DISEASE LAB

name:

Problem:
How does change in population density, population mixing, and vaccination rate affect the spread of influenza in a population?

Hypothesis:
How do you think increasing population density affects the spread of disease?

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How do you think increasing population mixing affects the spread of disease?

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How do you think increasing vaccination rate affects the spread of disease?

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Materials:
The Habitable Planet simulator (http://www.learner.org/courses/envsci/interactives/disease/disease1.html)

Procedure Day 1:

1. Open the simulator by entering http://www.learner.org/courses/envsci/interactives/disease/disease1.html in Mozilla Firefox. You can also get to the simulator by clicking on DiseaseBlossoms from the KMS Student Resources page.

2. First we will try to discover how population density and population mixing affect the spread of influenza.

3. TRIAL A: Set population mixing to *low* and countermeasure vaccination rate to none. Run 3 trials each for a population density LOW, MEDIUM, and HIGH. Record the data in the table below.

4. Make sure to hit "reset" after each trial BEFORE you run another test. Record the starting population, the number of contagious people, at risk at end of run (click on the green line in the graph for the value), the immune by end of run (click on the grey line in the graph for the value), and the death toll (red line for dead) in your data table. Calculate the average for each value (add the 3 trials and divide by 3… round to whole number).

5. TRIAL B: Set population mixing to *medium* and countermeasure vaccination rate to none. Run 3 trials each for a population density LOW, MEDIUM, and HIGH. Record the data in the table below.

6. TRIAL C: Set population mixing to *high* and countermeasure vaccination rate to none. Run 3 trials each for a population density LOW, MEDIUM, and HIGH. Record the data in the table below.

7. Now analyze your data. You may calculate the percent infected (infection rate) for each population density/mixing level. Use average number immune at end + average dead/ population density number x 100.

TRIAL A:

Population Mixing LOW (no vaccination)	Population Density	Population Number	Starting Number of Contagious People	At Risk at end of 100 days	Immune by end of 100 days	Death Toll
Run 1	**low**					
Run 2	**low**					
Run 3	**low**					
AVERAGE	**-**					
Population Mixing LOW (no vaccination)	Population Density	Population Number	Starting Number of Contagious People	At Risk at end of 100 days	Immune by end of 100 days	Death Toll
Run 1	**medium**					
Run 2	**medium**					
Run 3	**medium**					
AVERAGE	**-**					
Population Mixing LOW (no vaccination)	Population Density	Population Number	Starting Number of Contagious People	At Risk at end of 100 days	Immune by end of 100 days	Death Toll
Run 1	**high**					
Run 2	**high**					
Run 3	**high**					
AVERAGE	**-**					

TRIAL B:

Population Mixing MEDIUM (no vaccination)	Population Density	Population Number	Starting Number of Contagious People	At Risk at end of 100 days	Immune by end of 100 days	Death Toll
Run 1	**low**					
Run 2	**low**					
Run 3	**low**					
AVERAGE	**-**					
Population Mixing MEDIUM (no vaccination)	Population Density	Population Number	Starting Number of Contagious People	At Risk at end of 100 days	Immune by end of 100 days	Death Toll
Run 1	**medium**					
Run 2	**medium**					
Run 3	**medium**					
AVERAGE	**-**					
Population Mixing MEDIUM (no vaccination)	Population Density	Population Number	Starting Number of Contagious People	At Risk at end of 100 days	Immune by end of 100 days	Death Toll
Run 1	**high**					
Run 2	**high**					
Run 3	**high**					
AVERAGE	**-**					

TRIAL C:

Population Mixing HIGH (no vaccination)	Population Density	Population Number	Starting Number of Contagious People	At Risk at end of 100 days	Immune by end of 100 days	Death Toll
Run 1	**low**					
Run 2	**low**					
Run 3	**low**					
AVERAGE	**-**					
Population Mixing HIGH (no vaccination)	Population Density	Population Number	Starting Number of Contagious People	At Risk at end of 100 days	Immune by end of 100 days	Death Toll
Run 1	**medium**					
Run 2	**medium**					
Run 3	**medium**					
AVERAGE	**-**					
Population Mixing HIGH (no vaccination)	Population Density	Population Number	Starting Number of Contagious People	At Risk at end of 100 days	Immune by end of 100 days	Death Toll
Run 1	**high**					
Run 2	**high**					
Run 3	**high**					
AVERAGE	**-**					

Analysis: How many people infected for each category?

Percent Infection Rate (immune +dead)/population*100		**DENSITY**		
		Low	**Medium**	**High**
MIXING	**Low**			
	Medium			
	High			

Procedure Day 2:

1. Open the simulator by entering http://www.learner.org/courses/envsci/interactives/disease/disease1.html in Mozilla Firefox. You can also get to the simulator by clicking on DiseaseBlossoms from the KMS Student Resources page.

2. Now we will try to discover how receipt of vaccination can affect the spread of influenza. Set population mixing to *medium* and population density to *medium*.

3. Run 3 trials for vaccination rate of 10%. Record the data in your data table. Make sure to hit "reset" after each trial BEFORE you run another test. Calculate the average for each value (add the 3 trials and divide by 3… round to whole number).

4. Repeat steps for both 25%, 50%, and 75% vaccination rates still with medium mixing and medium density.

5. Now analyze your data. You may calculate the percent infected (infection rate) for each vaccination rate. Use average number immune at end + average dead – number vaccinated/ population density number x 100. **(to calculate # vaccinated multiply the percent of vaccinated * total population)**

10% Vaccination Medium Mixing	Population Density	Population Number	Starting Number of Contagious People	At Risk at end of 100 days	Immune by end of 100 days	Death Toll
Run 1	**medium**					
Run 2	**medium**					
Run 3	**medium**					
AVERAGE	**-**					

25% Vaccination Medium Mixing	Population Density	Population Number	Starting Number of Contagious People	At Risk at end of 100 days	Immune by end of 100 days	Death Toll
Run 1	**medium**					
Run 2	**medium**					
Run 3	**medium**					
AVERAGE	**-**					

50% Vaccination Medium Mixing	Population Density	Population Number	Starting Number of Contagious People	At Risk at end of 100 days	Immune by end of 100 days	Death Toll
Run 1	**medium**					
Run 2	**medium**					
Run 3	**medium**					
AVERAGE	**-**					

75% Vaccination Medium Mixing	Population Density	Population Number	Starting Number of Contagious People	At Risk at end of 100 days	Immune by end of 100 days	Death Toll
Run 1	**medium**					
Run 2	**medium**					
Run 3	**medium**					
AVERAGE	**-**					

Analysis: How many people infected for each category?

Percent Infection Rate (Medium Mixing and Population Density) $\frac{(\text{immune + dead - vaccinated})}{\text{Population density}} * 100$	**Vaccination Rate**				
	0%	**10%**	**25%**	**50%**	**75%**

Discussion and Analysis Questions:

1. Which infection rate more: population mixing OR population density?

2. Were you correct in your hypotheses?

3. How might the spread of disease in Montana compare to the spread of disease in more populated areas?

4. Should a person who is ill go to school or the grocery store? Use lab data to support your answer.

5. How can vaccination benefit a population?

Conclusion Summary:
Summarize what you have learned about the spread of influenza in a population. Include discussion of population density, population mixing, and vaccination effectiveness. Use detailed and specific data from the lab to support your conclusion and apply to larger populations. Remember to use CEAL to write the conclusion (state the claim or problem, give actual data as evidence to support, use mathematical analysis as you connect the results to the problem, and make sure to leave this paragraph all wrapped up with your amazing writing skills).