School: Academy for Technology and the Classics

Team Number: ATC50 (aka ATC-3)

Area of Science: Epidemiology

Title: Epidemiology Simulation

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Problem Definition

Harm caused by Influenza, a highly contagious and potentially deadly disease, can be limited when the spread of Influenza is known. We would like to understand how individual conditions affect the spread of a disease through various districts. To obtain such an understanding, we are working on a tool that can roughly simulate the spread of disease within the city of San Diego. In our model, the city is divided into eight "communities," where each "community" represents a percentage of the San Diego population. The communities are divided

up by the districts of San Diego[1]. Our program simulates disease spread by displaying the interactions of agents whose actions are controlled by altering variables, some of which are time of infectability, age groups, effect of vaccines, transportation[2] (bus system), health insurance, and careers (worker and student) [3]. The program displays the interactions of the agents as graphs, whose data offers insights about how individual variables that affect the agents contribute to the spread of influenza.

Problem Solution

We plan to solve this problem by creating a model that will incorporate the given variables, along with a rough agent-based python model in order to show the spread of the disease between the two different neighborhoods. We will compare how the different demographics will affect the severity of the illness in the seven communities.

We are researching the demographics and infectivity rates. We have found a statistic on the percentages of age groups that receive vaccines: 49% of people who are 6 months to 17 years old have gotten vaccines compared to 31.7% of people 18-49$_1$. We have also found that the Influenza virus doesn't create symptoms immediately, and someone can have the flu and spread it before they become noticeably sick. The flu is commonly spread from small infected droplets of moisture that are expelled from the mouth and nose. It is also shown that on average 5-20% of United States citizens will get the flu per year, therefore we can draw a conclusion that you have

[1] https://www.sandiego.gov/citycouncil

[2] https://bmcinfectdis.biomedcentral.com/articles/10.1186/1471-2334-11-16

[3] http://www.sandiegocounty.gov/content/dam/sdc/hhsa/programs/phs/documents/InfluenzaWatch_SEASON%20SUMMARY%202016-17.pdf

between a 1 in 20 and a 1 in 5 chance of contracting the flu in the U.S.[4]. It has also been shown that influenza isn't deadly unless you have pre-existing medical conditions. We are also beginning to learn about both Python and StarLogo, as well as discussing the parameters that will be implemented into the model. Other research areas we are investigating: how strong the immune system of an individual is, along with the age of the agent, and the time they are showing symptoms or spreading the sickness. One parameter that we are improving on is a more accurate count of the amount of people in the program. We are using accurate data measuring the population of San Diego, with data gathered per zip code at factfinder, an extension of the Census Bureau.[5]

Expected Results

In the program, we expect to see the neighborhood demographics without health insurance to recover and become immune faster than those without. With this, we expect the Influenza to spread faster in the areas with health insurance, but they will recover and become immune faster. We expect to see a larger congregation of the illness at the school rather than at the office building. We expect to gain an understanding of influenza spread patterns around different age and wealth groups.

[4] https://www.cdc.gov/nchs/products/databriefs/db267.htm
[5] https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml