Question

Our modeling question is does having students stay in one classroom reduce the number of students that get the common cold as opposed to having students switch classrooms like in most schools? This is a prediction question, because we are trying to predict if a certain way of arranging students will better protect against the common cold. This is interesting because it will help us find a new way of stopping the spread of a disease like the common cold in the school setting. Our model's results will benefit people who work in school districts such as teachers who interact directly with the high schoolers, principals, and the high schooler's family.

The main background information that is important to take note of is how long the common cold is contagious for, how likely someone is to get infected once exposed, and where it is most easily transmitted. The answers to these questions are that the common cold is transmitted through droplets that are coughed or sneezed into the air and direct contact with the virus through touching a surface that someone else with the virus touched (Johns Hopkins Medicine, 2023), it is most contagious for the first 2-3 days, and not contagious after a week (Hughes, 2017), and a person is more likely to get sick if they’ve had direct contact with the virus as opposed to inhaling it through aerosol transmission (Lorber, 1996). It is also more likely to spread in small, closed spaces where there is a lot of hand to surface contact, like a classroom (Giddens, 2020). Our literature research results are as follows: A close-up of a computer screen

Description automatically generated

One Classroom Model

Our first model shows these 7 pods with 20 nodes in each, this represents 7 classrooms with 20 students in each of them. All the nodes in each pod are connected to each other modeling how every kid in the classroom will interact in one way or another with every one of their classmates. We assume each connection between the nodes is the same. We also assume the classrooms do not interact with one another. This is acceptable for our modeling question because we are assuming there is so little contact between the other classes that any contact that does happen is negligible. This model visually shows if we used the one classroom method to decrease the spread of a disease, that disease would only be contained within that classroom and not spread to the others.

Switched Classroom Model

This model shows the connections between students if they switched classrooms for every class with a new set of students in each class. There are many more connections between the nodes. The weight between nodes also differs depending on how many classes certain students have together. This model assumes that every class has 20 people so that we are only measuring the contact between students, and not adding another variable by having different sized pods at different timesteps.

Results

This graph shows the difference in the mean number of people infected with both the one classroom model and the switched classroom model over 30 days. We used the function simulate\_absir() to simulate each model for 5 realizations over 30 timesteps. We then found the mean of these realizations and plotted the number of infected people for each model on a graph. This simulation proves that our one classroom method was successful in lowering the mean infection flow. Using the information that the average child gets 6-10 colds per year (Johns Hopkins Medicine, 2023), and that the cold is most contagious during the first 2-3 days and not after a week (Hughes, 2017), we were able to calculate the infection rate of the common cold as 32.4%, or 0.324, and the recovery rate as 14.3%, or 0.143. This rate represents how cold viruses spread through respiratory droplets when infected individuals cough or sneeze, making others who were susceptible to the disease infected.

Interpretation

Our results show that keeping students in one classroom all day decreases the rate of infection, this means our prediction that using the podding/one classroom method worked in decreasing and stopping the spread of the common cold in school. This information can be used for future pandemics to help decrease the spread in schools by implementing this method of podding/one classroom method.

Validation

Our results were that the maximum number of infected people in the one classroom model was 14, and the maximum number of infected people in the switched classroom model was 106. These results match the results of a 1996 study where participants were playing poker together. One person was infected with the cold and different amounts of people were placed together with different amounts of contact to see how it would spread. In a room of 15 people with lots of contact, 11 people got infected. When contact was limited and the number of people was decreased to 10, no one got infected (Lorber, 1996). This matches up with our results because in both cases where there were more people in one place and lots of contact 76% of people got infected in our model whereas in the study 80% of people got infected. In the case where there were less people and less contact 10% of people got infected in both our model and the study.