

Simulating Influenza Transmission with Real Network Data

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Keywords: Network Data, Simulation, Education, Influenza, Epidemic

Disease has been humanities arch rival since the dawn of our existence. As such, we have been trying our best to understand its spread and proliferation. One of the most common diseases, Influenza, is also one of the most complex. To understand the complexities of its spread would greatly improve our ability to combat it and other diseases like it. Using *R* in conjunction with the package **statnet**, I have created a simulation of influenza transmission in an American high school based on real data collected from a study using RFID chips to collect information about the duration of close contacts (within 3 meter) between students and faculty (Salathé[1]). Combining this network data with simplified research done on influenza transmission (Potter[2]), I have created baseline predictions for final size, duration and probability among other summary statistics per theoretical probability of transmission for a particular strain of the virus. After these baseline predictions have been simulated, I then used data on a known intervention strategy (Potter[3]) to determine the effectiveness of it in terms of a side-by-side comparison.

After modeling the natural course of a disease alongside potential intervention strategies, the next natural step was to make a function using easily changeable attributes so that the simulation can encompass up to date information about transmission probabilities, contact duration length, or other variables used to simulate the epidemic or intervention. From these changeable attributes, one could easily specify other diseases so long as its transmission is known to be similar to influenza.

Perhaps the most important function of this project is to create an interactive simulation to educate people on the effectiveness of intervention strategies as well as risks of epidemic given a certain social structure based on a given network of contact durations. These simulations are simple to understand and could be used and experimented on by anyone from middle-schoolers to policy makers.

References

- [1] Salathé (2007). “A High-Resolution Human Contact Network for Infectious Disease Transmission”, <http://www.pnas.org/content/107/51/22020.full.pdf%20html>
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- [3] Potter (2011b). Estimating Within-School Contact Networks to Understand Influenza Transmission. *The Annals of Applied Statistics* 2012, Vol 6. 14-15