

Model a Disease Outbreak

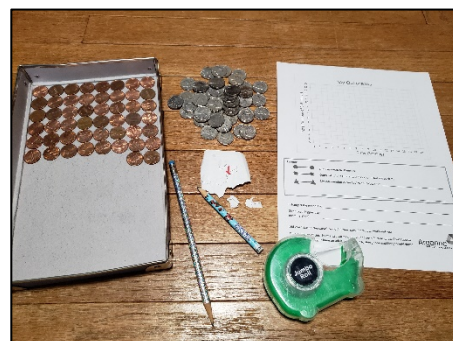
Make a model of a disease outbreak and share it with Argonne Education

Argonne scientists use models to understand how a disease can spread. These models imitate what could happen in the real world so that scientists can better understand what may happen. Models can also help us figure out ways we could slow down an outbreak.

How do diseases spread to lots of people so quickly? What are things we can do to slow down an outbreak? Using models, we can think about these questions and much more. In this activity, you will make a model of a disease outbreak. We hope you will share your data and ideas with Argonne Education!

Materials:

- “My Outbreak” sheet & pencil
 - Print ours from the last page or make your own.
 - If you know how, you can also use a computer to graph.
- 50 pennies and 50 nickels
 - You may substitute anything similar that is small and slides around easily.
 - Examples: washers, dry beans, paper clips, pasta colored with markers.
- A small tray, shoe box lid, or other flat-bottomed box
 - When your pennies (or other items) are spread flat, they should cover about half the area of the bottom.
- Scrap paper to tear into small pieces
- Extra pencil and tape



Introduction:

In a model, we use things (objects, numbers, simulated people in a computer, anything!) to imitate what happens in the real world. For this model, we will use coins to represent people and a tray to represent your community. Nickels will represent sick people, and pennies will represent healthy people. You will start with all healthy people, but then one person becomes sick. Watch and record how the disease spreads as people move around in your community (you shake the tray), people meet up (the coins touch), and new people become sick (pennies get swapped for nickels).

In this activity, you will:

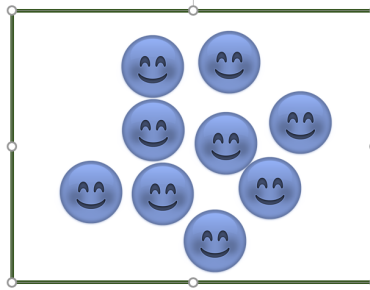
- Step 1: Build and run a basic model of a disease’s spread across a community.
- Step 2: Notice how fast your outbreak spreads. What can we do to slow the spread of germs?
- Step 3: Share your ideas and data with Argonne Education!

Step 1: The Basic Model

If you had a community of 50 people and one sick person joined your community, how fast could the disease spread? Let's set up a model community to find out:

1) Set up your healthy community:

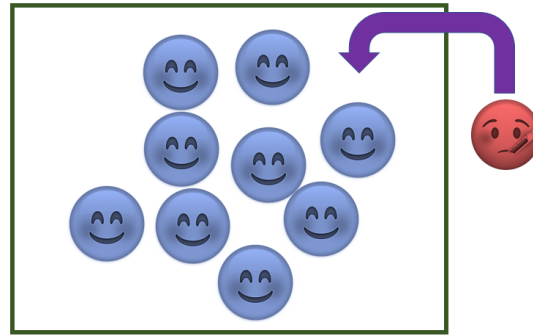
- Spread out 50 pennies in a tray. These represent healthy people.



What does this mean in the real world? All people in this community are healthy!

2) Get your outbreak started:

- Swap one penny with one nickel. This represents one sick person coming into your community.



What could this mean in the real world? Maybe someone visited their relative in another town and came back sick!

- Record the total number of sick people on your graph.
 - The bottom of your graph represents time (shakings). We haven't done any shaking yet, so time (shakings) is zero.
 - The units on the side of the graph are the total number of sick people. Here the total is 1.
 - Color in one rectangle above the "0" to represent your one sick person.

3) The outbreak spreads:

- Shake your tray 5 times back and forth to represent people mingling in the community. Stop and set down your tray. You have now completed one "shaking".
- If any penny is touching a nickel, it is now "sick."
 - Swap out sick pennies for nickels.



What does this mean in the real world? The sick person just has a little cough, no big deal. He or she goes about their day- going to school, participating in soccer practice, attending a birthday party, etc. - and everyone else is going about their day as well. How many people did this one person make sick that day?



If you have a lot of new sick people, you can tear off little scraps of paper and place them on the sick pennies to mark them. Then swap the sick pennies out for nickels. Try to place your new nickels in the same spots where you removed the sick pennies.

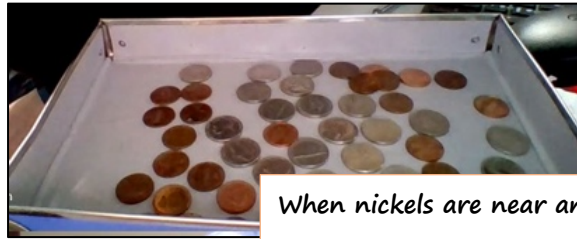
- Record your data on your graph.
 - The bottom represents time (shakings). The first time you shake your tray (5 times back and forth) counts as 1 shaking.
 - You want to represent the total number of sick people on your graph (the **total** number of nickels now in your tray) after 1 shaking. Above the number 1, color in one rectangle for every nickel in your tray.

4) **STOP AND THINK:** How many times do you think you will need to repeat shaking and replacing sick pennies until all of the pennies are nickels (all of the people are sick)? Give your answer (a number) on the “My Outbreak” sheet under “Prediction”.

5) **Repeat Step #3 to represent the spread of disease:**

- Shake the tray. Try to use the same number of shakes and force each time.
- After each time of shaking and switching pennies (healthy) to nickels (sick), record the total number of nickels present on your graph.

When pennies are near other pennies, what does this mean in the real world? Healthy people run into other healthy people. No problem! No one gets sick.



When nickels are near another nickel: sometimes a sick person runs into another sick person. For this disease, you can't get sick with the same thing again! So, these people don't change, but go back into the community and go about their days.

- Stop when all pennies have changed to nickels (meaning everyone is now sick) or after 18 shakings.

Step 2: How fast did the disease spread? How can we slow things down?

1.) **How many shakings did it take for all of your pennies to become nickels?**

- Write your answer on the “My Outbreak” sheet under “What really happened.” Think about this question: was the spread faster or slower than you first thought?

2.) **What can you do to slow down an outbreak?**

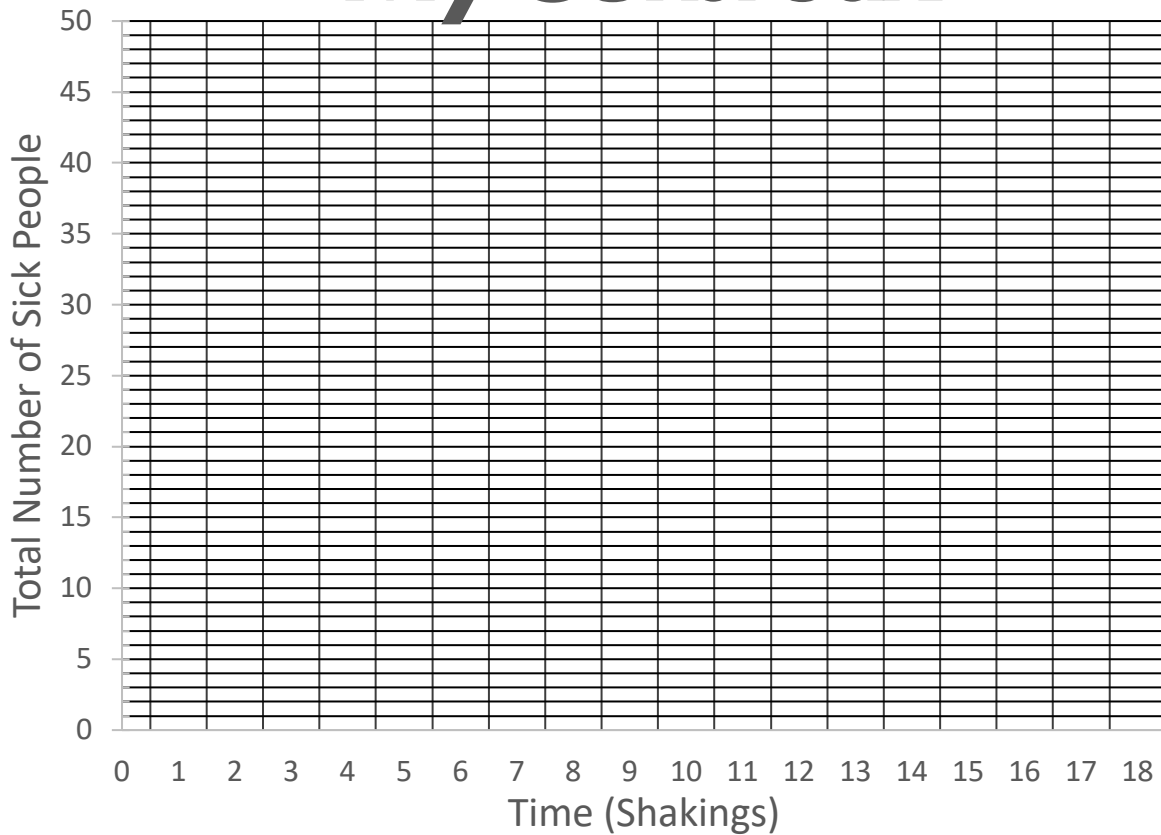
- If an outbreak spreads too fast, we might not have enough hospital space, doctors, or other supplies we need to care for everyone. We need to slow it down!
- When there is a disease like the flu or something more serious going around, we should be even more careful to wash our hands, stay home when sick, not go to school, etc.
- What are some things you are doing right now to slow down the spread of disease? Write down your ideas on the “My Outbreak” sheet in the space provided.

Step 3: Share Your Data and Ideas with Argonne Education



Take a picture of this sheet. Send it to us at learninglab@anl.gov or ask an adult to Tweet it @Argonne #ArgonneAtHome

My Outbreak



Prediction: I think I will need to do ____ shakings before all my healthy people are infected.

What really happened: It took ____ shakings before all my healthy people were infected.

In the real world, this is what I am doing to stop the spread of germs: _____

Congratulations! You've modeled a disease outbreak! Take a picture of this sheet and your new model, and send it to Argonne Education at learninglabs@anl.gov or have an adult Tweet it out to @Argonne and #ArgonneAtHome.