Playing a Pandemic

Background

Viruses cause many diseases — from the common cold to COVID-19. Viruses can't reproduce (make copies) by themselves. But viruses are good at getting inside our cells and using the cell's own "machinery" to make copies. The infected cell becomes so full of viruses that it bursts open. The virus copies travel through the body to infect other cells. The immune system fights these virus invaders. But you might be sick for a while until the immune system learns to recognize and fight a new virus. A vaccine gives the immune system a head start in recognizing a new virus, such as the coronavirus that causes COVID-19. With a vaccine, the immune system can respond so fast that you probably won't even feel sick.

You may have heard of one person who is sick with a virus infecting one, two, or even more people. Some viruses spread between people especially easily. In that case, one infected person might cause 25 or more people to become ill. We say that a virus that spreads easily is more "transmissible." Transmissibility is a property of the virus itself and can change as the virus changes genetically (mutates). How much a virus spreads also depends on people's behavior. More spread might result from people's behavior such as close physical contact, less hand washing, or sick people not staying home.

When most of a population has a vaccine to a virus, those without a vaccine have indirect protection. We call this herd immunity. Depending how contagious an infection is, usually 50% to 90% of a population needs immunity to achieve herd immunity.

Ideas Behind the Game

In this game of chance, you will explore how a virus spreads. Scientists would call a game like this a "scientific model." A scientific model is something that represents a process and allows us to experiment with changing some of the factors that affect the process.

- In this model, we change how easily the virus spreads by drawing a penny from a cup. The last number in the penny's date decides how easily the virus spreads at that time. A bigger number means more spread.
- In this model, we change what percentage of the population has a vaccine by making a certain percentage of pennies end in the number "1." Drawing a "1" means the virus doesn't pass to new people.

Game 1 represents a community with little or no immunity to a virus. Game 2 represents a community where 50% of the community members have immunity because they got a vaccine for the virus.

You could also repeat the game with greater percentages of vaccination and compare the results to Game 1 and Game 2.

Materials:

- 10 pennies with a variety of different dates
    - *Note: Do not include any dates that end in 1 or 0.*

- a cup, bowl, or other container to hold the pennies.
  - *Note: Make sure container has enough room to allow the pennies to be mixed.*
- permanent marker to mark the heads (side with the date) of the pennies
- alcohol or hand sanitizer to clean the marks off pennies after game
- paper and pencil to record results

Game 1: Game 1 models a population with very little immunity					
Setup: Cup with 10 pennies, none with dates ending in 0 or 1					
	Determine starting cases	**Round 1 of transmission**	**Round 2 of transmission**	**Round 3 of transmission**	**Round 4 of transmission**
Picking pennies	Pick a random penny out of the cup. The last digit of the penny's date is the number of cases. Return penny to cup.	Pick a random penny out of the cup. The last digit of the penny's date is the number to multiply the starting cases by. Return penny to cup.	Pick a random penny out of the cup. The last digit of the penny's date is the number to multiply the Round 1 cases by. Return penny to cup.	Pick a random penny out of the cup. The last digit of the penny's date is the number to multiply the Round 2 cases by. Return penny to cup.	Pick a random penny out of the cup. The last digit of the penny's date is the number to multiply the Round 3 cases by. Return penny to cup.
Sample calculations	If the penny drawn has the date 2013, there are 3 cases to start.	If the penny drawn is 2016, the new number of cases is 3x6 = 18 cases.	If the penny drawn is 2009, the new number of cases is 18 X 9 = 162 cases.	If the penny drawn is 2014, the new number of cases is 162 x 4 = 648 cases.	If the penny drawn is 2012, the new number of cases is 648 x 2 = 1296 cases.
Model represents		*Fairly high spread, as each of the original 3 people infect 6 people.*	*High level of spread, as each of the previous 18 cases infect 9 people.*	*Moderate spread, as each of the previous 162 cases infect 4 people.*	*Low spread, as each of the previous 648 cases infect 2 people.*
Factors affecting spread	• Spread is affected by the transmissibility of the virus. Transmissibility is a property of a particular virus and can change as the virus mutates (genetically changes). • More spread might result from people's behavior such as close physical contact, less hand washing, or sick people not staying home.				

Game 2:

Game 2 models a population with 50% of them having immunity from vaccinations.

Setup:

1. Randomly remove 5 pennies from the cup (50% of the 10 pennies). Make a mark over the date on these 5 pennies with the permanent marker.
2. Return the 5 pennies with dates marked out to the cup of pennies. These pennies will now all function as a date that ends in number 1.

	Determine starting cases	**Round 1 of transmission**	**Round 2 of transmission**	**Round 3 of transmission**	**Round 4 of transmission**
Picking pennies	Pick a random penny out of the cup. The last digit of the penny's date is the number of cases. Return penny to cup.	Pick a random penny out of the cup. The last digit of the penny's date is the number to multiply the starting cases by. Return penny to cup.	Pick a random penny out of the cup. The last digit of the penny's date is the number to multiply the Round 1 cases by. Return penny to cup.	Pick a random penny out of the cup. The last digit of the penny's date is the number to multiply the Round 2 cases by. Return penny to cup.	Pick a random penny out of the cup. The last digit of the penny's date is the number to multiply the Round 3 cases by. Return penny to cup.
Sample calculations	If the penny drawn has the date 2019, there are 9 cases to start.	*If the penny drawn has a line drawn through date, there are still the original 9 cases after round 2.*	If the penny drawn is 2005, the new number of cases is 9 X 5 = 45 cases.	*If the penny drawn has a line drawn through date, there are still 45 cases.*	If the penny drawn is 2013, the new number of cases is 45 x 3 = 135 cases.
Model represents		*No spread, as none of the original 9 people infect anyone.*	*Moderate level of spread, as each of the previous 9 cases infect 5 people.*	*No spread, as none of the previous 45 people infect anyone.*	Fairly low spread, as each of the previous 45 cases infect 3 people.
Factors affecting spread	• Spread is affected by the transmissibility of the virus. Transmissibility is a property of a particular virus and can change as the virus mutates (genetically changes). • More spread might result from people's behavior such as close physical contact, less hand washing, or sick people not staying home. • Less spread will result from some percentage of people being vaccinated against the virus.				