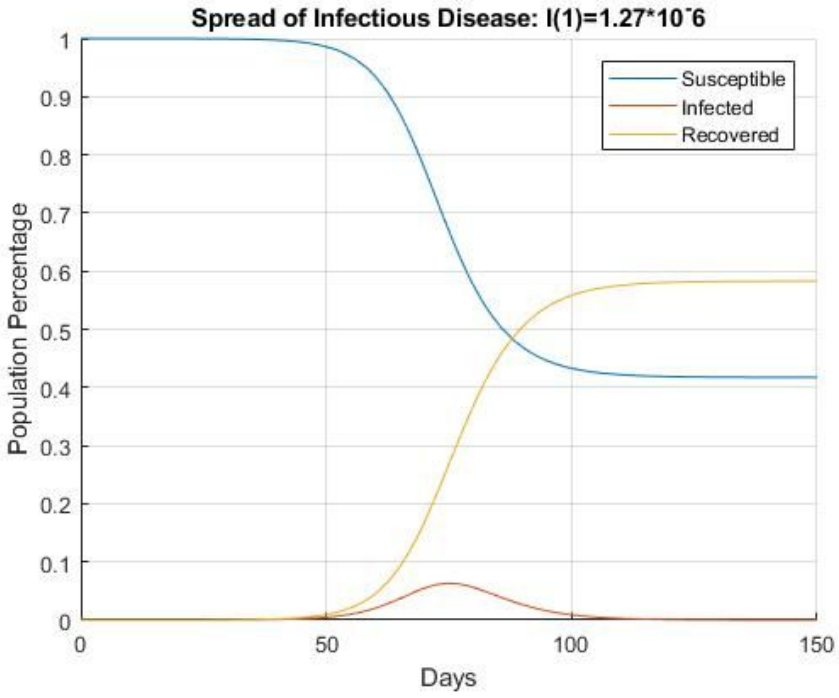
System Simulation Project: Josh Humphrey

Modeling the Spread of Infectious Disease

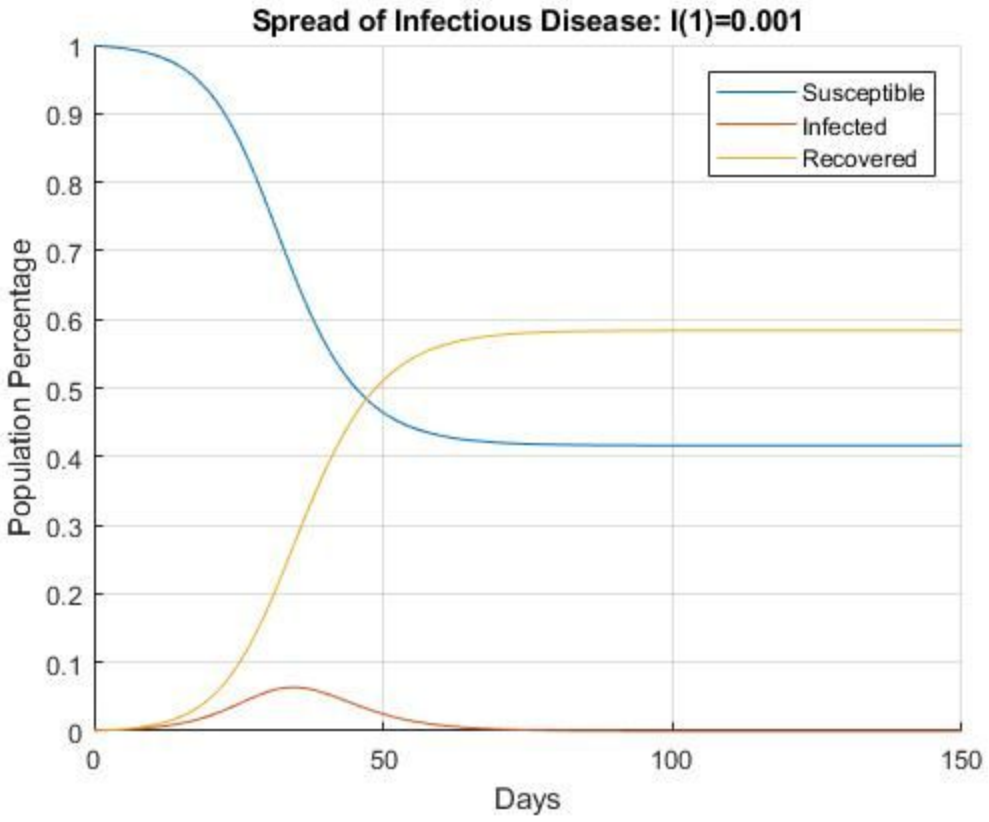
Article Reference:

https://www.maa.org/press/periodicals/loci/joma/the-sir-model-for-spread-of-disease-the-differential-equation-model

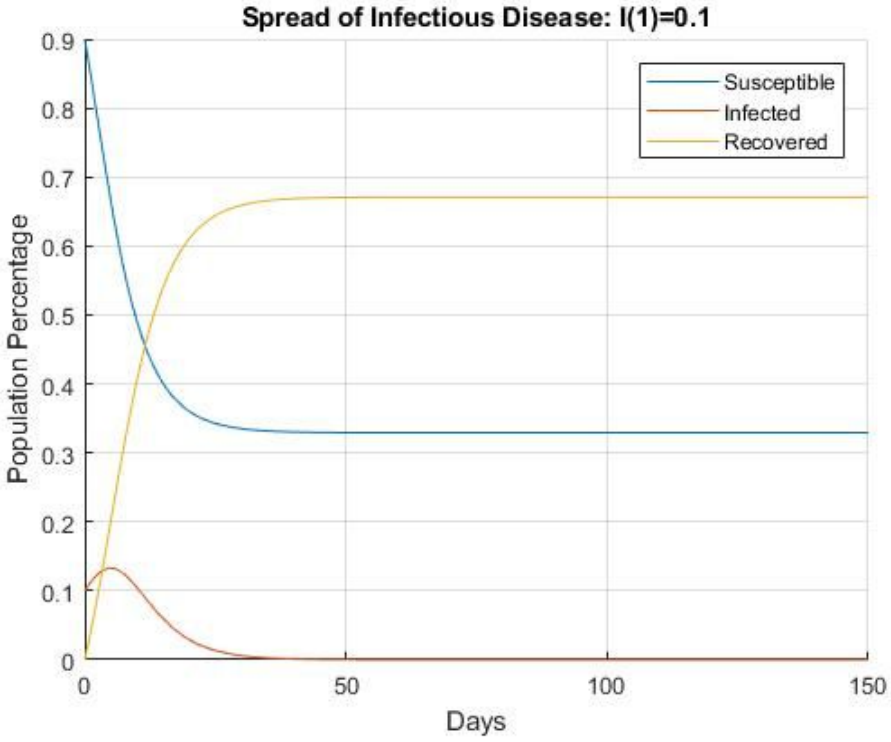
The spread of infectious disease is a very pressing problem for many people around the world. I found an article at the above link that attempted to model the spread of an infectious disease throughout a controlled population. This model assumes three groups: S (Susceptible Individuals), I (Infected Individuals), and R (Recovered Individuals). In my first simulation I gave initial conditions of S(1) = 1 which assumes that almost the entire population is healthy while a very small group of people I(1)=1.27*10^-6 are unfortunately infected.

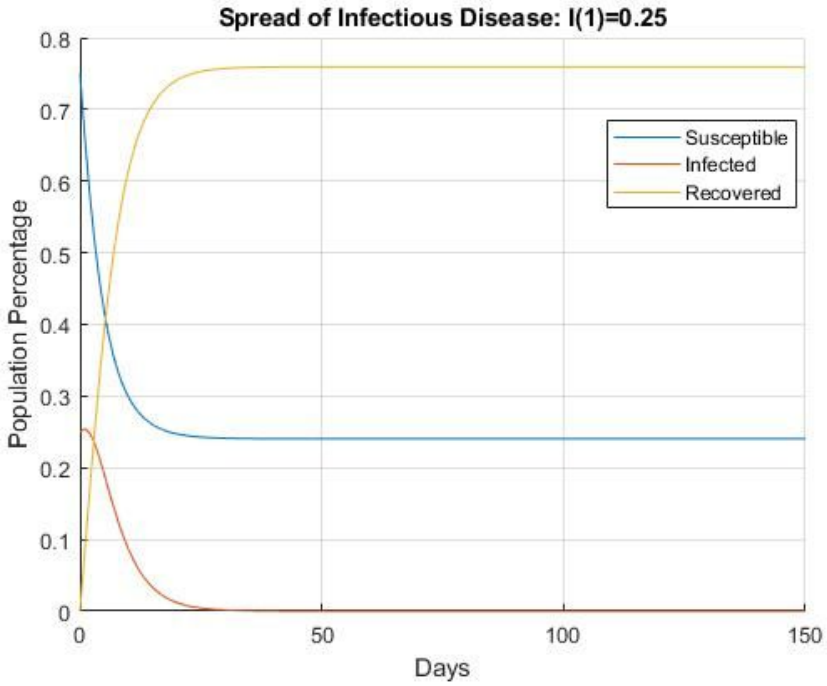


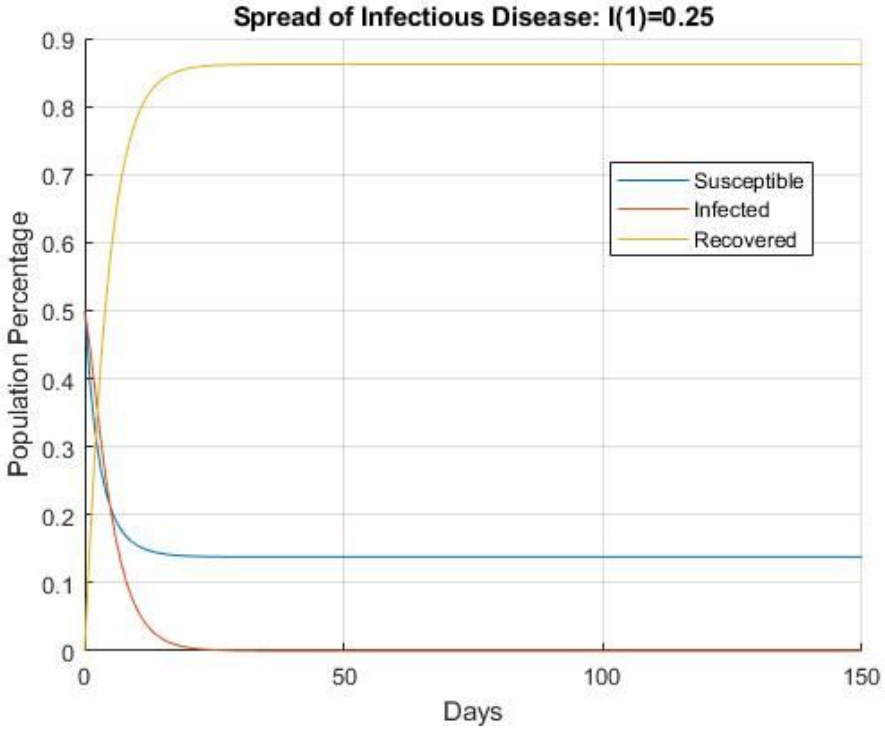
A very small group ended up infected but proportionally to the initial infected population the disease was actually quite potent. At its peak it had around 8% of the controlled population sick. By changing the infected amount to a slightly larger I(1)=0.001 we get the following results.



While the results of the above simulation are mostly the same in terms of disease effectiveness I found it very interesting that the peak occurs quicker if more people are initially infected. Below are the results of various simulations where I(1) was varied.


Spread of Infectious Disease: I(1)=0.1
Susceptible
Infected
Recovered
Population Percentage
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
0
50
100
150


Spread of Infectious Disease: I(1)=0.25
Susceptible
Infected
Recovered
Population Percentage
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0
50
100
150


Spread of Infectious Disease: I(1)=0.25
Population Percentage
Days
Susceptible
Infected
Recovered
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
0
50
100
150