**ACTIVITY: Spreading diseases**

**Activity idea**

In this activity, students model how a virus spreads through a group.

By the end of this activity, students should be able to:

* explain how viruses are spread
* practise behaviours that limit the spreading of viruses (hand-washing)

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**Introduction/background**

This activity shows how an infection in one person can spread easily through a group.

For effect, the spiked ‘virus’ solution needs to be clear to look like water. The solution needs to be made from an alkaline product with a pH of at least 8. This is not easy, as most alkaline household items tend to be cloudy in appearance when made into a solution. We found that some brands of dishwashing powder could be diluted down to look clear and still turn pink when the indicator was added. We suggest that you experiment yourself to obtain a satisfactory result before conducting the lesson.

This experiment was trialled with year 7 and 8 students. The students were engaged. They asked for it to be repeated and concluded with an in-depth discussion on infection – how and why it spreads.

***Safety***

Care needs to be taken when handling alkaline solutions. Immediately wash off spills on skin.

**What you need**

* 2 numbered clear small plastic cups for each student (shot glasses can be purchased cheaply from a ‘2 Dollar’ shop)
* Water
* Permanent marker
* Dishwashing powder (for dishwashing machines) or other alkaline household product
* Container to make up the spiked ‘virus’ dishwashing powder solution
* Phenolphthalein (pH indicator that turns pink with basic solutions – can be purchased from a laboratory supplier, or your friendly local high school may give you some)
* Access to the Science Ideas and Concepts article [Infection](https://www.sciencelearn.org.nz/resources/179-infection)
* Copies of the student handout [Pass it on](#handout)

**What to do**

1. Preparation:
* Label duplicate containers from 1 up to the number of students in the class.
* Label one of each pair PRE (for pre-exposure) and place these aside for handing out as empty containers.
* Prepare the spiked ‘virus’ solution. Dissolve dishwashing power in water so that it looks clear (like water) but will still turn pink when a drop or two of the pH indicator is added.
* Choose one labelled student cup at random and half fill with the spiked solution. If the activity involves more than 20 students, prepare a second spiked cup. Keep some of this spiked ‘virus’ solution as the positive control sample.
* Fill the remaining cups to the same level with water (not the cups labelled PRE as these remain empty to be handed out to students).
* Add an extra cup for the negative control.
1. As a class, read and discuss the [Infection](https://www.sciencelearn.org.nz/resources/179-infection) article, emphasising how viruses can spread through fomites (objects that carry infectious diseases).
2. Hand out copies of the student worksheet and have students read and complete the task.
3. Tell the class that, unfortunately, at least one of the cups contained bodily fluids that were infected with the shocking pink virus. By exchanging bodily fluids with their friends, it is likely that several more students are now infected with shocking pink virus.
4. Let them know that you can identify the virus-infected samples by adding drops of an indicator. Demonstrate with the positive and negative control sample.
5. Add a drop or two of the indicator to the post-exposure cups. Those cups with water that turns bright pink contain the virus, so each student whose water is pink (it might just have a swirl of pink, depending on how much liquid is in the cup) is now infected and contagious. Typically, at least two-thirds of the class will have become infected during the exchange process.
6. Give the students a chance to comment on the results of their experiment. Probably they will ask who the original infected people were, so return the question to them by asking, “How can we find out?” They will soon realise they need to start by eliminating those students who were not infected at the end of the experiment and then try to work backwards from there. Treat this as a puzzle for them to solve – try to keep out of things as much as possible. Give them time to realise that they will need to get organised and devise a systematic way to look at the data they have. They will probably realise they need one or two students at the board to lead the discussion and record information as they go along. Once they get going, it may be easy at first to eliminate students who could not have been the initially infected ones, but it will then become more difficult. They may not be able to deduce the original infected persons, but they should be able to eliminate all but 4–6 students.
7. At this point, you can go back to the pre-exposure samples. Put a drop of indicator in each of the pre-exposure cups and let the students see how close they got to determining the original sources of the virus. Lead a discussion on the reason for including a positive and negative control sample.
8. After the sources have been revealed, ask the class how pouring water between cups can represent a virus spreading through a group of people. (Some viruses spread by sneezing and coughing, and some can be spread by an exchange of bodily fluids including saliva and blood. Glandular fever can be spread by kissing, and HIV and hepatitis B are both transmitted through sexual or blood-to-blood contact.)

**Student handout: Pass it on**

Have you ever caught a cold? Do you know where it came from? How did you ‘catch’ it? Did everyone in your family have the cold or just you? The disease that we call ‘the common cold’ is caused by a virus that gets into the cells in our noses and throats. Other diseases that we can ‘catch’ from other people include measles, mumps, chickenpox, influenza, tuberculosis and meningitis. These are all caused by microscopic organisms getting into our bodies and infecting our cells.

Sometimes we breathe in the organism if it is floating in the air, but many times we put bacteria or viruses into our own mouths. Why would we do that? Because we don’t know we’re doing it. If you have a cold and sneeze into your hand, your hand gets covered in viruses. Whatever you touch in the next hour or two could get covered in viruses from your hands. (Imagine if you had sticky glitter on your hands – where would you find it in a few hours from now?) The next person to touch that object might get viruses on to their hands. If they then eat their sandwiches or scratch their nose, the viruses could then get into their body.

Scientists call the objects that are able to carry infectious organisms from one person to another fomites (e.g. pencils, telephones, door handles, books). Rather than trying to disinfect the whole of your house and school, there is a much easier way to protect yourself from these infectious organisms put there by your family and friends: wash your hands before you eat!

This activity will demonstrate how easily a viral disease can spread through a population, even if each individual only comes into contact with three others.

You will ‘share’ a sample of ‘bodily fluid’ with other students. One student will have a sample that has been spiked with a ‘virus’.

1. Your teacher will give you two numbered cups. One of these will contain a clear liquid – DO NOT DRINK IT!!!
2. Transfer about half of the liquid into the empty cup labelled PRE (it must have the same number on it as your cup of liquid) and return this to the front of the room. This small sample will be your pre-exposure sample.
3. Pair up with another student. Pour all the contents of one cup into the other cup, swirl to mix, then pour half back so that each person has the same amount again. Write down who you paired with.
4. Pair up with someone else. Share the liquid as before and write down who you paired with.
5. Pair up with a third person. Share the liquid as before and write down who you paired with.
6. Return your cup to the front of the room. Your teacher will now test your samples to see if you have ‘caught’ the virus.