BMRGs and ARGs Co-occurrence

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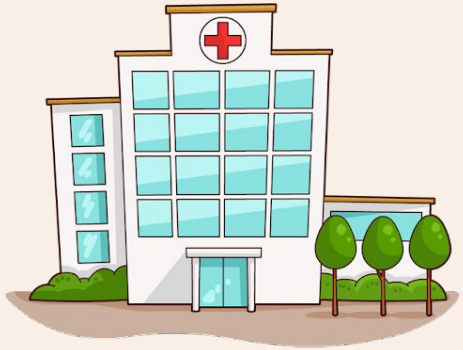
Resistant Bacteria

- Bacterial infection is a current global challenge.
- Overuse of antimicrobial agents contributes to the issue.
- Some settings where they are used: hospitals, food chain, and environment.
    - In 2017, the global sales of antimicrobial agents for livestock was 93, 309 tons.
    - By 2030, the sale can go up by 11.5%.
    - In 2019, 35% of abx Rx was unnecessary worldwide.
- Overtime, the bacteria can develop the resistant gene to both biocide/metal and antibiotic.

Project's Goal

- Identify bacterial gene that are resistant to both biocide/metals and antibiotics
- Determine a list of dangerous bacteria
- Inform the audience the factor contributing to failure in bacterial treatment globally
- Raise public awareness on antimicrobial agents overuse reduction



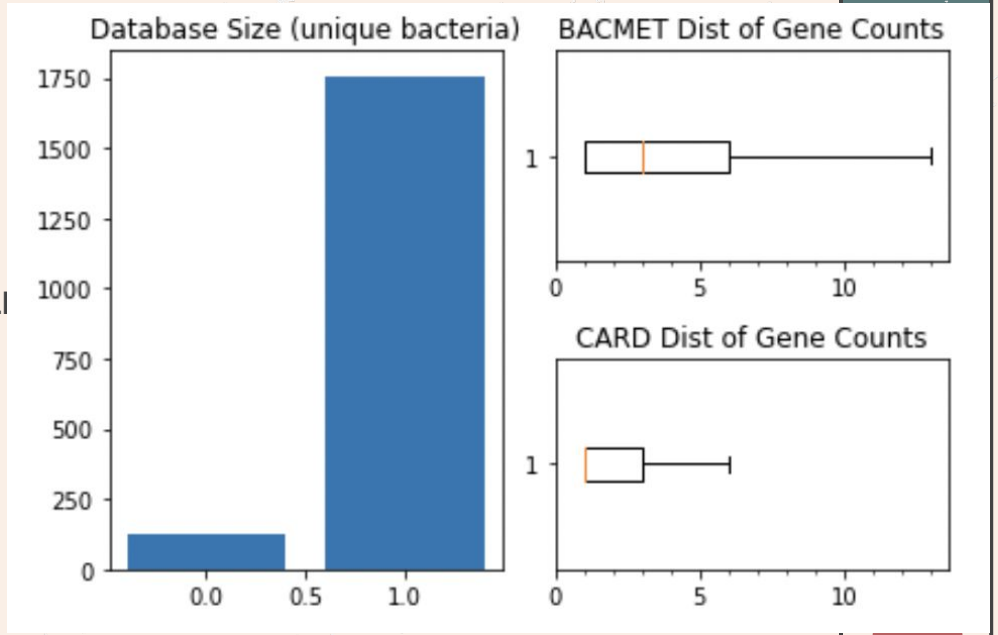
Data Sources

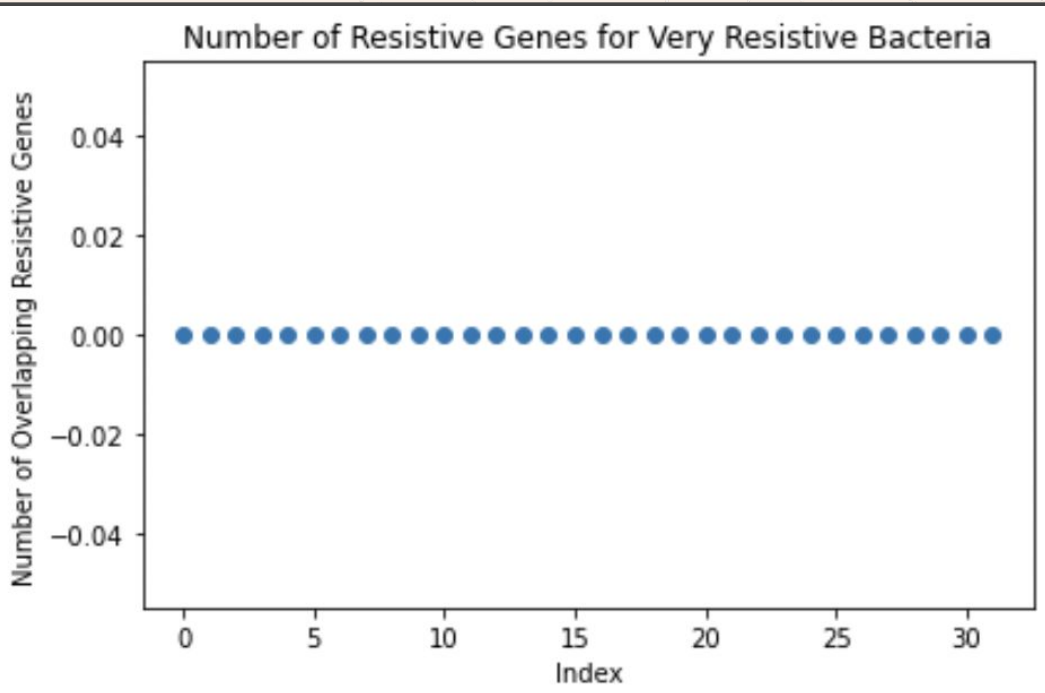
CARD, the **Comprehensive Antibiotic Resistance Database**

- Collects and organizes reference information on antimicrobial resistance genes, proteins and phenotypes

BacMet, the **Antibacterial Biocide and Metal Resistance Genes Database**

- Identify bacterial gene that are resistant to both biocide/metals and antibiotics





Bacteria that crossed both Databases
(non-fuzzy search) with num of 2x Danger Genes

Top 5 Bacteria most dangerous bacteria...

Most Dangerous by Gene Count...

1. escherichia coli has 134 metal/biocide resistive genes && 624 antibiotic resistant genes
2. klebsiella pneumoniae has 4 metal/biocide resistive genes && 691 antibiotic resistant genes
3. pseudomonas aeruginosa has 25 metal/biocide resistive genes && 560 antibiotic resistant genes
4. acinetobacter baumannii has 8 metal/biocide resistive genes && 511 antibiotic resistant genes
5. staphylococcus aureus has 18 metal/biocide resistive genes && 372 antibiotic resistant genes

Most Dangerous by Number of Resistivities...

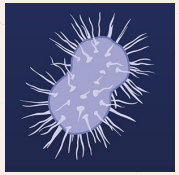
1. escherichia coli has 54 metal/biocide resistances && 39 antibiotic resistances
2. staphylococcus aureus has 26 metal/biocide resistances && 41 antibiotic resistances
3. pseudomonas putida has 29 metal/biocide resistances && 33 antibiotic resistances
4. acinetobacter baumannii has 21 metal/biocide resistances && 37 antibiotic resistances
5. pseudomonas aeruginosa has 17 metal/biocide resistances && 38 antibiotic resistances

Most Dangerous Bacterium Genes...

1. rhodococcus rhodochrous has a 1.285714 ratio of resistivities to resistive genes
2. neisseria gonorrhoeae has a 0.415730 ratio of resistivities to resistive genes
3. pseudomonas fluorescens has a 0.390909 ratio of resistivities to resistive genes
4. streptococcus pneumoniae has a 0.380952 ratio of resistivities to resistive genes
5. pseudomonas putida has a 0.354286 ratio of resistivities to resistive genes

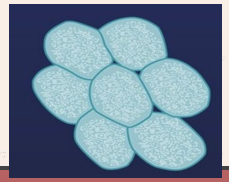
Most Dangerous Bacteria

Streptococcus Pyogenes

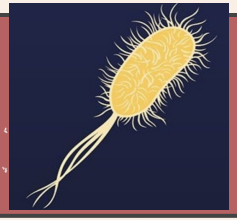


Neisseria Gonorrhoeae

Mycobacterium Tuberculosis

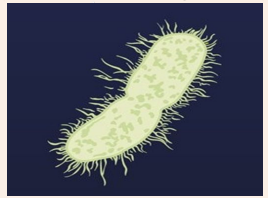


Acinetobacter Baumannii

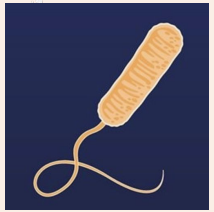


Escherichia Coli

Klebsiella Pneumoniae



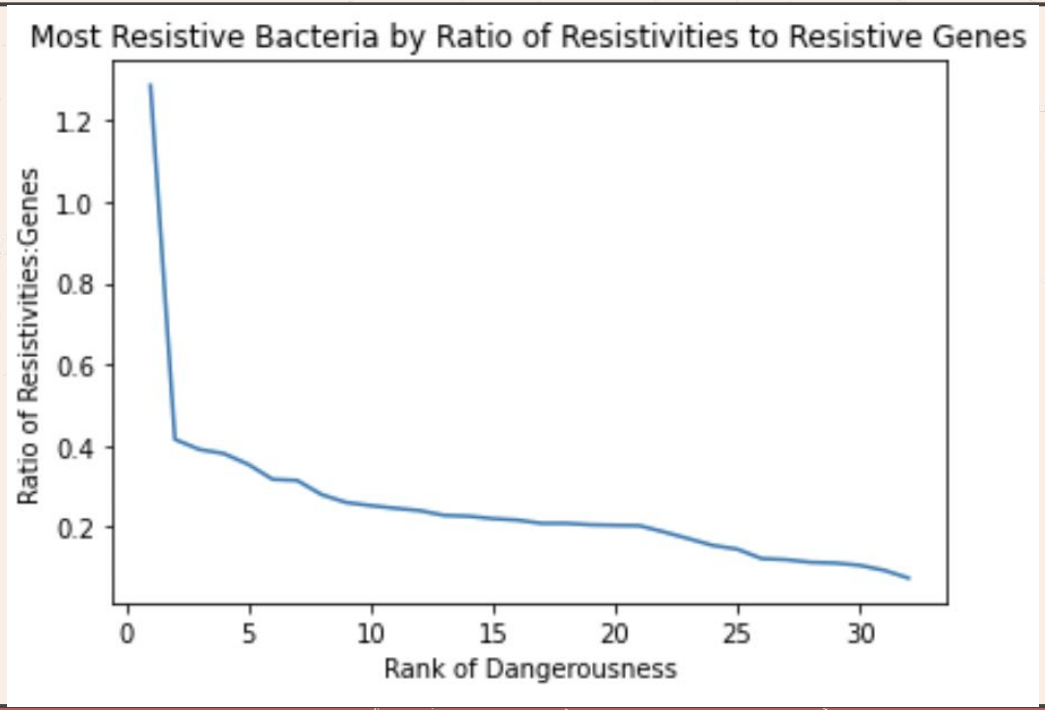
Clostridium Difficile



Pseudomonas Aeruginosa

Burkholderia Cepacia

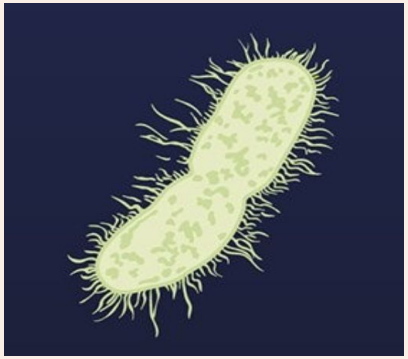
Staphylococcus Aureus

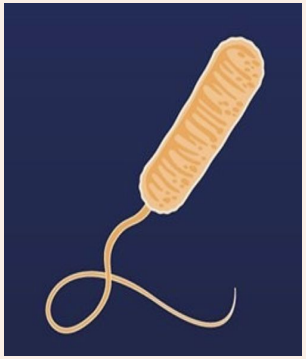


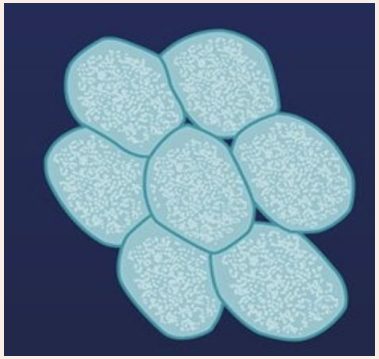
Resistivities : Resistive Genes by Index Rank

Verified Data via Threat List Overlap

Klebsiella Pneumoniae	is a verified threat at	dangerousness rank: **1**
Pseudomonas Aeruginosa	is a verified threat at	dangerousness rank: **2**
Acinetobacter Baumannii	is a verified threat at	dangerousness rank: **4**
Escherichia Coli	is a verified threat at	dangerousness rank: **7**
Staphylococcus Aureus	is a verified threat at	dangerousness rank: **10**
Mycobacterium Tuberculosis	is a verified threat at	dangerousness rank: **24**
Neisseria Gonorrhoeae	is a verified threat at	dangerousness rank: **31**







Implications

- These bacteria and mutations disproportionately affect marginalized communities in the US
- Knowing this, we need to direct research and outreach to researchers and encourage increased funding to target
- Observe experimental methods to perhaps prevent these specific bacteria from mutating
- For further research... explore the prevalence of these bacterium and present trends