Virus Spread Simulation Using The SIR Model

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**Introduction**

“An estimated 300 million people died from smallpox in the 20th century alone” is terrifying statistic and even more so when taken into account that smallpox is a single virus among countless other; many of them having the possibility to cause disease, including death, among humans (). While their existence may be hard and costly to eradicate fully, understanding how they spread and what factors affect this most can save countless lives and be done with minimal resources. That’s the goal of the project described in this paper: simulating virus spread with enough accuracy to provide useful data and the ability change certain factors such as the spread radius, the infection chance, the required recovery period, the use of masks, and the effectiveness of masks affect virus spread.

**Background Research**

To understand the effectiveness of this project one first must understood the model the simulation uses; that being the SIR model which stands for simulated, infected, and recovered (Zurich par. 2). The idea of applying mathematic models to epidemiology was brought about by Bernoulli in 1760 and later Kermack and McKendrick in 1927 furthered the framework; however, the SIR model is credited to Sir Ronald Ross and a few others in the early 20th century (). The SIR model can be simulated multiple ways, and at points can be boiled down to a few equations to find extremes in virus outbreaks, but in general a SIR model starts with an index case, which is the first introduction of an infected individual, can spread it to other susceptible individuals and they can go on to spread the virus more and cause a chain of infections ().

In contrast to speaking about past research, further research regarding the study of viruses, how they spread, and how simple simulations could save millions of lives one would have to look no further than the current sars-covid-19 pandemic. A research paper by Dmitry Ivanov shows that computer simulations of viruses are used quite frequently and even goes on to prove their effectivity by demonstrating a fairly accurate one (). It’s quite clear how data like this can be incredibly useful; projections like this could give hospitals a rough estimate of what patient load to expect, the quantity of medicine needed, and the space required.

Even more relevant, projections like this can show the necessary requirement of the general population’s reaction to a virus. For example, if 2 projections were estimated, one where people wore masks and social distanced and another where people didn’t, it could show how necessary or unnecessary practices like this are. However, these estimations are based on past data research which already achieves the goal of seeing how important a populations reaction is, it just puts it into perspective. Research goes on to say, that at least for the sars-covid-19 virus, “along with preventing someone from transmitting the coronavirus, a range of new research shows that the risk of infection to the wearer is decreased by 65%” and similar statistics can be expected when looking at air born or saliva dependent spread viruses ().  
 Other factors than just the amount of susceptible, infected, and recovered individuals effect a population. For instance, certain occupations and areas will be subject to a higher risk of virus spread rather than just an entire population being at risk equally. This can be seen in a study from 2015 that stated “02% of Guinea's population had died due to Ebola, compared with 45% of the country's doctors, nurses, and midwives. In Liberia and Sierra Leone, the differences are more dramatic, with 11% and 06% of the general population killed by Ebola versus 07% of the health-care workers in Liberia, and 85% in Sierra Leone … health-care workers are at greater risk of contracting Ebola” (). The SIR model fails to take factors like occupation, age, or even general health of the infected population which offers fair reasoning to any inaccuracies from its predictions ().

**The Goal and Hypothesis**

**Procedures**

**The Collected Data**

**Conclusion**

**Bibliography**

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