Handshake: The Spread of Disease

Objectives

- Understand the spread of disease
- How to find the probability of the spread of a disease through a population

Materials

- Tape
- Index Cards
- Bag
- Marker
- Handshake Activity Sheet

Instructional Plan

Vocabulary:

There are two main model classes used in this activity:

1. **Susceptible Class [S]** - People in this class do not have the disease, but are all capable of contracting it. In the beginning of the activity, everyone is “susceptible”.
2. **Infected Class [I]** - People in the class currently have the disease.

Model - A representation of how something works, often much simplified.

SIR Model - A disease model that has susceptible, infected, and recovered classes. This is considered by scientists and mathematicians studying disease epidemics to be one of the simplest examples of a disease model. For this activity, we are using an SI model.

Before class begins, set up two large tape boxes on the ground. From left to right, place an S, for susceptibles, and an I, for infected. Once the students enter the classroom, tell the students that today we will be simulating the spread of a disease through a population. To simulate spreading the disease, the students will follow the instructions on the Handshake Activity Sheet.

After completing the first part of the Handshake activity, tell the students that they are all part of the susceptible population which means that they are capable of being infected. Now, make sure that there are more of the index cards, which all have three different colors, preferably yellow, green, and red, than there are students in the class. Ask all students to go and stand in the S box. They are all susceptible: no one is sick, but anyone can become sick.

Then, let each student grab a card and tell them that if there color is green or yellow they have not been infected, but if they have a red dot, they are now infected. The students that have been infected need to move to the infected box. Now, the students need to look at their handshake activity sheet and see if they shook hands with any of the infected individuals. If they have shaken hands with any of those individuals, they need to move into the infected box as well (we are under the assumption that this disease will only spread once after a handshake). Then, from this information, write how many people are infected in the box. From the infected individuals, if they have a yellow dot, they will transition/recover back into the susceptible class, and if they have a green or red dot, they stay in the infected class. Then from this transition/recovery, write on the board how many moved back to the susceptible.

Repeat this process twice more with new individuals contracting the disease and spreading it to other classmates. Now, move to part two of the activity sheet and break the students up into groups of two or three. After giving the students time to do part two of the activity, work through part two of the activity on the board. After the students have completed the second part of the worksheet, walk through the problems with the students. Then, using the probabilities, talk about why the probability is not the same after each round.

Finally, the students need to work through part three of the activity. This section will be done as an entire class. Using the index cards in the bag as the entire population, find the probabilities of becoming infected and transition back to susceptibles. Answer the rest of the questions of part three as a class.

Assessment Options

With a town population of 300, there is an outbreak of the cold were 120 became infected. Out of those 120 people, 36 people become susceptible again. Find the probabilities of becoming infected and susceptible again.

Extension

Using the equations from above, find a way to use sequencing/equations to develop different types of spread of disease model.

Tennessee Mathematics Standards

7th Grade:

Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative sample and support valid inferences.

Approximate the probability of a chance event by collecting data on the chance even by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability.

Apply the properties of operations as strategies to add, subtract, factor, and expand linear expression with rational coefficients.

Solve multi-step real-world and mathematical problems posed with positive and negative rational numbers presented in any form (whole numbers, fractions, and decimals)

(b) Assess the reasonableness of answers using mental computation and estimation strategies

Adapted by Cameron Cook, Suzanne Lenhart, Virginia Parkman, and Greg Wiggins

Name:_____

Handshake Activity Sheet

Part 1: Make some new friends! Introduce yourself to three people and shake hands. Make sure to write their name down in the table below.

Person 1:	
Person 2:	
Person 3:	

Part 2: After completing each simulation, fill in the questions and blanks below.

Round 1:
Number of Susceptibles: _____

Number of Infected: _____

Number of people transitioned to Infected from Susceptibles: _____

Round 2:

Number of Susceptibles: _____

Number of Infected: _____

Number of people transitioned to Infected from Susceptibles: _____

Round 3:

Number of Susceptibles: _____

Number of Infected: _____

Number of people transitioned to Infected from Susceptibles: _____

1.) Find the probability of becoming infected.

Round 1:

Round 2:

Round 3:

2.) Find the probability of transitioning from being infected to being susceptible.

Round 1:

Round 2:

Round 3:

3.) Why are the probabilities different for each round? Is this an accurate representation of reality?

Part 3: Looking at the contents of the entire bag fill out the blanks below.

Number of Susceptibles: _____

Number of Infected: _____

Number of Infected to Susceptibles: _____

1.) Find the probability of becoming infected.

2.) Find the probability of transitioning from being infected to being susceptible.

3.) How does this compare to simulations from Part 2? Why are the probabilities of the disease spread for the entire population?