**Names:\_\_\_\_\_Colin Quinn\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Epidemiology study guide 2021**

**Using the Simbio “Epidemiology” simulation, please answer the following questions about epidemiology as you proceed through the simulations (3 sections).**

**Section1: Pathogens and Infectious Disease**

**A. Terms: Please define the following:**  
a. pathogen : a biological agent that produces a disease in its host

b. microorganism : an organism too small to be seen with the naked eye and requires a microscope.

c. infection*:* when a pathogen invades and reproduces within a host, causing damage.d. host: an organism on or in which a parasite lives.e. Centers for Disease control (purpose of CDC) Agency : track and analyze human diseases

f. epidemiology : the study of the distribution, causes, and risk of health-related events.

g. epidemic : when a disease infects an increasing / unusually high number of individuals in a population.

h. pandemic: an epidemic that spreads to multiple continents or worldwide.

i. SARS-CoV2 (what it is and what it stands for): Severe acute respiratory syndrome coronavirus 2

j. COVID19 (what it stands for and symptoms): CoronaVirus Disease 2019. Fever, coughing trouble breathing, and fatigue.

j. spillover event: an event during which a disease that is caused by a pathogen typically infecting one species can suddenly infect other species.

k. virus: DNA or RNA surrounded by protein coat that can hijack a host cell to reproduce.

l: bacteria: prokaryotic single-celled organisms

m: binary fission: a cell that replicates its DNA and the splits in half, a copy of the DNA goes to each of the daughter cells.

n. fungi: eukaryotic organisms that include yeast, mushrooms, and molds.

**B. Questions:**

1. Compare and contrast binary fission and viral replication. Viral replication requires binary fission to duplicate and infect the host.

2. Why don’t antibiotics work on viruses? Also, using the image in section 1, slide 7, what are some of the common ways that antibiotics might work? Viruses don’t have cell walls to be attacked by the antibiotics. They usually go for the walls that protect the cells.

3. Why is it difficult to design drugs against fungi, helminths, viruses, and protozoa (compared to the drug used to treat prokaryotes—antibiotics): They use different types of gene injection compared to prokaryotes, that are very similar to our cells.

4. For humans, what are the two types of immune responses? Describe their characteristics. Adaptive is immunity that is developed through our lives, likely due to exposure or vaccinations. Innate is rapid and generic, we are typically born with them

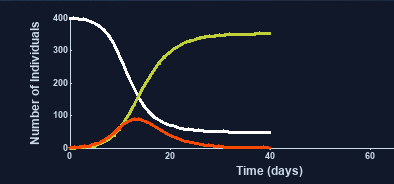
5. Click on the images for first exposure and subsequent exposure in slide 8. Why does the immune system respond more rapidly/robustly for the subsequent exposure than the first one? Compare and contrast these two processes. The body has to first identify what is wrong before trying to solve it, while once a body has fought something off, it can remember how and use the same strategy for next time.

6. Use this space to record any questions that you have. Use Google to find the answers and report those here, also providing the link to a credible source.

**Section 2: Modeling Epidemics**

1. What is the impact of recovery on modeling the number of susceptible vs. infected individuals? What is the impact of death? With less susceptible, the amount of infected individuals will drastically decrease. Similar results are seen with death.

2. What is the purpose of a SIR model? What do the terms S, I, and R refer to? Susceptible, Infected, Recovered. It helps get an understanding of the potential future of the disease.

3. Draw a typical curve of a) # of susceptible individual vs. time. b) # of infected people vs. time and c) # of recovered people vs. time. 

4. In disease modeling, what are the three factors that determine the course of an infectious disease epidemic? And how each of them affect the proportion of population infected and how fast the disease spreads. Susceptible, Infected, Recovered. The amount of people that are able to be infected greatly impacts the spread of the disease.  
5. What are the three parameters used to predict the daily new infection values in the simple SIR model? Population density, transmission rate, and infectious period.

6. What are the three assumptions of the simplest SIR models?

7. What is R0? What is the minimum value of R0 if a disease will spread through a population? R0 = SBL. Define the terms. Basic reproductive number, where S = susceptible, Beta = transmission rate, and *L* = infectious period

8. How does vaccination affect Ro? What is the critical immunization threshold? How is the critical immunization threshold determined by Ro? Vaccination decrease the amount of susceptible hosts. CIR is the amount of people needed to be immune for the disease to no longer thrive.

9. What are some of the challenges of COVID-19 disease models? It has been changing consistently as we did not know very much about the disease in the earlier stages.

10. How do births and deaths factor into SIR models? How is this influence displayed on a graph of the number of measles infections over time as the birth rate is adjusted to be higher than the death rate? Newborns do not have immunity, thus increasing the amount of susceptible population.

11. Use this space to record any questions that you have over this section. Use Google to find the answers and report those here, also providing the link to a credible source.

**Section 3: Controlling Disease Spread**

1. How is herd immunity established? When the amount of infected is diminished by those who are either recovered or vaccinated.

2. What is the critical immunization threshold? Why does this vary between different diseases? What equation displays pc ’s relationship to R0? Minimum proportion of a population that must be immune to achieve herd immunity. P = (1- 1/R0)

3. Why is R0 so difficult to estimate? There are many variables in finding a model that is accurate.

4. What effect did social distancing/mask wearing have on the simploid model? Drastically decreased the initial spike in exchange for prolonged exposure. Or with both, significantly less exposure.

5. What does it mean to flatten the curve? What are some reasons why it might be desirable to flatten the curve? So that less people will be affected earlier when there is less known information about the disease.

6. What are examples of community mitigation strategies? Social distancing and mask wearing.

7. Use this space to record any questions that you have over this section. Use Google to find the answers and report those here, also providing the link to a credible source.