Spread of Flu Strains through Populations

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Executive Summary

While European and American forces in the early 1900s were deciding the fate of the world to come, a wild strain of influenza infected the soldiers on the battlefield and would affect the whole planet. Dubbed the Spanish Flu, the H1N1 type-A Influenza virus killed an estimated 50 million people, more than the combined casualties of World War One. This was due mostly to its 50 percent infection rate and atypical age profile, along with the withdrawal of troops after the German surrender.

Scientists recovered the remains of the Spanish Flu from the tissues of the virus's victims for further research. As it remains one of the deadliest viruses ever encountered, a heated debate regarding the wisdom of reconstructing the virus was ignited. Despite protests, specimens have been studied and analyzed.

Using the information gathered from the reconstructed virus, we can model a representation of the virus as it spread after World War One using NetLogo. We can also determine the most effective methods of containment should another strain of the virus reappear. These methods can then be applied to other viruses affecting the global population.

Introduction

With a fifty percent infection rate, prevention is paramount when containing the Spanish Flu. The most problematic aspect of the Flu was how it infected its victims. Infection could be caused from anything to touching someone who is infected to breathing it in from within an infected house. When one was infected, a broad spectrum of symptoms presented themselves. The symptoms were so varied doctors misdiagnosed the flu as dengue, cholera, or typhoid. Another deadly attribute was the magnitude of the symptoms; the flu often caused massive hemorrhages, edema in the lung, and bacterial pneumonia (a secondary infection induced by the flu). Most deaths were caused from a cytokine storm, a massive procreation of immune cells which can ravage the body.

Computational Solution

Using the agent-based modeling program NetLogo, we were able to determine some of the best methods of prevention to minimize the effect of the Spanish Flu. It seemed that there was roughly a natural immunity present within three percent of the population that was included in the models. From there, the infection rate was tuned to 50 percent, with random infection. Random infection was deemed acceptable, as the method of infection varied significantly. There was no known recovery, only a mild deterrent through blood plasma injections was discovered, so recovery was eliminated as a possibility within the models.

Conclusion

We found that if people avoided each other as much as possible, either through enforced quarantine or through decreased public appearance, there were far fewer people infected. This is understandable, as the proximity of the population in the 1920s was very close and the most effective method of infection is contact.

Personal Achievements

We have gained an intricate understanding of the nature of influenzas and their various methods of infection through research of the Spanish Flu. We have also learned much about agent-based modeling. It is much like object-oriented programming and drastically different from mere number crunching using programs such as C# or C++.

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