Sphero of Influence - Vaccines

Using Spheros to Mimic the Spread of a Disease

Students, you are the leaders of a population of people hit by the Sphero Virus. Your task is to learn what you can about this virus, and to prevent further transmission within the population.

Transmission rate: the chance to infect another person (in this case, another Sphero upon collision).

Base efficacy rate: the measurement of how much the vaccine increases the chance to resist infection of a person (again, another Sphero upon collision). The Sphero Virus Vaccine has a 40% base efficacy.

Transmission risk: the risk of an individual will get sick. This is a result of the average exposure (in our case, # collisions per minute) x transmission rate.

As the leaders of the Sphero population, you have a budget of $8 million to tackle transmission of this virus. It costs $1 million to vaccinate one Sphero or $2 million to boost the efficacy of the vaccine by 10% (e.g. 40% - 50%). You need to work as a group to decide the best allocation of your money. Then we will program the Spheros based on your choices and observe how many robots are left uninfected at the end of five minutes.

Part 1: Make Your Plan

1 vaccinated Sphero, 10 unvaccinated Spheros

Vaccine efficacy 40%

$8 million dollar budget; $1 million to vaccinate one Sphero; $2 million boost efficacy of the vaccine

What will you do?

_____ vaccinated Spheros and _____ unvaccinated Spheros = $_____

_____ Vaccine efficacy = $_____

Part 2: Run Your Simulation

Record the following data:

collisions that resulted in an infection: _____

collisions that did not result in an infection: _____

Elapsed time of simulation (should be 5 min): _____

You started with 1 infected and 11 uninfected Spheros. At the end of 5 minutes, how many were infected? _____ uninfected? _____

Adapted from SpheroEdu: Sphero of Influence

Calculate the average collisions per minute: $\frac{\text{total \# collisions}}{\text{elapsed time:}}$ _____

Calculate the percent of collisions that result in infection: $\frac{\text{\# collisions result in infection}}{\text{total \# collisions}}$ =

_____

Calculate the transmission risk:

average collisions per minute X percent of collisions result in infection =

_____

Part 3: Real Disease Data

While you are waiting your turn, or are waiting for everyone else to finish their simulation, do a little research on some real diseases. Some suggestions: measles, Rubella, chicken pox (Varicella), Meningococcal, Hepatitis A, Hepatitis B, influenza, Rotavirus, Diphtheria, Tetanus, Poliovirus, Human papillomavirus (HPV).

Disease _____

Transmission rate _____

Base efficacy of vaccine rate _____

Transmission risk if unvaccinated _____

Transmission risk if vaccinated _____

Part 4: Evaluate Class Results

In your class, which plan had the fewest infected (most uninfected)?

_____ vaccinated Spheros and _____ unvaccinated Spheros

_____ Vaccine efficacy

Do you think this plan would be the best strategy for all viruses? Why or why not?