Spread of Illness

OVERVIEW

Model how quickly germs can be spread through the community using grocery store materials.

WHAT ARE WE LEARNING?

In this activity you learn how quickly one sick person can spread germs to a wider community.

Image 1: Supplies - (worksheet not shown)

Materials

- Baking Soda
- Vinegar
- 15 cups - larger cups preferred- we used 16 oz Solo cups
- Water
- Bowl and spoon
- Sharpie to label cups (if not using paper labels)
- "Spread of Illness" companions sheet (can be read off computer or printed)
- (Optional) Pictures of people to tape on cups. Can be drawn or printed

INSTRUCTIONS

1. Download and print (if possible) the companion sheet for "Spread of Illness."
2. You will need to label your cups from #1 -15. Decide if you want to label them only with numbers, or if you'd like to add pictures of people to the cup for fun. If the latter, make your people. We used stock people icons (image 2).
3. Label your cups with a sharpie or your pictures! Line them up in numerical order.
4. Fill cup #1 with vinegar. Fill it at least 3/4th of the way full. (If you have smaller cups, use extra vinegar for this step.
5. Fill the rest of the cups, #2 - #15, with water about 1/2 full.
6. Fill your bowl with baking soda and set it aside along with the spoon.

Image 2: 15 Labeled cups filled with liquid

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INSTRUCTIONS (CONT)

7. Get out your "Spread of Illness" companion sheet. Every time two "people" interact, you will exchange the liquids of the two numbered cups. For example, for step one, pour liquid from cup 1 into cups 8 and 14. Then pour liquid from cup 8 into cups 1 and 14. Finally, pour fluid from cup 14 into cups 1 and 8.

Make generous pours, pouring out at least 1/2 of the liquid in the cup for each exchange. Especially in step one, you will want to pour a lot of the vinegar into cups 8 and 14 for this activity to appropriately model community spread.

8. After you have gone through steps 1 - 12 on the "Spread of Illness" companion sheet, ensure the cups are lined up in numerical order and get your baking soda and spoon ready.

9. Add a large spoonful of baking soda to cup 1.

10. Observe to see if you get bubbling, or a reaction. If you do that means your "person" is sick! If there's no reaction your person is healthy. Record who is sick and who is healthy on your "Spread of Illness" companion sheet.

11. Repeat steps 9 + 10 for cups #2 -12.

Image 3: Exchange liquids from the cups of people who interact.

Image 4: Put baking soda in the cups to see who is "sick!"

NOTE

This activity is a model of how germs spread through the community. Like all models it has aspects that model the real life situation well and aspects that don't! Talk with your child about the strengths and weaknesses of this model.

For example, this model does a good job of showing how one person can make many people sick! However, in this model, the vinegar gets diluted with multiple pours, causing reactions of different strengths in different cups. This aspect of the model does *not* replicate real life, but you can use it as an opportunity to discuss how not everyone exposed to a virus will get sick, or how some people will get sicker than others, even if the mechanism in the model is different from the real life mechanism. Talking about strengths and weaknesses of different models is an important part of science!

THE SCIENCE

Certain illnesses can spread very rapidly through the community, and some diseases are more contagious than others. The level of contagion of a disease is measured by something called "R0" (pronounced "R-naught"). If a disease has an R0 of 2, that means, on average, one infected person spreads the disease to two people. If the R0 number is 3, an infected person would, on average, spread the disease to 3 other people. The typical flu has a R0 number of 1.3. Early estimates of COVID-19 put its R0 between 2-3. (The information in this paragraph was from the LiveScience article "How Does the New Corona Virus Compare to the Flu").

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THE SCIENCE (CONT)

Remember, an average is only that, an average. If you are sick with an illness transmitted by saliva and share drinks and food with multiple people, or cough in crowded spaces without covering you mouth, you will likely infect an above average number of people. If you stay away from people while sick, you will infect below average.

There are a lot of other concepts that can be studied in relation to illness spreading throughout a community including exponential growth of infection, herd immunity, vaccines, and more.

The content (viruses and virus spread) in this activity lines up best with middle and high school topics in the Next Generation Science Standards (NGSS, used in many states). "Developing and Using Models" is an NGSS "Scientific Practice" that is promoted for all grades.

ADVICE FOR DOING SCIENCE WITH YOUR KIDS

- Encourage exploration and curiosity - science is about more than facts and content (although these things are important too!)
- Consider writing down your child's questions and ideas during the activity. You may be able to turn these into a future research project or activity!
- Consider getting a dedicated science journal for your child where they can keep all their thoughts, ideas, and notes on their experiments.
- Do not worry about not knowing the answer to questions! 1. Many "simple" kids science activities have very complicated, or even unknown(!) science behind them. 2. Even scientists will often not know the answers to questions outside their field. No one knows everything! Be honest about not knowing the answer and suggest trying to figure it out together.

- Deviations from exact instructions can often be fruitful - especially if the child has been inspired and wants to try out another line of investigation.
- In many states, the science standards are called the "Next Generation Science Standards," or "NGSS." They can be complicated to parse through but in essence they want student to learn not only content (called "disciplinary core ideas" or "DCI") but also the practices scientists and engineers use ("scientific and engineering practices" or "SEP") and also concepts that cut across all fields ("crosscutting concepts" or "CCC").