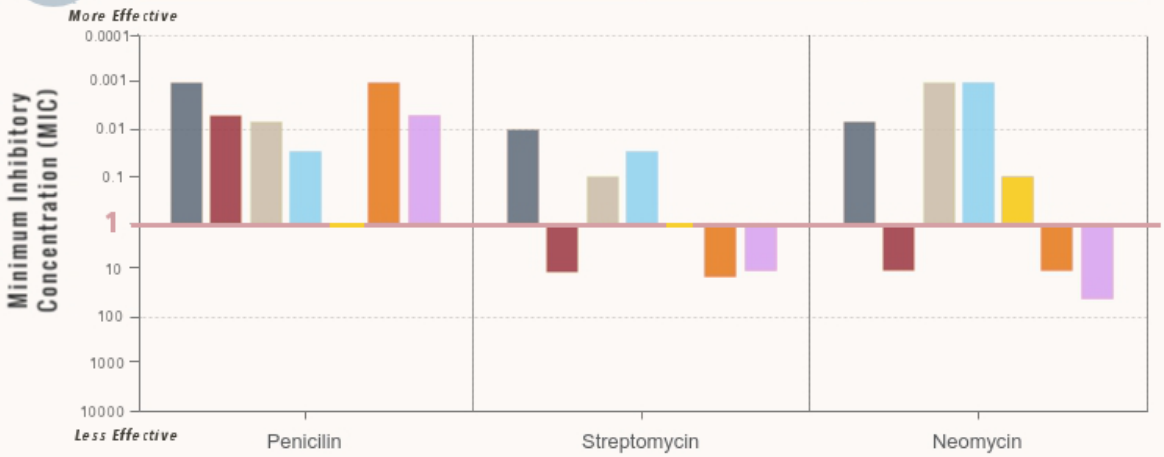
EFFECTIVENESS OF PENICILLIN, STREPTOMYCIN, AND NEOMYCIN ON DIFFERENT BACTERIA

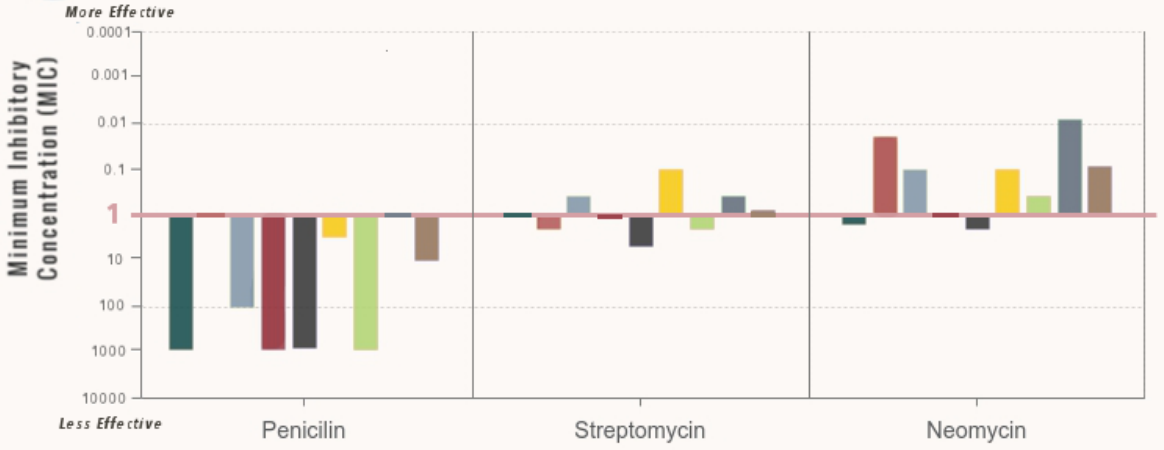
ANTIBIOTIC EFFECTIVENESS ON GRAM-POSITIVE BACTERIA



- Brucella anthracis
- Diplococcus pneumoniae
- Staphylococcus albus
- Staphylococcus aureus
- Streptococcus fecalis
- Streptococcus hemolyticus
- Streptococcus viridans

Gram-positive bacteria

ANTIBIOTIC EFFECTIVENESS ON GRAM-NEGATIVE BACTERIA



- Aerobacter aerogenes
- Brucella abortus
- Escherichia coli
- Klebsiella pneumoniae
- Mycobacterium tuberculosis
- Proteus vulgaris
- Pseudomonas aeruginosa
- Salmonella (Eberthella) typhosa
- Salmonella schottmuelleri

Gram-negative bacteria

Antibiotics Data Visualization – Elise Lee

The main purpose of this visualization is to aid viewers in seeing which antibiotic(s) are best for gram-positive/gram-negative bacteria. To best convey this comparison, the overall type of visualization is a set of two grouped bar charts. The first bar chart shows antibiotic effectiveness on gram-positive bacteria only, which means that all the bacteria in the data set that were marked "positive" in the gram staining category are represented. The second bar chart shows antibiotics effectiveness on gram-negative bacteria only, which includes all the gram-negative, remaining types of bacteria not represented in the first bar graph. Within these bar charts, to best compare the three types of antibiotics against each other, the antibiotic type (Penicillin, Streptomycin, or Neomycin) is placed on the x-axis. Then, each data point is shown as a colored bar (where the color represents the bacteria involved) above the corresponding antibiotic used. Each type of bacteria has a distinct color, marked in the legend.

By separating the data by gram-positive/gram-negative bacteria, as well as by antibiotic type used, users can better contrast the effectiveness of different antibiotics for gram-negative vs. gram-positive bacteria. A bar chart was chosen for its effectiveness in communicating comparison-based data. In addition, a grouped bar chart was chosen to emphasize similarities in data points that have the same antibiotic type and gram staining. In particular, on the first chart, it is possible to see that for gram-positive bacteria, penicillin seems to be most broadly effective. In sharp contrast, on the second bar chart, penicillin appears to be largely ineffective and neomycin appears to be a better choice for gram-negative bacteria. This information could be helpful if a researcher had an unknown gram-negative or gram-positive bacterium (within this data set) and was trying make a more well-informed decision about which antibiotic to choose to deal with the said bacterium.

In order to show meaningful differences between data points, the data was scaled and transformed by taking the natural log of each data point (x --> ln(x)). The original scale of the data, with values exceeding 800, would make the difference between a value of 0.001 and 1 on the chart almost impossible to visualize. By scaling the data logarithmically (for visual display purposes only), the huge exponential differences between data points are reduced. Next, since lower MIC values represented higher effectiveness, each data point was inverted (multiplied by negative one) so that higher bars on the chart would correspond to higher antibiotic effectiveness. The transformed values are plotted on the graph. However, the labels on the y-axis showing the MIC (Minimum Inhibitory Concentration) still reflect the true, non-transformed values in order not to mislead viewers. To emphasize effectiveness vs. non-effectiveness, a MIC of "1" (emphasized by a larger font size on the y-axis, as well as a line across the charts in a distinct color) was chosen as a zero point since it is the zero point considering the natural log transformation (i.e. ln(1) = 0). Therefore, values less than one (more effective, 0.0001 to 1), are shown as bars going up from the line, and values greater than one (less effective, 1 to 10000) are shown as bars going down from the line. This provides an especially notable contrast when looking at gram-positive penicillin (all bars going up) compared to gram-negative penicillin (all bars going down).

Since the purpose of the visualization was analyze antibiotic effectiveness considering gram-staining, the visualization design may down-play other aspects of the data. For example, because of the way the data is scaled to fit the graph, it obscures the true numeric difference between the MICs. In addition, it does not provide an immediate comparison between the efficacy of different antibiotics for an individual bacterium, since bacteria were grouped to emphasize trends of antibiotic effectiveness. Finally, although using a MIC of "1" as a reference point helps draw comparisons, there may be a more scientifically accurate MIC baseline that conveys the effectiveness of an antibiotic.

Tools used:

- *Excel (for graphing data and mathematical transformations)*
- *Photoshop (for other visual components)*