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# Antimicrobial Resistance (AMR) & Antibiotic Use in the U.S. (2019–2023)

**Data Links:**

**Dataset 1: CDC AR Patient Safety Portal (ARPSP) – AMR Rates**

🔗 https://arpsp.cdc.gov/explorer

**Dataset 2: CDC Outpatient Antibiotic Use**

🔗 https://arpsp.cdc.gov/profile/antibiotic-use

**Dataset 3: U.S. Census State Population Estimates**

🔗 https://www2.census.gov/programs-surveys/popest/datasets/2020-2024/state/totals/

## 1. Project Overview & Motivation

This analysis investigates the "silent pandemic" of Antimicrobial Resistance (AMR) in the United States. By integrating resistance phenotypes, antibiotic prescribing data, and demographic context from 2019 to 2023, this project seeks to understand how resistance patterns are evolving and identifying the primary drivers of these trends.

- **Definition:** AMR occurs when bacteria evolve genetic mechanisms to withstand drugs, leading to increased treatment failures and healthcare costs.
- **Data Scope:** The analysis aggregates resistance rates, prescribing per 1,000 population, and state-level migration/population statistics.

## 2. Key Findings: National Trends

The national landscape reveals that resistance is not uniform across all bacteria; it is highly specific to the pathogen.

- **The Surge in *Acinetobacter*:** The most critical finding is the dramatic rise in Multidrug-resistant (MDR) *Acinetobacter*. Resistance rates for this pathogen skyrocketed from stable levels in 2019 to nearly 50% by 2023. This correlates with the COVID-19 pandemic, likely due to increased ventilator use and hospital strain.
- **Stability in Other Pathogens:** In contrast, MDR *E. coli* resistance remained relatively flat (~8%), indicating that the current crisis is driven by specific hospital-associated phenotypes rather than a universal rise across all bacteria.

## 3. Drivers of Resistance: Antibiotic Prescribing

The relationship between drug usage and resistance is complex and varies by antibiotic class.

- **Macrolide Overuse:** Prescribing rates for Macrolides consistently exceed the national average, suggesting sustained selection pressure.
- **Fluoroquinolone Decline:** Conversely, Fluoroquinolone prescribing has steadily declined, likely reflecting successful stewardship initiatives warning against their use.

## 4. Geographic Hotspots & Persistence

Resistance is not evenly distributed across the United States. It is characterized by distinct regional hotspots and endemic persistence.

- **High-Risk States:** There is significant geographic variation, with the highest resistance rates concentrated in **Illinois (~21%)**, **New York (~16%)**, and **Texas (~16%)**.
- **Endemic Persistence:** Heatmap analysis reveals that high-risk states like Texas and New York exhibit "banding," meaning they remain high-risk year over year rather than experiencing isolated outbreaks.
- **The Role of Demographics:** High-risk states often correlate with high populations and high international migration, suggesting these hubs may act as entry points for resistant strains.

## 5. Correlation Analysis

- **Prescribing vs. Resistance:** Statistical analysis shows only a weak-to-moderate positive association between prescribing intensity and resistance levels.
- **Conclusion:** While antibiotic overuse is a driver, it is not the sole cause. Factors such as hospital infection control, migration, and population density are significant confounders.

## 6. Conclusion & Recommendations

AMR in the U.S. is defined by specific high-risk pathogens (MDR *Acinetobacter*) and specific high-risk geographies (IL, NY, TX). Broad reductions in prescribing are necessary but insufficient.

**Strategic Recommendation:** Public health policy must shift toward targeted surveillance and rigorous infection control specifically within the identified "hotspot" states to break the chain of endemic transmission.