1. In this lab, what is the “disease” being spread from person to person by shaking hands?

2. What will we use to detect whether a person is infected with this “disease”?

3. What part of the heart produces the sounds of a heart beat?

4. What two pieces of equipment will we use to measure blood pressure?

5. What is the objective of the Harvard Step Test?
Lab #9: Epidemiology & Cardiovascular Fitness

Objectives
1. Epidemiology:
   a. Perform a classroom simulation of the spread of a disease in order to practice tracking the disease back to the first infected individual.
2. Cardiovascular Fitness:
   a. Listen to and understand the sound of a human heartbeat
   b. Measure your pulse rate and blood pressure

§

Part I: Epidemiology

Epidemiology is only one branch of the study of disease. It is the study of the spread of disease. This exercise is designed to demonstrate how an epidemiologist might track the spread of a communicable disease back to the original source.

1. Each person will receive a dish that is identified with a number and filled with a clear liquid. All but one of the dishes will contain water. One dish will contain a solution of starch. This solution represents the "disease" we will be tracking. We will be unable to visually discriminate between the water (healthy individuals) from the starch (sick individual). Write down your I.D. number on your data sheet.

2. Put a clean disposable glove on the hand you do not write with. Thoroughly smear the palm and fingers of the glove with the liquid.

3. You will shake gloved hands with three different people. When you shake hands, smear the palms of your gloves together as well as possible. You must shake hands with all three contacts before your glove dries out, within a minute or so. Don’t rewet your glove in your dish after shaking hands with anyone! Record your contacts' I.D. numbers and the order in which you came in contact with them on your data sheet.

4. Once everyone has finished shaking hands, you will bring your glove up to the instructor's desk for "diagnosis". We will use iodine to test for the presence of the "disease" (starch) by placing a few drops on the palm of the glove. Contact with the "disease" will be indicated by a bluish-black precipitate formed in the presence of the starch (remember our biochemical tests lab?).

5. If you tested positive for being infected with the disease, report the I.D. numbers of those you shook hands with. We will use this information to determine the initial carrier of the disease.

6. Identify the initial carrier by a process of elimination. Any "sick" individual who came in contact with someone who was not infected will not be the initial carrier. Continue to eliminate individuals based on the order of their contacts.

To consider when determining the initial carrier: 1) the initial person will infect a different person each and every round. 2) The initial person infects only one other person on the first round. 3) An infected individual who contacted someone not infected, is not likely to be the initial carrier.
Data Sheet
Lab #9: Epidemiology

Your Name: __________________________
Your ID#: __________

ID Numbers and Names of those you contacted: ID Number and Name of Initial Carrier:
1. ________________________________
2. ________________________________
3. ________________________________

<table>
<thead>
<tr>
<th>ID Number and Name of those infected</th>
<th>Round 1</th>
<th>Round 2</th>
<th>Round 3</th>
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</table>
Questions to review:

1. What is the pathway of infection in this lab?
2. Is it possible in this exercise to determine a single person as the initial carrier is? Why or why not?
3. Discuss at least 2 reasons why this lab is limited as a model for the spread of disease.

Part II: Cardiovascular Fitness
Work in-groups of two

Activity 1: Heart Sounds
A. The normal sounds are produced by the closing of the heart valves. Look at the heart diagram below and find the valves, noticing their specific location and structure.

4. For each chamber of the heart, identify its location and determine the direction that blood flows through the heart.
5. Describe what would occur to blood flow in the heart if the valves fail to close properly?

In the diagram below, number the text labels from 1-12, according to the flow of blood through the heart. Start by writing the number “1” next to both the Superior and Inferior vena cava. Continue numbering each label in the proper “blood flow” sequence.
B. Obtain a stethoscope and listen to your own heart. The instrument must be placed directly against the skin for best results. You should be able to distinguish two heart sounds. The first sound occurs when the ventricles contract (systole) and the A-V valves snap shut. The A-V valves closing produce a low-pitched sound, the “lub” sound.

The second sound occurs when the ventricles begin to relax (diastole) and the semi-lunar valves snap shut. The closing of the semilunar valves produce a “dub” sound.

You should now be able to hear the typical “lub, dub” sounds of the heart. These two sounds should be “crisp”. Any slurring of lisping sounds are called murmurs.

6. Explain what causes the heart valves to open and close. (Hint: think of the changing fluid pressure inside the heart chambers as the heartbeats)

7. How might a serious heart murmur affect one’s health?

Activity 2: Heart Rate/Pulse Rate and Blood Pressure

A. Heart rate/Pulse rate

When the heart pumps blood into the arteries, the walls of the arteries are pushed outward by the wave of the blood. The heart rate is determined by counting the number of waves that pass a given point in one minute. Place your three middle fingers on the wrist so that their tips are just below the thumb. Find a place where your fingers feel the pulse and count the number of pulses in one minute. Record below.

__________________________ Resting pulse rate (pulses/minute)

B. Blood pressure

The heart creates blood pressure when it pumps the blood into the arteries. Because the walls of the arteries are elastic, they expand outward to accommodate the blood pumped during the heartbeat. In this lab exercise one student will use a blood pressure cuff and stethoscope to measure another student’s blood pressure. Each student should have their blood pressure measured and record the results below.

Your blood pressure (Systolic/Diastolic) _______________

8. How does a blood pressure cuff work to help measure blood pressure?

9. What do the two numbers of blood pressure represent?

10. What would happen to blood pressure if someone were in an accident and their body lost a large amount of blood? (This situation results in the physiological response called”shock”)

Activity 3: The Harvard Step Test

A. The step test

When a person is in good physical condition (capable of strenuous and sustained physical activity) the resting pulse is slow and returns rapidly to the resting state after exercise. The objective of the Harvard Step Test is to measure a person’s cardiovascular and fitness health. To perform this test you and your group will need a bench or step about 15-20 inches high, a stop watch, and this handout to record pulse rates at set times.

The test is conducted as follows:

A. Step up onto the bench once every two seconds for 4 minutes (120 steps at a rate of 30 steps per minute).
B. Have someone help you keep the required pace. Step up from the floor onto the bench and back down again is one step. Do not jump up and down. Raise both feet to the step before putting one back on the floor. If you get too tired to go on, please stop the test.

C. After the test sit down in a chair and take your pulse as follows:

1. One minute after finishing, count your pulse for 30 seconds and record here ________.
2. Two minutes after finishing, count your pulse for 30 seconds and record here ________.
3. Three minutes after finishing, count your pulse for 30 seconds and record here ________.
4. Add up all of your counts for the 3 steps above and record here. ___________

B. Determining your Recovery Index (RI)

Calculate your RI by the following equation:

$$RI = \frac{\text{Duration} \times 100}{\text{total counts} \times 2}$$

Duration is 240 seconds (if you completed 4 minutes)

Example: $$(240 \times 100) / ([75 + 55 + 36] \times 2) = 24,000/325 = 74.$$ 

The following table lists RI’s for 16 yr old athletes

<table>
<thead>
<tr>
<th>Sex</th>
<th>Excellent</th>
<th>Above Average</th>
<th>Average</th>
<th>Below Average</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>&gt;90</td>
<td>80-90</td>
<td>65-79</td>
<td>55-64</td>
<td>&lt;55</td>
</tr>
<tr>
<td>Female</td>
<td>&gt;86</td>
<td>76-86</td>
<td>61-75</td>
<td>50-60</td>
<td>&lt;50</td>
</tr>
</tbody>
</table>

12. Why does the heart rate change for the three readings taken after the step test?

13. If you are more fit how would your three pulse readings be different than someone less fit?

14. Knowing the function of the circulatory system and knowing that cigarette smoke contains tars and carcinogens that accumulate in the tiny air sacs of the lungs, describe how smoking would negatively affect your cardiovascular health, your fitness and your susceptibility to lung infections.