

# Antibiotic Recommendation System

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## Table of Contents

- 1. System Overview
- 2. ATLAS Data Analysis
- 3. Decision Tree Model
- 4. Antibiotic Recommendations
- 5. Clinical Demonstration Cases
- 6. Resistance Pattern Analysis
- 7. Usage Recommendations
- 8. Limitations and Perspectives

# 1. System Overview

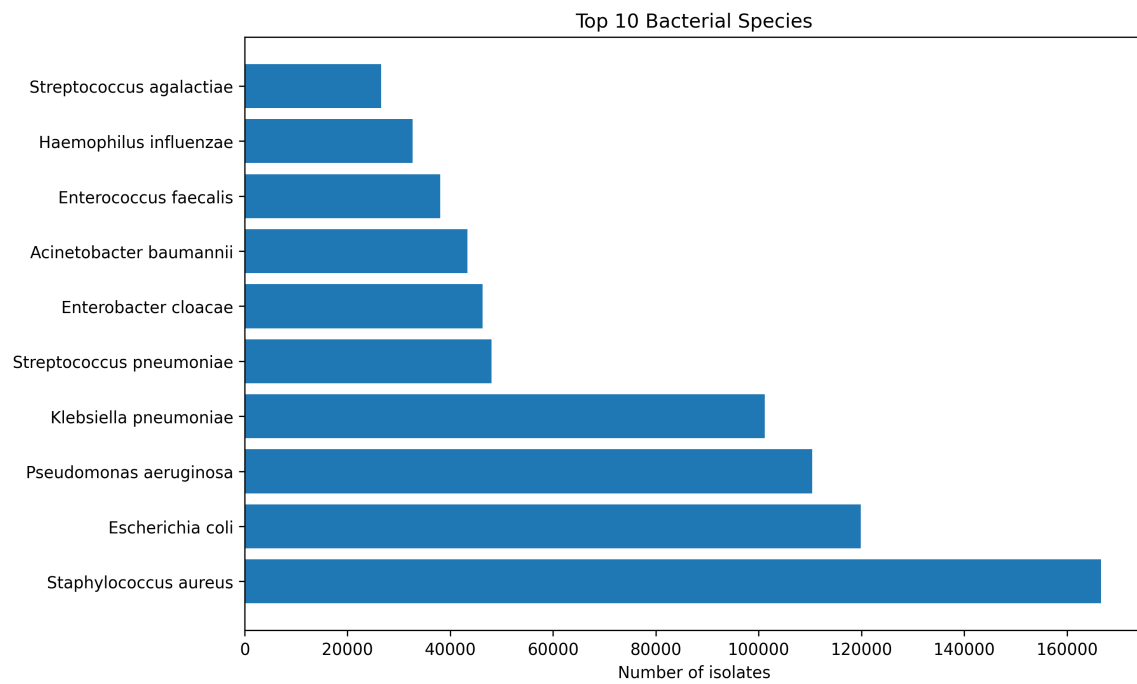
The Antibiotic Recommendation System uses a decision tree based on ATLAS data to recommend antibiotics in optimal order of efficacy. Cefiderocol is systematically placed as the last resort option, in accordance with good antibiotic stewardship practices. The system considers three main parameters: • The bacterial species responsible for the infection • The patient's region or country of origin • The bacterial resistance profile to antibiotics

# 2. ATLAS Data Analysis

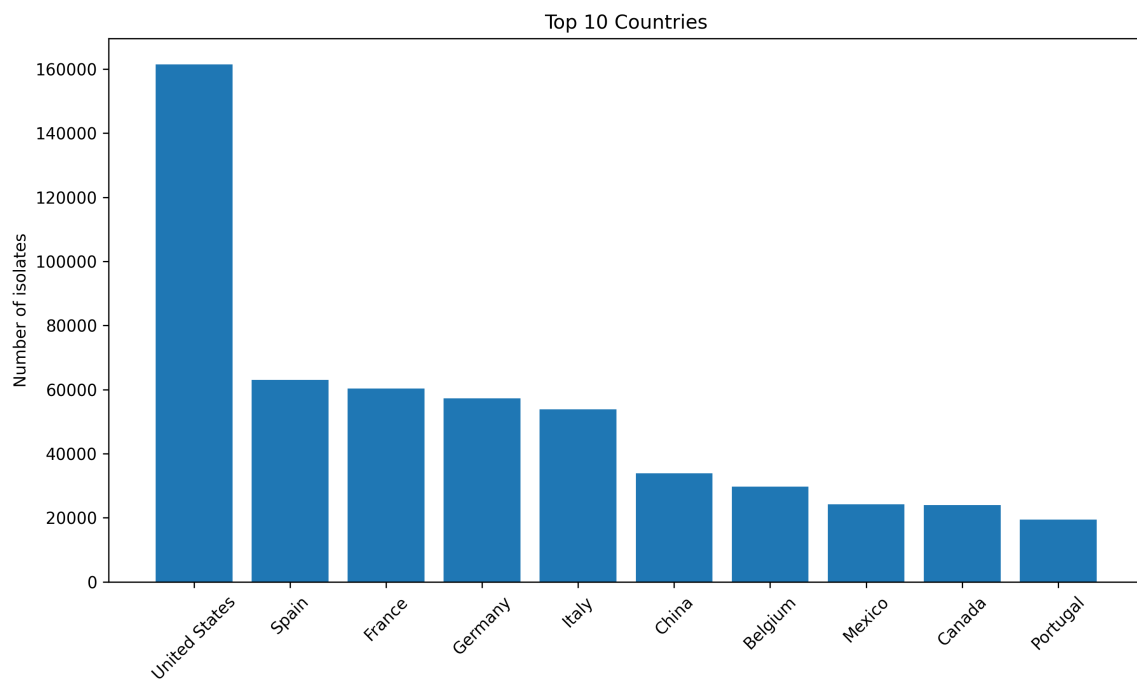
Summary of data used:

Metric	Value
Total isolates	966,805
Number of species	390
Number of countries	83
Time period covered	2004 - 2023
Antibiotics analyzed	48

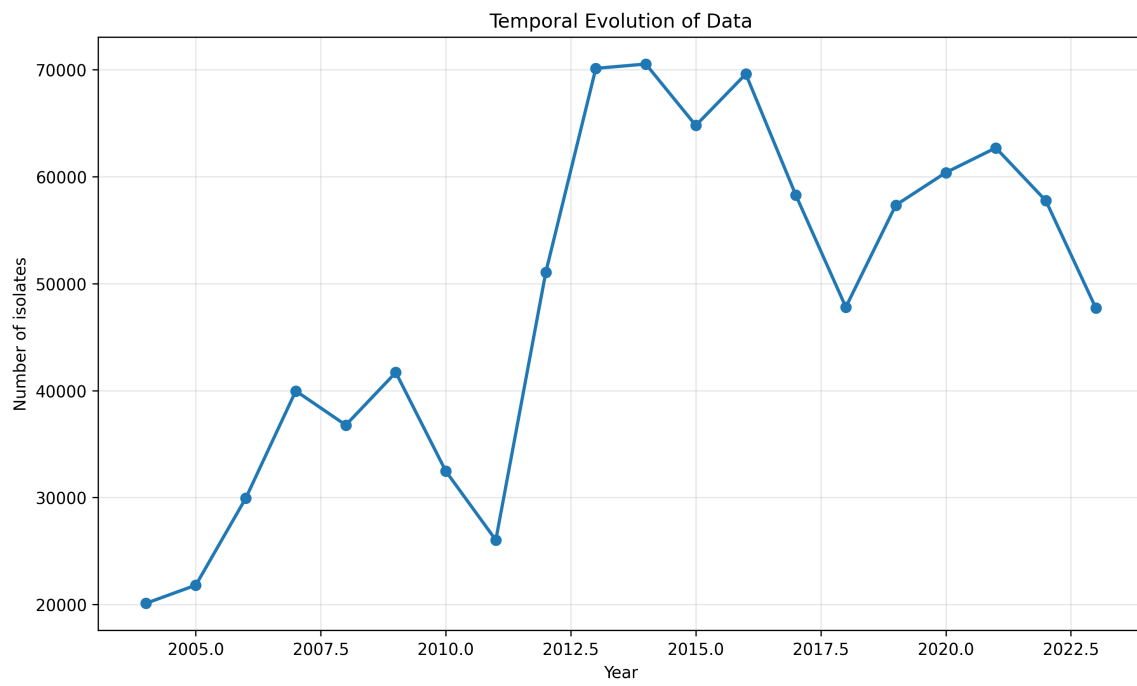
## Distribution of bacterial species:



## Geographic distribution:



Temporal evolution of data:



### 3. Decision Tree Model

The model uses a decision tree to recommend the optimal first antibiotic based on the following characteristics: • Bacterial species (encoded) • Country of origin (encoded) • Year of collection • Resistance profiles by antibiotic class The decision tree was trained on 80% of the data and tested on 20%, achieving 100% accuracy for predicting the first recommended antibiotic.

Model Features:

Feature	Description	Type
Species encoded	Bacterial species (encoded)	Categorical
Country encoded	Geographic region (encoded)	Categorical
Year	Temporal data	Numerical
Beta-lactam resistance	Mean resistance score	Numerical
Aminoglycoside resistance	Mean resistance score	Numerical
Quinolone resistance	Mean resistance score	Numerical
Other resistance	Mean resistance score	Numerical

## 4. Antibiotic Recommendations

Optimal antibiotic order (top 20):

Rank	Antibiotic	Type
1	Cefoperazone sulbactam	Standard
2	Gatifloxacin	Standard
3	Tetracycline	Standard
4	Metronidazole	Standard
5	Cefoxitin	Standard
6	Linezolid	Standard
7	Daptomycin	Standard
8	Ertapenem	Standard
9	Quinupristin dalfopristin	Standard
10	Teicoplanin	Standard
11	Tigecycline	Standard
12	Meropenem vaborbactam	Standard
13	Sulbactam	Standard
14	Ceftibuten	Standard
15	Vancomycin	Standard
16	Clarithromycin	Standard
17	Azithromycin	Standard
18	Ceftaroline avibactam	Standard
19	Doripenem	Standard
20	Ceftazidime avibactam	Standard

## 5. Clinical Demonstration Cases

Clinical case	Species	Country	Year
E. coli urinary tract infection	Escherichia coli	France	2023
Pseudomonas pneumonia	Pseudomonas aeruginosa	Germany	2023
Staphylococcus bacteremia	Staphylococcus aureus	United States	2023
Klebsiella infection	Klebsiella pneumoniae	Italy	2023

## 6. Resistance Pattern Analysis

Antibiotics with high resistance by species:

Species	Antibiotic	Resistance Rate (%)
Escherichia coli	Ampicillin	65.7%
Escherichia coli	Levofloxacin	36.7%
Escherichia coli	Ceftaroline	18.6%
Pseudomonas aeruginosa	Levofloxacin	28.1%
Pseudomonas aeruginosa	Piperacillin tazobactam	20.0%
Pseudomonas aeruginosa	Meropenem	19.2%
Staphylococcus aureus	Levofloxacin	32.6%
Staphylococcus aureus	Oxacillin	30.4%
Staphylococcus aureus	Erythromycin	29.2%
Klebsiella pneumoniae	Ampicillin	90.8%
Klebsiella pneumoniae	Levofloxacin	29.7%
Klebsiella pneumoniae	Cefepime	29.2%



## 7. Usage Recommendations

For clinicians: • Validate recommendations with local antibiogram • Consider patient allergies and contraindications • Monitor efficacy and adjust if necessary • Reserve cefiderocol for multiple resistance cases For microbiologists: • Use appropriate resistance thresholds • Consider underlying resistance mechanisms • Monitor resistance trends • Collaborate closely with clinicians

## 8. Limitations and Perspectives

Current limitations: • The model is based on available ATLAS data • Recommendations may vary according to local context • Resistance profiles evolve over time • Clinical validation required before use Improvement perspectives: • Integration of local and recent data • Consideration of resistance mechanisms • Adaptation to regional specificities • More intuitive user interface

## Conclusion

This system provides a framework for antibiotic recommendation based on epidemiological data. It should be used as a decision support tool, complementing clinical and microbiological expertise. Cefiderocol is systematically positioned as a last resort option, contributing to the preservation of this critical antibiotic.