# Lesson 4

## Herd Immunity

Hilleman & Vaccines

Student Pages

## What is Herd Immunity?

Herd immunity is a threshold at which enough of a population is immune to a disease to make the spread of the disease unlikely (McPhillips, 2021), or the number of people who are still vulnerable is too small to have continued outbreaks. In general, epidemiologists do not speak of herd immunity without vaccinations, because immunity through exposure has never resulted in herd immunity before. Medical professionals prefer to call it herd protection, because immunity does not just happen for everyone, but if a large portion of the population is protected, then the most vulnerable people, who cannot use or respond to the vaccine, are less likely to contract the disease (Aschwanden, 2020).

Based on other coronaviruses that cause the common cold, immunity lasts for approximately one year. In that scenario, the population will not reach herd immunity through transmission. For COVID-19, we do not actually know yet. In a community, when the number of people who are immune or vaccinated falls below the herd immunity threshold, outbreaks can happen in that community (Aschwanden, 2020). At this time, approximately 70-85% of the U.S. population would need to be infected and recover from COVID-19 or be vaccinated. By the end of 2020, about one third of the U.S. population is estimated to have been infected (McPhillips, 2021), which has resulted in 511, 839 deaths (CDC, 2021). So far, 7.7% of the U.S. population has been entirely vaccinated (CDC, 2021).

There is still much to be accomplished to prevent the loss of another 500,000 lives in this country alone, not to mention the aftermath for the people who suffer long-term effects from the virus. The threat of new variants can change the herd immunity threshold, so the current goal is to get people vaccinated before these variants spread too far (Aschwanden, 2021). Below is a simulation of what the spread of a new virus looks like in different scenarios and it highlights the importance of vaccination programs and why they are so successful (Wilburn & Harris, 2021). As you view the simulation, consider how many lives were saved by Dr. Hilleman who developed 40 vaccines, including eight of the 14 common vaccines received by children today.

## Run Simulations of a New Virus and Graph the Results

1. Open this website to view the simulation and consider exactly what is being studied in this simulation. https://www.npr.org/sections/health-shots/2021/02/18/967462483/how-herd-immunity-works-and-what-stands-in-its-way

2. Open a Google Sheet or an Excel Spreadsheet to create your data table and graph. Start by giving your spreadsheet a title with your last name at the end.

3. Begin creating your data table by placing a title at the top of it. The title should include all of the types of data being collected. You will find this information by studying the simulation.

4. Run the first simulation five times and record the data in your data table. The first simulation is for the original virus and has 3 different vaccination groups. Make sure you record data for all three vaccination groups.

5. Continue doing this for the next three scenarios (more infectious variant, a population already heavily exposed, a population with low initial exposure).

6. Create a graph of your data. Make sure the graph has a title and both axes are clearly labeled and have units of measurement where needed. This graph will need a legend.

## Follow-Up Questions

1. Does your data make sense to you? Why?

2. In which scenario did the least amount of people become infected? Be very specific about the details of the scenario.

3. What insights do you gain about new variants from the second simulation?

4. If vaccinating 75% of the population is considered to be herd immunity, why are there still people being infected in the first and third simulations at 75% of the population being vaccinated?

5. If 75% of the 400 people are vaccinated, how many people could be infected in the first simulation? Did your data represent that in the first simulation? How do you know?

6. If the vaccine has 94% efficacy like the current COVID-19 vaccine, and 75% of the population of 400 people are vaccinated, how many people could be infected out of 400?

## Bibliography

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McPhillips, D. When will the US reach herd immunity and what will it look like? Retrieved March 2021, from https://www.cnn.com/2021/02/26/health/herd-immunity-united-states/index.html.

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