# Epidemiology and Antimicrobial Resistance Patterns of Adult Uropathogens in Two Healthcare Institutions in Southwestern Colombia, 2019–2024

Jhon Esterilla-Viafara[1], Sebastian Cuadros-Mateus[1], Maria del Mar Alfonso-Gómez[2], Sofia Vasquez-Palacio[1], Catalina Garzón[1], Luz Faid Carime Ballesteros Hernandez[3], Daniel Fernando Cardozo Aricapa[3] and Jose Guillermo Ortega Avila[1,4]

1. Student Research Group in Microbiology, Immunology and Cancer, School of Health Sciences, Pontificia Universidad Javeriana Seccional Cali, Cali, Colombia
2. Student Research Group in Urology, School of Health Sciences, Pontificia Universidad Javeriana Seccional Cali, Cali, Colombia
3. Department of Epidemiology, CHRISTUS SINERGIA Salud, Cali, Colombia
4. Department of Basic Health Science, School of Health Sciences, Pontificia Universidad Javeriana Seccional Cali, Cali, Colombia

## Background

Antimicrobial resistance (AMR) in urinary tract infections (UTIs) compromises empirical treatment and increases the risk of therapeutic failure. In southwestern Colombia, updated regional data on uropathogen resistance remain limited, hindering locally informed treatment decisions.(1,2)

**Objective:** To describe the epidemiology, temporal distribution, and antimicrobial resistance patterns of urinary isolates from adults in two healthcare institutions in southwestern Colombia, from 2019 to 2024.

## Materials and Methods

- **Design and setting:** Retrospective observational study in two tertiary-care institutions in southwestern Colombia (2019–2024).
- **Population and sample:** Adults ≥18 years with positive urine cultures and available susceptibility results. Of 39,397 records reviewed, 11,351 were included.
- **Laboratory methods:** Disk diffusion; susceptibility interpreted according to CLSI M100-S33 (2023). Intermediate results were classified as resistant.
- **Statistical analysis:** Descriptive analysis using Python 3.12 and Pandas.
- **Ethics:** Approved by the Institutional Ethics Committee.

## Results

**Study population:** 11,351 urinary isolates; median age 58 years (IQR 36–74.5); 68.1% were from female patients. Emergency departments accounted for 78.6% of isolates.

**Predominant uropathogens:** Escherichia coli (63.1%), Klebsiella pneumoniae (13.0%), Enterococcus faecalis (6.2%), Proteus mirabilis (6.0%), and Pseudomonas aeruginosa (4.3%).

**Temporal trends:** The proportion of *E. coli* decreased from 65.4% in 2019 to 60.0% in 2024 ($p$ for trend = 0.020), whereas *P. mirabilis* increased from 5.3% to 7.3% ($p$ for trend = 0.032).

**Antimicrobial resistance:** *E. coli* showed high resistance to ampicillin (61.5%), ciprofloxacin (51.6%), and trimethoprim–sulfamethoxazole (44.4%), but low resistance to nitrofurantoin (3.1%), fosfomycin (3.7%), and carbapenems (<1%). *P. aeruginosa* showed marked resistance to imipenem (60.3%).

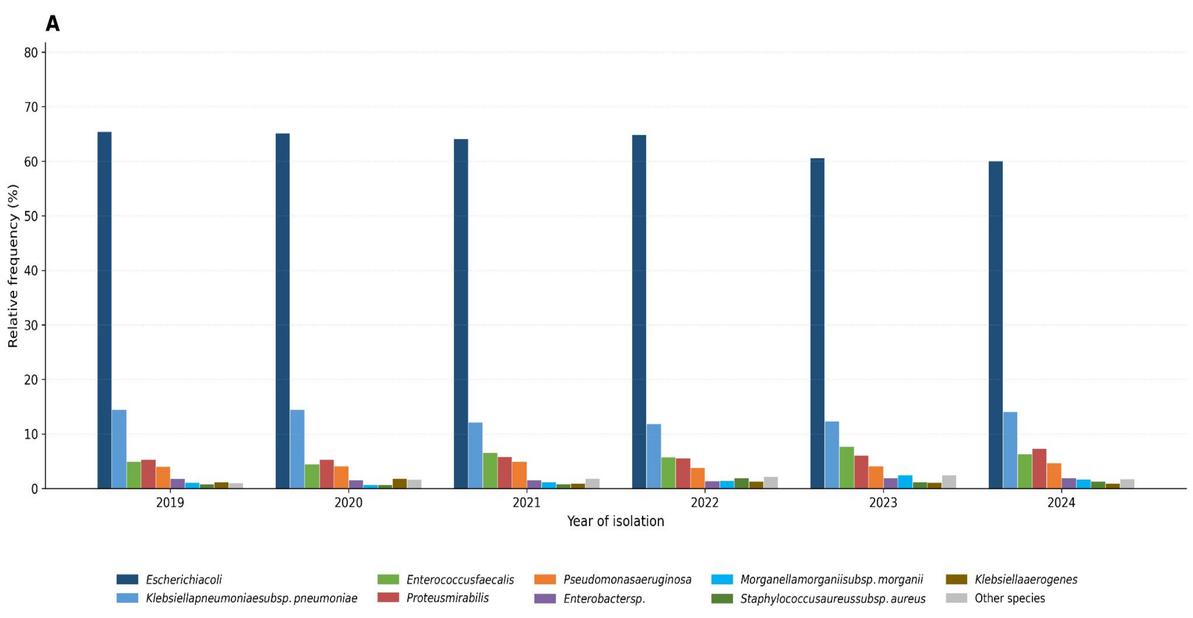


**Figure 1.** Temporal dynamics of major uropathogens isolated from adult urine cultures, 2019–2024. (A) Overall cohort.. Bars represent the annual relative frequencies of major uropathogens. Panel A includes the nine most prevalent microorganisms and a grouped "Other species" category.". Relative frequencies were calculated using the total number of urinary isolates obtained each year as the denominator. Temporal trends were evaluated using Cochran–Armitage test for trend.

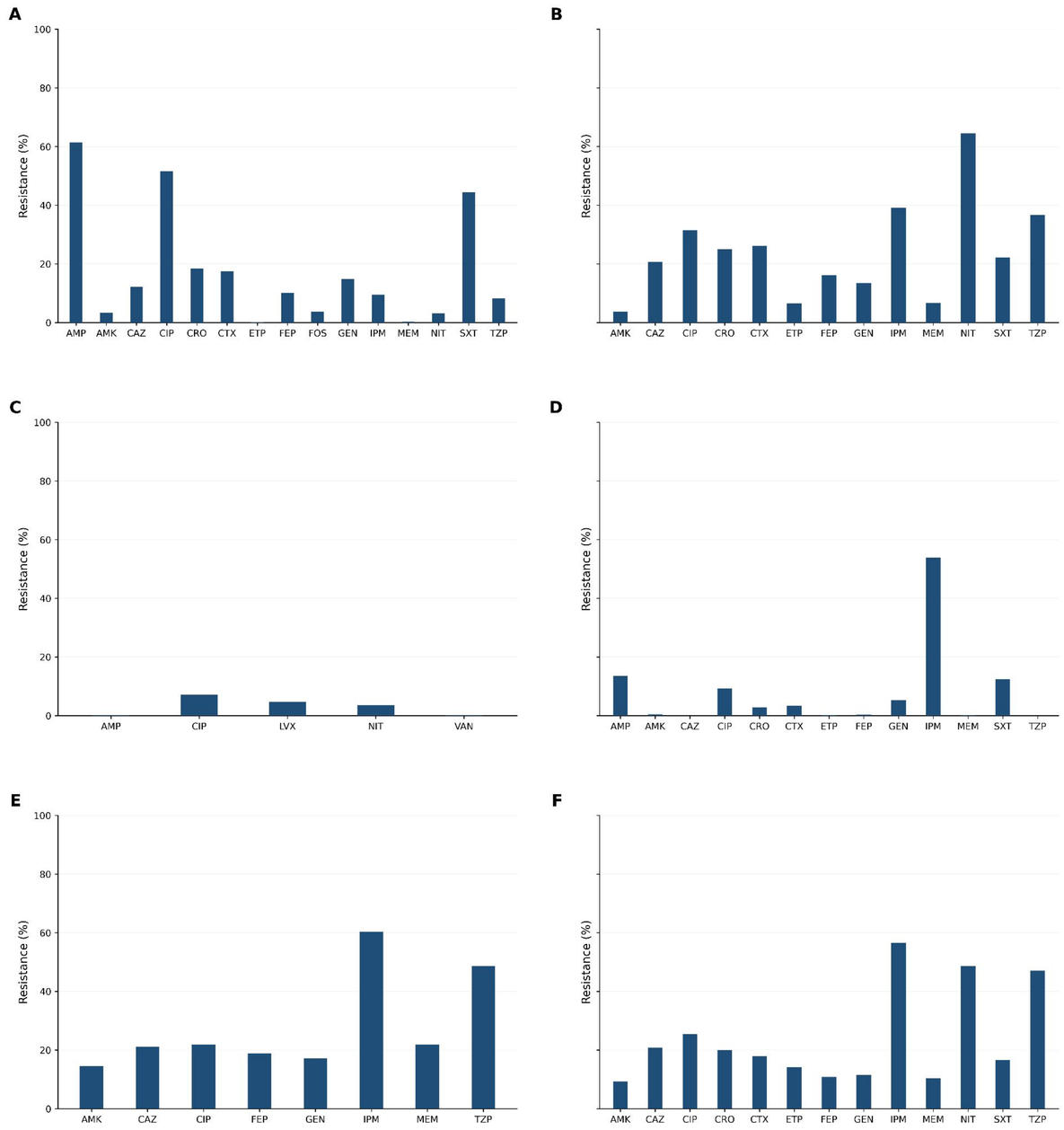


**Figure 2.** Antimicrobial resistance profiles of major uropathogens isolated from adult urine cultures. Panels represent (A) *Escherichia coli,* (B) *Klebsiella pneumoniae* subsp. *pneumoni*ae, (C) Enterococcus faecalis, (D) Proteus mirabilis, (E) *Pseudomonas aeruginosa*, and (F) *Enterobacte*r spp. Points represent the proportion of resistant isolates for each antimicrobial agent. Resistance rates were calculated as the number of resistant isolates divided by the total number of isolates with valid antimicrobial susceptibility testing results for each antibiotic, excluding missing or non-interpretable results.

## Discussion

**Uropathogen distribution:** *E. coli* predominated (63.1%), consistent with reports from other Colombian regions.(3) However, pathogen distribution varied across clinical settings, reflecting differences in patient populations and healthcare complexity.

**Antimicrobial resistance:** High E. coli resistance to ciprofloxacin (51.6%) and trimethoprim–sulfamethoxazole (44.4%) may limit their empirical use. Nitrofurantoin and fosfomycin retained *in vitro* activity, depending on infection site and clinical context.(4)

**Multidrug resistance:** Higher proportions of ESBL-producing and XDR isolates in hospitalized patients highlight the potential impact of healthcare exposure and antimicrobial selection pressure.(5)

## Conclusions

Uropathogens isolated from two tertiary-care institutions in two cities in southwestern Colombia showed substantial antimicrobial resistance, including multidrug-resistant and extensively drug-resistant phenotypes, particularly in hospital settings.

These findings provide a regional epidemiological reference to support the periodic review of empirical treatment protocols and strengthen antimicrobial stewardship in southwestern Colombia.

Standardized surveillance and prospective studies incorporating molecular characterization are needed to better understand local resistance patterns.

## References

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