

Point-Gene Mutations and Antimicrobial Resistance

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Introduction

- Antimicrobial resistance led to 1.27 million deaths worldwide in 2019 (1)
- Leads to higher medical costs and difficulty treating infections (2)
- Mutations in penicillin-binding proteins of gram-positive bacteria can contribute to resistance to Beta-Lactam antibiotics. (3)

Objective of the Study

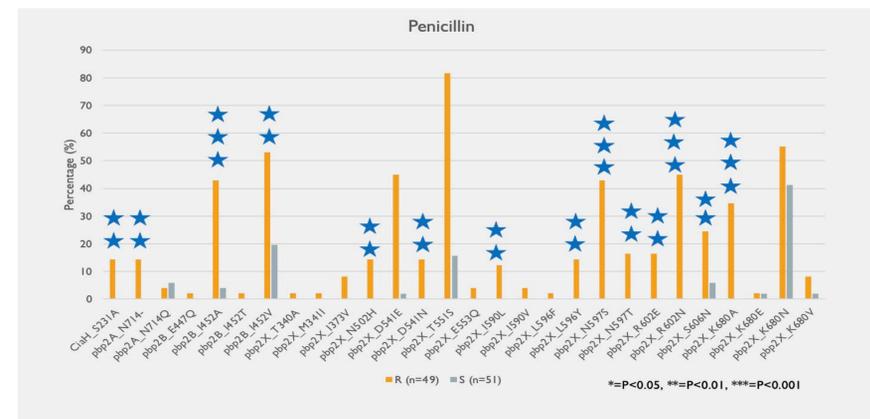
The purpose of this research internship was to use systematic literature review to identify mutations in penicillin-binding proteins of gram-positive bacteria, document their resistance to beta-lactam antibiotics, transform the mutations to *Streptococcus Suis*, and document patterns in the mutations.

Methods

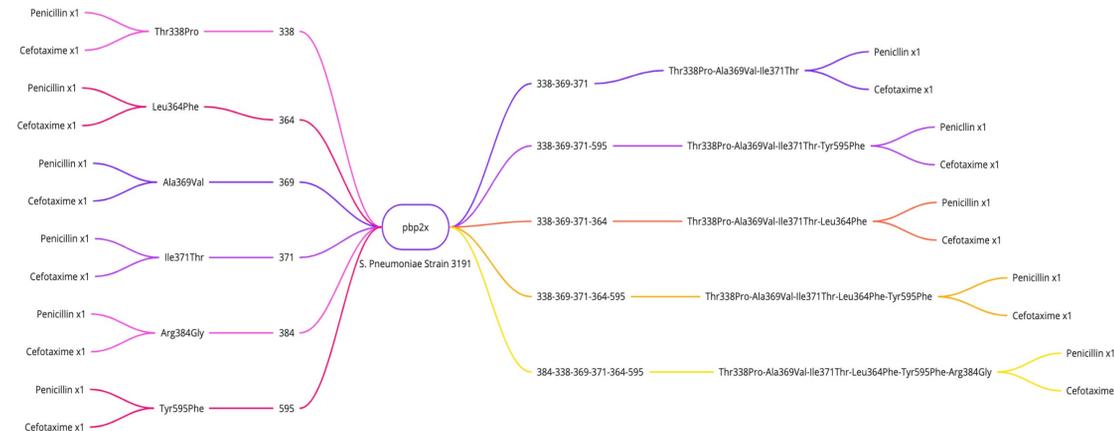
- Review literature to make a database of mutations
- Covert the mutations into *S. Suis* with BioEdit and R Studio
- Analyze patterns in the mutations and the statistical significance of the patterns.

Results

- In the literature, more than 300 mutations were identified that showed an increase in antimicrobial resistance.
- Many mutations were common across different species and different strains.



Pictured above: A graph representing the results of the prevalence of mutations in resistant and susceptible phenotypes of the *S. Suis* collection



Pictured above: A map of amino acid changes in the penicillin-binding protein 2x of *S. Pneumoniae* Strain 3191

- Different antimicrobial resistant *Streptococcus Suis* isolates have similar mutations patterns in penicillin-binding proteins.
- Mutations were common across isolates that were resistant to different antibiotics (Penicillin and Ceftiofur).
- Some mutation patterns were more statistically significant than others, and those that showed the largest discrepancy in MIC values between the susceptible and resistant phenotypes were deemed to be most important for antimicrobial resistance.

Discussion

- Mutations in penicillin-binding proteins of gram-positive bacteria contribute significantly to antimicrobial resistance

Questions

- How might antimicrobial resistance differ among different communities? Does race or class play a role in one's susceptibility to acquiring antimicrobial-resistant bacteria?

Conclusion

Looking at bacteria on a genomic level is important to addressing antimicrobial resistance and ultimately for informing policy.

Acknowledgements

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References

- (1) Oxford University. 2022. *An estimated 1.2 million people died in 2019 from antibiotic-resistant bacterial infections*. [Online]. Available at <<https://www.ox.ac.uk/news/2022-01-20-estimated-12-million-people-died-2019-antibiotic-resistant-bacterial-infections#:~:text=An%20estimated%201.2%20million%20people,bacterial%20infections%20%7C%20University%20of%20Oxford>> [Accessed 8 August 2022].
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- (3) Georgopapadakou, N. H. (1993). Penicillin-binding proteins and bacterial resistance to beta-lactams. *Antimicrobial agents and chemotherapy*, 37(10), 2045-2053.