SMMG April 29th, 2006
featuring Dr. Lauren Ancel Meyers
"New Mathematical Methods for
Forecasting the Spread of Infectious Diseases"

1. Disease Transmission Activity

Helpers will be giving you paper cups filled with colored beads.

- During the next 5 minutes you should walk around within your assigned group and mingle with each other. That is, talk to one of the other participants about the last time you were sick for a little while and then talk to another student for a little while and so on. By the end of the 5 minutes you should have talked to 2 or 3 others – it is okay if you talk to more or less than that.

After you are done talking, write down the name of the person you talked to. Also, pour a few of your beads into each other's cup. Before and after pouring shake up the beads a little bit.

- Use the board to do the following exercise.

a) Make a circle of dots with the names of the members of your group next to each dot.
b) Come up to the board and draw a line between your name and everybody with whom you exchanged beads.
c) If you have any red beads in your cup, go ahead and circle your name.

2. Vaccination Activity

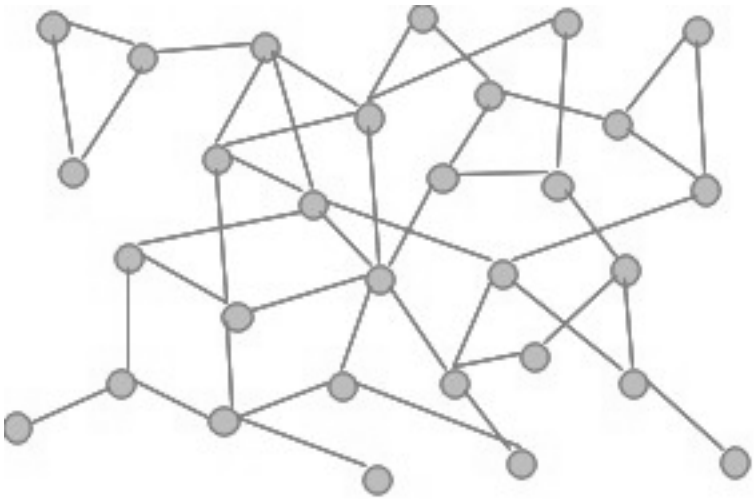
- Here we go again! The procedure is the same as above except that now, before exchanging beads, check to see if you have a "V" written on your paper cup. If so, you are vaccinated. That means you cannot catch the disease.
After you are done talking with someone, if one or both of you have a "V", do NOT pour beads into each other's cups.

- Now use the board to make a new diagram.

a) Make a circle of dots with the names of the members of your group.
b) Come up to the board and draw a line between your name and everybody with whom you talked to in this exercise.
c) Draw a square around your name if your cup was marked with a "V".
d) If you have any red beads in your cup, go ahead and circle your name.

3. Degree Distributions

This is a simple example of a contact network graph.



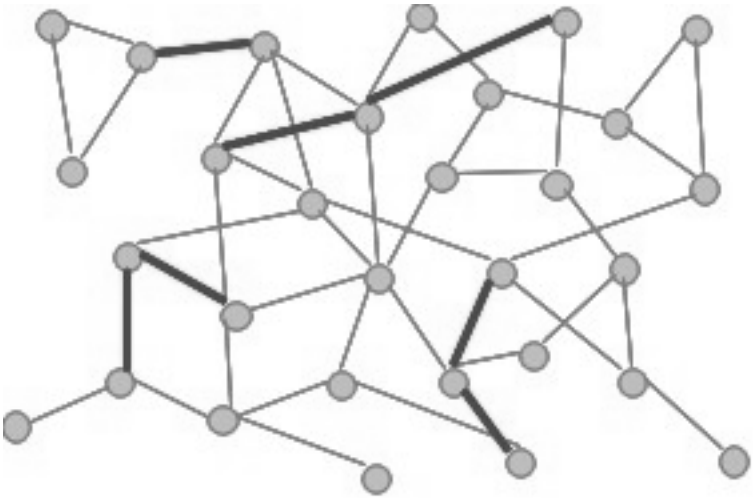
Remember our terminology:
Node: these represent people or places that can become infected.
Edge: contacts between nodes (people) that can lead to disease transmission.
Degree: the number of edges coming out of a node.
Transmissibility: the probability that an infected individual will transmit the disease to another individual on the opposite side of an edge.

a) Label each of the nodes with its degree.

b) Use the following table to determine the degree distribution, that I the frequency of each degree in the population.

Degree	Frequency
1	
2	
3	
4	
5	
6	

c) In this next picture, we have modeled a control strategy which prevents contacts between individuals. We model this by removing a few edges (shown in dark lines). Compute the new degree distribution after these edges are removed.

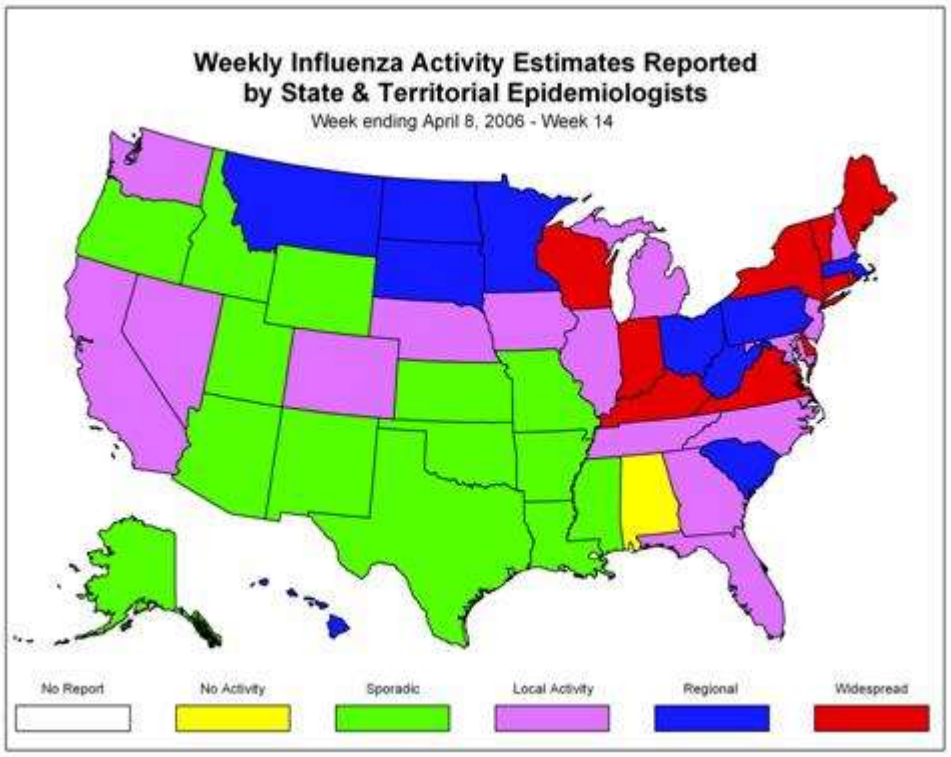


Degree	Frequency
1	
2	
3	
4	
5	
6	

Talk to your neighbors about how this control measure helps to reduce the transmission of diseases.

4. Map Analysis and Graphing

The United States map (Center for Disease Control and Prevention, Department of Health and Human Services) shown below depicts cases of flu (influenza virus) activity per state, as reported to the Center for Disease Control (CDC) in April 2006. Use this map to answer the following questions:



a) How many states have had sporadic influenza activity reported to the CDC?

b) Three states have reported local flu activity; name these three states.

c) What percent of the total 50 states has had widespread influenza activity?

d) What percent has had regional influenza activity? Local? Sporadic?

e) Draw and color code a circle graph depicting the percentage of the four types of reported influenza activity, based on question c).

f) Analyzing your own circle graph. Which color (or type of state influenza activity) is the most common? Which color (or type of state influenza activity) is the least common? Does this match with the data presented in the map?