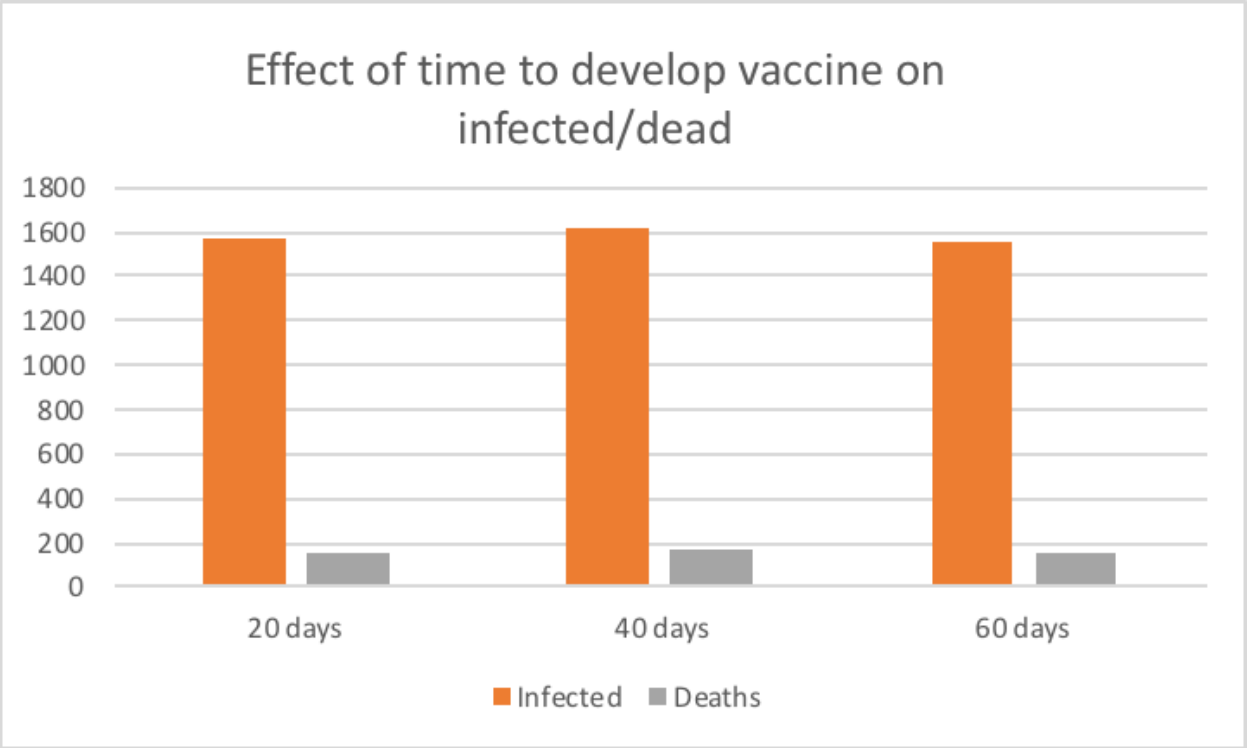
Our project is called Virus Network, an epidemic simulator that reads in data from a graph and runs a simulation of the epidemic unfolding. It includes a GUI so you can view the spread over time, and it allows you to set different parameters to change how the disease spreads. We used this simulator to do some analysis on how different factors affect the spread of disease. Our project is an implementation project, but we used our code to do some empirical analysis as well.

Below, we have shown graphs depicting our analysis of changing the values for various parameters.



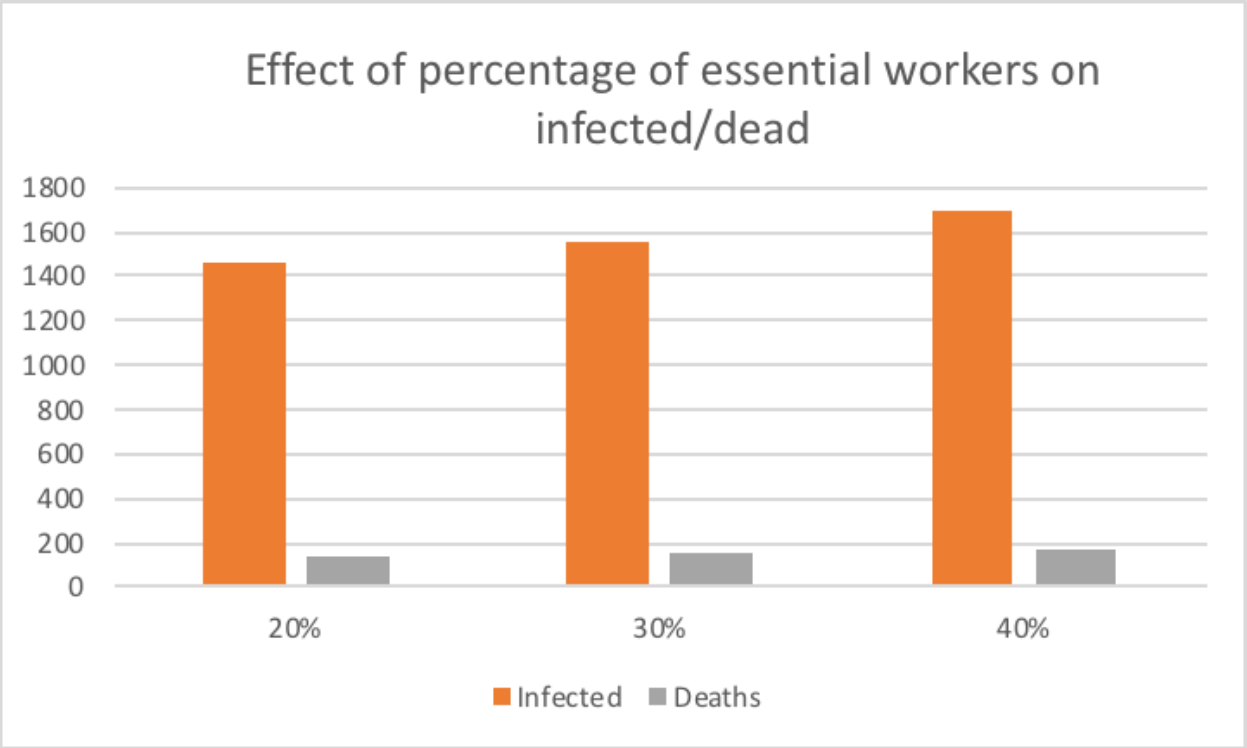
With an infection rate of 0.2, a contagious period of 14 days, a mortality rate of 0.1, a testing capacity of 4, and an essential worker rate of 0.3.

It appears that social distancing, when done effectively, can have a massive effect on the spread of a pandemic, as with the social distancing parameters we have established (removing 70% of weak ties and 20% of strong ties), the total numbers for dead and infected were less than half than with no social distancing (1422.4 vs 3243.3 infected; 141.9 vs 327.6 dead) across 100 simulations each.



With an infection rate of 0.2, a contagious period of 14 days, a mortality rate of 0.1, a testing capacity of 4, social distancing on, and an essential worker rate of 0.3.

Within our simulation, the development of a vaccine appeared to have little to no effect on the total deaths and infected persons (1570 infections, 155 deaths for 20 days, 1615 infections, 164 deaths for 40 days, 1556 infections, 156 deaths for 60 days across 100 simulations each). While the parameters are certainly different from real life, this shows that within a smaller community that has been infected and only begins practicing social distancing once roughly 1/10th of the community has been infected, it's unlikely that a vaccine will have any effect on the total numbers, showing why it's important to take measures even before a significant percentage of a population has been infection.



With an infection rate of 0.2, a contagious period of 14 days, a mortality rate of 0.1, a testing capacity of 4, and social distancing on.

Within the simulation, the percentage of essential workers appears to have a noticeable effect on the total deaths and infected persons (1460 infected and 145 deaths for 20%, 1556 infected and 156 deaths for 30%, and 1690 infected and 170 deaths for 40% across 100 simulations each). It appears that limiting the percentage of “essential” workers who cannot break their ties with social distancing can have a large effect on the impact of a virus in a pandemic.

Overall, social distancing has by far the greatest effect, with the time to develop a vaccine having little to no effect and the percentage of essential workers having a smaller but still significant effect.