

## **MUCUS SWAP – instructor guide**

### **LEARNING OBJECTIVES**

- Explain who is at highest risk for becoming ill from a disease.
- Explain ways zoonotic diseases might be spread to you or your animals on the farm and at exhibitions.
- Describe measures to prevent zoonotic disease spread to you and your animals on the farm and at exhibitions.
- Practice basic epidemiologic methods to solve the outbreak.

**PREPARATION TIME:** 15 minutes

**ACTIVITY TIME:** 20–30 minutes

### **MATERIALS**

- Clear plastic cups – one per participant
- Nitrile gloves
- Distilled water
- Distilled water with baking soda
- Phenol red
- Dropper
- Permanent marker
- Large address labels or sticky name tags
- Large pad of paper or white board and markers
- Handouts and worksheets
- Bubble blower and bubbles

### **PREPARATION**

- Print enough copies of worksheets and instructions to give one set to each participant
- Number cups
- Number enough nametags to have one per participant and place with corresponding cup.
- Half fill up to 10% of cups with baking soda water. (E.g., if there are 10 participants, fill one cup with baking soda water; if there are 20 participants, fill two cups with baking soda water.)
  - Make note of which cups contain baking soda water.
- Set a behavior card under each cup in the set with the numbered nametags. Ensure the baking soda cup(s) is paired with a “Participates in multiple open, county, and state shows” card.
- Half fill the remaining cups with distilled water.

### **EXPLANATION OF ACTIVITY**

Some people are carriers of disease. Initially, these carriers may appear healthy or show only mild signs of disease. At some point they may eventually get sick, but they may not be recognized as having the disease until they’ve exposed and infected others. This is one reason why some pathogens can spread so quickly.

This activity is designed to simulate the uncontrolled spread of a disease through a population. Cups have been half-filled with water, except for one or two which contain baking soda water. The one or two people with the baking soda cups will be the original carriers of the “disease,” but they will carry this disease in a cup rather than in their body—and appear healthy on the outside. The original carrier(s) will make contact with other participants who will then make contact with others. At the end of the activity, everyone will be tested to see who has become infected, and we’ll discuss how to trace the infection back to its source.

**NOTE:** We will be wearing nitrile gloves for this activity, but you still need to be careful with your cup and solution as we work through this portion of the activity. If you spill any on yourself, immediately go to a bathroom to wash it off. It may stain clothing.

## INSTRUCTIONS

- 1) Have participants pick up gloves, one cup, associated behavior card, and corresponding numbered sticker.
- 2) Instruct participants to put on their numbered sticker and review their behavior card. Tell them that each fluid swap should occur with someone they haven’t swapped with previously.
- 3) Ask participants to move about the room, during which time they should exchange fluids according to the instructions on their behavior card.
  - a. To exchange fluids, one person will dump all of the contents of their cup into the other person’s cup.
  - b. Return half of the solution back to the empty cup. (Demonstrate with two water cups.)
  - c. Record the number of the person exchanged with.
- 4) Participants should repeat step 3 as many times as specified on their behavior card.
  - a. Remind participants that each swap should be with someone they haven’t already swapped with, and that they should only swap as many times as their behavior card indicates.
- 5) When the swapping has finished, instruct participants to return to their desks with their cups.
- 6) Have a group leader go around to all participants and add 2–3 drops of phenol red to each cup.
  - a. A pink color change (bright or faint) indicates a positive result—this person is now considered “infected.” No color changes is “uninfected.”
  - b. Discuss mild–severe infection and those at increased risk of severe complications (pregnant, very young or old, immunocompromised).
- 7) After all testing is complete, participants should record their results and return their cups for disposal.

## OUTBREAK INVESTIGATION & ADDITIONAL DISCUSSION

*Work with the group to fill out the table and discuss any apparent risk factors.*

Ask all with one exposure to raise their hands or stand—mark in total column.

	<b>Infected <i>Yes</i></b>	<b>Infected <i>No</i></b>	<b>Total</b>
<b>Exposure</b> <i>Participated in county fair only</i>			
<b>Exposure</b> <i>Participated in county and state fair only</i>			
<b>Exposure</b> <i>Participated in multiple open shows, county fair, and state fair</i>			
<b>Total</b>			

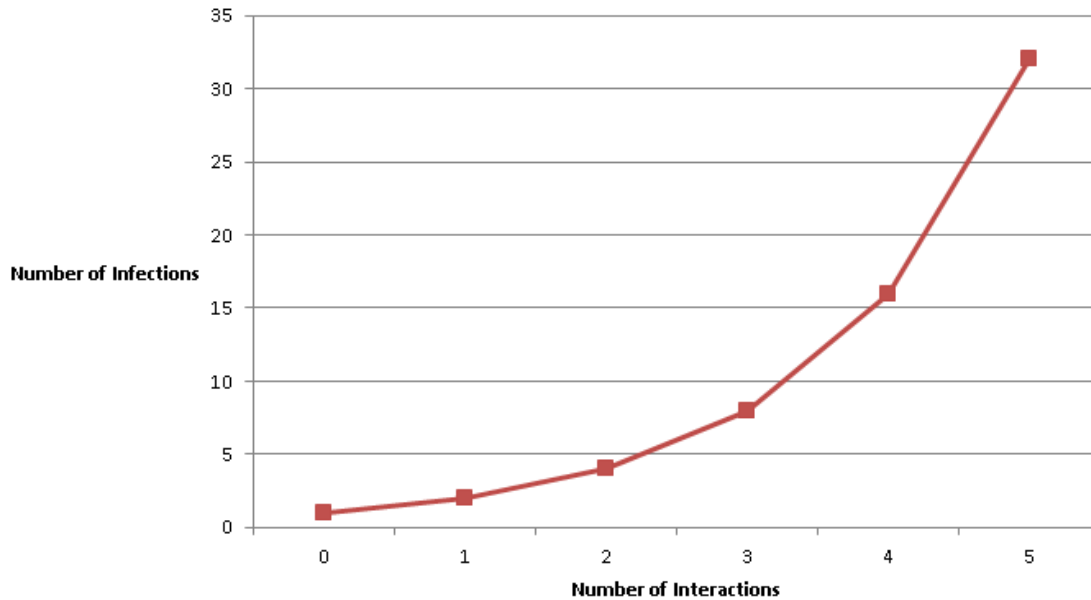
- Did any of the exposures lead to greater risk of becoming infected?
- How does this translate to the increased risk of infection for you and your animals based upon the shows you attend, and number of animals commingled in real life?

*How did the number of people infected increase with each round of interactions?*

- This can be thought about in multiple ways...instruct participants to fill out the table and graph provided.

<b>Number of interactions</b>	<b>Previously Infected</b>	<b>Newly Infected</b>	<b>Total # of Infections</b>
0	Student #1	N/A	1
1	Student #1	Student #2	2
2	Student #1 Student #2	Student #3 Student #4	4
3	Student #1 Student #2 Student #3 Student #4	Student #5 Student #6 Student #7 Student #8	8
4	...	....	16
5	...	...	32

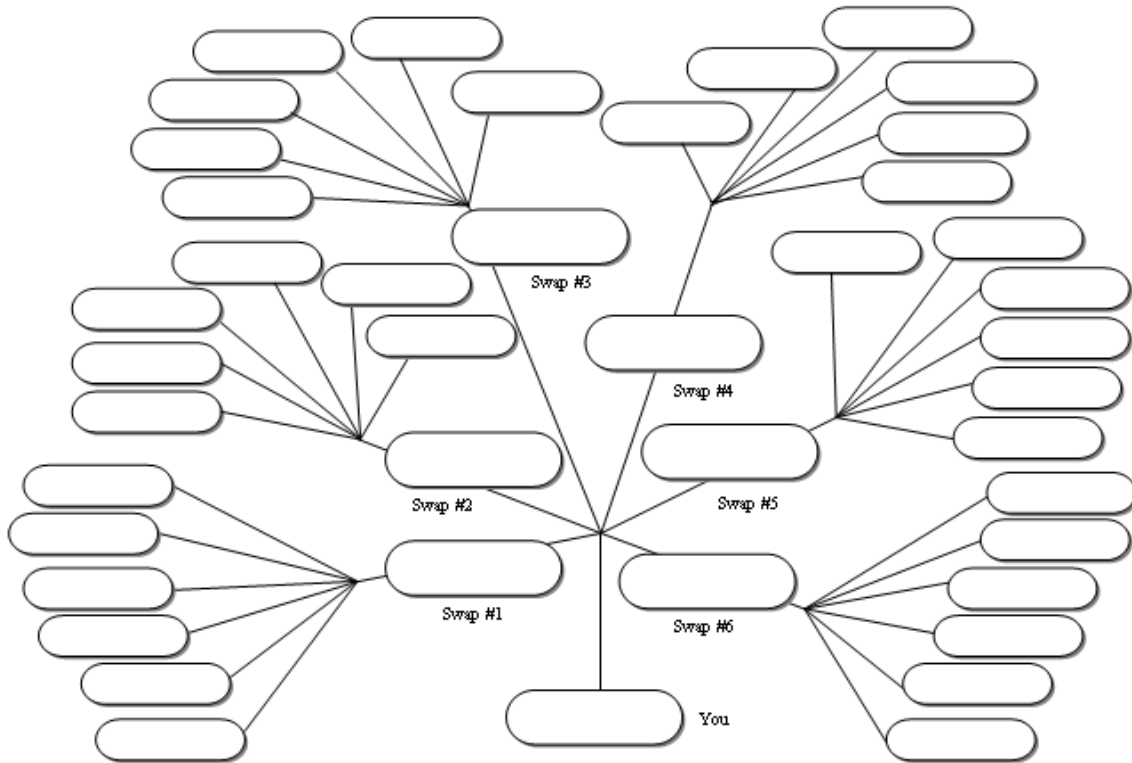
## Number of Infections per Interaction



- Discuss doubling of number of infections in each round
  - Graph shows exponential, not linear growth
- If we did this activity long enough, would everyone become infected?
  - Yes, but the doubling of infection we see in each generation does not continue indefinitely. In the beginning the curve increases exponentially, but then levels out – this pattern is known as a logistic growth curve (S-curve). As the number of infected participants increases, it becomes increasingly more likely that an infected participant interacts with another participant that has already been infected. As a result, the number of new infections slows down.
  - This type of growth also assumes that no one has any protection from the infection (such as vaccination).

### ***How can we determine who was the original source of infection?***

- Discuss ideas – it’s important for participants to realize that if they are infected but can identify people they swapped with that AREN’T infected, then they could not have been the original source. Working through this should lead back to the people that were originally infected and those they infected after the first swap
- After discussion, have all “infected” participants stand up and “non-infected” participants remain seated.
  - “Infected” participants should look around at “non-infected” participants – if anyone they exchanged fluids with is sitting, they should sit down as well.
  - Continue this until there are 7–10 participants still standing.
  - Direct the remaining participants to bring their list of people they swapped with to the front of the room and complete an “infection tree” similar to the one shown below.
    - Participants have a full-sized worksheet that they can work on as the group discusses.
    - Completing the tree will require input from participants that remain seated.



- Once the tree is complete, shade in all bubbles representing people that were “infected” at the end of the activity. Use this diagram to discuss and identify the probable initial source of the infection.
  - Important to note that you will only be able to narrow it down to twice as many “suspects” as there were initial infected cups (e.g., starting with two cups means you’ll be left with four suspects).
    - You may need to use your knowledge of which cups were actually infected to help guide this portion of the conversation to ensure the two cups that were the original source of “infection” are included in the list of suspects.
  - In a real investigation, how could we distinguish between who was the original source and who they infected? Why can’t we do that here?
    - In this activity, the potential first exposure to disease for everyone was the same – when you were randomly handed a cup that either had water or a baking soda solution. You can’t use earlier exposure or timeline to further narrow down who was originally infected and spread the “disease” to rest of group.

***How would this investigation be different if you hadn’t kept notes about whom you swapped fluids with and in what order?***

- Do you think you would have remembered clearly after the activity was over? How well do you think you’d remember tomorrow or in a week from now?

- Discuss how that's one of the difficulties of a true outbreak investigation. It typically takes time for a disease to appear after initial exposure and takes more time for an epidemiological investigation. People's memories aren't that great!

***What preventative measures could have been taken to avoid exposure to the disease?***

- Lots of possible answers, including vaccination, attending fewer shows, etc.

***How would an airborne disease spread differently? Why?***

- In this activity, disease spread was dependent on a very direct, one-on-one interaction (more similar to the spread of an STD than an airborne disease like influenza). Airborne diseases are able to spread more easily and indirectly from person to person (or animal to animal, or animal to person) and it often isn't as clear when you've been exposed to someone with the disease. In this activity it was very clear whom you swapped liquids with. It's much more difficult to track who you simply walked by, were in the barn with at the same time, etc.
- Use a bubble blower and see who gets hit with a bubble. Airborne disease spread requires less movement; some diseases can be transmitted in the air for long distances.

**ADAPTING THIS ACTIVITY FOR SHORTER DURATION**

- Rather than using the "infection tree" to identify the initial source of infection, simply use the "stand up/sit down" method
  - Have everyone stand up that is infected at the end of the activity
  - If anyone standing up swapped fluids with anyone that is still sitting (uninfected), they should sit down.
  - Continue this until you're left with twice the number of people standing as you had initially infected cups
  - One infected cup would result in two people left standing at the end. In this activity, there is no way to determine which person was the original source of infection, but you can share that information with the group).

**ALTERNATIVE MATERIALS**

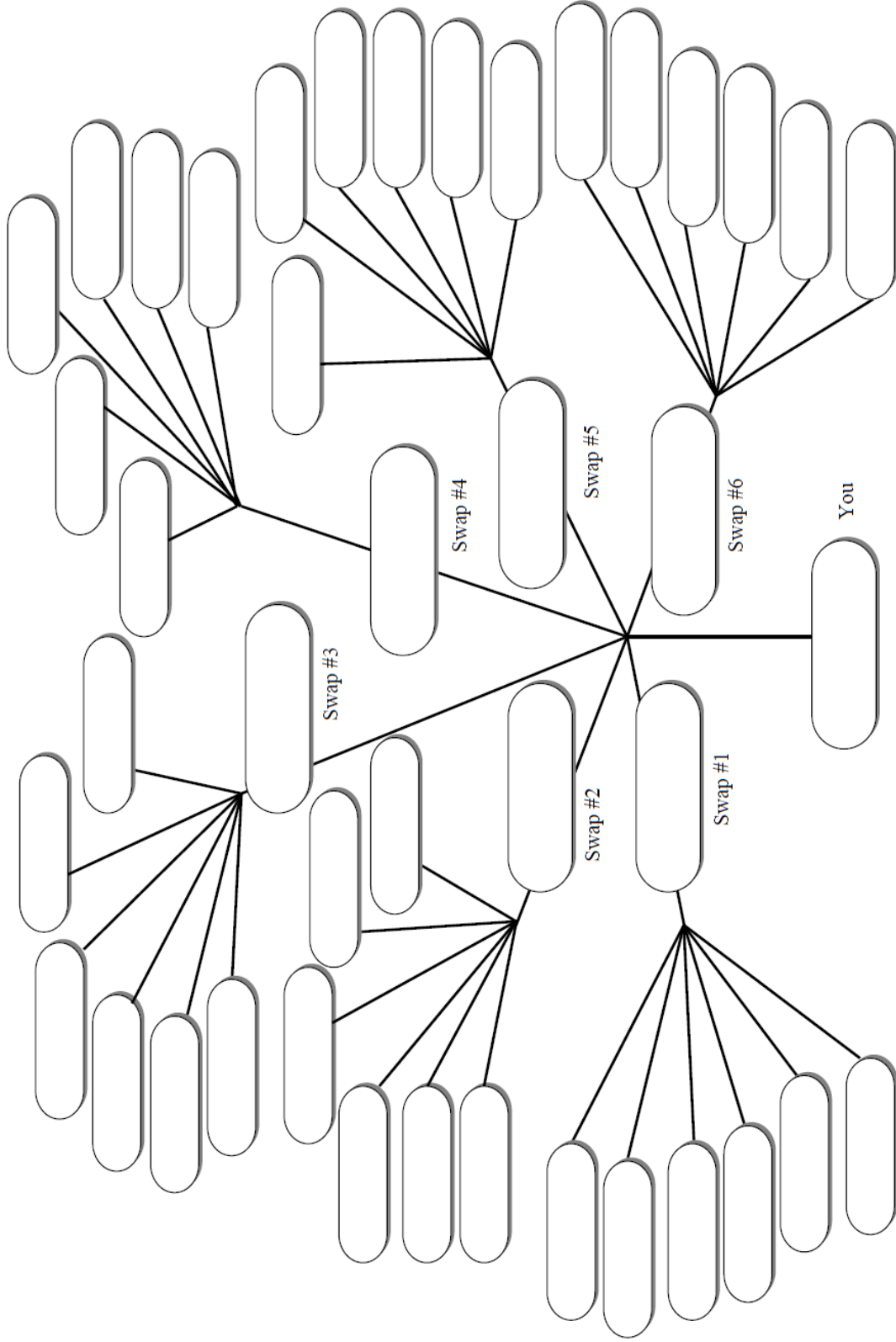
Yellow food coloring (uninfected) and blue food coloring (infected) may be used instead of baking soda and phenol red. Any shade of green will represent infection at the end of the swapping activity and may better demonstrate varying severity of illness. These materials may be easier to obtain.

This document was adapted from an activity guide developed by the Center for Food Security and Public Health at the Iowa State University College of Veterinary Medicine in collaboration with the Iowa Department of Public Health, and originally based on an activity developed by the Indiana State Department of Health and from the following resources:

- <http://seplessons.ucsf.edu/node/226>
- <http://www.cpet.ufl.edu/wp-content/uploads/2013/03/Epidemic-lab-with-bodily-fluid-cups.pdf>
- <http://lpsl.coe.uga.edu/mile3/resa/gpsinaction/lessonplans/Virus.pdf>
- [http://www.accessexcellence.org/AE/AEC/AEF/1996/good\\_virus.php](http://www.accessexcellence.org/AE/AEC/AEF/1996/good_virus.php)
- <http://www.plymouth.edu/eportfolio/view/artefact.php?artefact=86147&view=19172>

Funding for this project was made possible through a joint organizational partnership between the Council for State and Territorial Epidemiologists and the Centers for Disease Control and Prevention.

**Instructions:** Complete this "tree" to trace back the path of transmission of the disease. Write your cup number and the cup numbers of the people that you exchanged fluids with. Depending on your behavior card, you may have swapped with less than six people. Find out which of your partners had a positive test (were infected). Highlight their cup numbers. Talk to each of the people you swapped with and find out if they had interactions with infected people before they interacted with you. Circle the cup number of the partner that infected you. Draw a box around the partner that you infected (directly or indirectly).



<b>Participated in County Fair Only</b> Swap Once	<b>Participated in County and State Fair</b> Swap Twice	<b>Participated in Multiple Open, County, and State Shows</b> Swap Three Times
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