Lab 3

Epidemiology & the Spread of Disease by Shaking Hands

Theory:

Every disease-causing microorganism must eventually come into direct contact with the host organism's cells and tissues in order to even have a chance at causing a disease. How the microorganism "spreads to" the host and where it "spreads from" can be highly variable, with examples being **direct contact**, **droplet spread**, **blood-borne**, **fecal-oral**, and **airborne**. Even when the spread of a microorganism has been successful, *most are unable to cause a particular disease unless the host also has a compromised immune system, the number of microbes spreading is high, or some other conditions are met to provide a successful portal of entry, and usually it is never known specifically how it happened*. Here are some common terms and their definitions frequently used when discussing the statistics of infectious diseases & epidemiology:

Index Case: The first instance of the disease in a given area or population.

Prevalence: There are two types of Prevalence, but both refer to the TOTAL number of diseased people within a TOTAL population. If you are not dead, you are counted in the total population (any age, any gender, any health condition, etc.). The **Period Prevalence** looks at the total number of diseased individuals during a specific time period (a range of time such as last month, or 2012). The **Point Prevalence** looks at the total number of diseased people at a *specific moment* or *point in time* (such as today—i.e., "right now"). *Death, birth, moving populations, or recovery from the disease will obviously affect the calculation of the prevalence*. Prevalence is a way of quantifying **how "common" a disease** (or anything really) **is in a given population**.

$$\textbf{\% Prevalence} = \frac{\textbf{\# of TOTAL EXISTING cases}}{\textbf{\# of individuals in the "TOTAL" Population}} \times 100\%$$

Incidence: This is the number of **NEW cases** of a specific disease, in a defined population of AT RISK people only and during a specific time period. This number is similar to the **morbidity rate** of a disease which is reported in the United States as a number per 100,000 people, rather than as a percentage. This allows one to easily compare the incidences of different diseases. It is a way of quantifying **how infectious a disease is and how easily it is spreading amongst at specific at risk population.** *Remember, only people who are still "at risk" and "currently free of of the specific disease" have the potential of getting the illness for the first time or getting a repeat infection.*

$$\textbf{\% Incidence Rate} = \frac{\textbf{\# of NEW cases}}{\textbf{\# of individuals in the "At Risk" Population}} \times 100\%$$

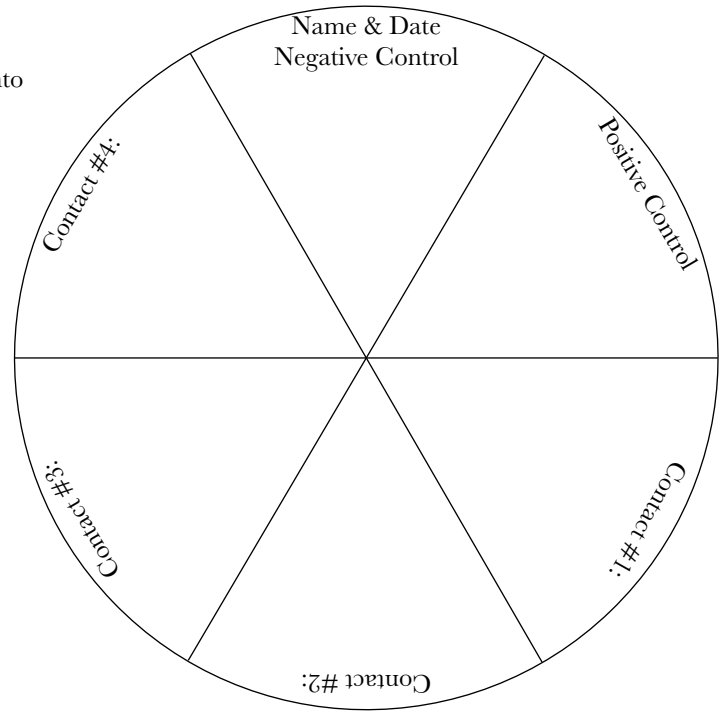
Materials:

***** Note: This experiment may be modified due to the number of students in the lab. Don't work ahead.**

Amount per Student	Material
1	Test Tube with a bacterial species in it (usually *Serratia marcescens*)
1	Nutrient Agar Plate
1	Sterile Cotton Swab
1	glove (to be worn on the left hand only). *Right hand does NOT wear a glove.*

Procedure:

1. Using the sharpie marker, divide the agar plate into **6** equally spaced pie pieces and label it as shown in the diagram:



2. For the **Negative Control**, do not touch the sector at any point during the experiment.

3. For the **Positive Control**, insert a sterile Q-tip into your unknown test tube, obtain a sample and swab the positive control sector. Only one individual should have positive growth, the rest of the unknowns samples are sterile media. KEEP this Q-tip, as we will reuse it for all the following steps.

4. For the remaining "**Contact sectors**" we will perform the following steps "**as a group**" in a coordinated fashion.
   - **DO NOT work ahead.**
   - **DO NOT take off your glove till everyone is done.**
   - ONLY shake with your GLOVED HAND (yes this is awkward, but ~90% of people are right-handed and we are saving the right hand for the more delicate step of swabbing sectors and writing).

5. **As INSTRUCTED do the following steps at the same time as everyone else:**
   - A. Insert a sterile Q-tip into your test tube and swab your GLOVED HAND generously. For this lab only, it is okay to leave the Q-tip in the test tube and reuse it for each handshake.
   - B. Shake with your GLOVED HAND with a NEW person (not a problem the first time).
   - C. Swab your GLOVED HAND with a NEW sterile Q-tip and inoculate sector 1.
   - D. Write the number of the person you shook hands with on sector 1.
   - E. Repeat steps A, B, C, and D for sectors 2, 3, and 4 (DO AS A GROUP AS INSTRUCTED).

6. Incubate the petri dish at room temperature for 1 week, and interpret during the next lab.

Lab 3 Questions (**Due at the end of this lab**)

Name: _____ **Grade:** _____ **of 10 points**

1. (10 points) The following chart of a population of 18 individuals has information about a spreading infection due to contaminated handshakes. One person is infected prior to the first handshake and this is the "INDEX CASE" (sometimes called "PATIENT 0"). The Index Case will have a "+" in the positive control column. If the bacteria is found on the person's hands they will have a "+", and a "—" means no bacteria is present. Contact data is also provided. Based on this chart of information answer the following questions. Blocks not needed are shaded grey, and there are no external contaminants found as evidenced by all patients having a "—" result in the negative control column. Formulas for % prevalence and % incidence rate should be memorized and are on page 1 of this handout. Complete the bottom of the chart. Use a calculator as needed. Dead people are NOT counted anywhere in this!!!

Culture # / Patient #	Negative Control	Positive Control (Contact 0)	Handshake 1	Handshake 2	Handshake 3	Handshake 4
1	—	—	— , 17	— , 18	+ , 2	— , 3
2	—	—	— , 5	+ , 6	+ , 1	+ , 4
3	—	—	— , 10	— , 17	— , 16	— , 1
4	—	—	— , 18	— , 16	— , 13	+ , 2
5	—	—	— , 2	— , 8	— , 11	— , 7
6	—	+	+ , 14	+ , 2	+ , 17	dead , 13
7	—	—	— , 12	— , 15	— , 18	— , 5
8	—	—	— , 9	— , 5	+ , 9	+ , 15
9	—	—	— , 8	+ , 14	+ , 8	+ , 11
10	—	—	— , 3	— , 13	+ , 14	+ , 18
11	—	—	— , 13	— , 12	— , 5	+ , 9
12	—	—	— , 7	— , 11	— , 15	+ , 14
13	—	—	— , 11	— , 10	— , 4	+ , 6
14	—	—	+ , 6	+ , 9	+ , 10	+ , 12
15	—	—	— , 16	— , 7	— , 12	+ , 8
16	—	—	— , 15	— , 4	— , 3	+ , 17
17	—	—	— , 1	— , 3	+ , 6	+ , 16
18	—	—	— , 4	— , 1	— , 7	+ , 10
# of TOTAL "+" Cases		1				
TOTAL Population		18				
# of NEW "+" Cases		1				
Number in "At-Risk" Population*		18				
% Prevalence		5.5%				
% Incidence Rate		5.5%				

* The number of patients in the "At-risk population" is simply the number of "—" patients in the previous column. If you are an "at-risk patient, then it means you are Alive, Healthy, and Potentially able to get infected by a "+" individual in the next time frame. It may happen, or it may not. Thus the % incidence rate" informs you how "contagious" a disease is. The % prevalence rate only tells you how "common" a disease is. For example, a Rhino virus that causes a cold is very common and very contagious, but the 2020 Corona Virus is actually rarely the cause of a cold (about 15% of colds), but it is also very contagious, with a higher mortality rate.