

Thesis Project Portfolio

**A Computational Model Driven Design of a Novel Therapeutic Strategy for Targeting
*Klebsiella pneumoniae***

(Technical Report)

The Causes and Implications of the Overuse of Antibiotics in Healthcare

(STS Research Paper)

An Undergraduate Thesis

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Table of Contents

Sociotechnical Synthesis

A Computational Model Driven Design of a Novel Therapeutic Strategy for Targeting *Klebsiella pneumoniae*

The Causes and Implications of the Overuse of Antibiotics in Healthcare

Prospectus

Sociotechnical Synthesis

In recent years, strains of infectious bacteria have evolved to become increasingly more resistant to the drugs commonly used to treat them, culminating in around 3 million drug-resistant infections in the United States each year. By far the most common cause of these infections is the bacterial pathogen *Klebsiella pneumoniae*. With the vast majority of *K. pneumoniae* clinical strains now demonstrating a wide range of resistance to antibiotics, almost all available medications have been rendered ineffective. To address this blatant need for alternative treatment options, I have identified and subsequently validated a novel therapeutic strategy for targeting *K. pneumoniae* infections. This rise in drug-resistant bacteria is being further accelerated by the vast over-prescription of antibiotics in the healthcare field. It is of utmost importance to additionally consider the sociotechnical aspects surrounding antibiotics because they are key drivers contributing to this cycle of overprescribing. If the details around why antibiotics are being overused can be better understood, proper actions may be taken to ameliorate this global health issue. To analyze the many sociotechnical factors that are thought to influence the unnecessary prescribing of antibiotics, I used Susan Star's article on infrastructure as a basis of analysis. Using this framework to analyze the infrastructure surrounding antibiotics allowed for the easier identification of deficiencies within this system so that these shortfalls may be addressed. To collect data on this particular research topic, I distributed surveys to both people in the medical field and to the general public to gauge their knowledge around, and tendencies towards, antibiotic usage. Using the gathered results, I have identified trends (parsing out majority answers, minority answers, and other unique trends) indicating the common tendencies towards, and outliers around, antibiotics from both the clinicians' and the patients' points of view. Through these collected survey results, I found that the general public does not have a basic understanding of antibiotics, even though they feel that they do have a comprehensive understanding of this subject matter. Additionally, I identified trends showing that, while the general public does not feel like they are pressuring doctors to give them antibiotic prescriptions, doctors do feel like they are being pressured by their patients. Ultimately, the development of a novel therapeutic for the treatment of *K. pneumoniae* infections will result in the ability to treat these otherwise deadly infections. Additionally, this alternative treatment will lower the usage of current antibiotics, thus helping to minimize any future evolution towards antibiotic resistance. Further contributing to this solution, through gaining a better understanding of the sociotechnical aspects contributing to antibiotic over-prescription, we can work to remedy this issue from a social perspective.