

Individual assignment critique

SI 649 W20: Information visualization

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University of Michigan

(no quiz)

(but reading is fair game for next week)

(laptops)

This week

Lecture

Individual assignment critique (booooo)
Grades out after lecture

Lab

More Altair (yaayyyy / boooooo)

Group project proposal

Must be in **same section**

Sidebar: Submission format (-10% = 3 points)

You must turn in two things:

1. Your visualization. This should be as a single 16:9 aspect ratio **PNG or PDF**.
2. Your rationale. This should be as a **text file or PDF** describes (1) the communication goals of your visualization (1–2 paragraphs) and (2) your design rationale (1–2 paragraphs).

Some notes up front

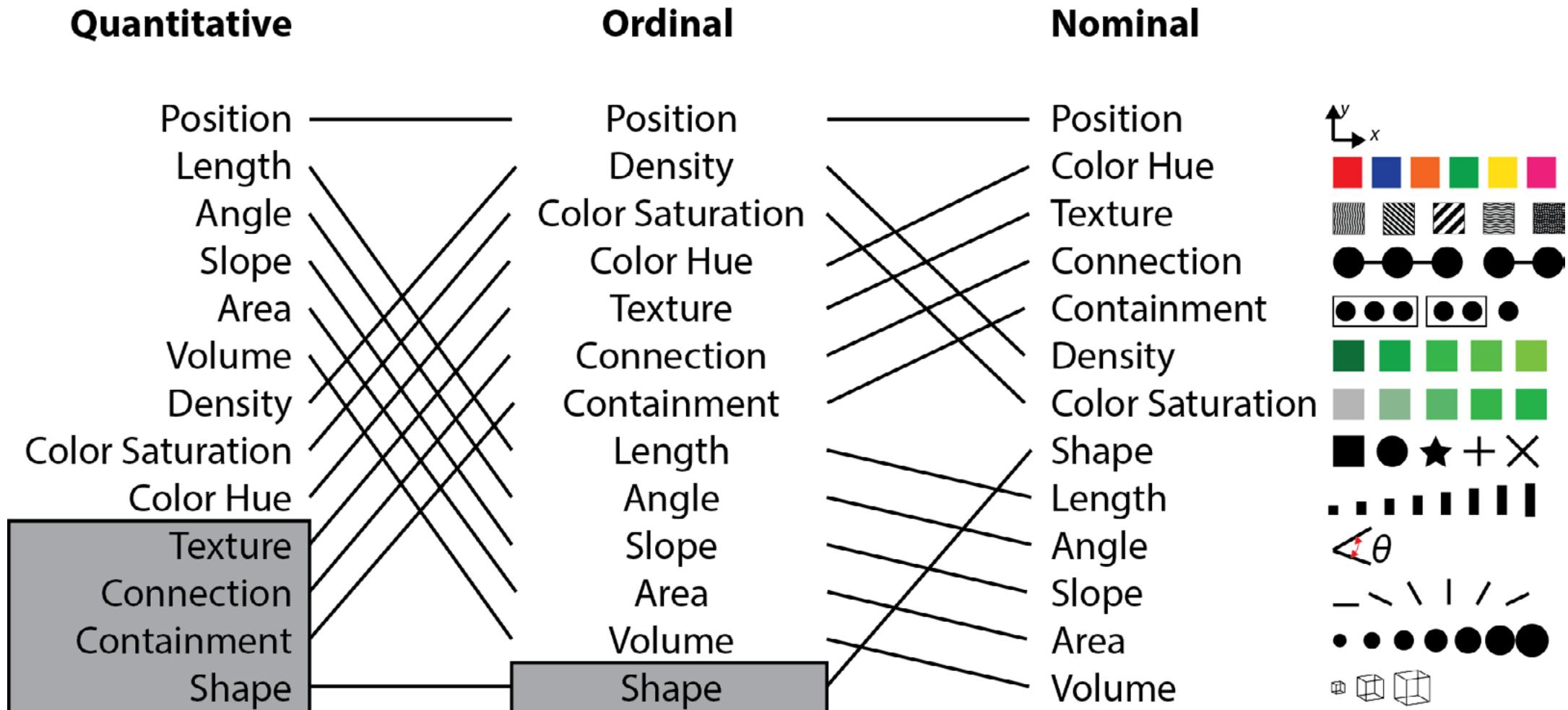
Use **layering**

Remember what is **most important** to your goals

Use **direct labels** and annotation

Remember **channel effectiveness**

Channel effectiveness



It's worth asking up front...

What are the **variables**?

What are some **communication goals**?

Which variables are **most important** to those goals?

Also:

I am going to be a little harsh

There are a lot of details to getting this right

Visualizations should be self-contained

Criteria

Clarity and Visual Hierarchy

Text and Annotation

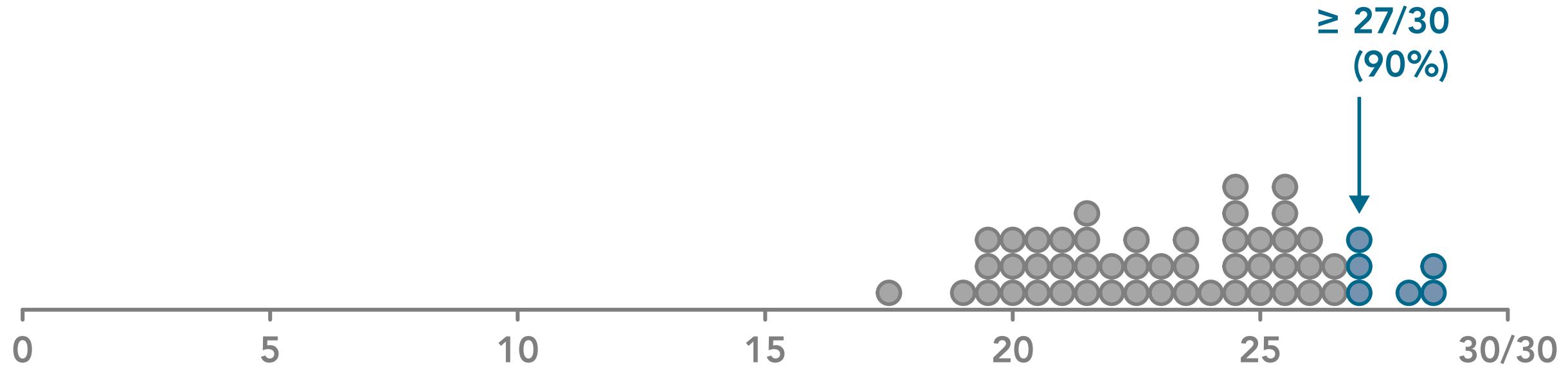
Effectiveness and Expressiveness

Visual Design

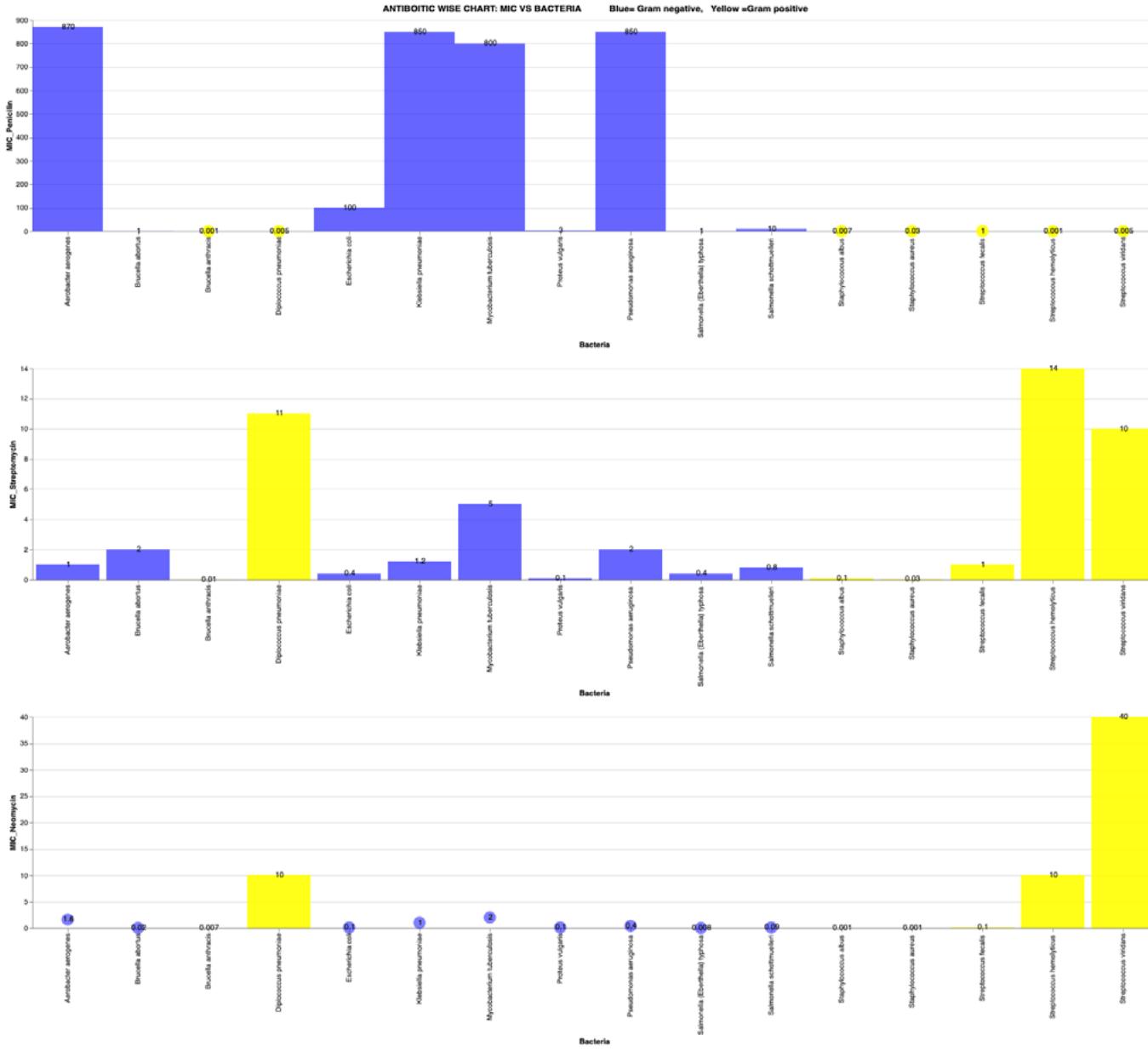
Rationale

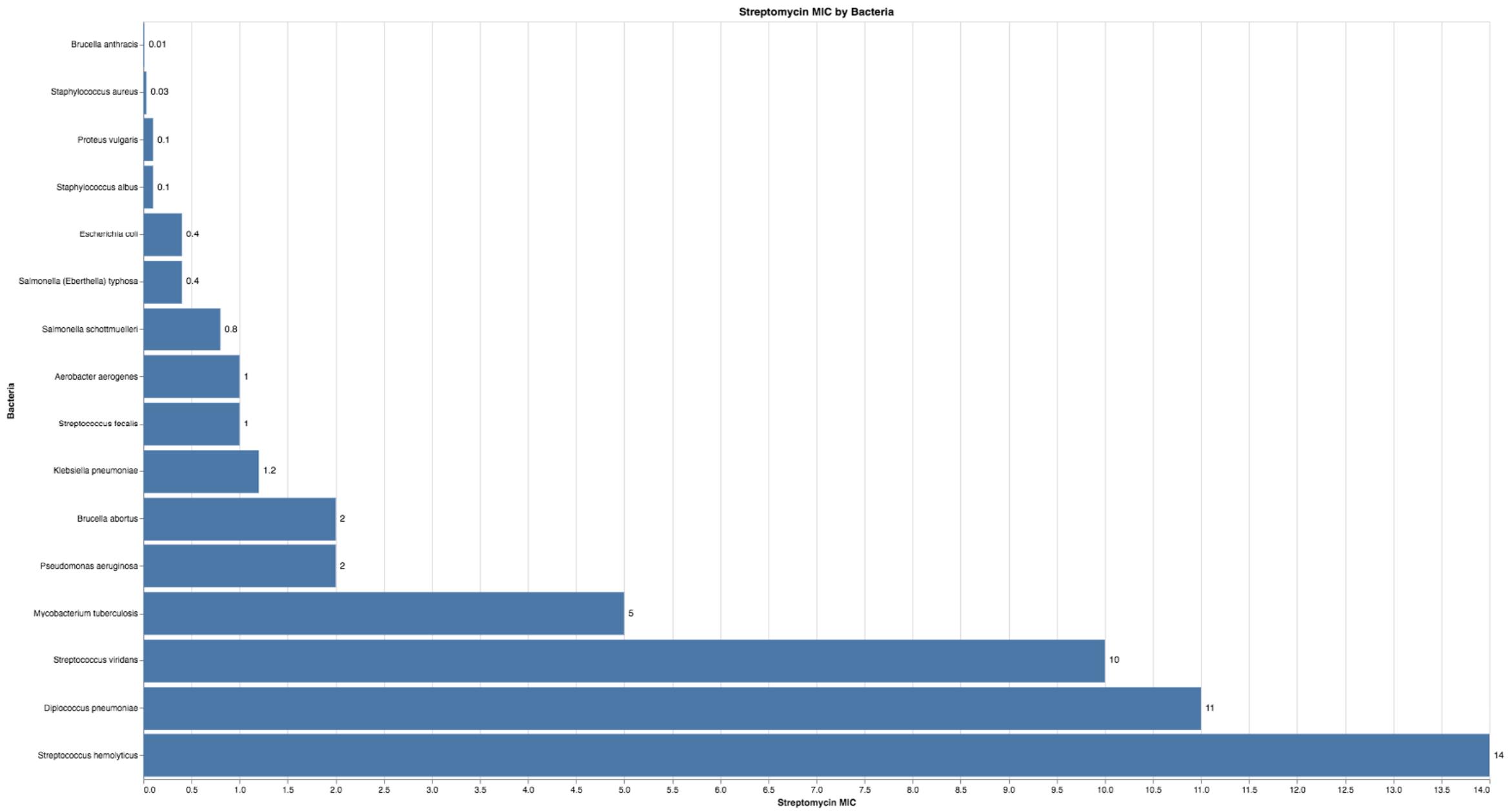
Task and Communication Goals

Round 1 grades

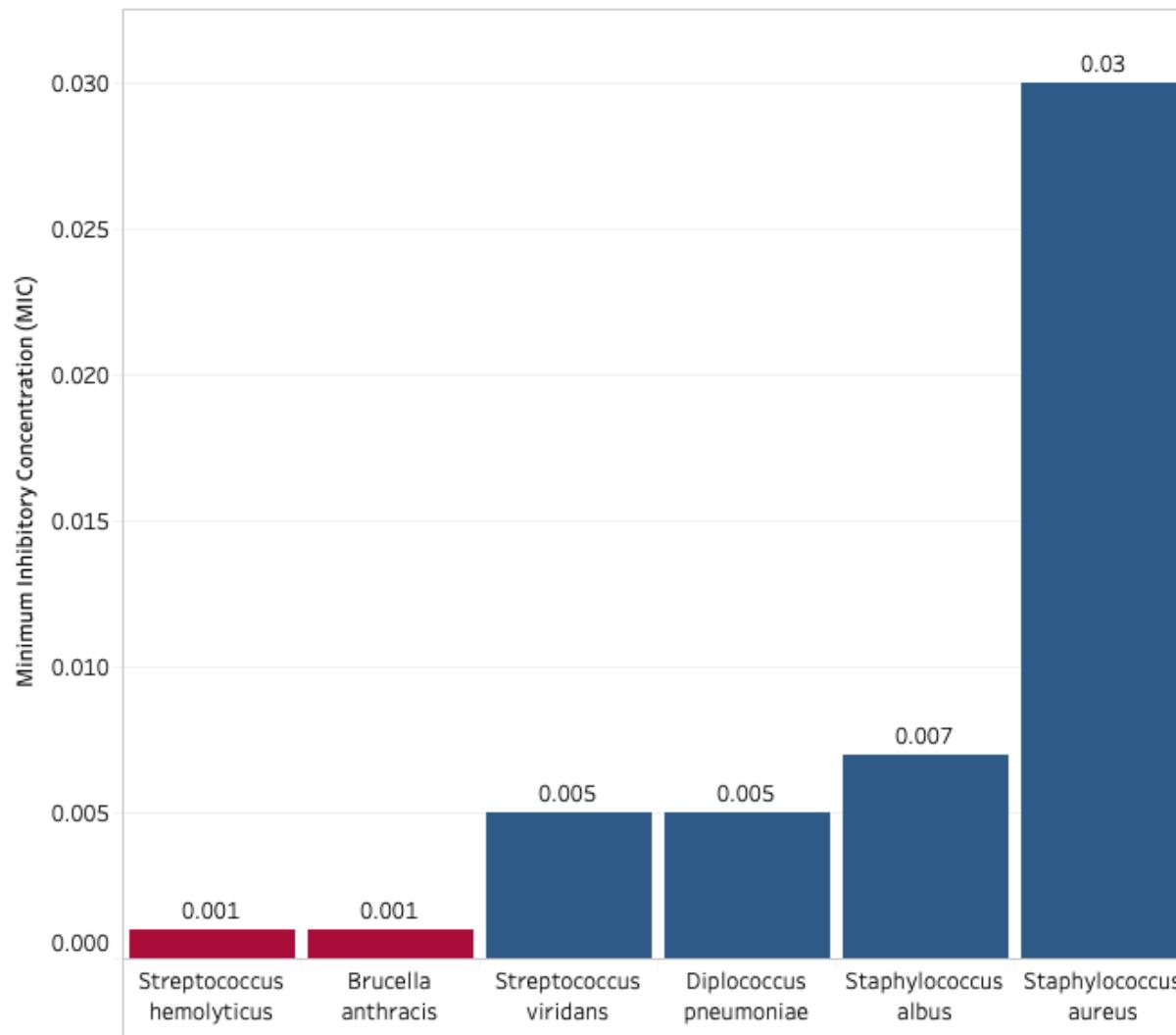


Let's start with bars mostly...

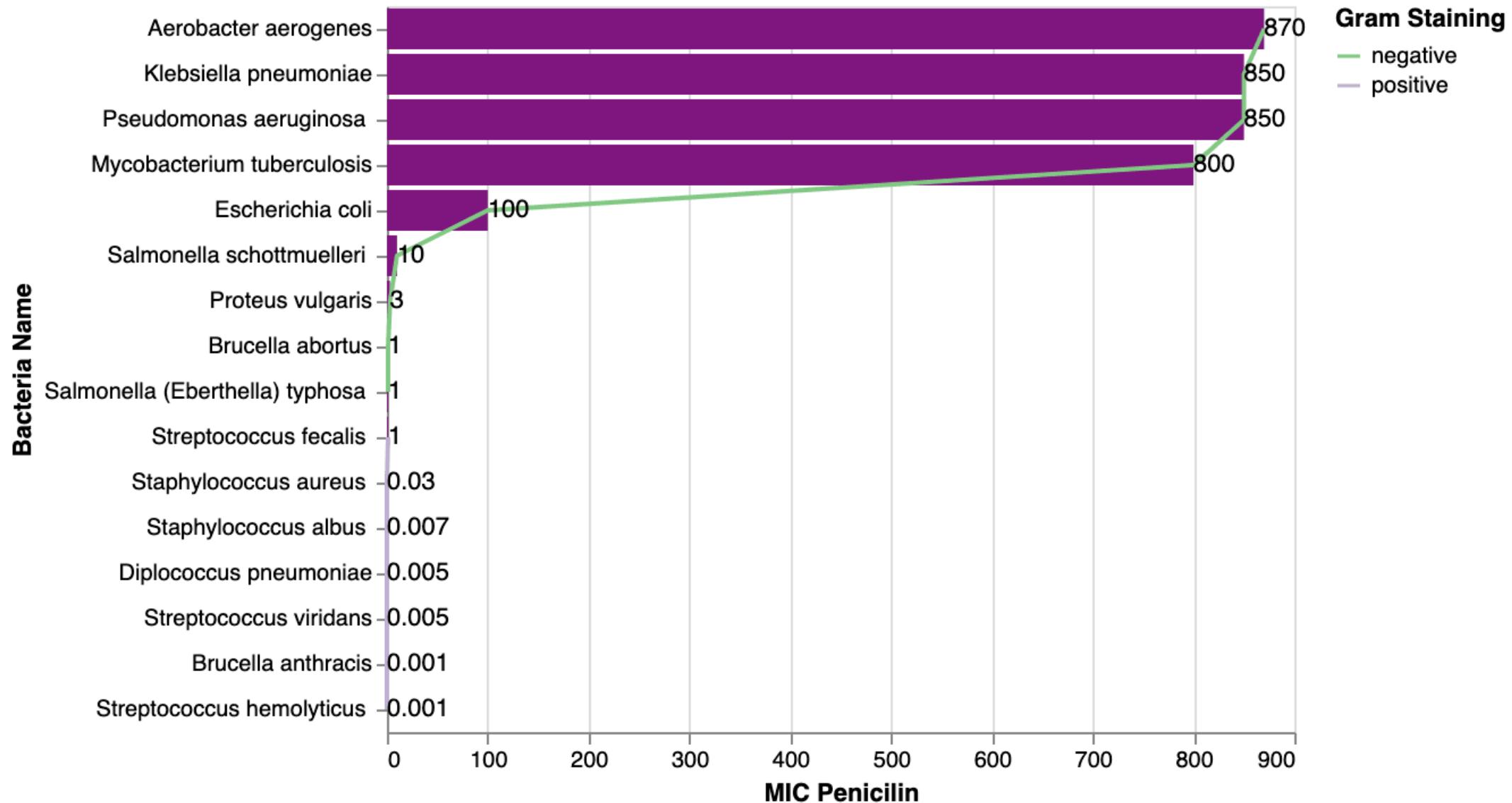




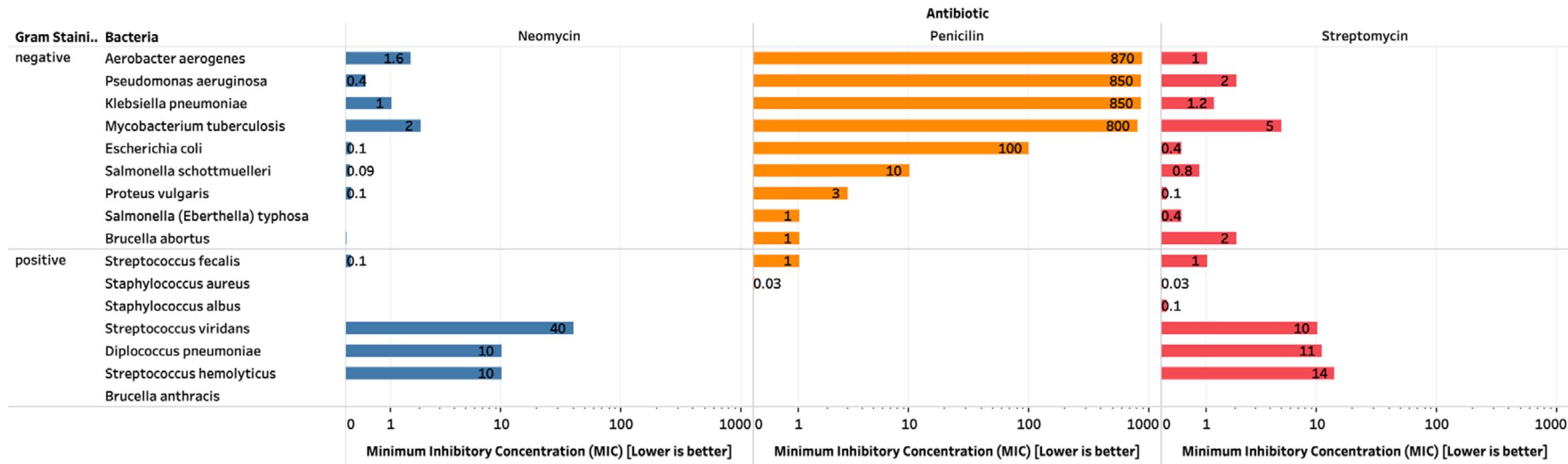
Penicillin's Effectiveness on Bacteria



Penicilin Effectiveness on Various Bacteria



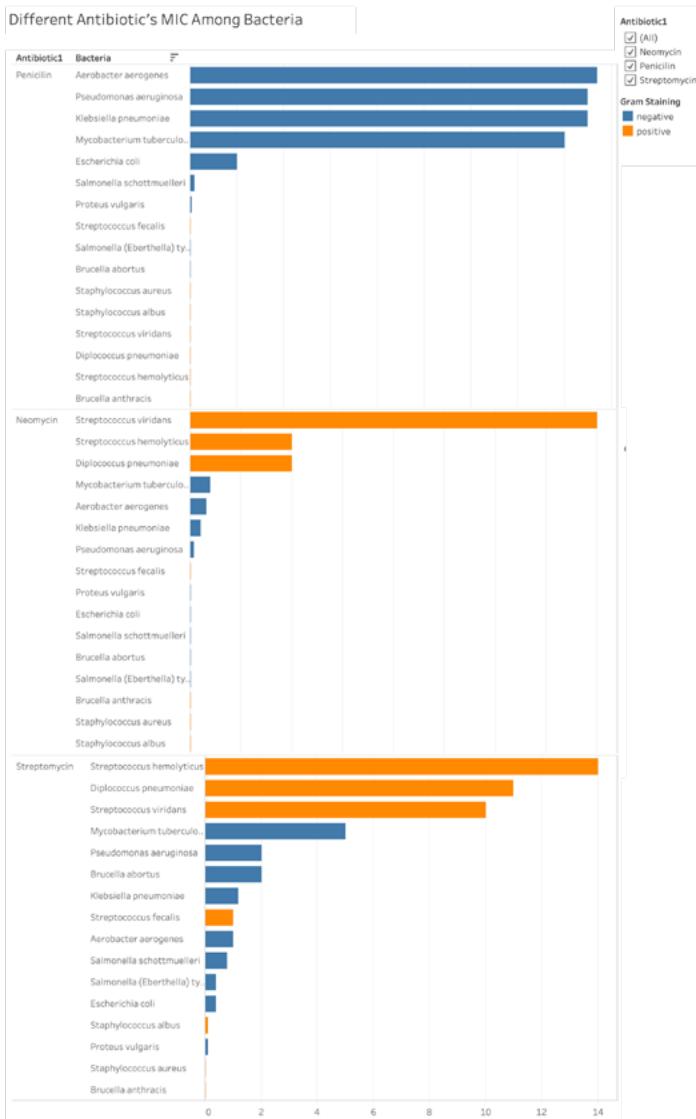
Antibiotic Efficacy on Positive Bacteria and Negative Bacteria



What is a bar on a log scale?

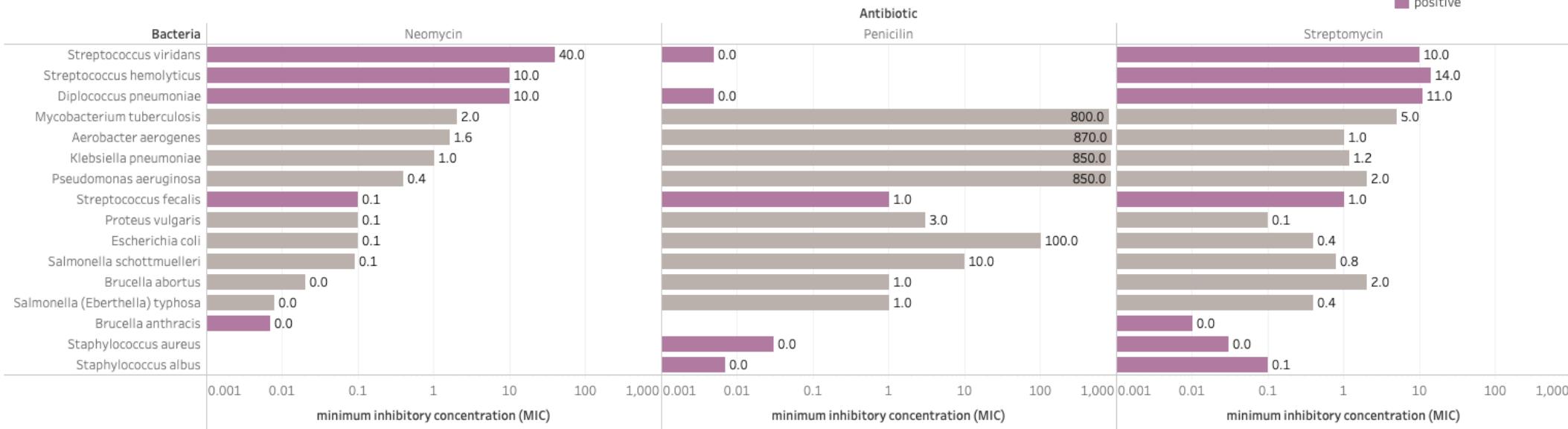
Is 0 meaningful?

Different Antibiotic's MIC Among Bacteria



Comparison of effectiveness of the antibiotic on bacteria.

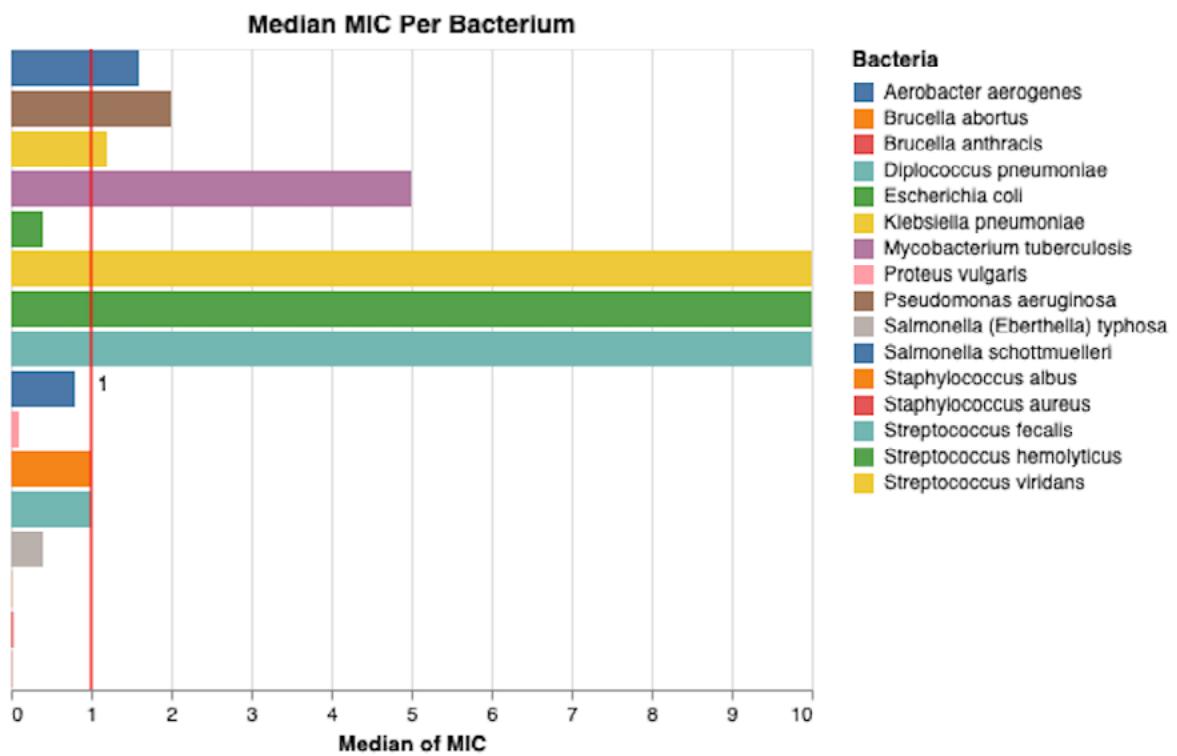
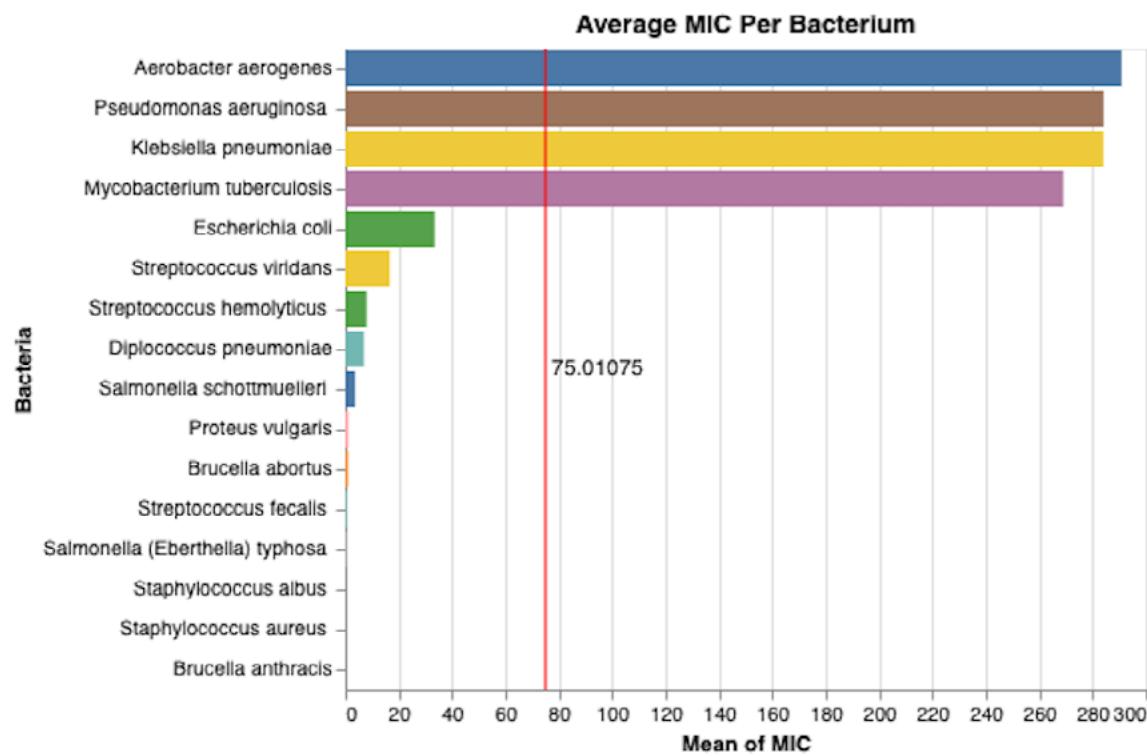
Gram Staining
 negative
 positive



Streptomycin works best for Staphylococcus aureus and Brucella anthracis.

Penicillin works best for Staphylococcus aureus, Staphylococcus albus, Staphylococcus viridans and Diplococcus pneumoniae.

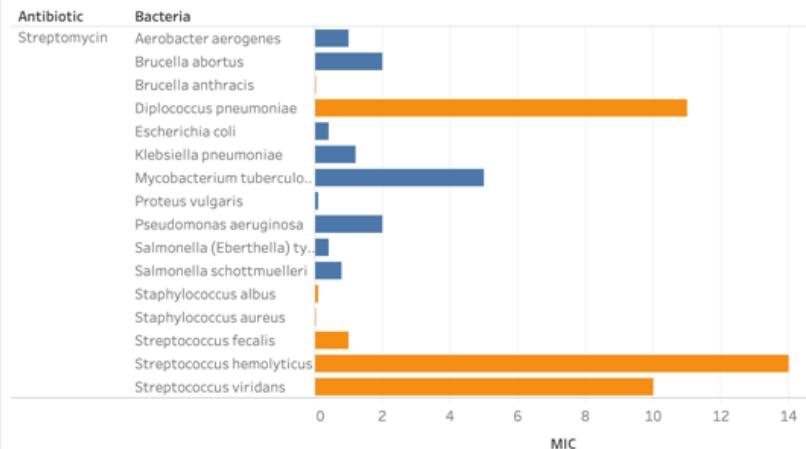
Neomycin works best for Brucella abortus, Salmonella (Eberthella) typhosa and Brucella anthracis.



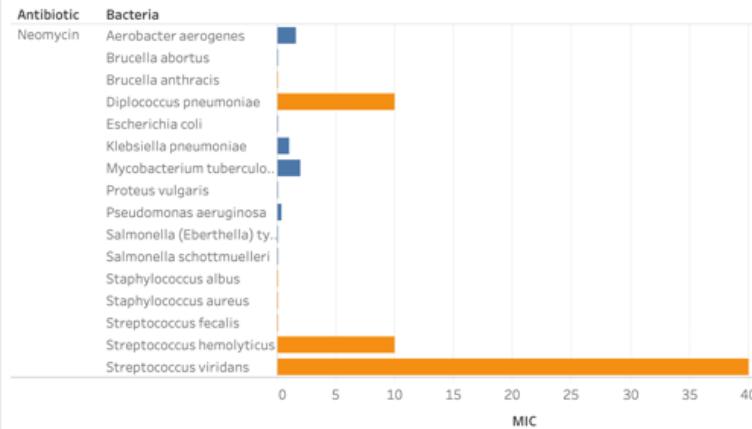
Bacteria

- Aerobacter aerogenes
- Brucella abortus
- Brucella anthracis
- Diplococcus pneumoniae
- Escherichia coli
- Klebsiella pneumoniae
- Mycobacterium tuberculosis
- Proteus vulgaris
- Pseudomonas aeruginosa
- Salmonella (Eberthella) typhosa
- Salmonella schottmuelleri
- Staphylococcus albus
- Staphylococcus aureus
- Streptococcus fecalis
- Streptococcus hemolyticus
- Streptococcus viridans

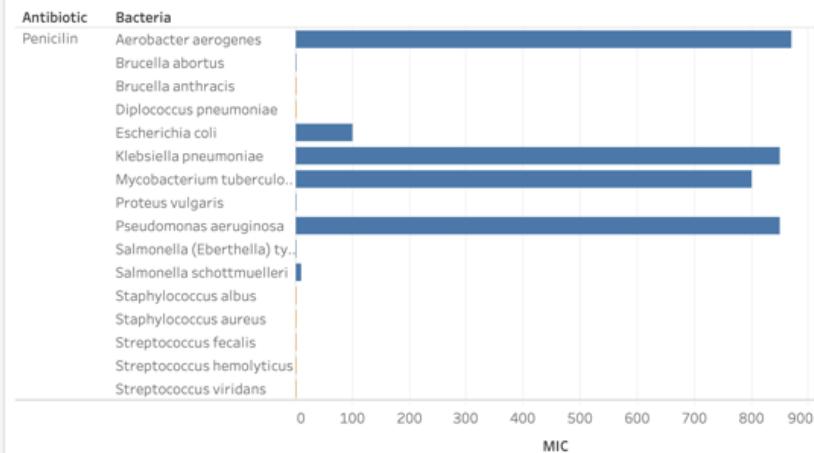
Streptomycin Effectiveness



Neomycin Effectiveness

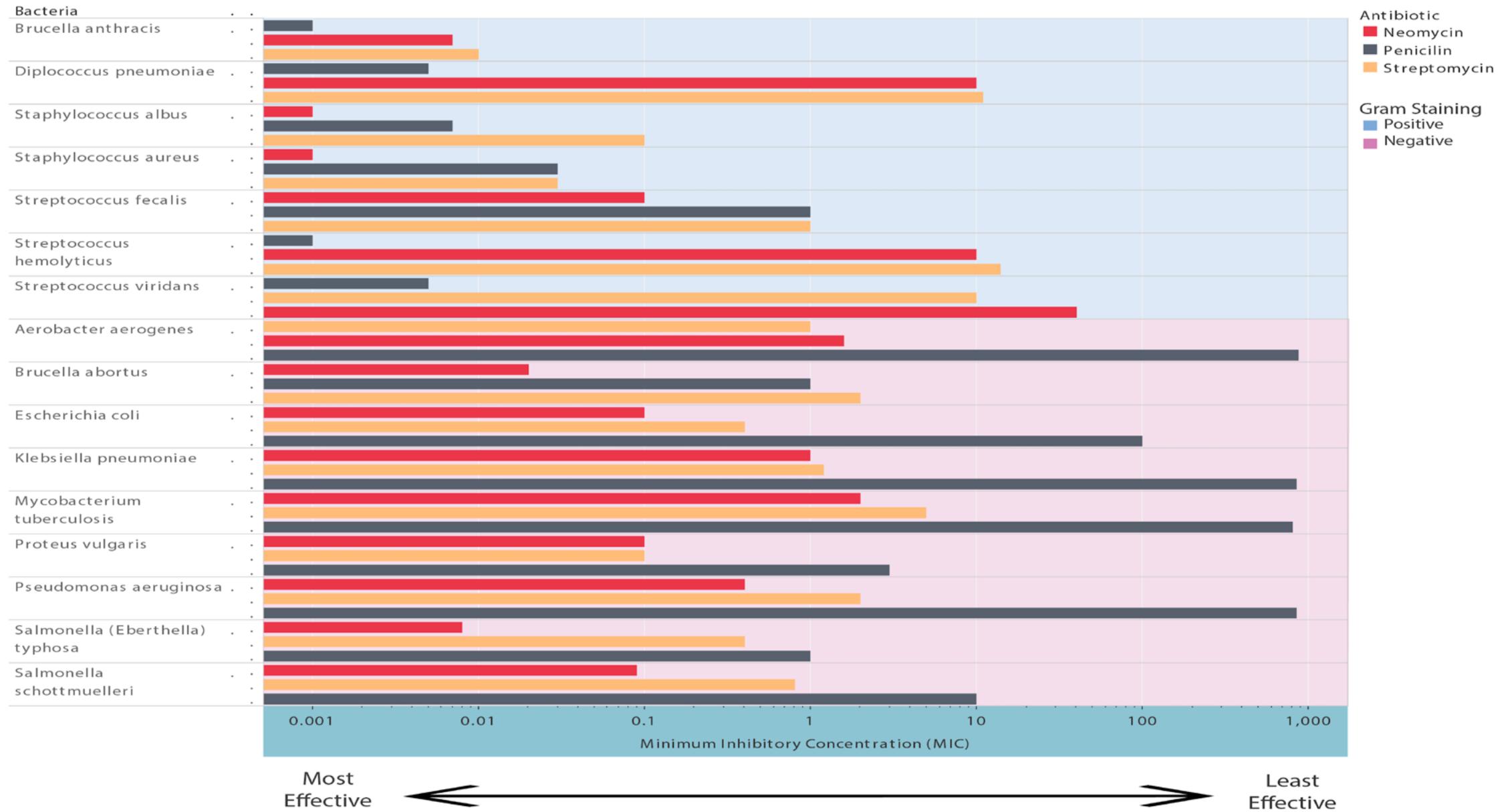


Penicillin Effectiveness



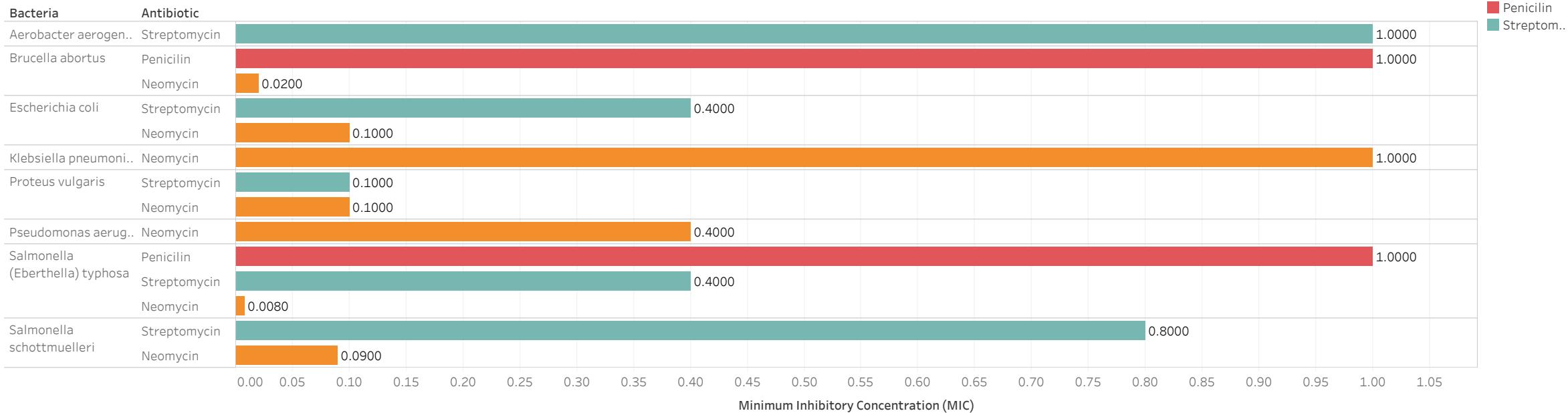
Gram Staining
█ negative
█ positive

Effectiveness of Antibiotic against different Bacteria

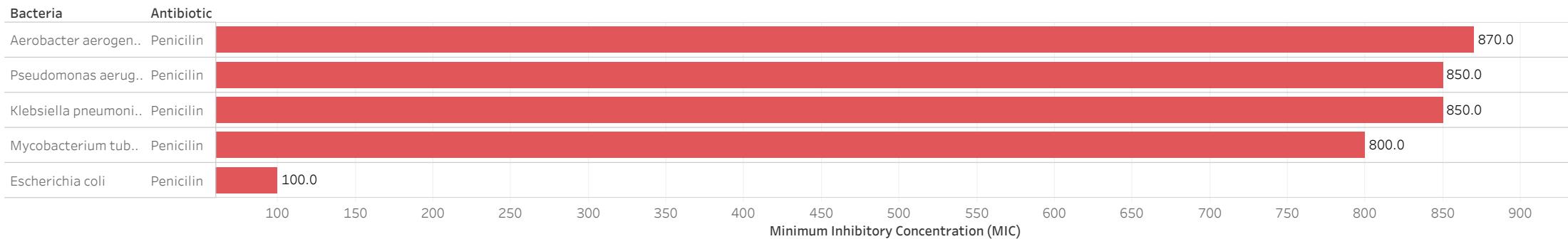


<Gram-Negative Bacteria that categorized with Antibiotic>

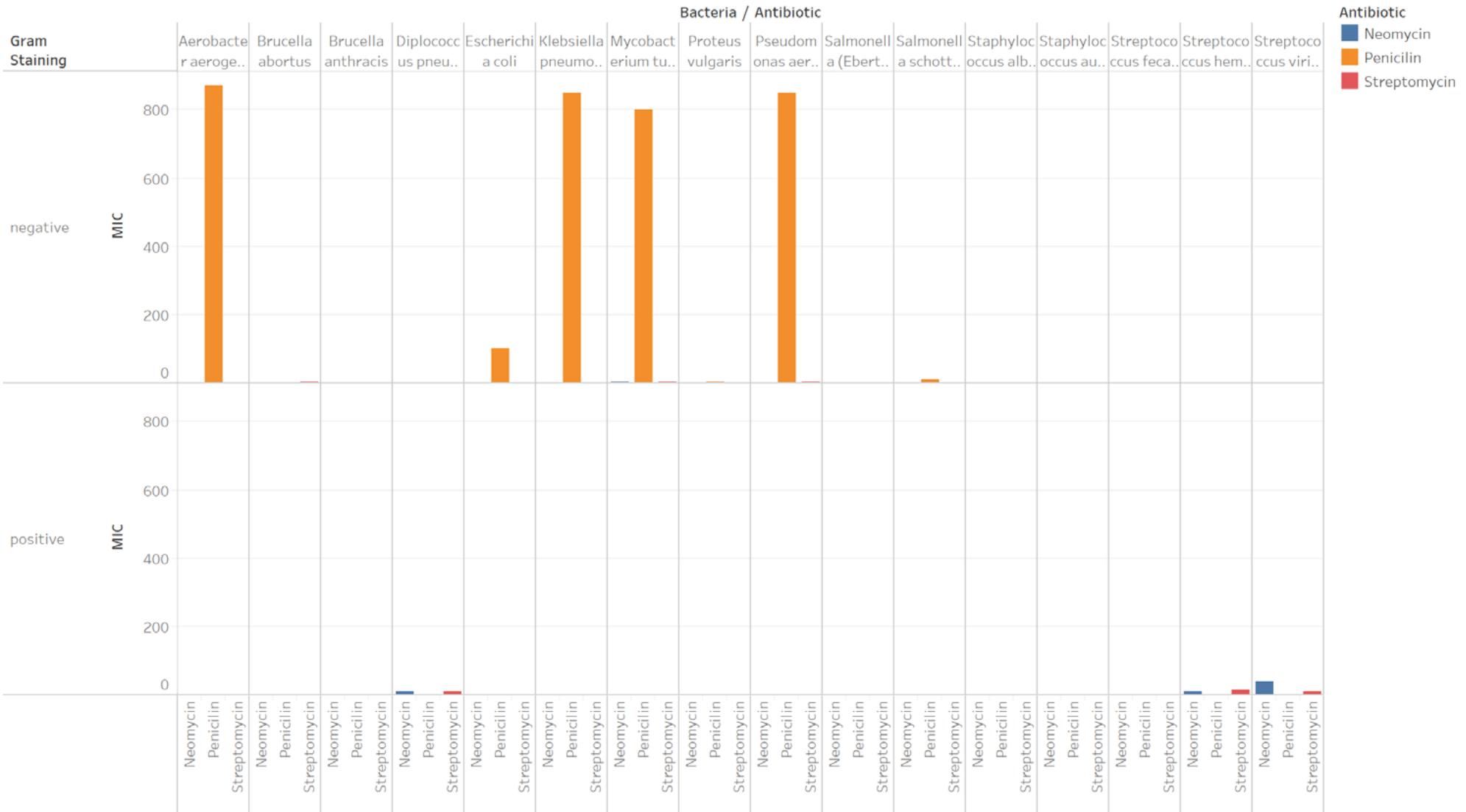
Bacterias Showed Less than 1.0 Of MIC



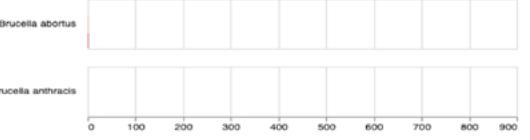
Bacterias Showed More than 50.0 Of MIC



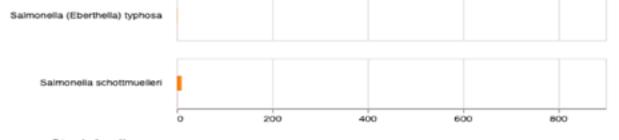
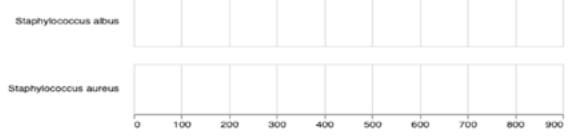
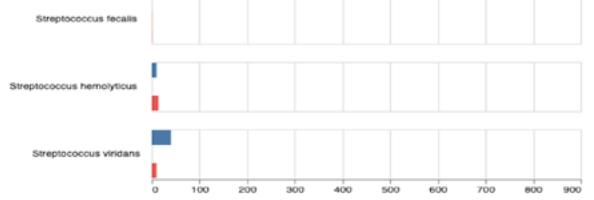
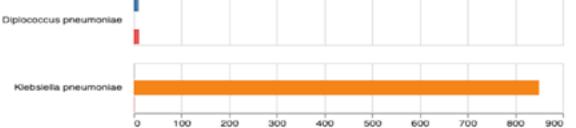
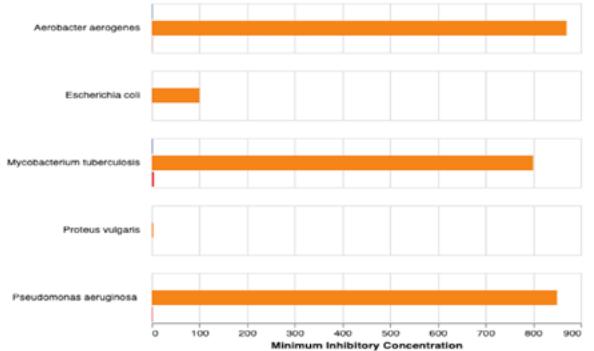
Sheet 2



Sum of MIC for each Antibiotic broken down by Bacteria vs. Gram Staining. Color shows details about Antibiotic.

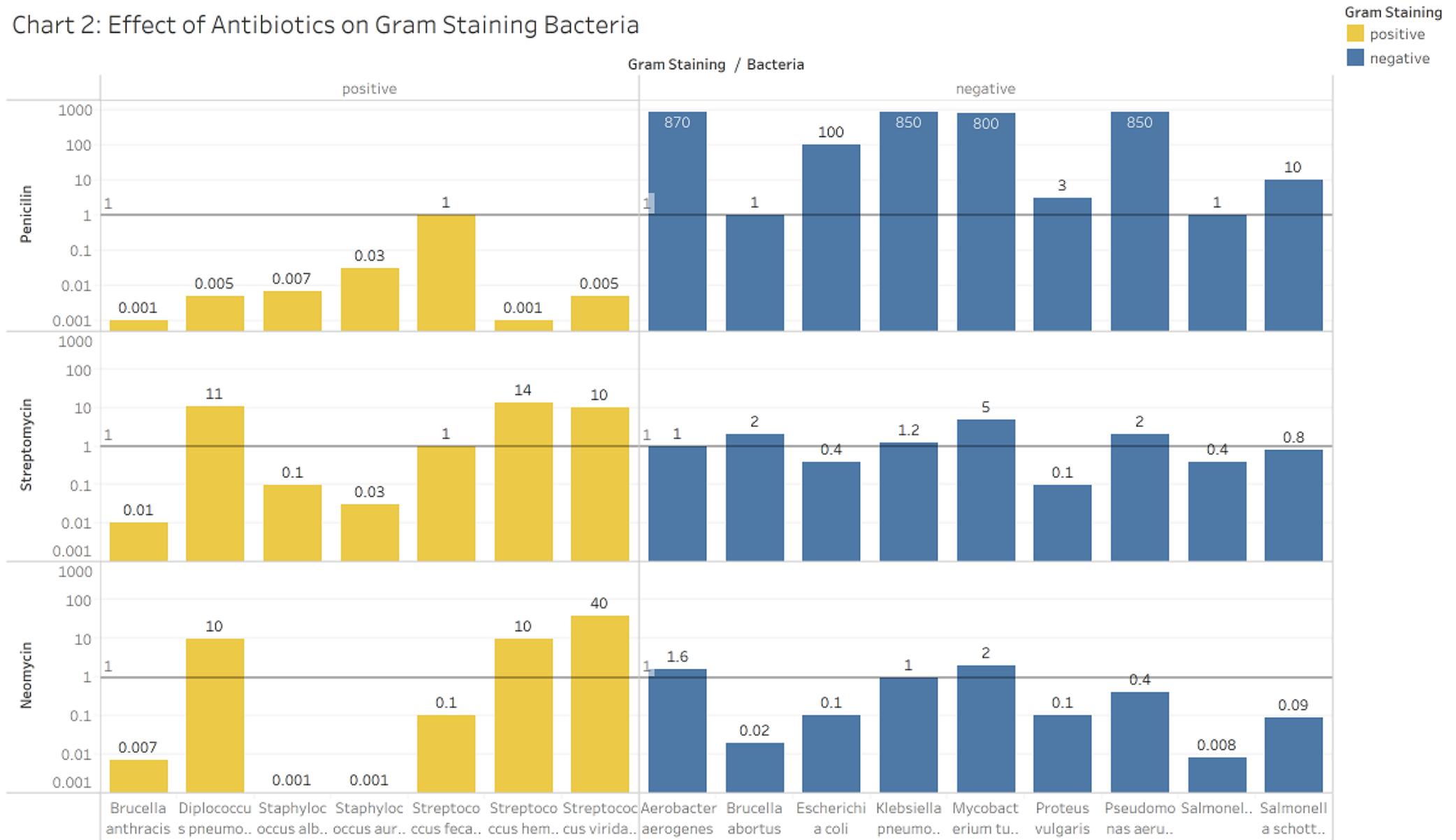
Antibiotic Minimum Inhibitory Concentration (MIC), by Bacteria Family**Brucella family**

Antibiotic
■ Neomycin
■ Penicillin
■ Streptomycin

Salmonella family**Staph family****Strep family****Pneumoniae family****Other**

Minimum Inhibitory Concentration

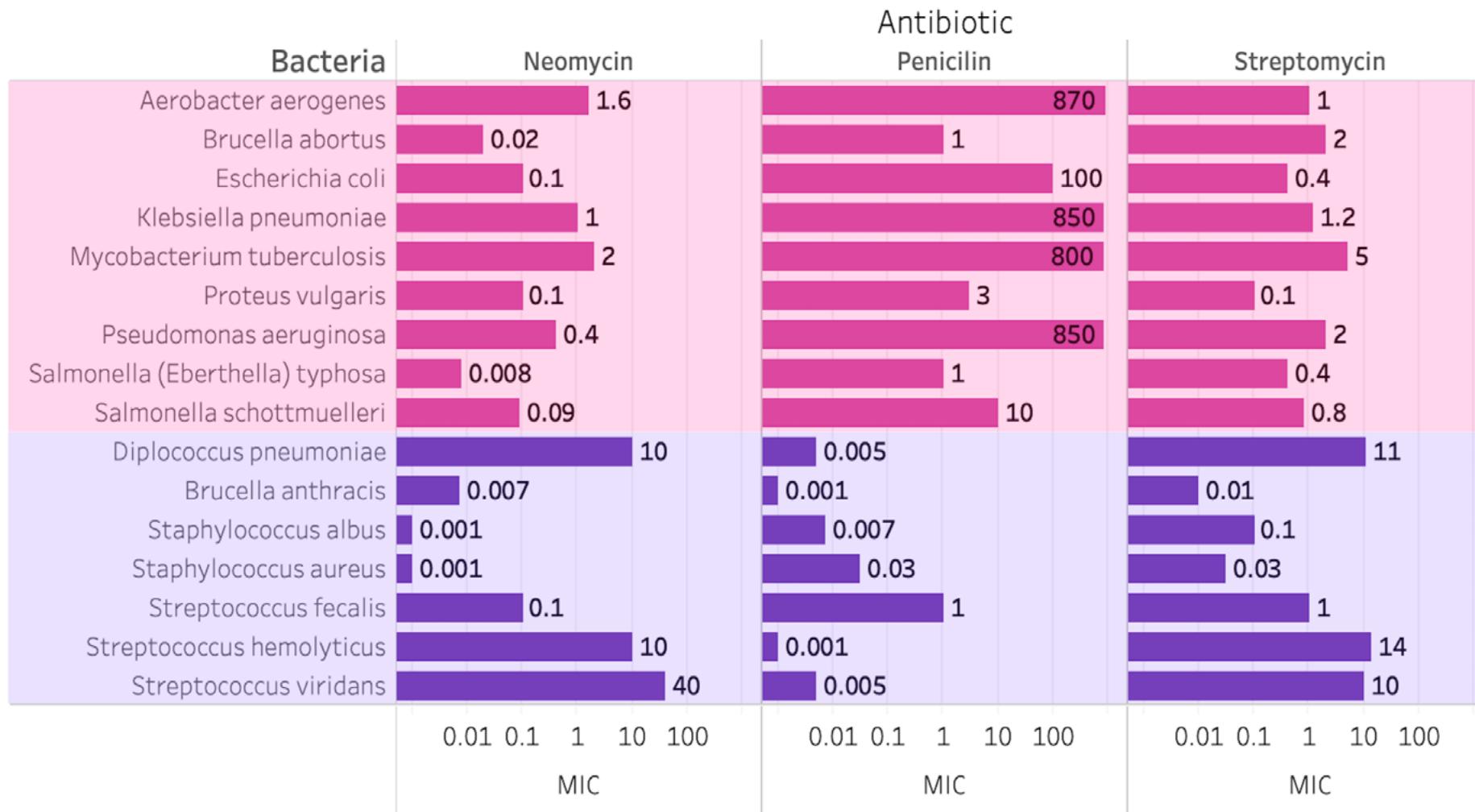
Chart 2: Effect of Antibiotics on Gram Staining Bacteria



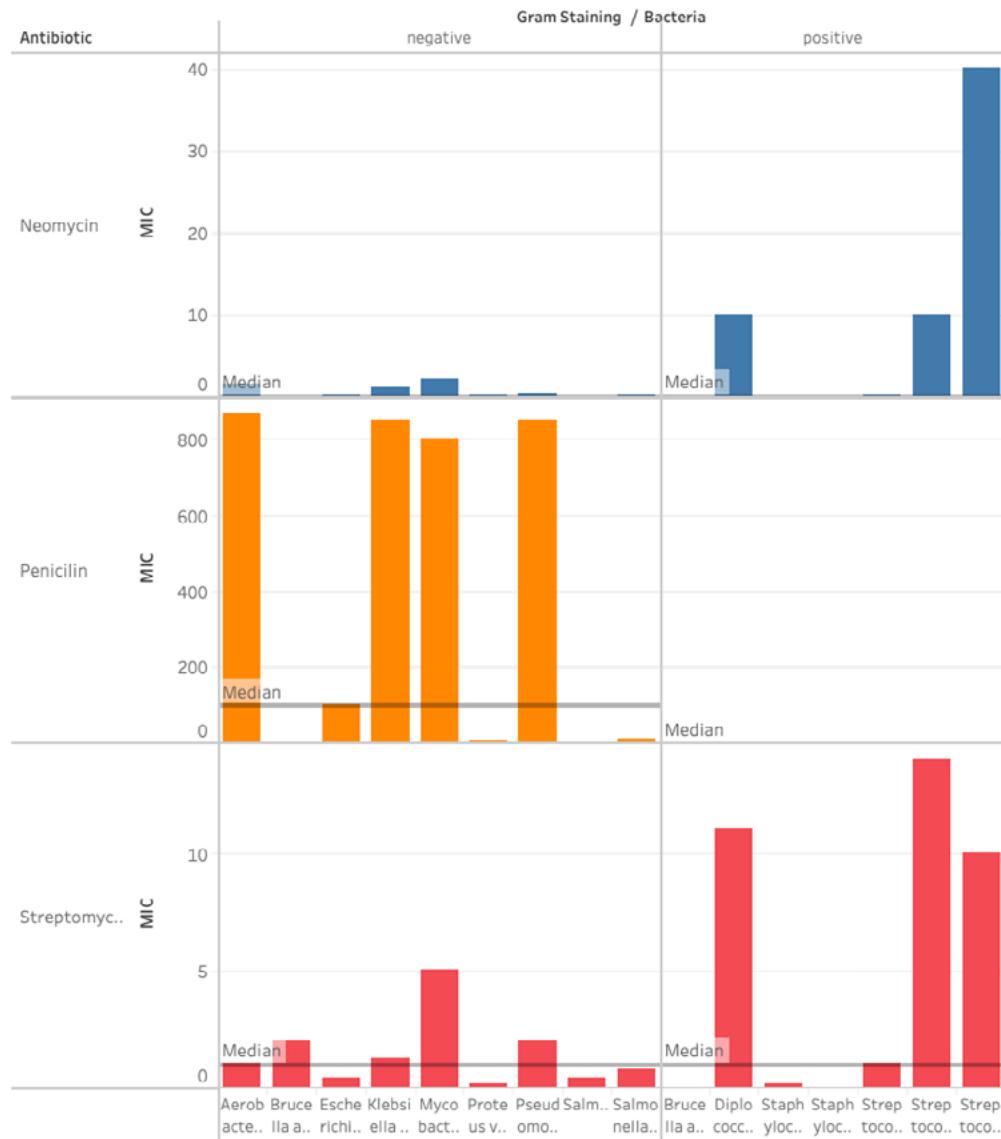
Performance of Antibiotic on Bacteria

Effectiveness represented by MIC and gram staining

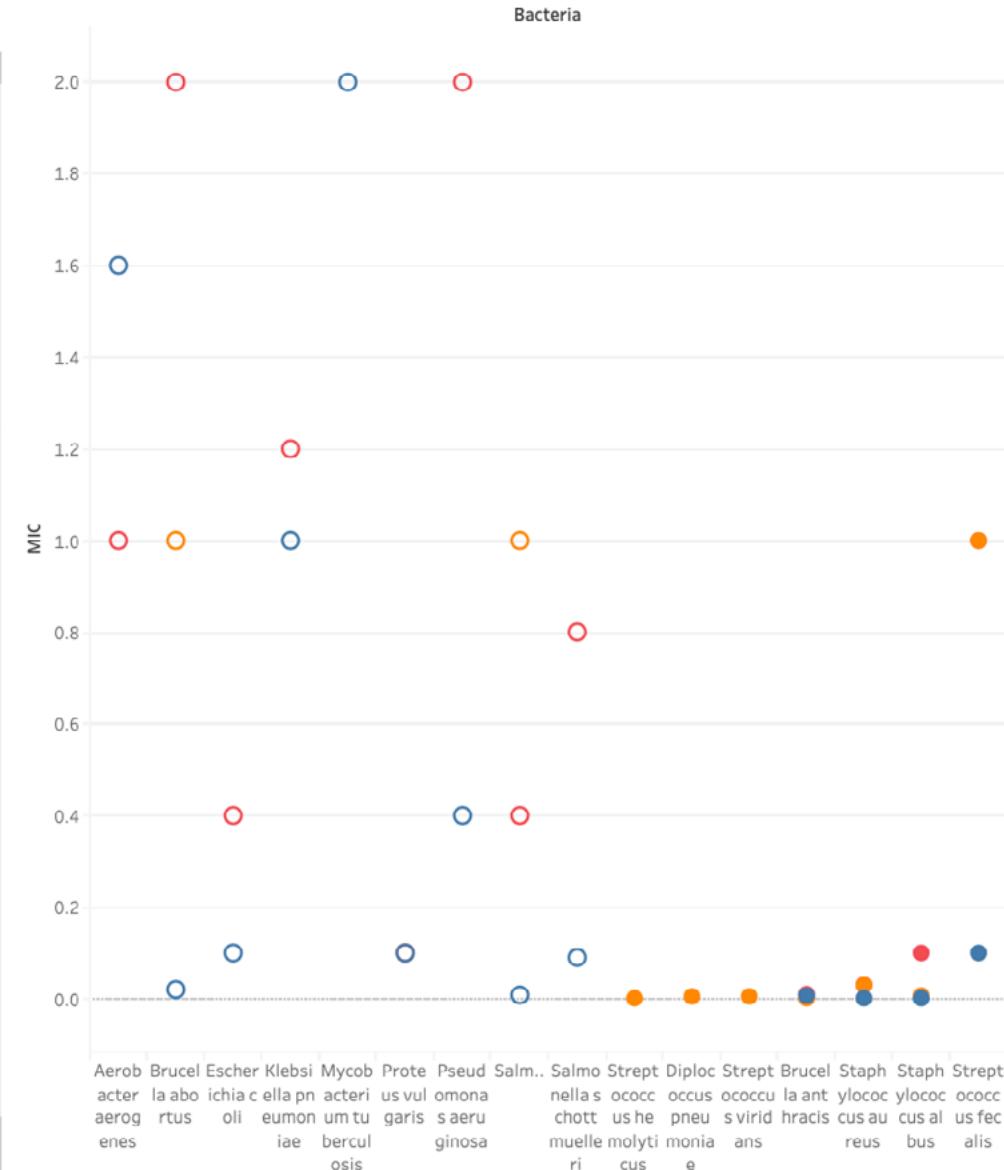
Gram Staining
negative
positive



Bacteriostasis of Three Antibiotics against Different Gram Staining Bacteria



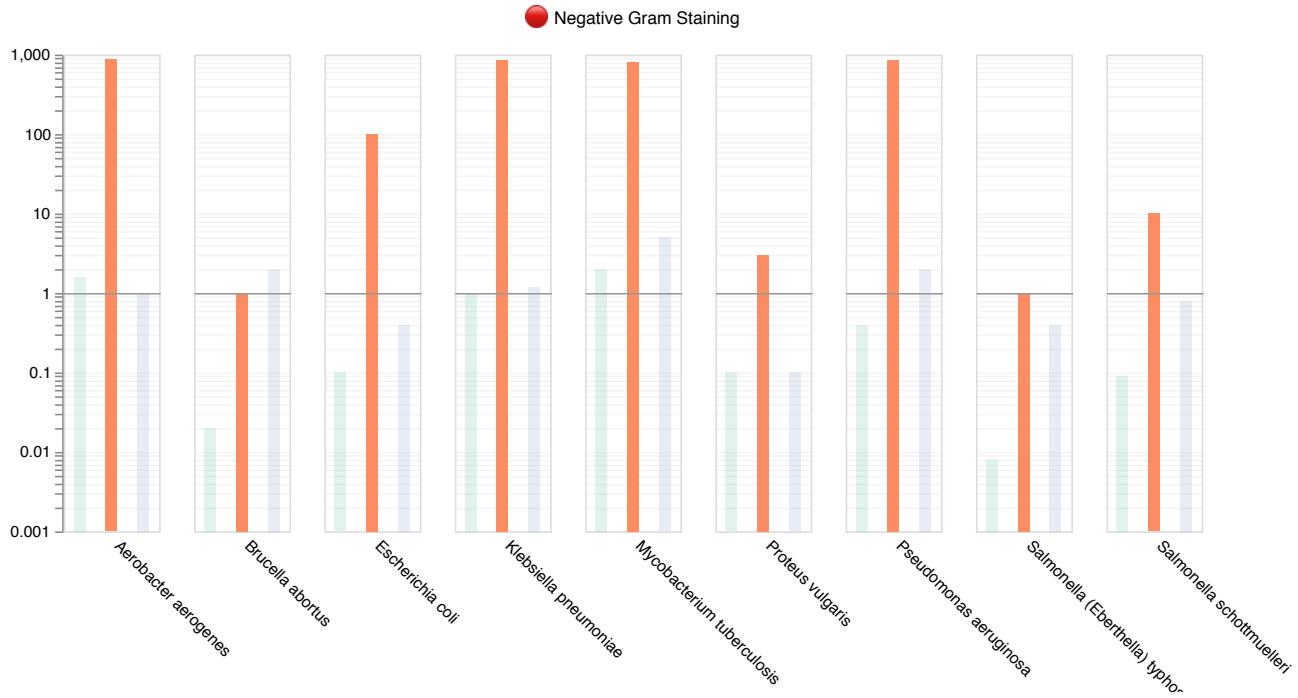
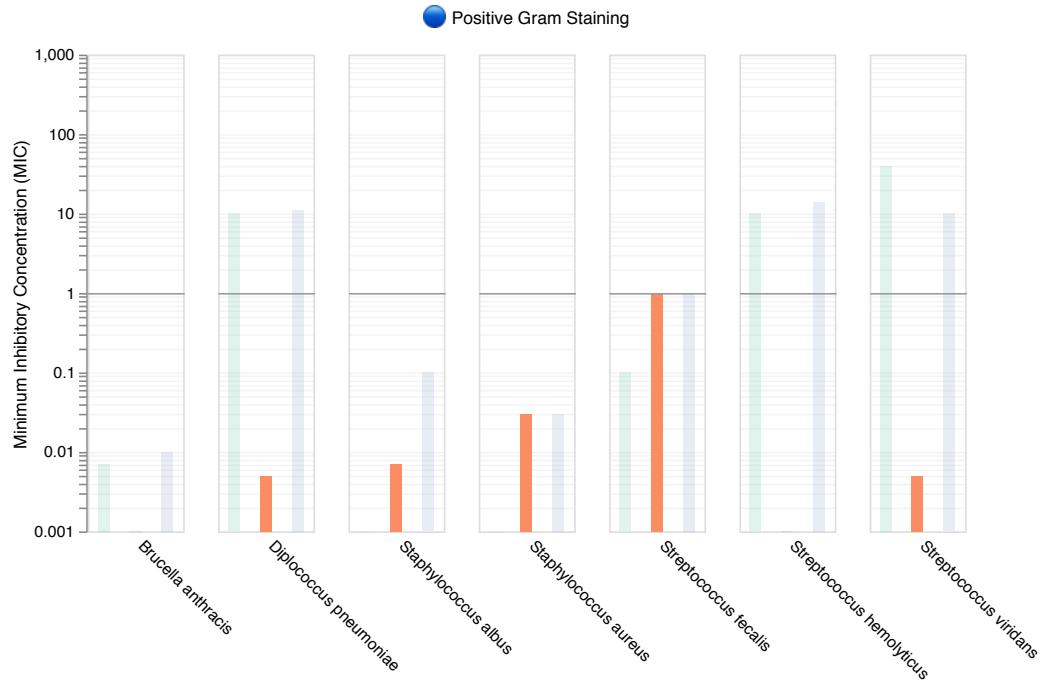
Minimum MIC for Each Antibiotic Using Different Antibiotics



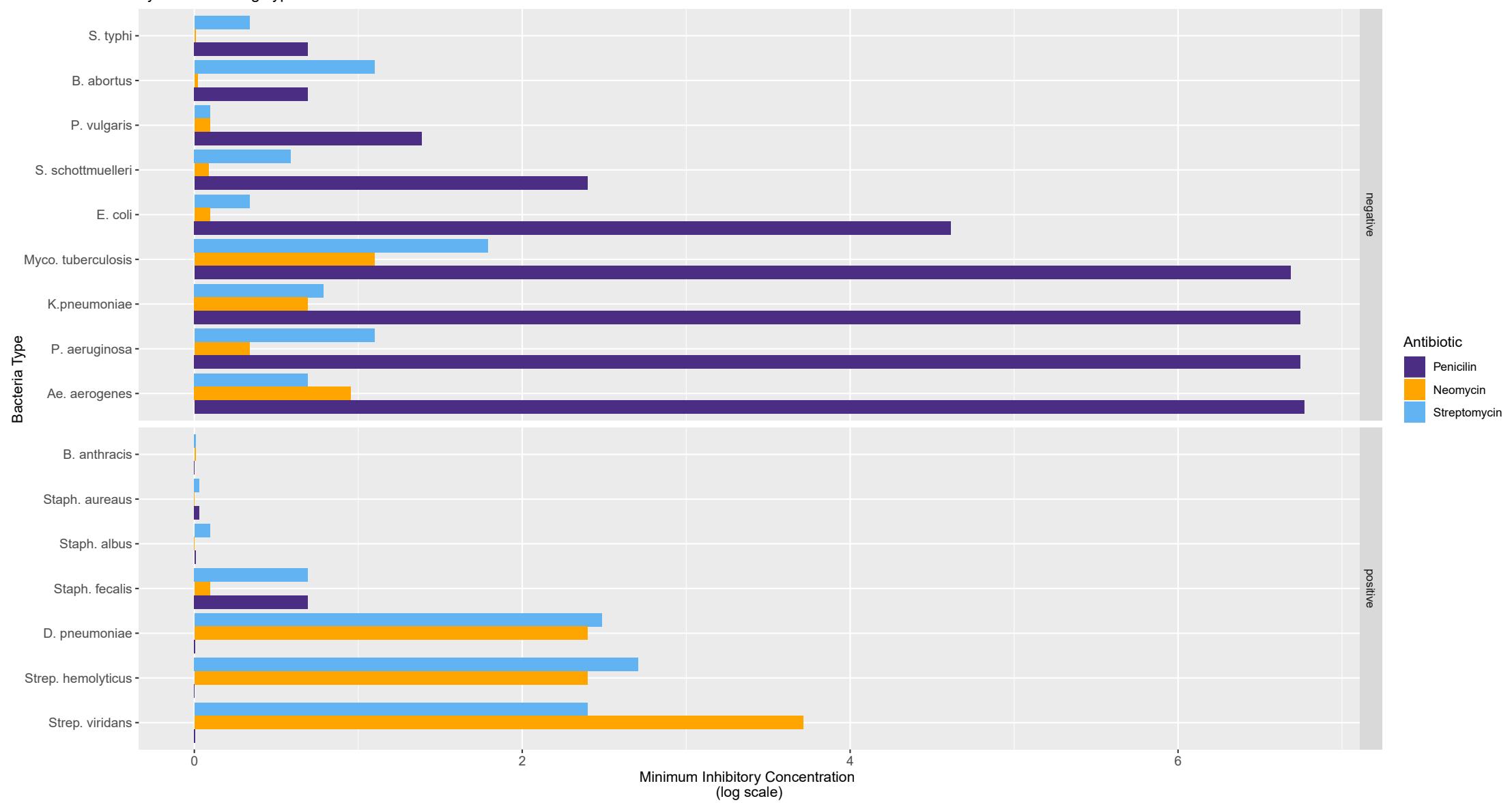
Pencillin vs Other Antibiotics Effect on Gram Staining Result

Pencillin above 1.0 MIC highly likely to bring negative Gram Staining result

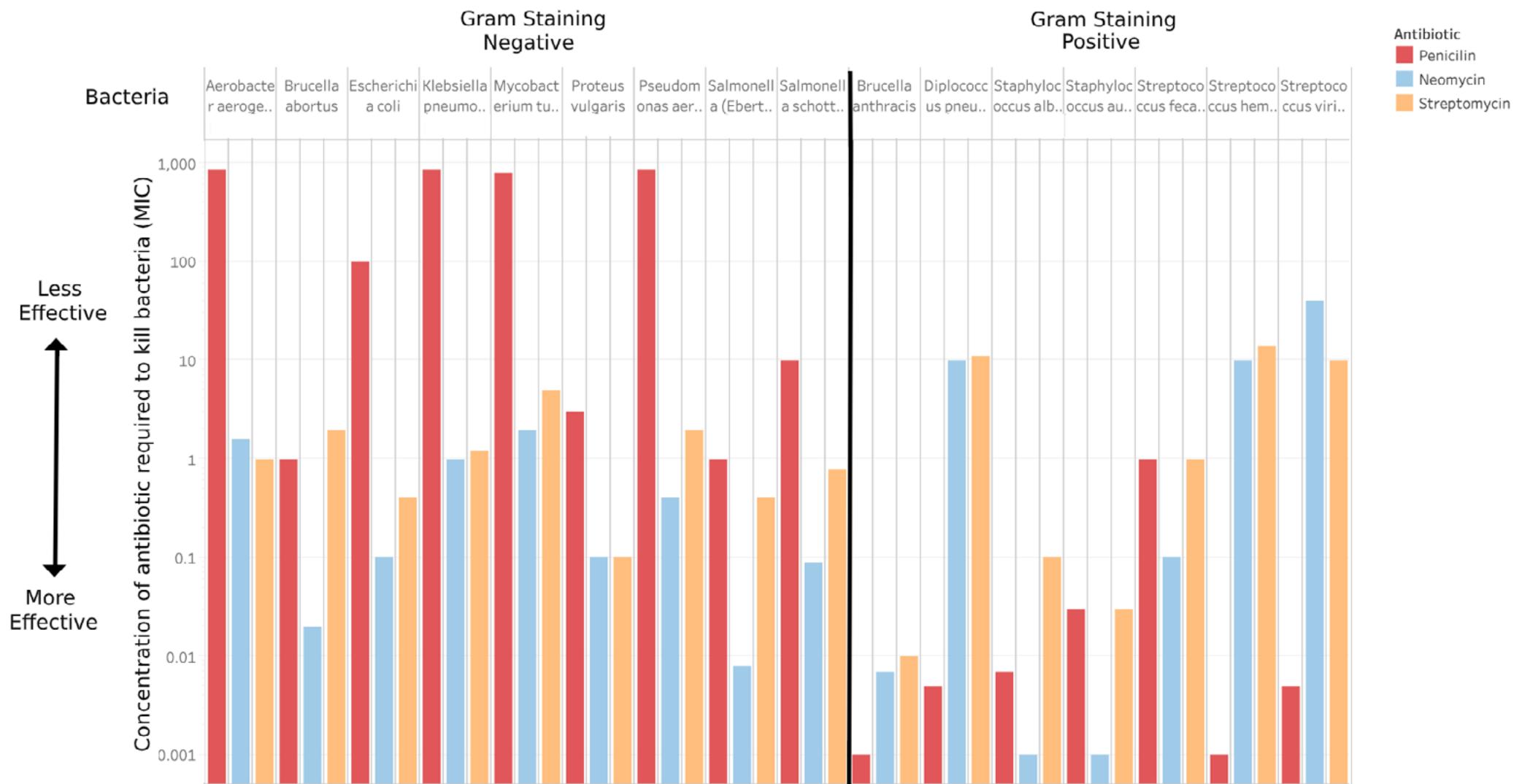
Antibiotic	Neomycin	Penicillin	Streptomycin
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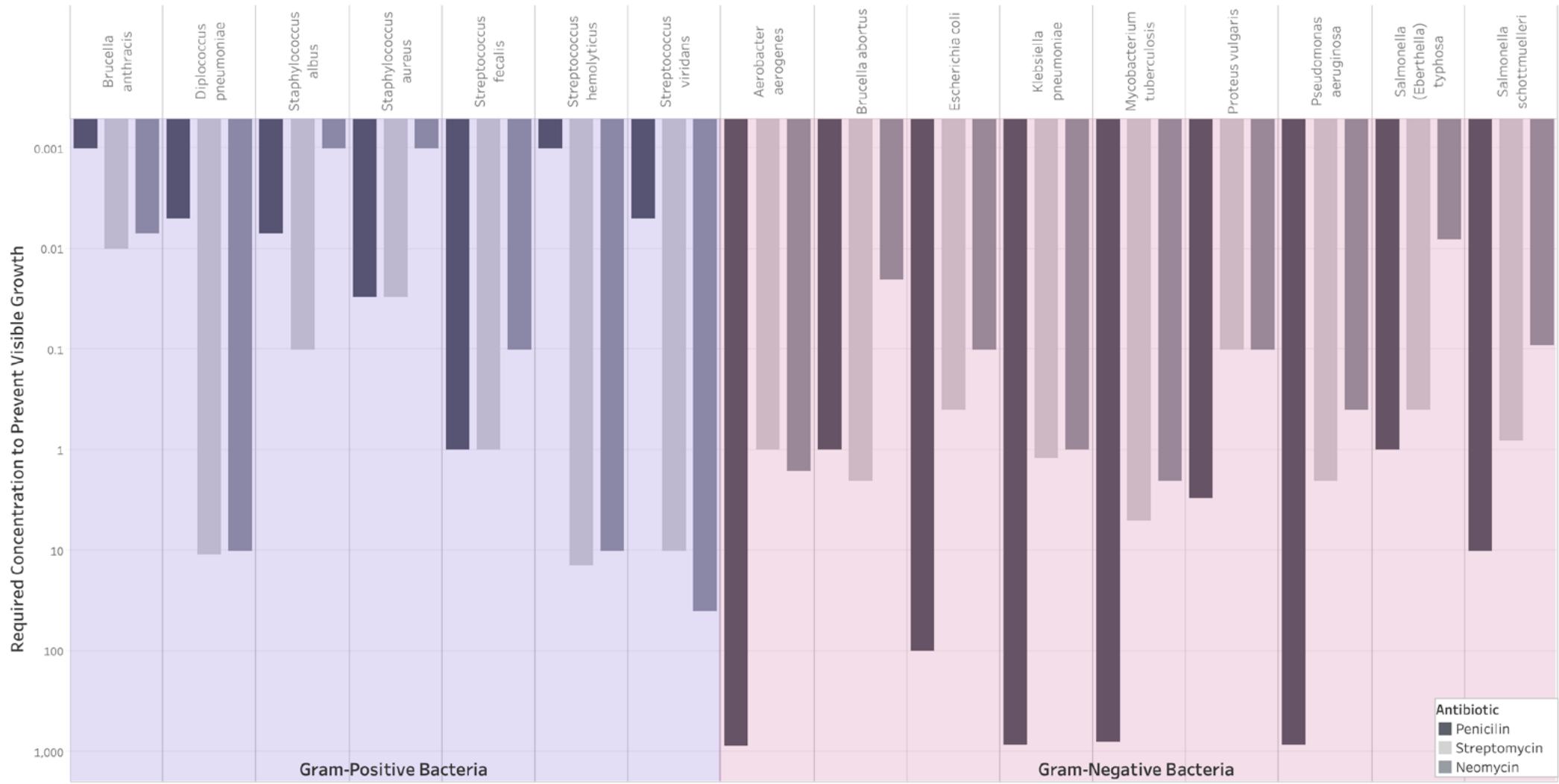
Minimum Dosage Required To Inhibit Bacteria Growth by Gram Staining Type and Antibiotic



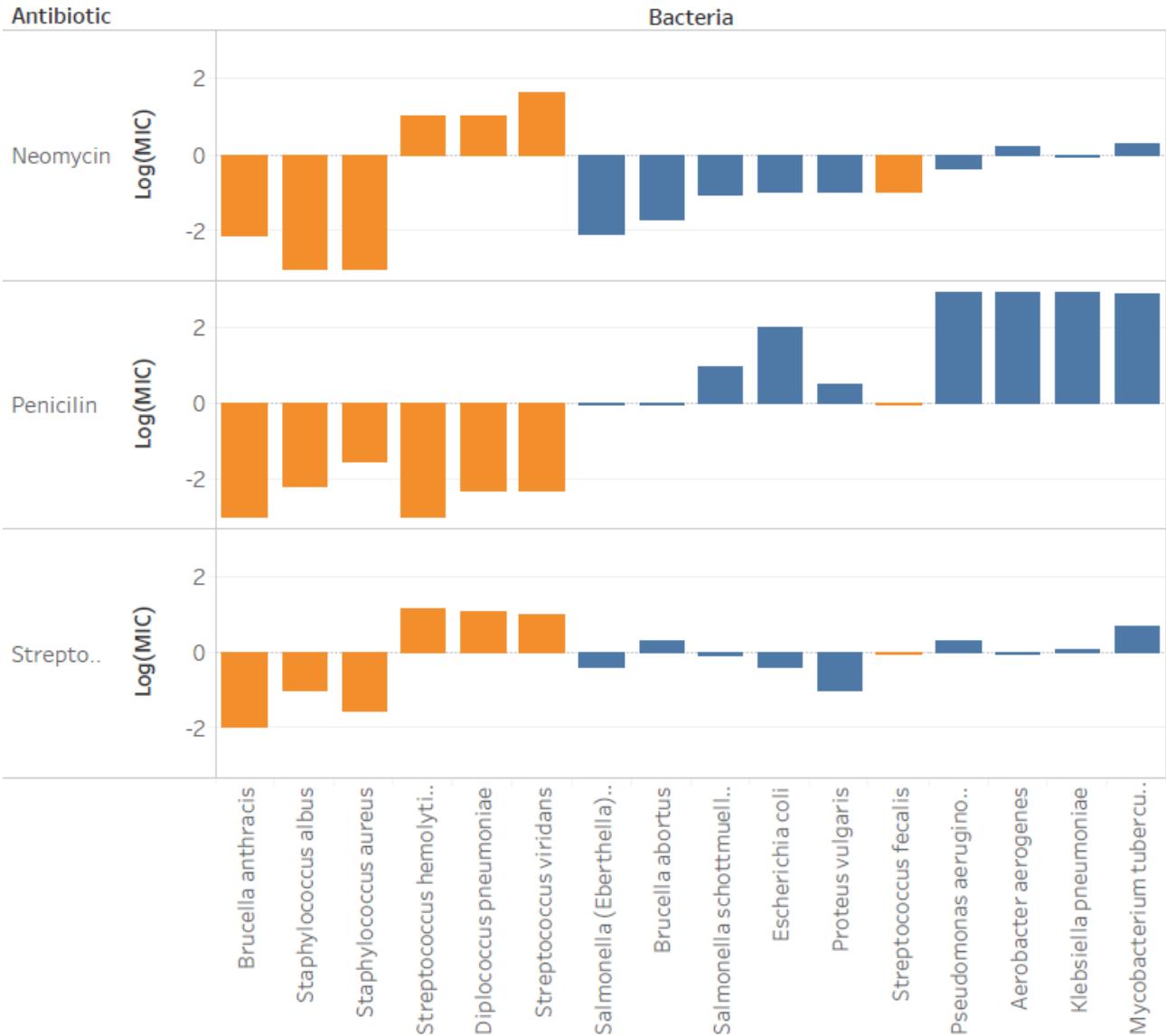
Burtin's Data: Measuring Antibiotic Effectiveness



Antibiotic Effectiveness on Gram-Positive and Gram-Negative Bacteria



Effectiveness of Antibiotic and Gram Staining on Several Bacteria



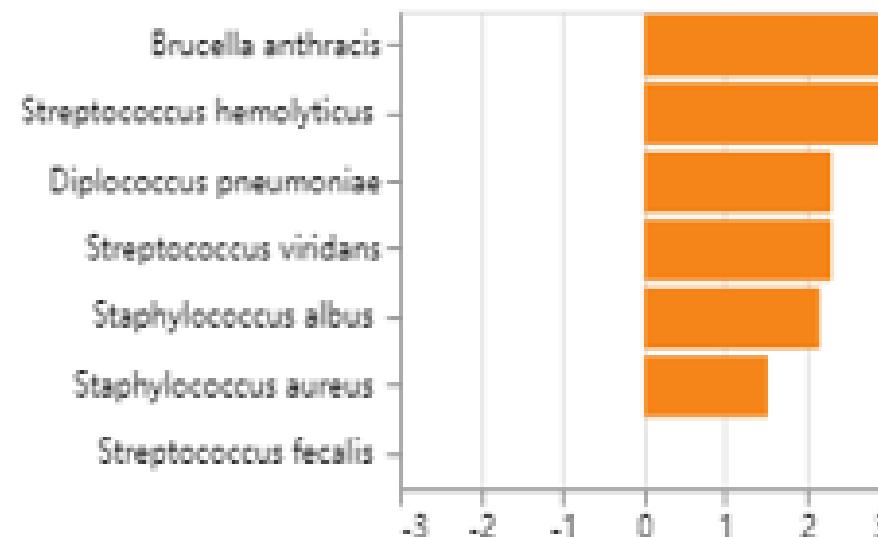
Antibiotics Effectiveness on Bacteria

- Penicillin
- Neomycin
- Streptomycin

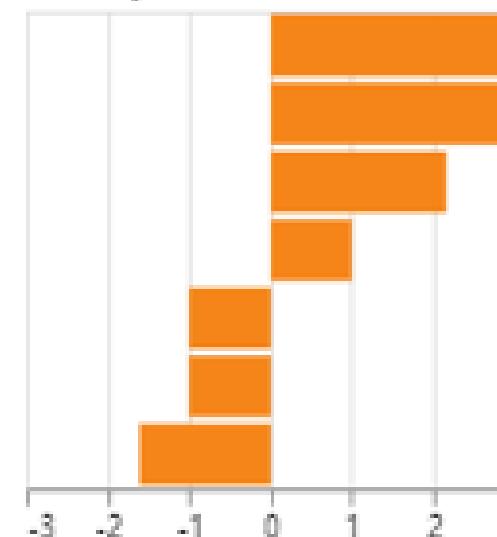


Effectiveness of Antibiotics Converning Gram Staining Properties

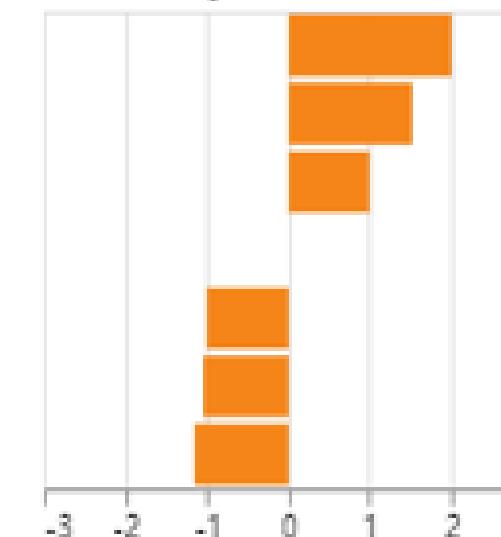
Penicillin



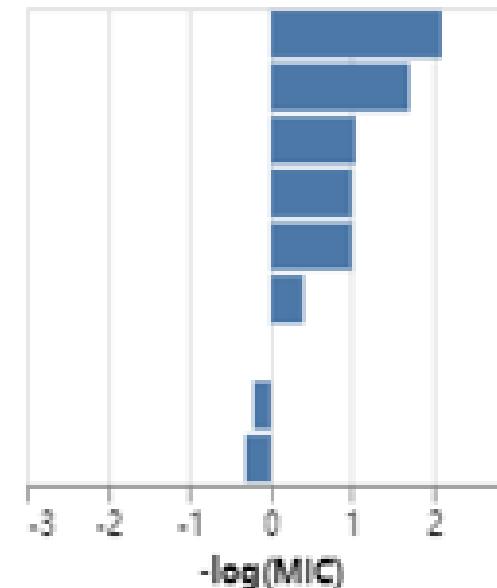
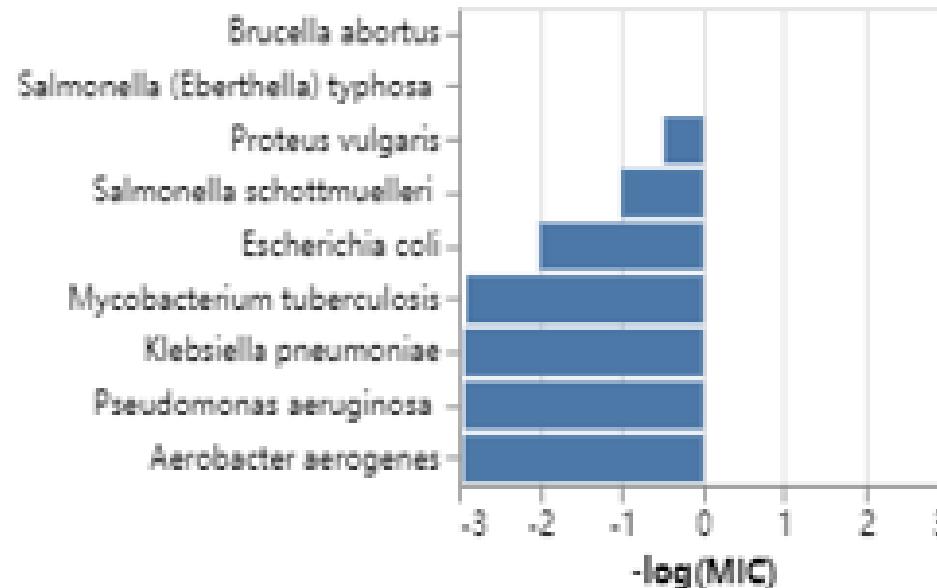
Neomycin



Streptomycin



Negative Gram Staining



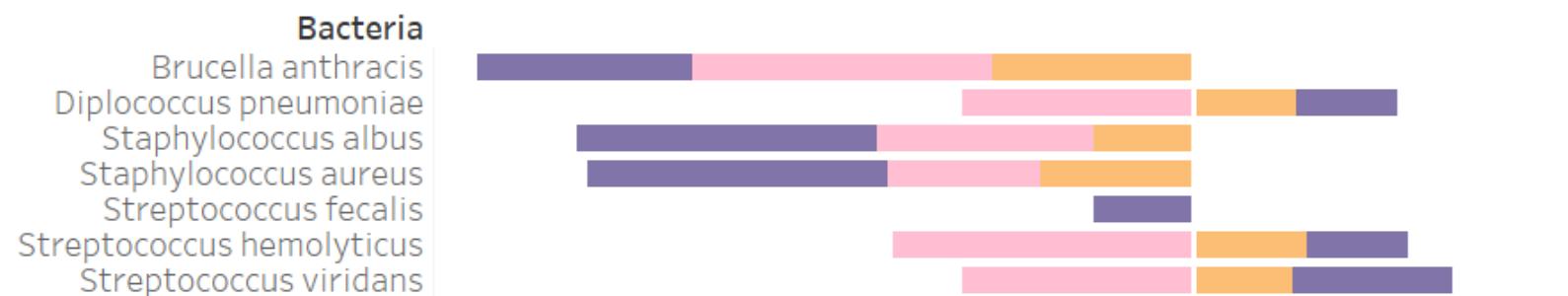
Gram_Staining

- negative
- positive

Stacking...

The Minimum Inhibitory Concentration (MIC) Statistics of Antibiotics with Different Bacterias

Gram-Positive



Antibiotic

- Neomycin
- Penicilin
- Streptomycin

Gram-Negative



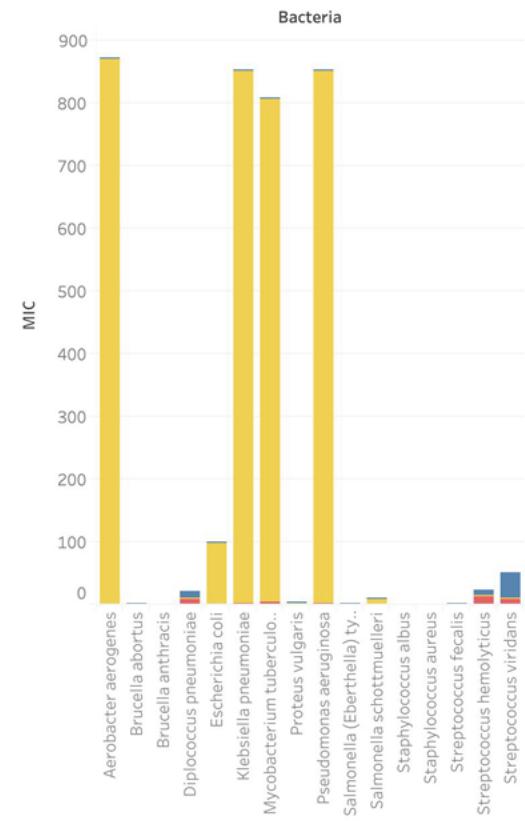
Notice:

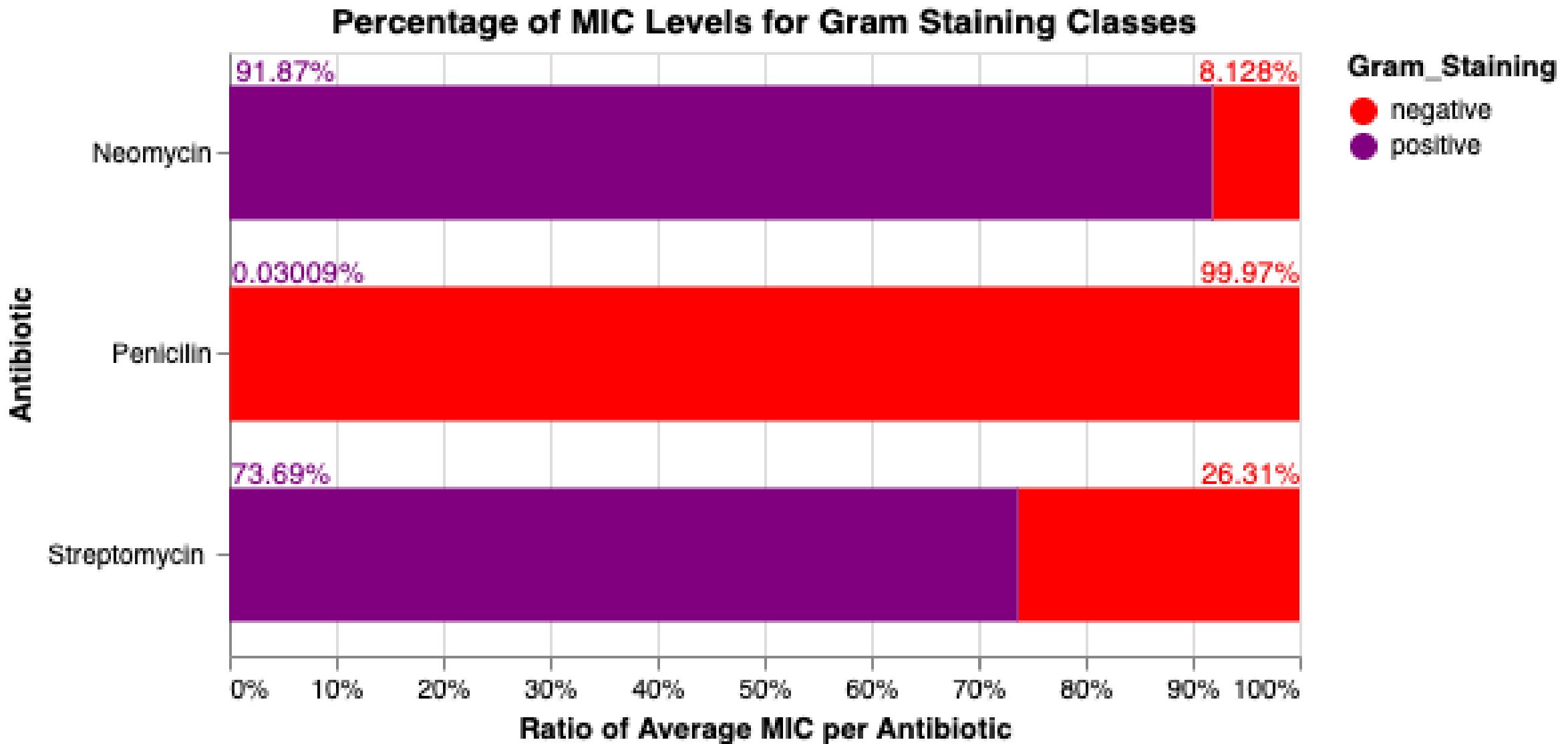
Remember that log function is applied.
If the log_MIC is 0, which is not shown on the figure, it indicates that the MIC is 1.

Stacking invokes particular **meaning**: a **part/whole** or **sum** relationship

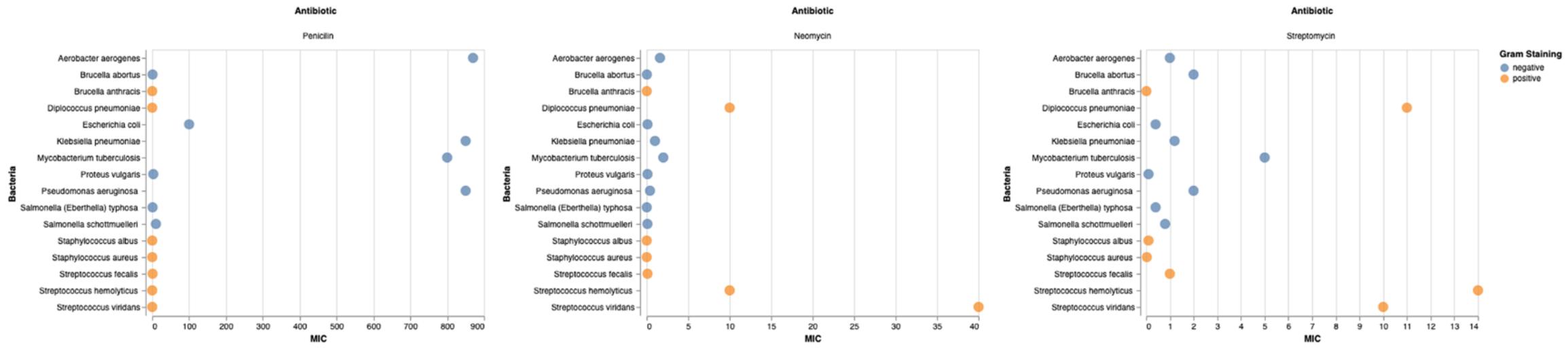
Porblematic when this does not apply

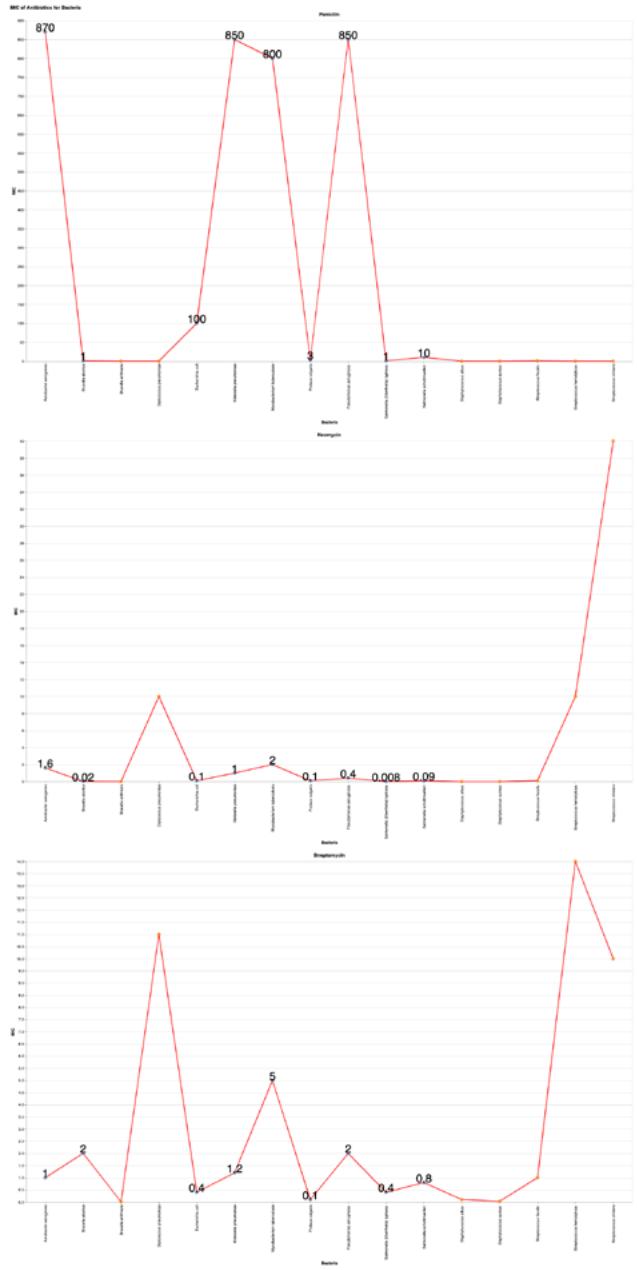
<Possible Treatment of Bacterias>



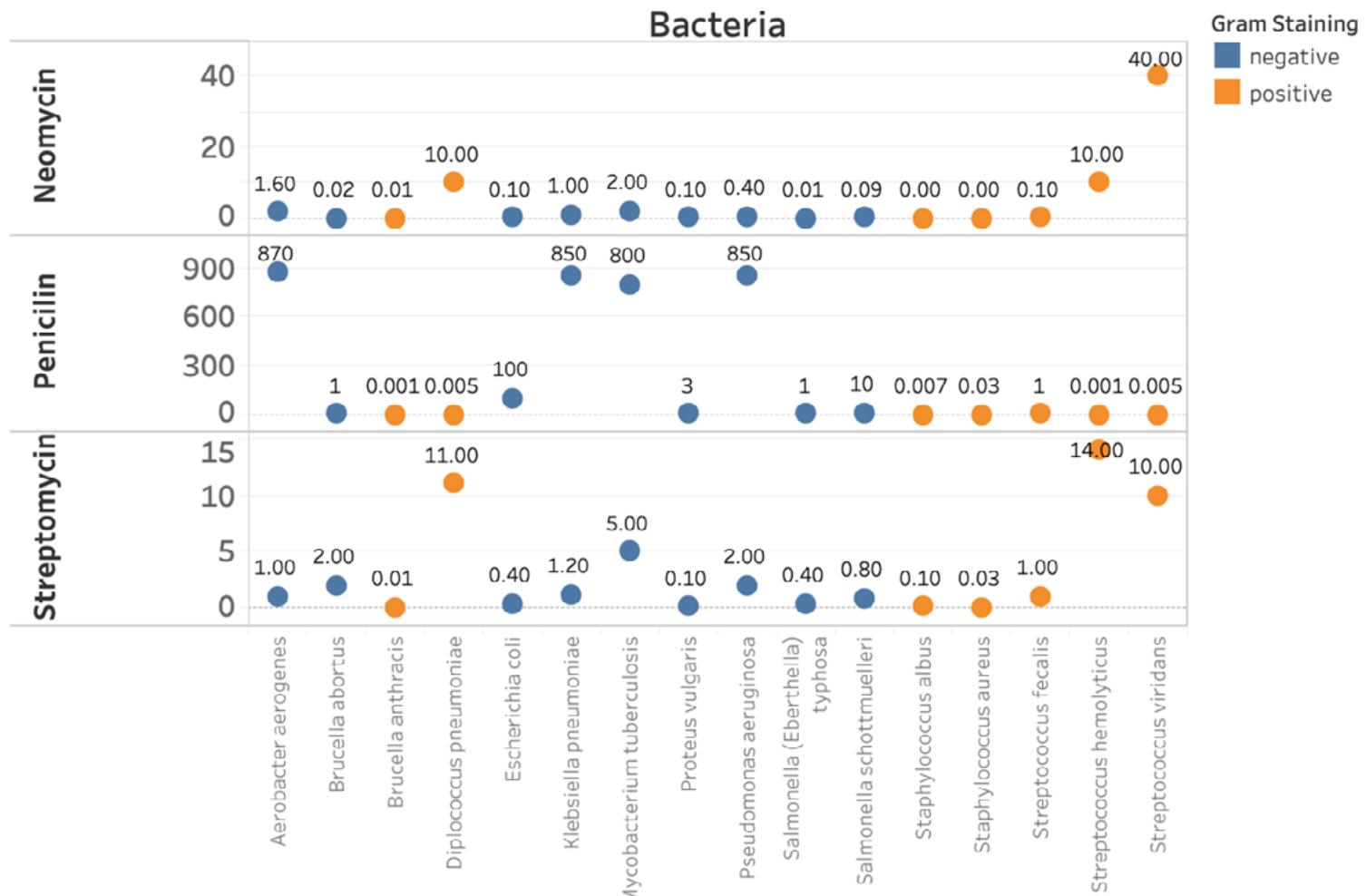


Points/lines...



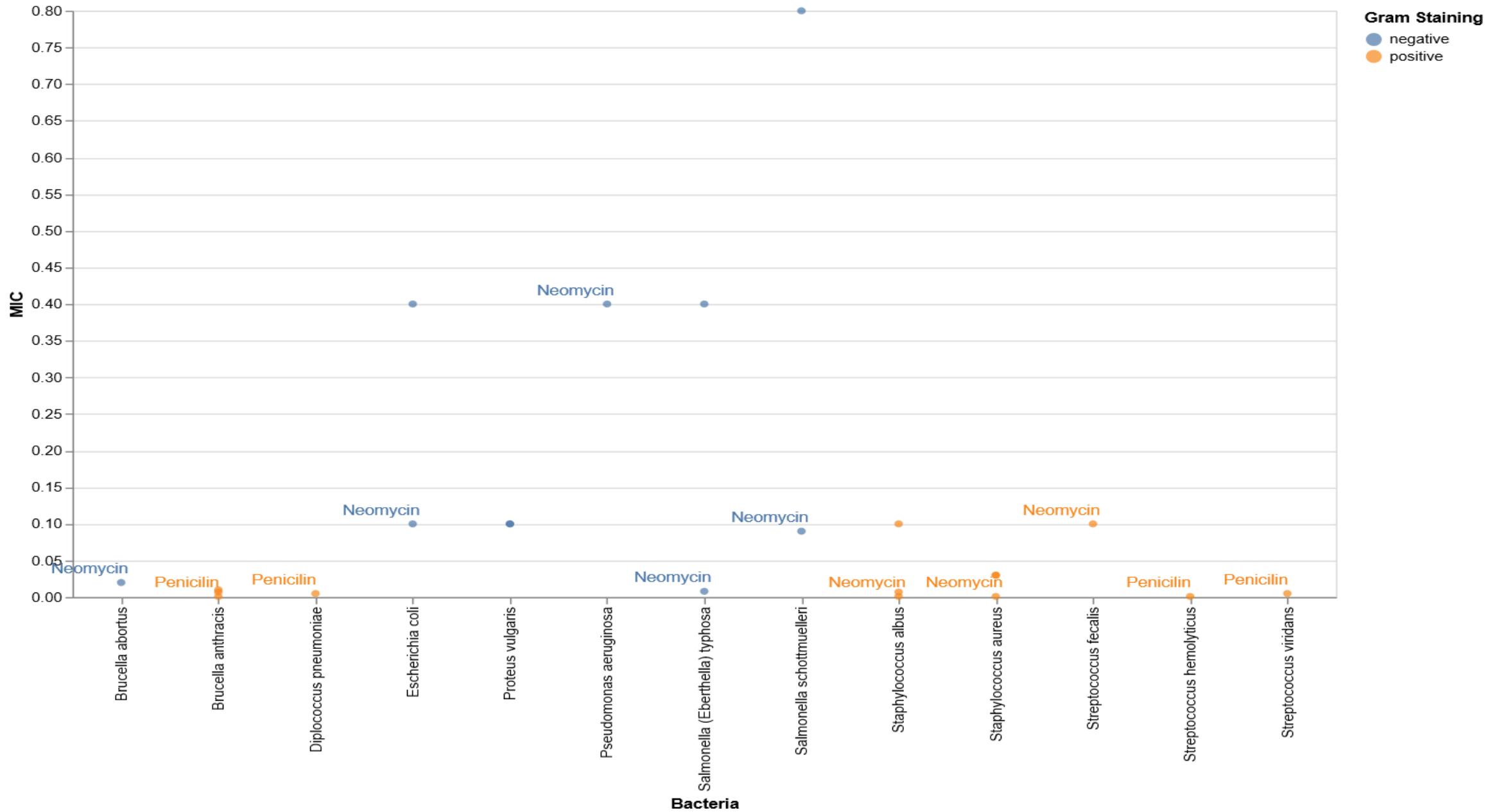


Performance of Antibiotics Based on Different Bacteria

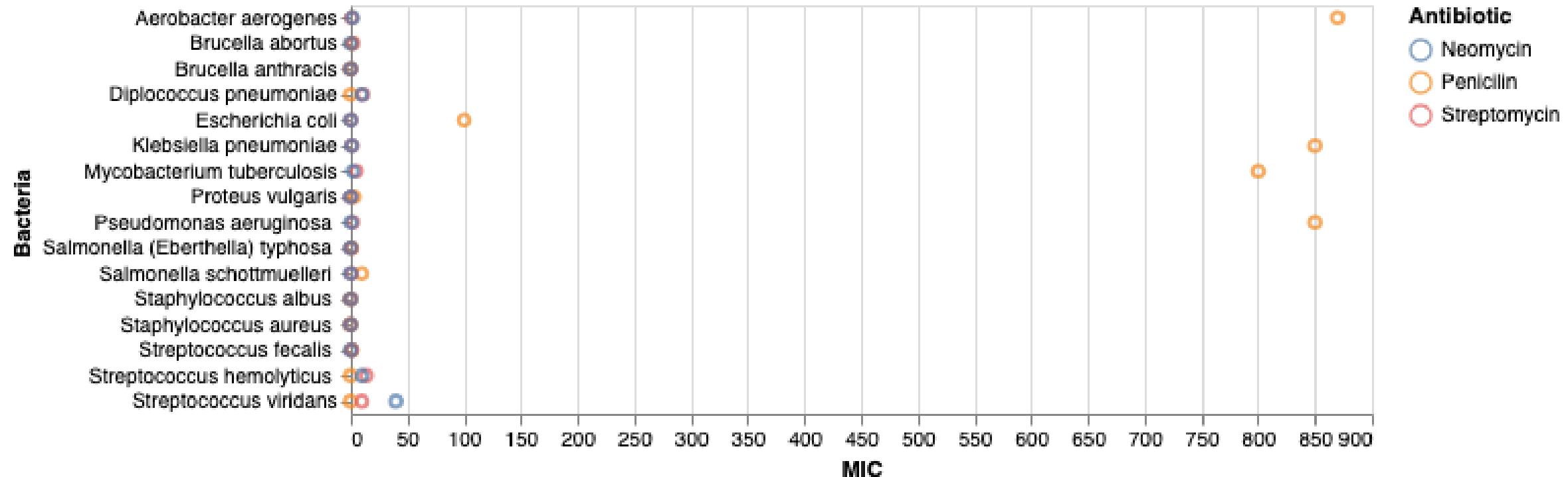


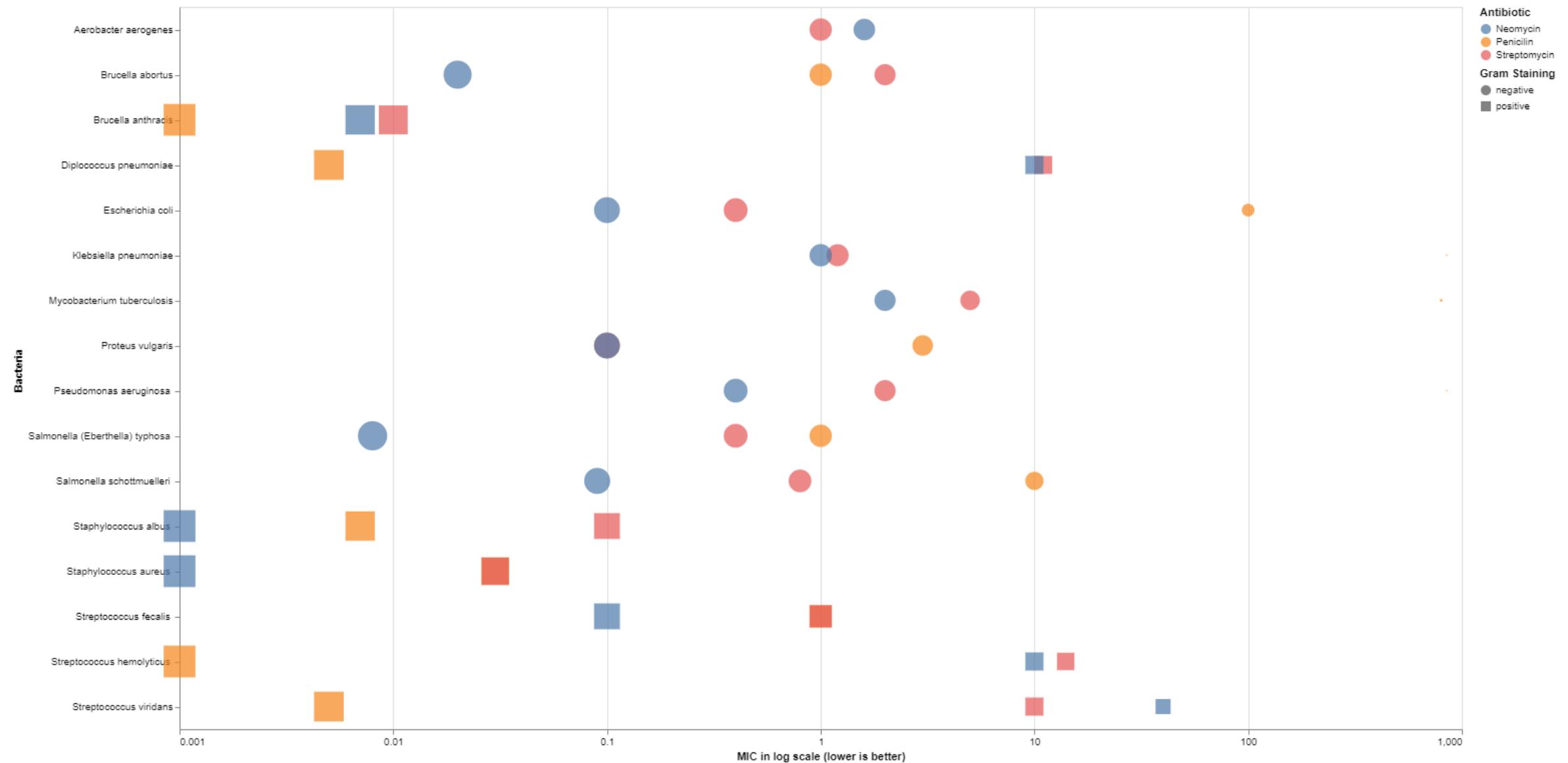
Neomycin, Penicillin and Streptomycin for each Bacteria. Color shows details about Gram Staining.

Most Effective Antibiotic for each Bacteria

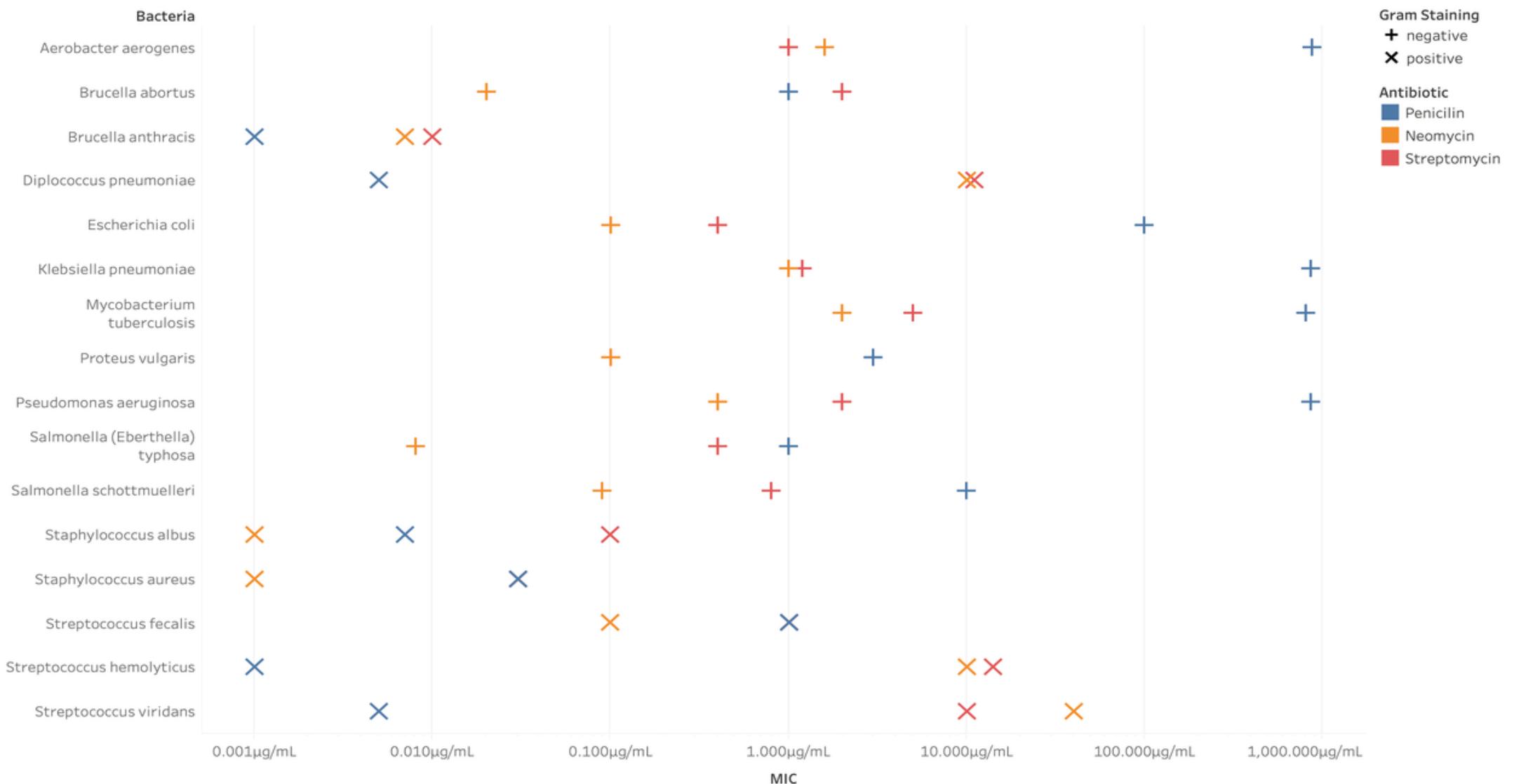


Treatments That Work Against Bacteria and Do Not After WWII



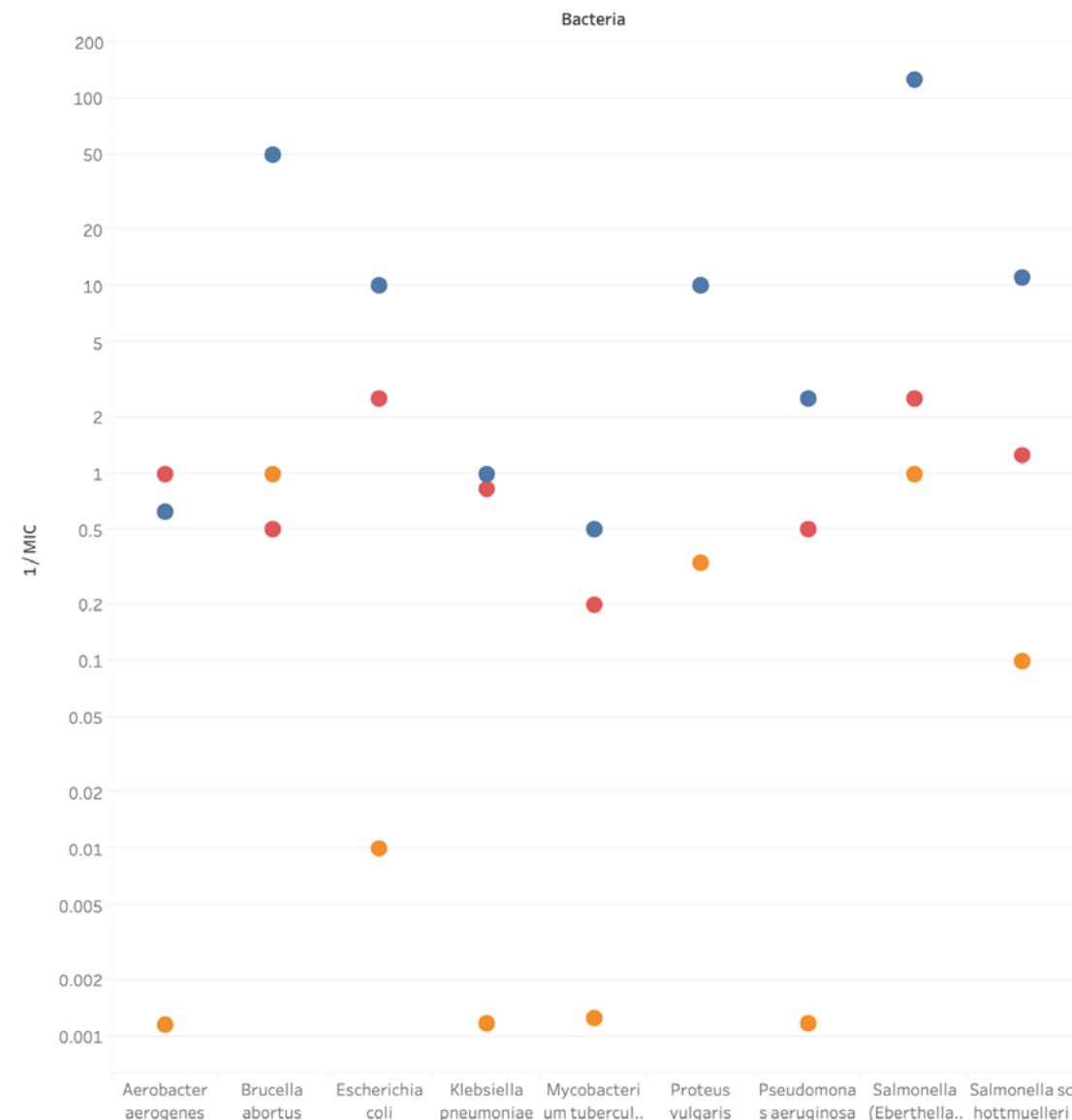


Which Antibiotic are Useful?

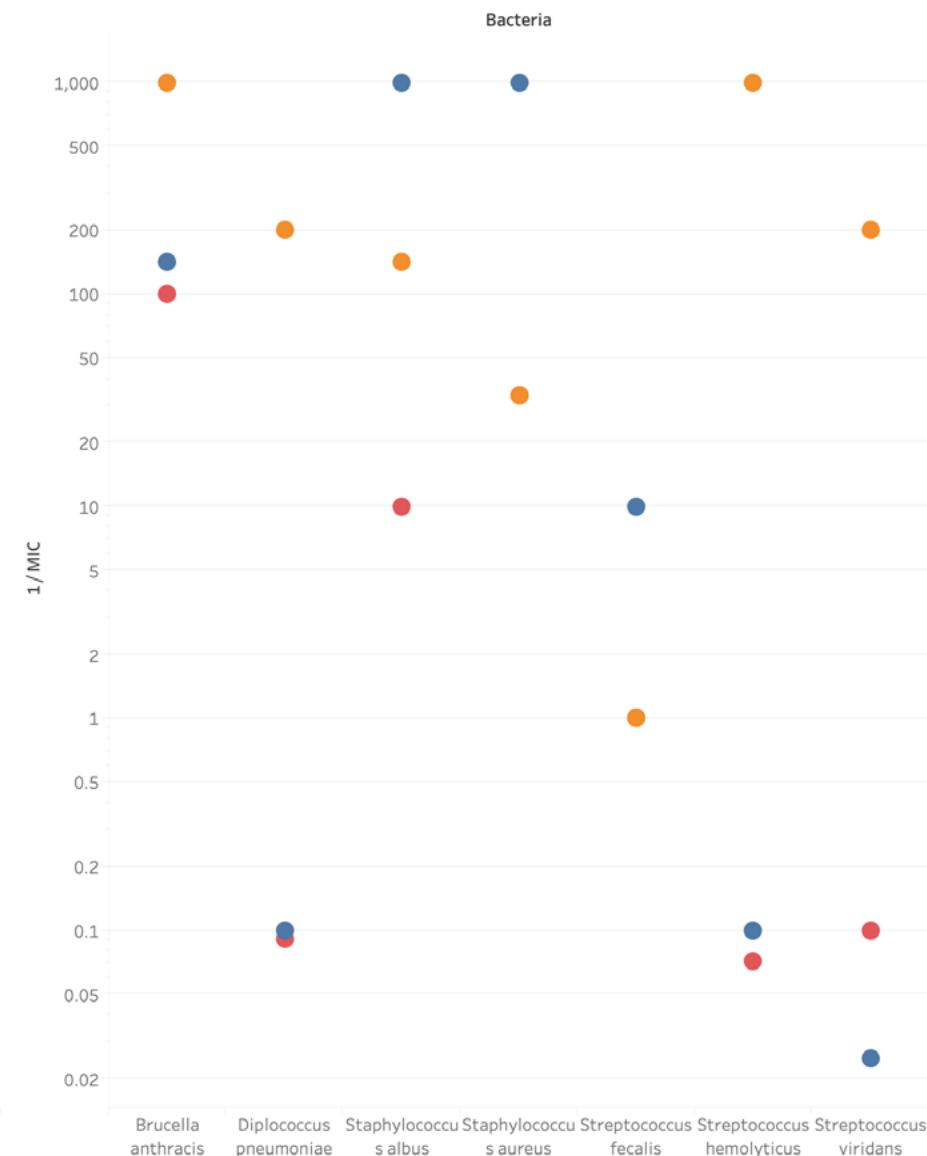


Sum of MIC for each Bacteria. Color shows details about Antibiotic. Shape shows details about Gram Staining. The view is filtered on sum of MIC, which includes everything.

Antibiotic Performance of Gram Staining Negative Bacteria



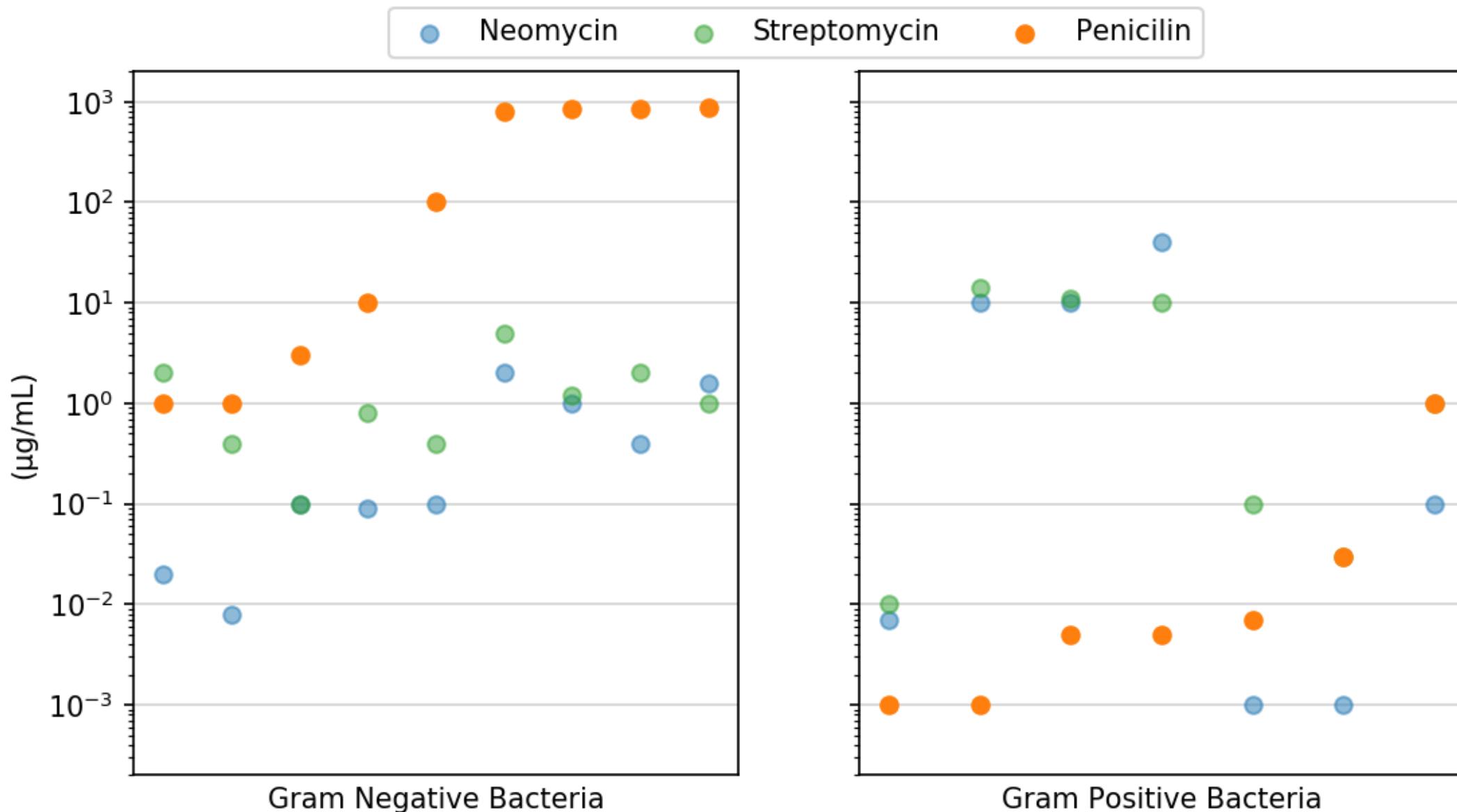
Antibiotic Performance of Gram Staining Positive Bacteria

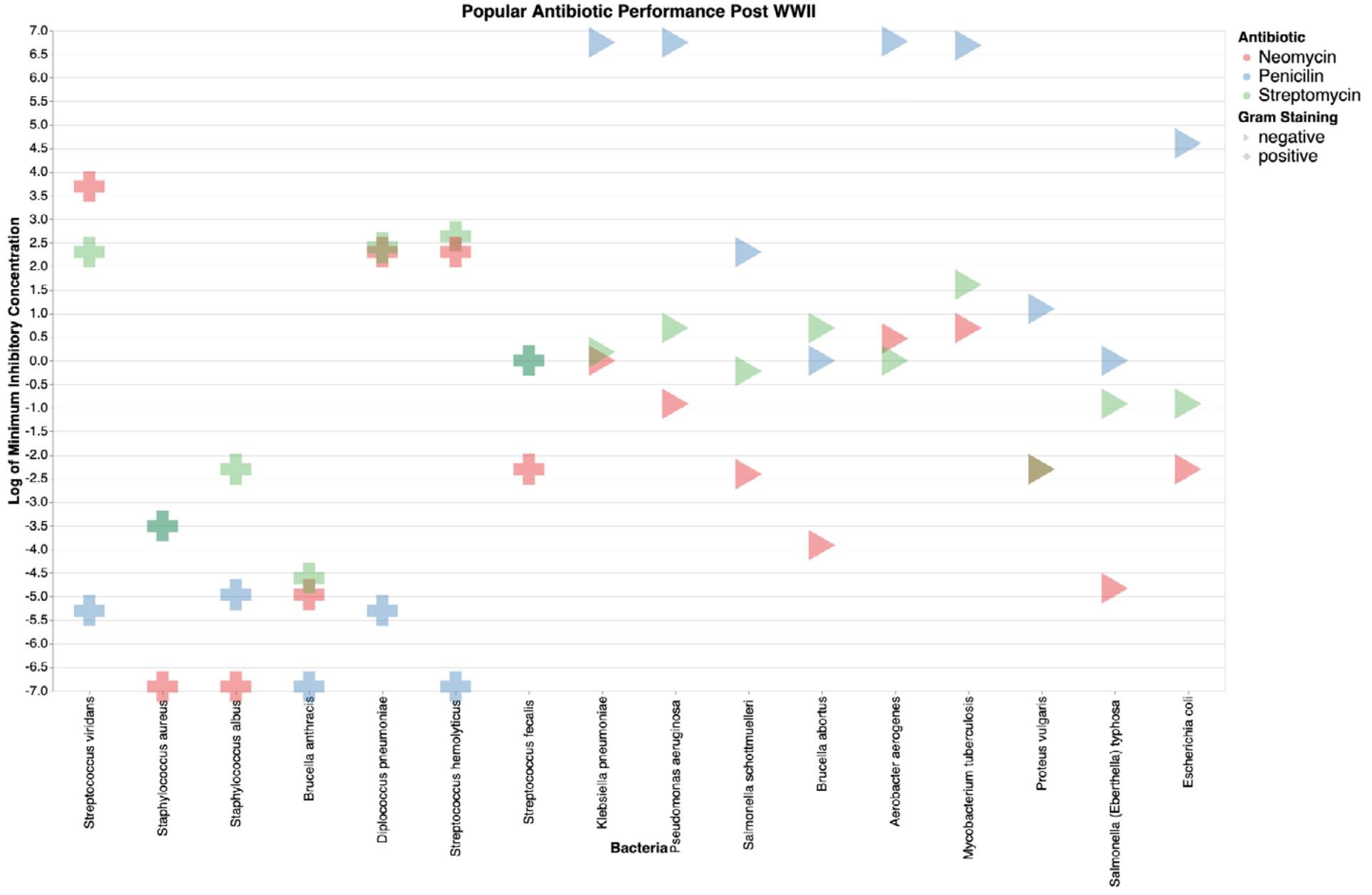


Antibiotic

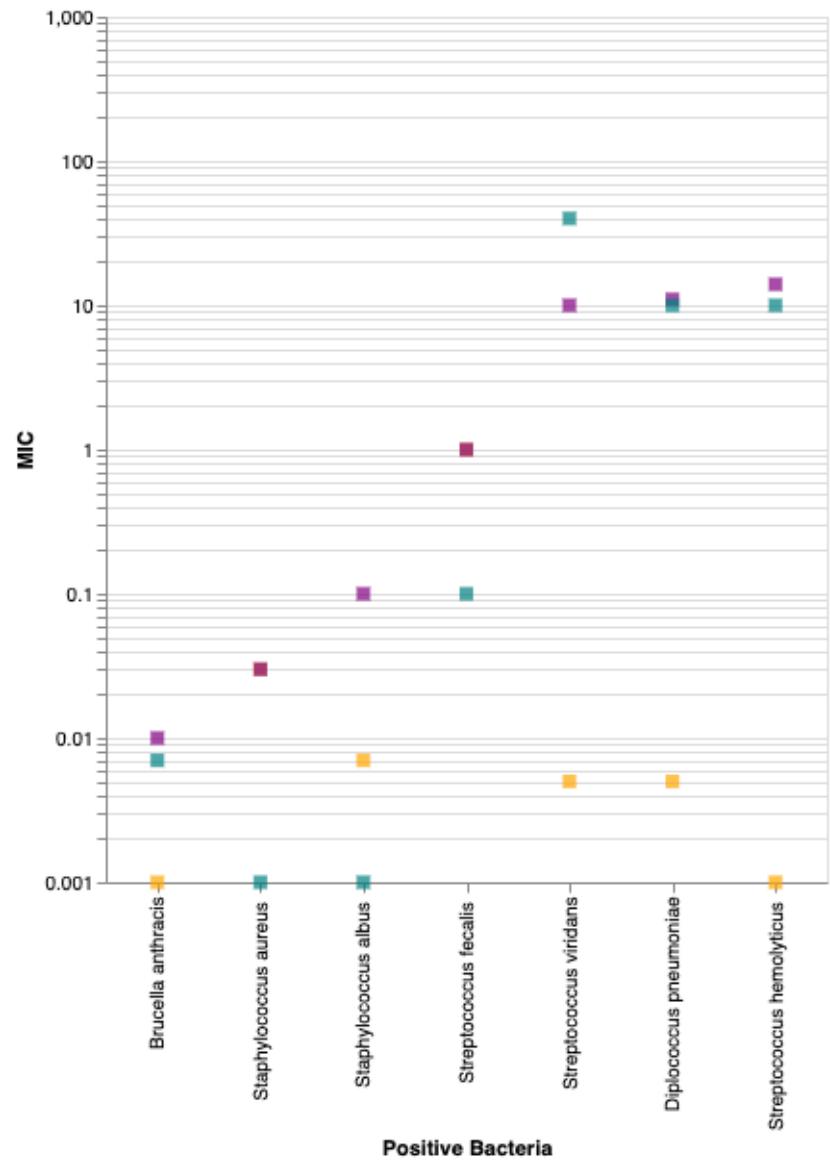
- Neomycin
- Penicillin
- Streptomycin

Minimum Inhibitory Concentration (lower is better)



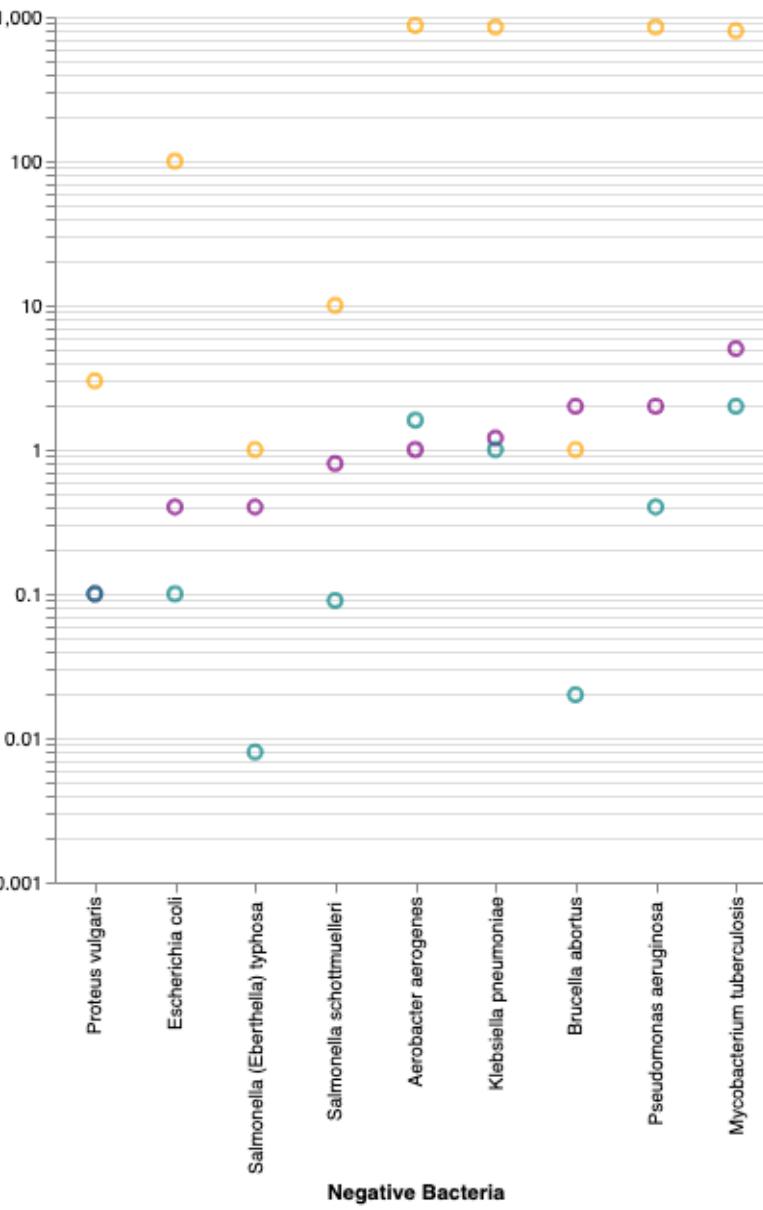


Minimum Inhibitory Concentration (MIC) of Antibiotics on Bacteria



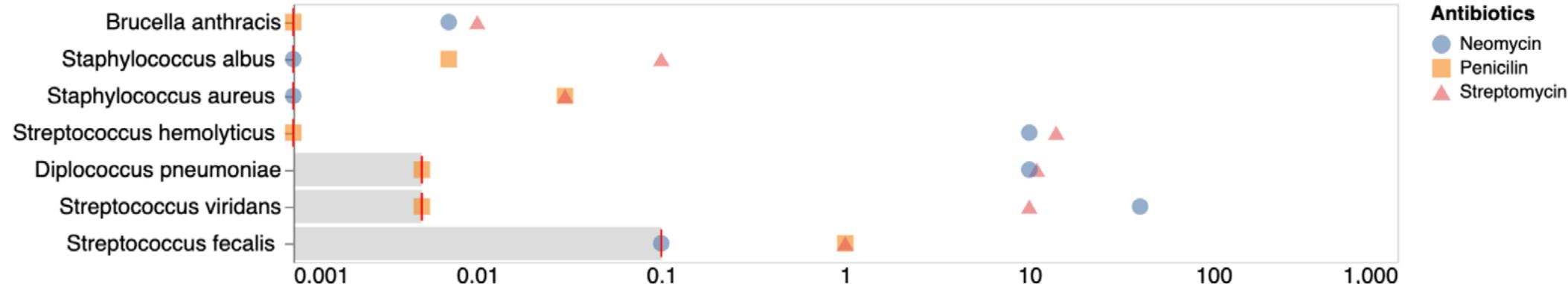
Antibiotic

- Penicillin
- Streptomycin
- Neomycin

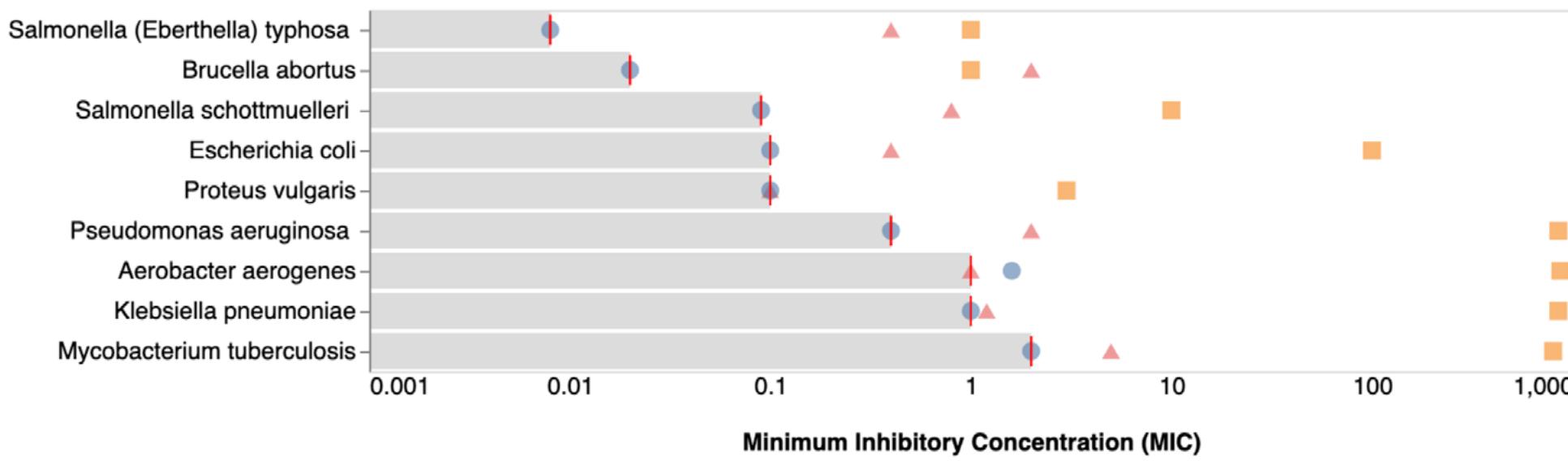


Effectiveness of Different Antibiotics on Gram Positive and Negative Bacteria

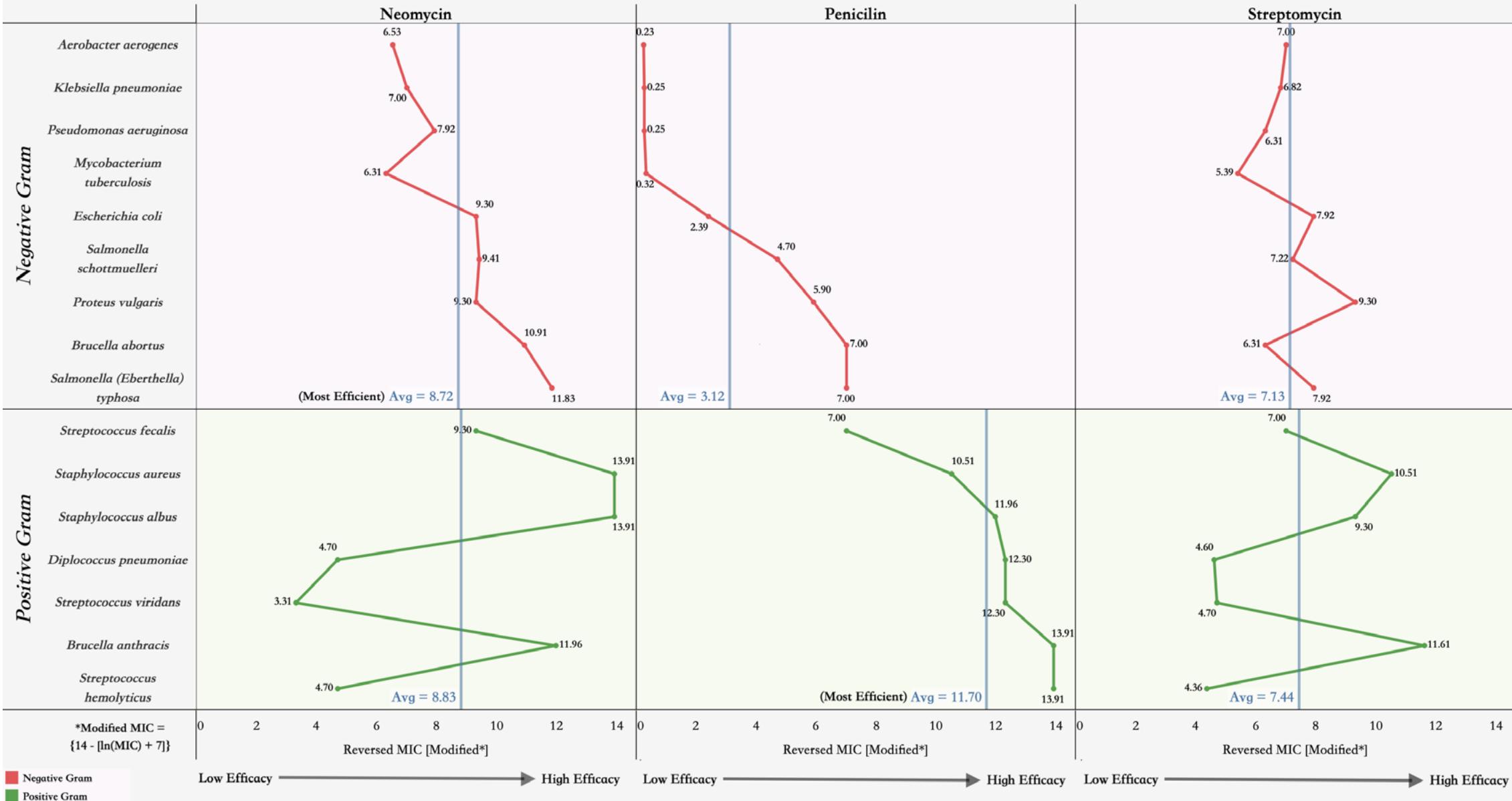
Gram Positive



Gram Negative



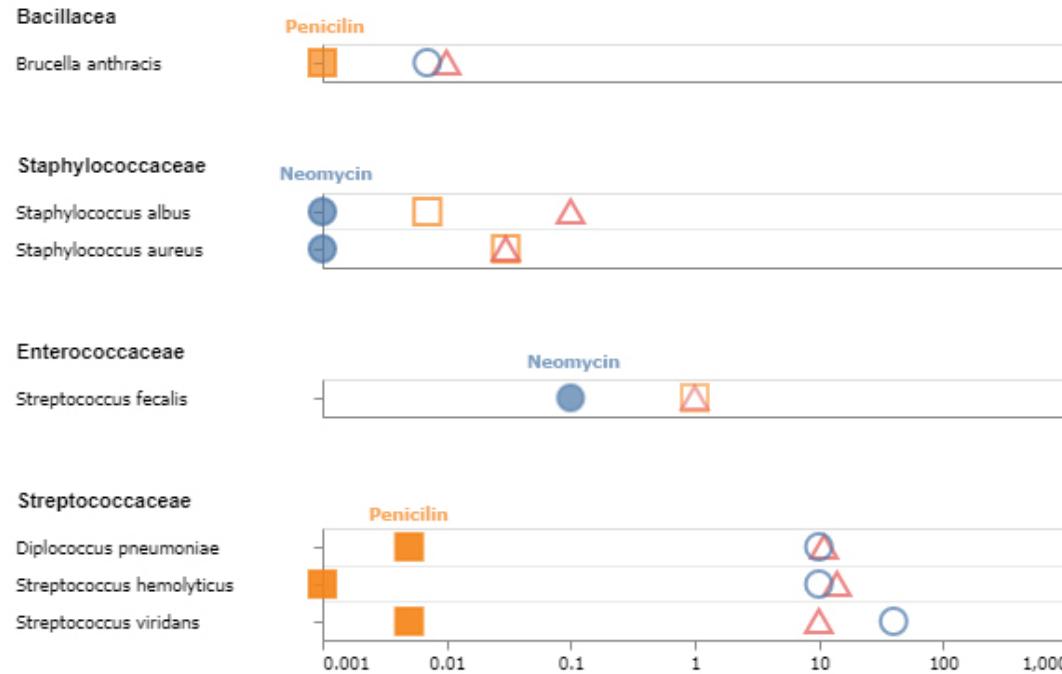
[SI649]Comparing Efficiency of 3 Antibiotics against Bacteria (Burtin's Data)



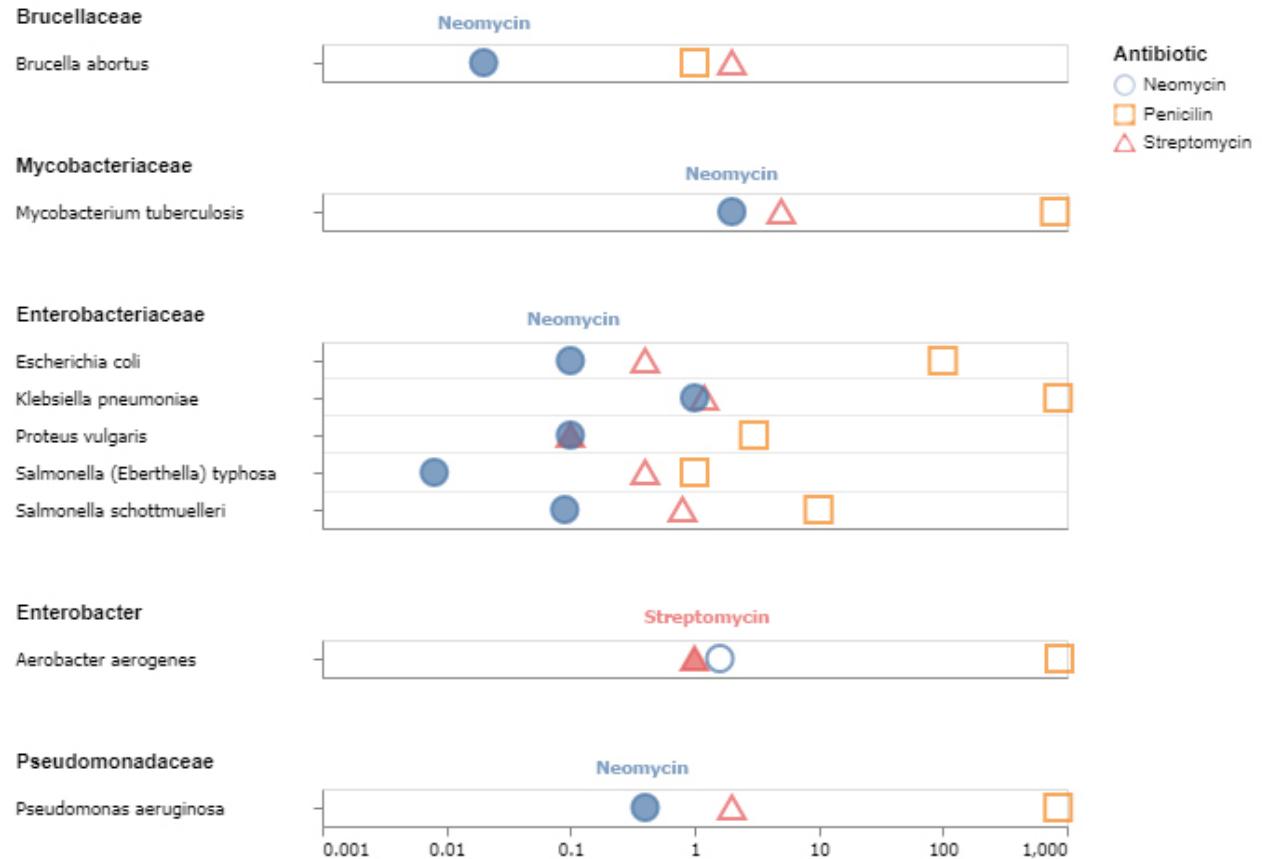
Most Effective Antibiotic for Bacterial Infection

Minimum Inhibitory Concentrations of Neomycin, Penicillin, & Streptomycin

Gram Positive Bacteria



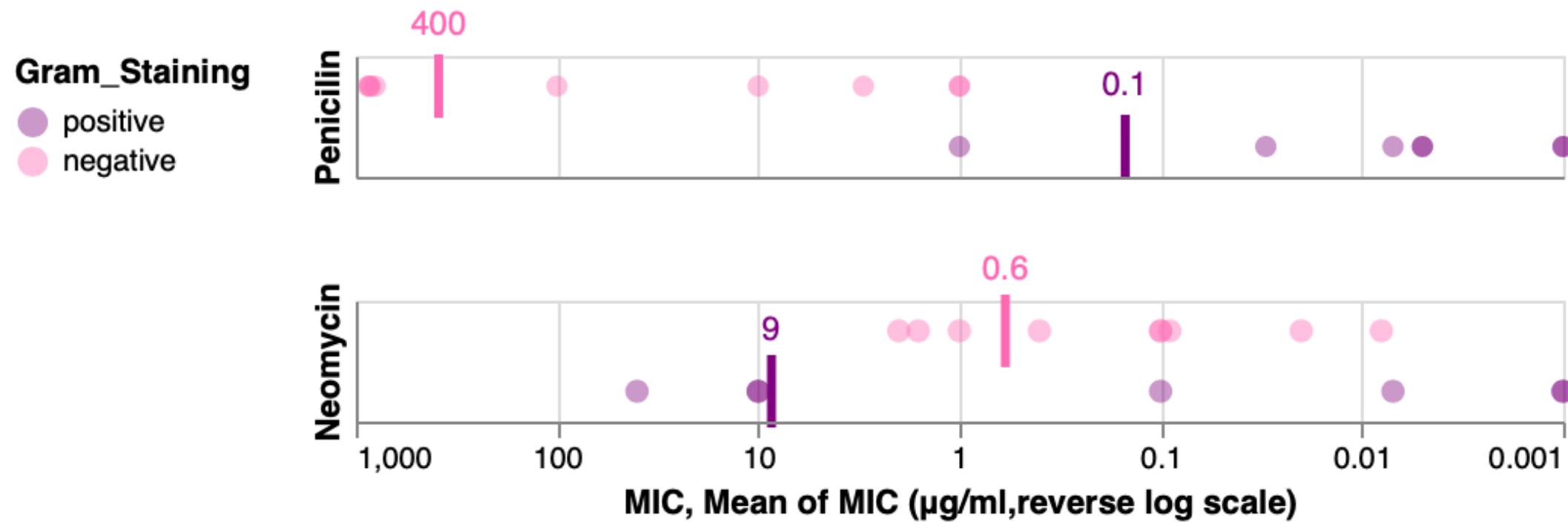
Gram Negative Bacteria

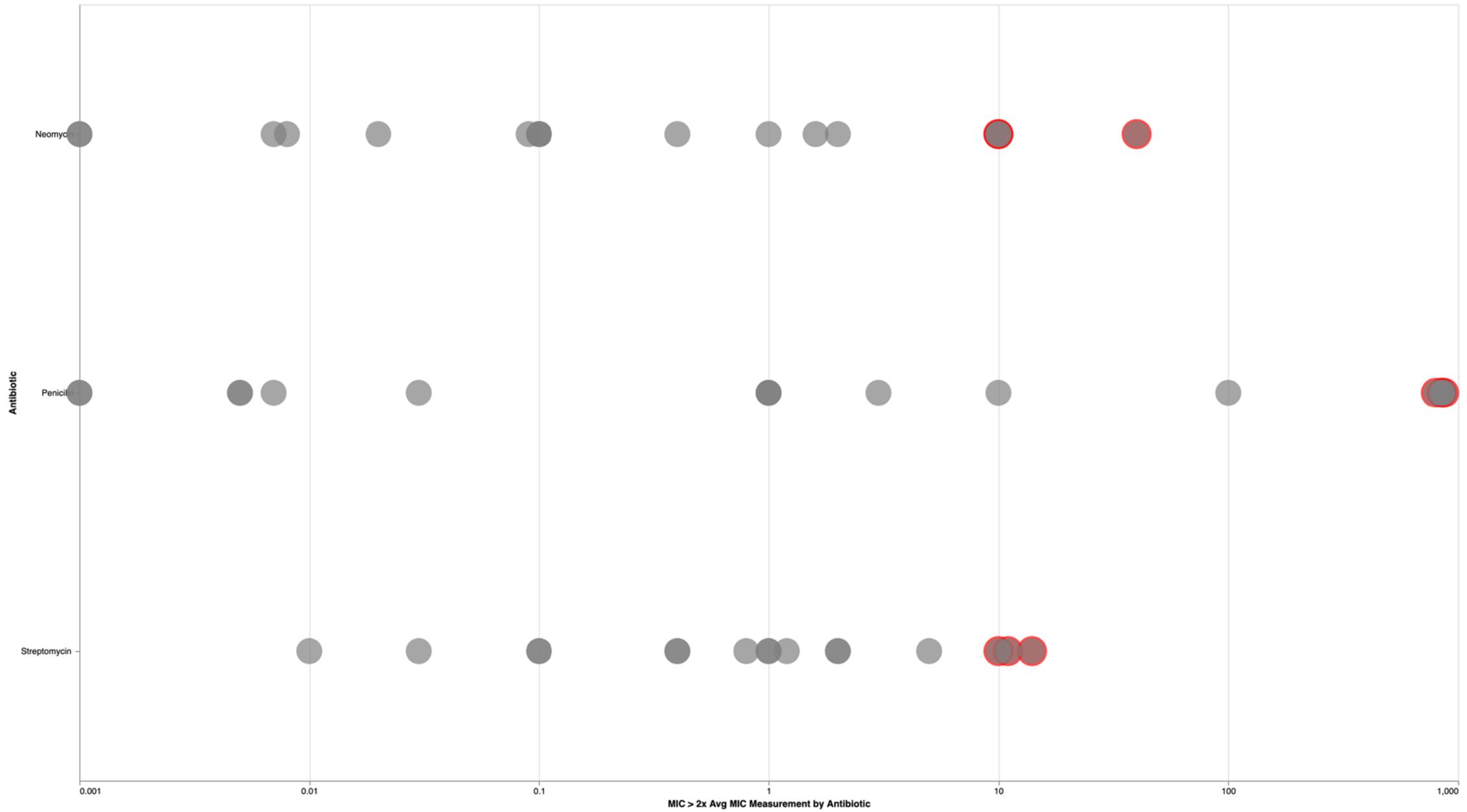


¹Filled marks and labels indicate which antibiotic is best suited (has lowest minimum inhibitory concentration) for a given bacterial infection.

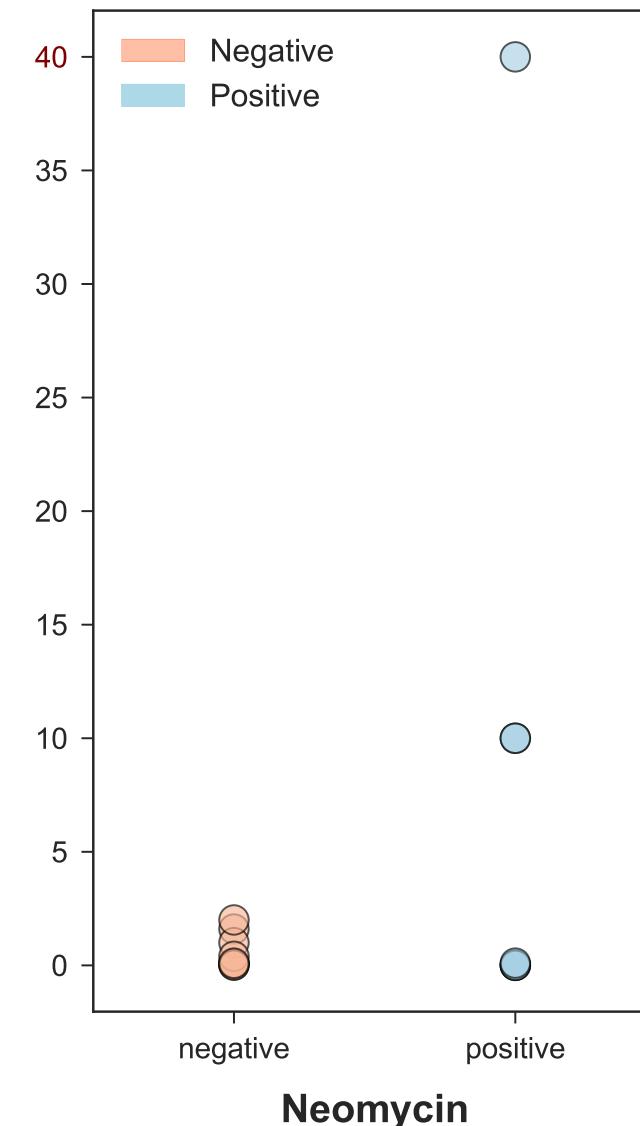
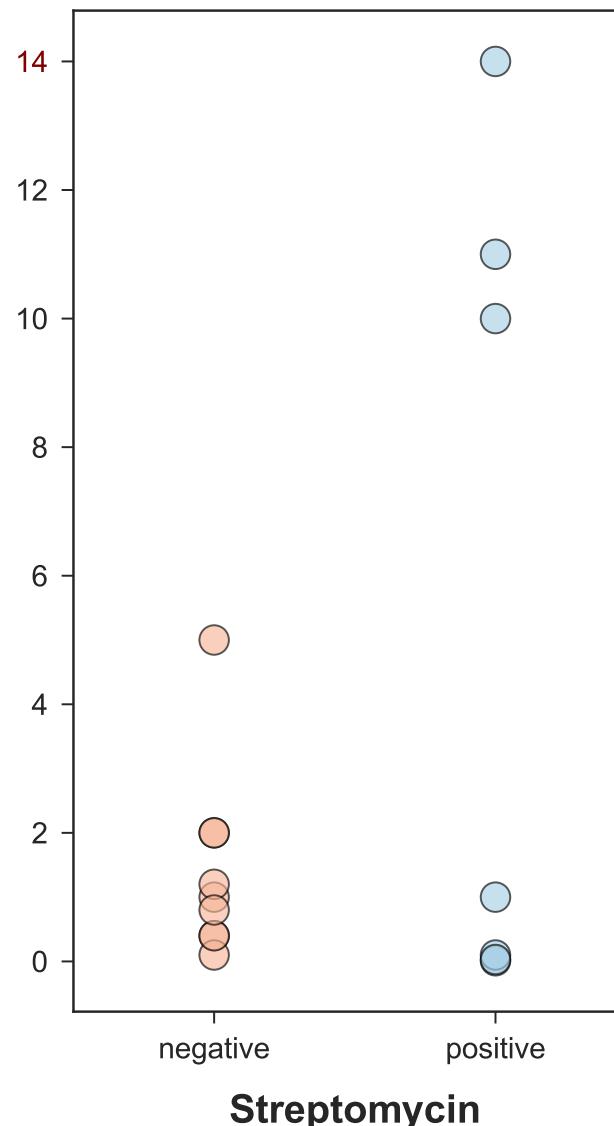
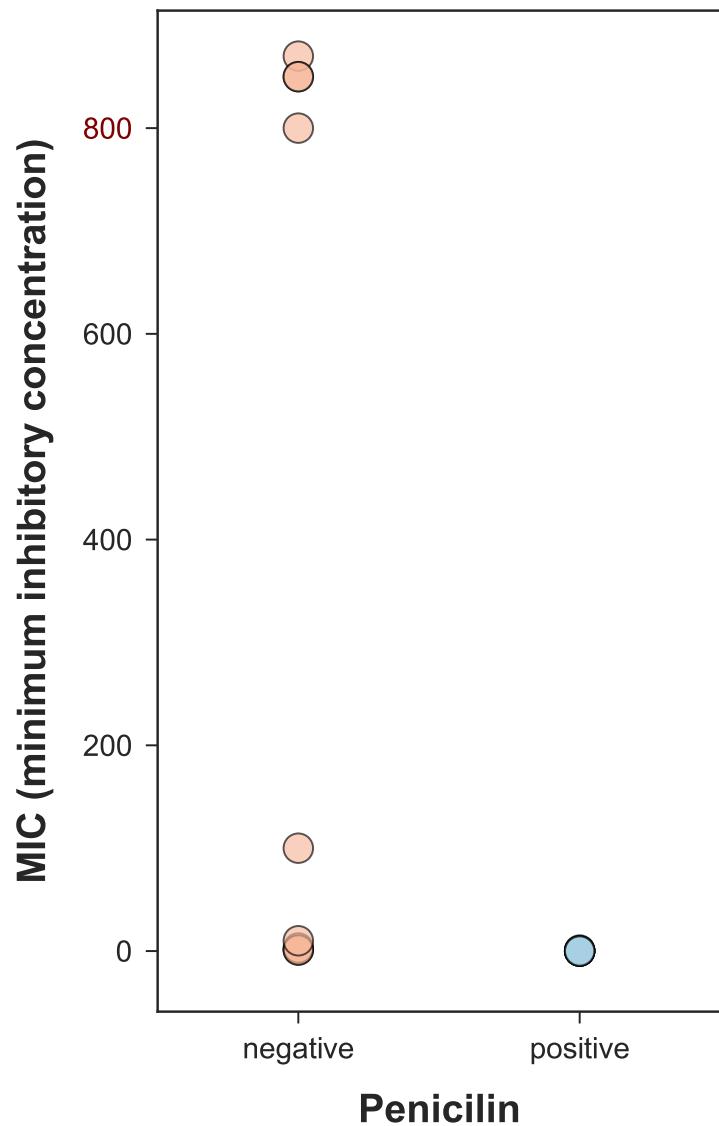
Minimum Inhibition Concentration of different antibiotics for Gram Positive and Negative bacteria

To prevent growing a Gram-Negative bacteria, would you choose 0.6 µg/ml of Neomycin or 400 µg/ml of Penicillin?



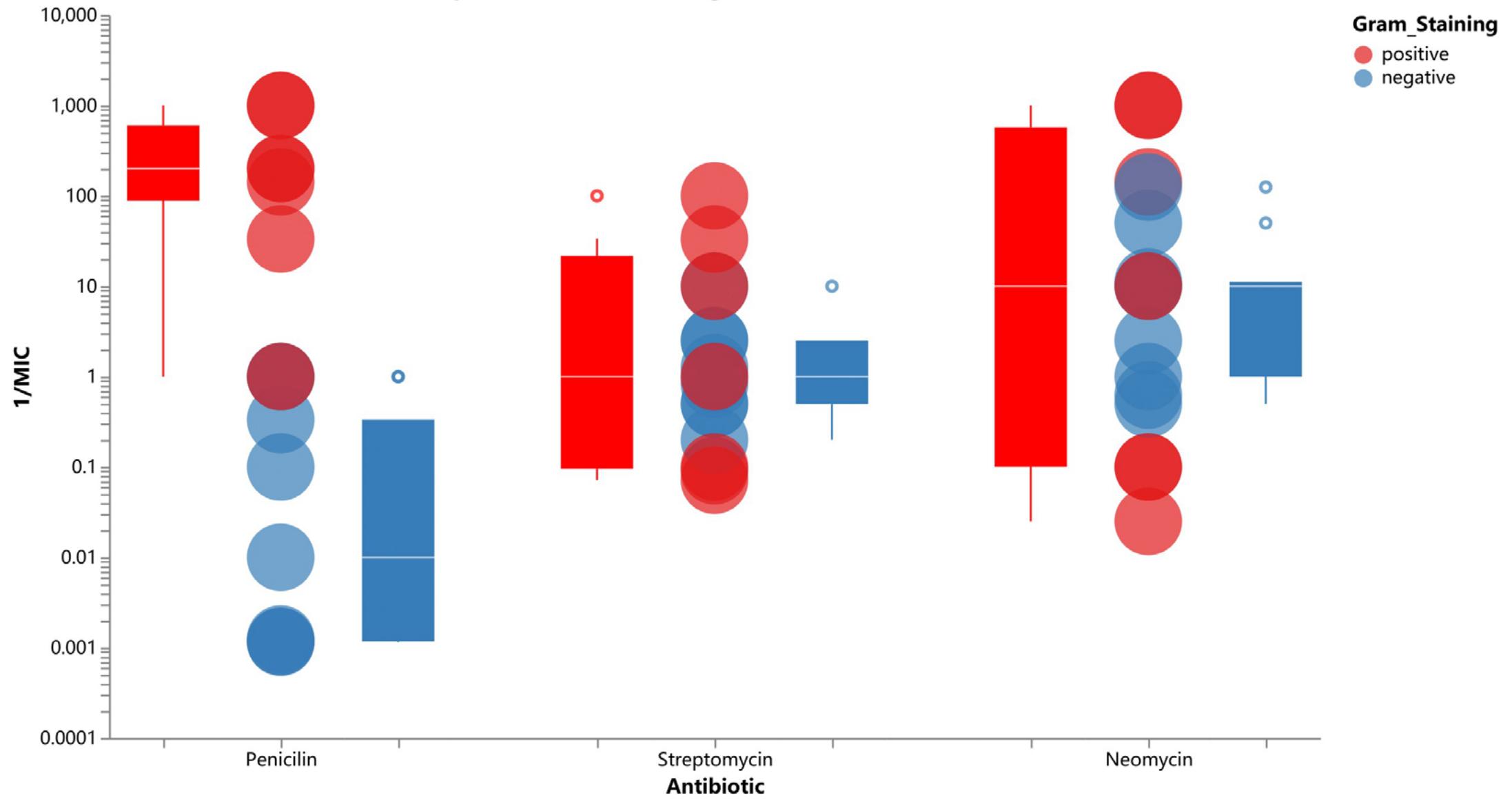


Antibiotic Effectiveness, Based on MIC Doses



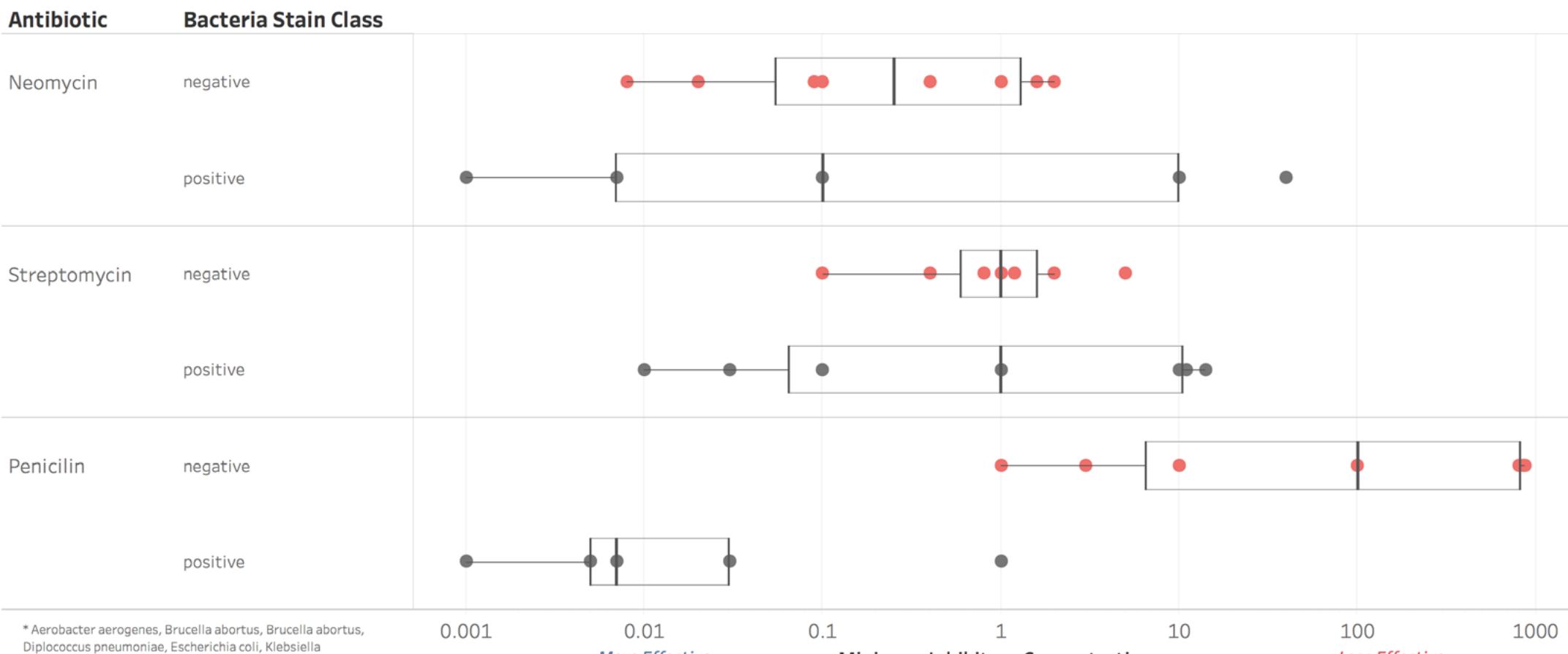
Distributions

Effectiveness of Antibiotics on Gram-positive and Gram-negative Bacteria



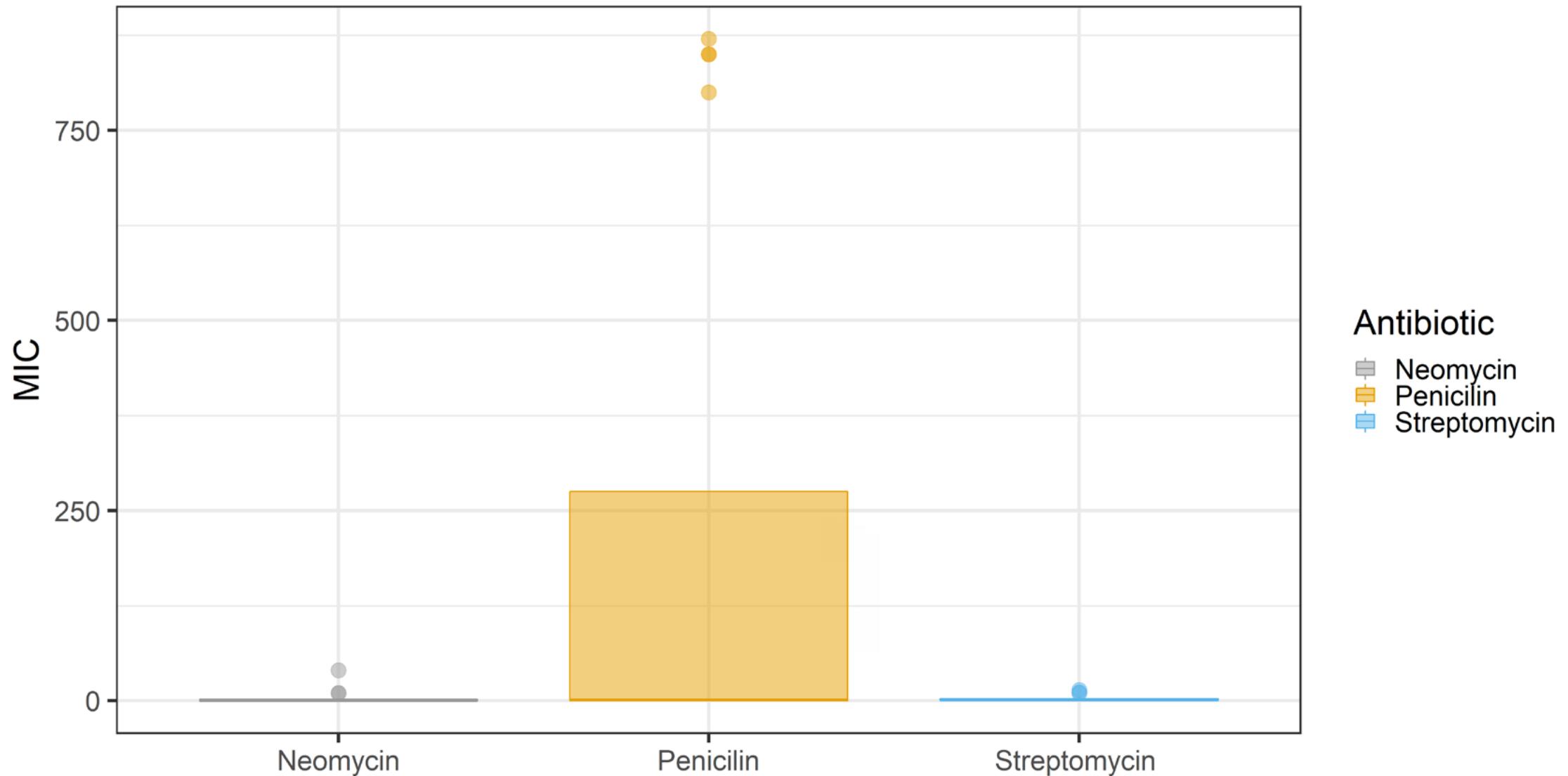
Distributional vis can help us understand higher-level properties of sets of data

Antibiotics and Their Effectiveness Against Different Gram-Stain Classes of 16 Common Bacteria*



* Aerobacter aerogenes, Brucella abortus, Brucella abortus, Diplococcus pneumoniae, Escherichia coli, Klebsiella pneumoniae, Mycobacterium tuberculosis, Proteus vulgaris, Pseudomonas aeruginosa, Salmonella (Eberthella) typhosa, Salmonella schottmuelleri, Staphylococcus albus, Staphylococcus aureus, Streptococcus fecalis, Streptococcus hemolyticus, and Streptococcus viridans

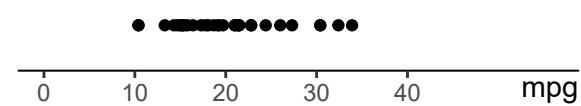
Distribution of MIC by Antibiotic Group



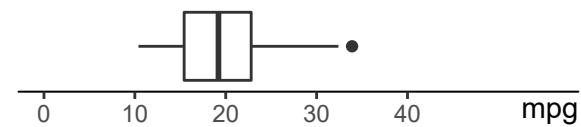
Number of Bacteria that are Resistant to Penicillin



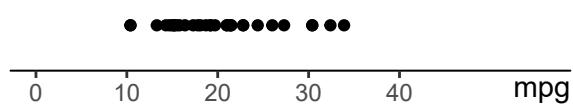
(sidebar on distribution vis)



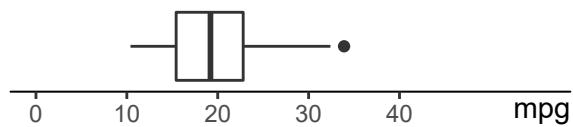
Raw data



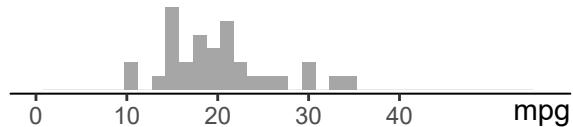
Boxplot



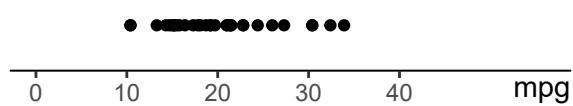
Raw data



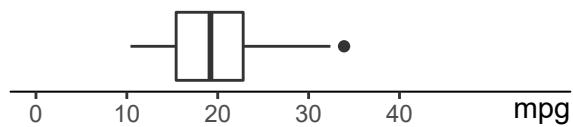
Boxplot



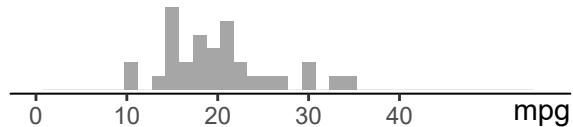
Histogram



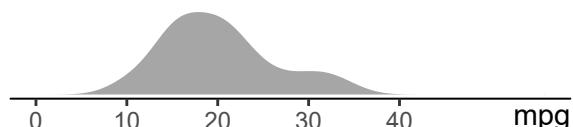
Raw data



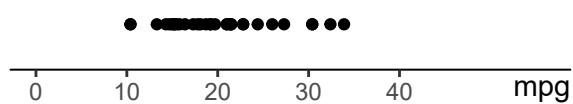
Boxplot



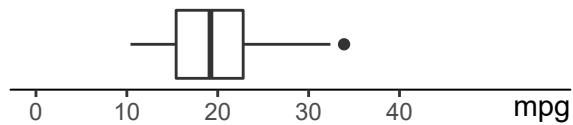
Histogram



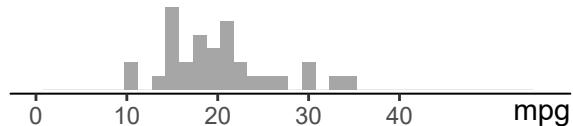
Density plot



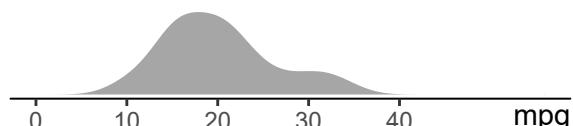
Raw data



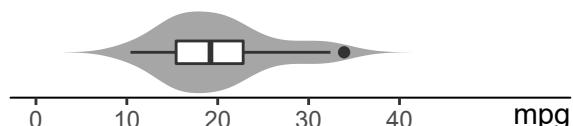
Boxplot



Histogram

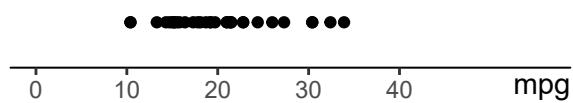


Density plot

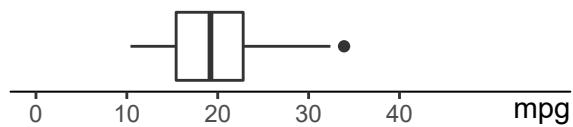


Violin plot

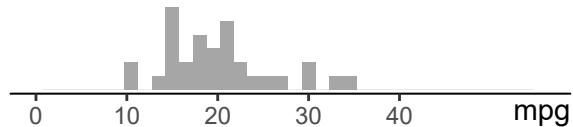
(or similar: “bean plot”)



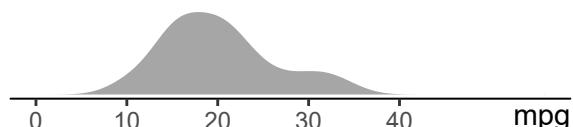
Raw data



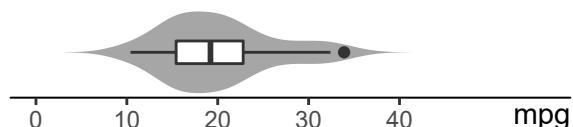
Boxplot



Histogram

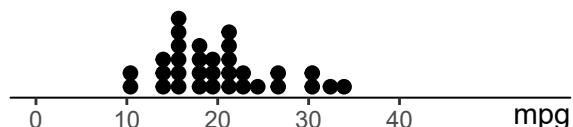


Density plot



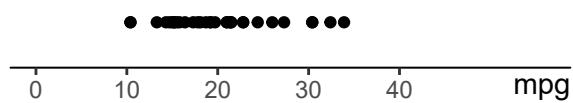
Violin plot

(or similar: “bean plot”)

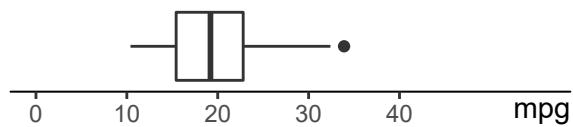


(Wilkinson) dotplot

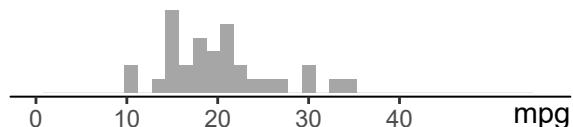
(or similar: “beeswarm”)



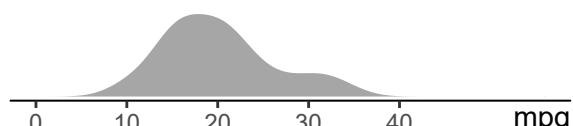
Raw data



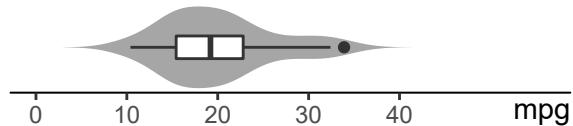
Boxplot



Histogram

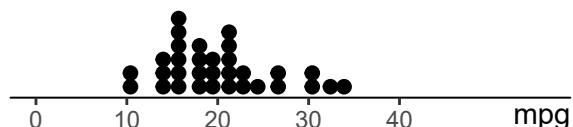


Density plot



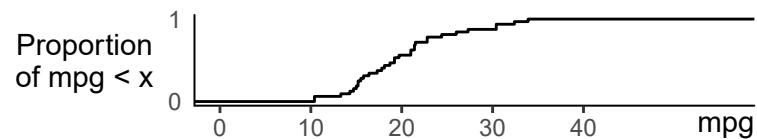
Violin plot

(or similar: “bean plot”)



(Wilkinson) dotplot

(or similar: “beeswarm”)

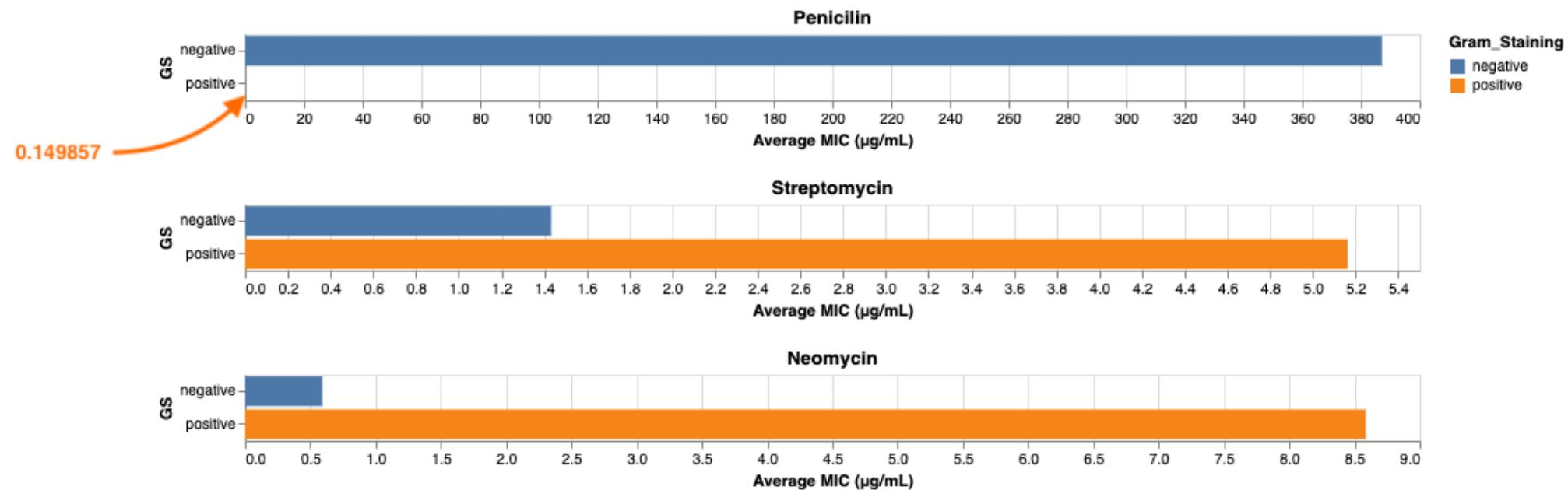


Cumulative distribution function (CDF)

(back to our program)

Instead of the distribution, maybe we show statistics...

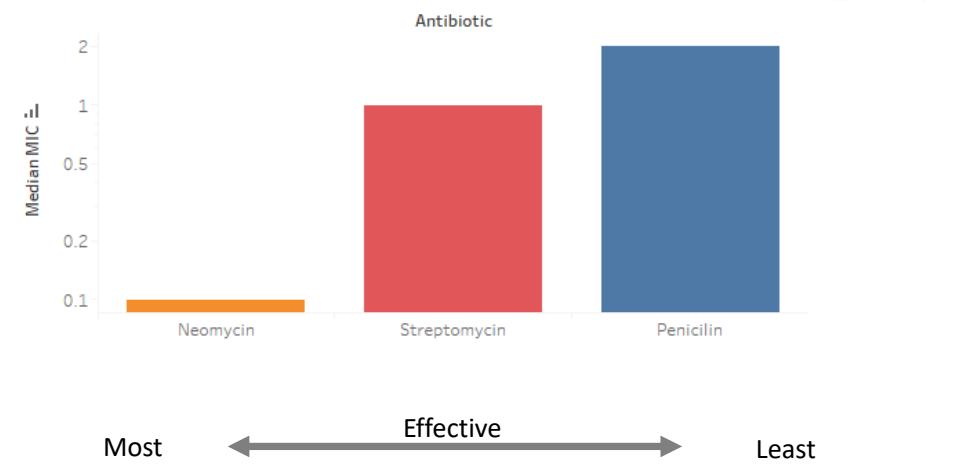
Average MIC (minimum inhibitory concentration) of Antibiotics by GS (Gram Staining)"



1

The Most Effective Antibiotic

The Antibiotics Are Sorted From Most to Least Effective

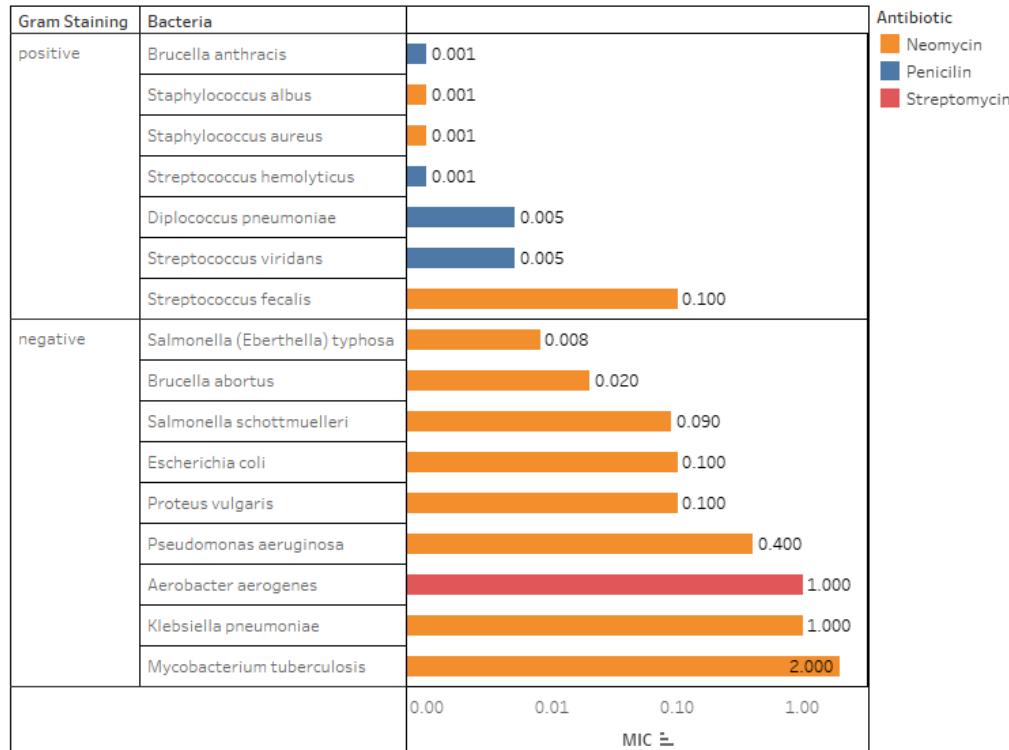


The most effective antibiotic across each tested disease.
Neomycin seems to be the most effective (**in general**) relative to Streptomycin and Penicillin.

2

The Most Effective Antibiotic by Gram Staining

Each Bacteria Has Been Identified by Its Name



Neomycin has a higher success rate against **negative** staining bacteria. Whereas, Penicillin has a higher success rate against **positive** staining bacteria.

	NEOMYCIN	PENICILLIN	STREPTOMYCIN
Aerobacter aerogenes			✓
Brucella abortus	✓		
Brucella anthracis		✓	
Diplococcus pneumoniae		✓	
Escherichia coli	✓		
Klebsiella pneumoniae	✓		
Mycobacterium tuberculosis	✓		
Proteus vulgaris	✓		✓
Pseudomonas aeruginosa	✓		
Salmonella (Eberthella) typhosa	✓		
Salmonella schottmuelleri	✓		
Staphylococcus albus	✓		
Staphylococcus aureus	✓		
Streptococcus fecalis	✓		
Streptococcus hemolyticus		✓	
Streptococcus viridans		✓	

■ Gram **negative** bacteria

■ Gram **positive** bacteria

✓ MIC ≤ 0.005

✓ MIC > 0.005

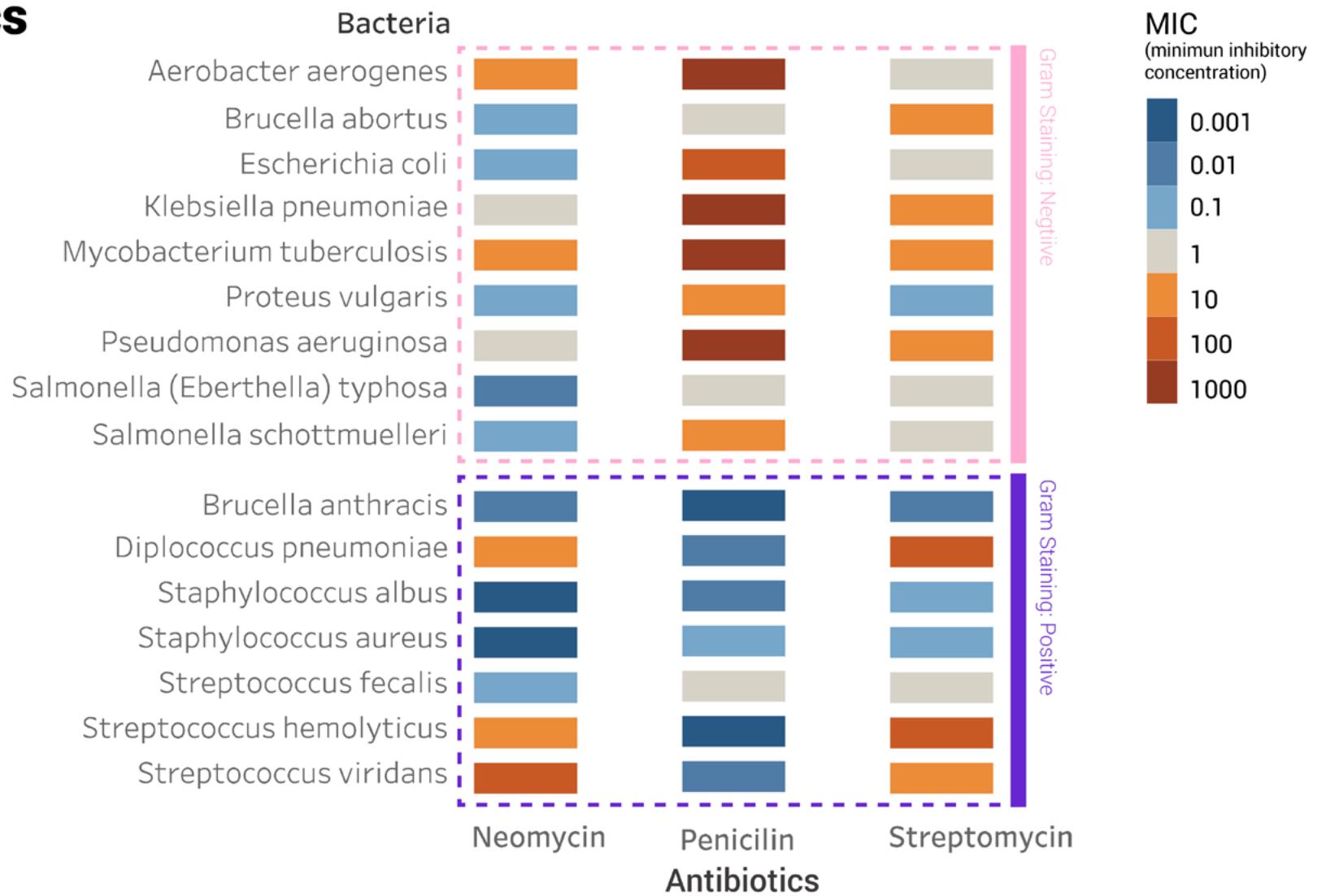
MIC: concentration of antibiotic required to prevent growth in vitro

Let's find out the...

**Most effective
drug for a
bacterial infection**

Heatmaps and other things...

Bacteria Inhibition Performance of Antibiotics



Remember **sequential** versus **diverging** color scales

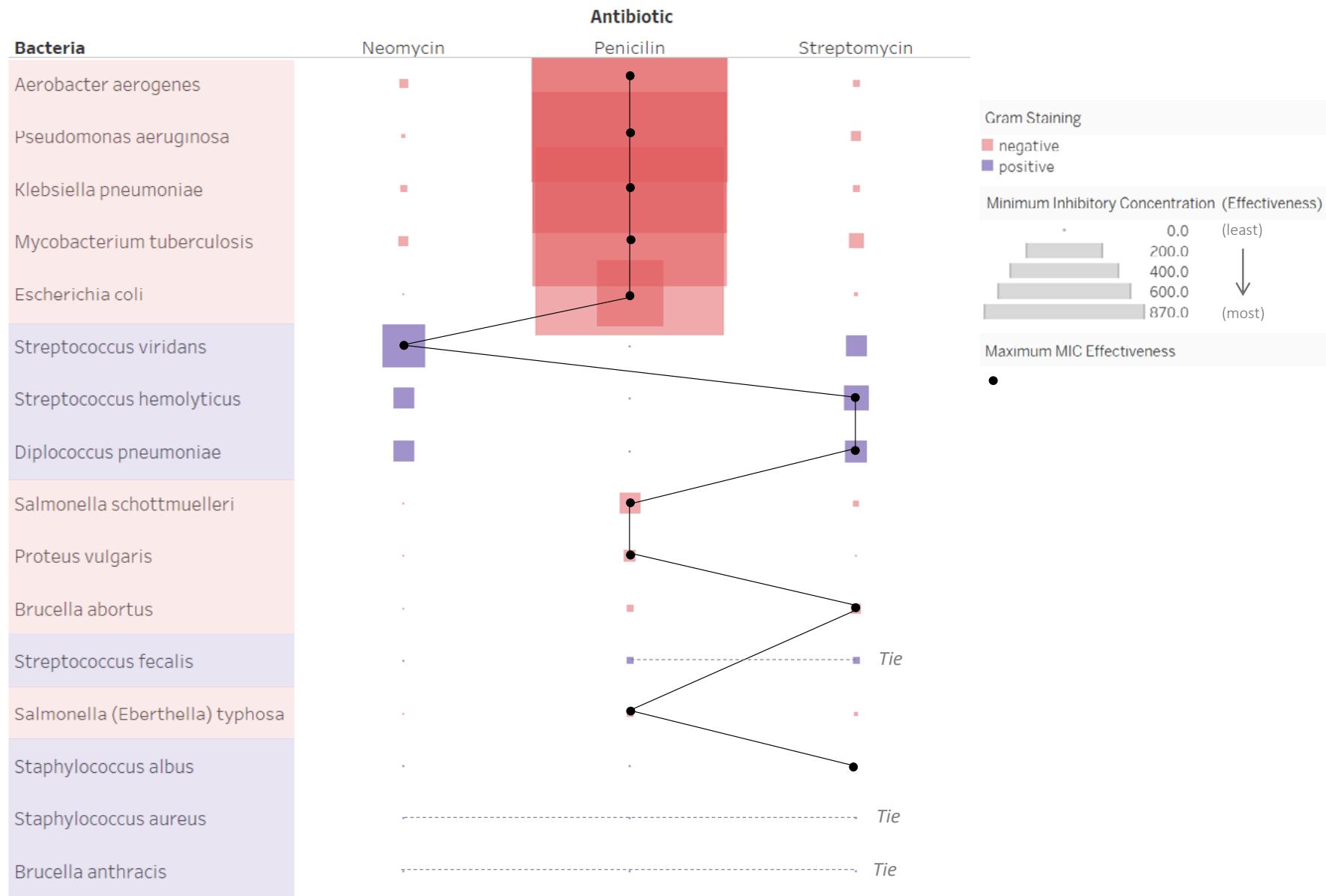
Sequential color scale:



Diverging color scale:

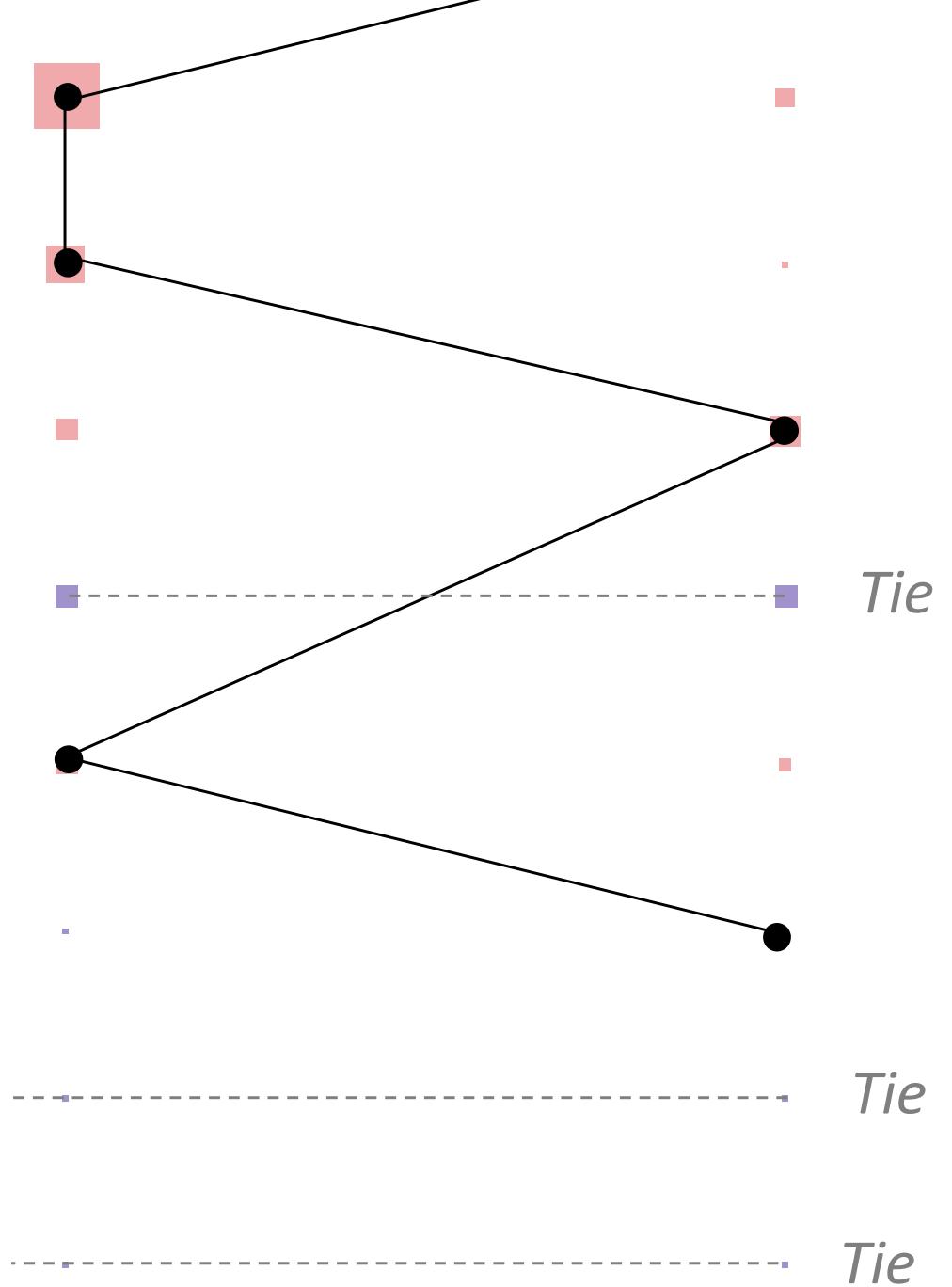


Effectiveness of Antibiotics per Bacteria Strain



Trying to establish a
visual vocabulary...

Good idea, but needs
explanation / scaffolding



Other notes...

Horizontal labels good

Nominal axes have **no inherent order** – alphabetical often not what you want

Must think about how to **index into** a chart

and what **comparisons** are easy or hard...

Transformations

log can be very helpful...

- but make sure **axes are interpretable**, with units
- what is length with **no meaningful 0**?
- is there a **non-arbitrary** reference point?

Annotate, annotate, annotate...

... your axes, interesting observations, hints for interpretation...

Don't put this info far away!

Lookups kill performance

Thing <-----> Info I need to interpret thing

Thing <-> Info I need to interpret thing

Layer + make readable at different levels

Squint test / **intra-ocular trauma** test

(hits you **between the eyes**)

Methods for displaying distributions

Boxplots, rug plots, dotplots, densities, cumulative distribution functions...

More to come in design lecture

Take my feedback seriously in re-submit