

## ABSTRACT

### Background:

Antimicrobial stewardship programs (ASPs) are hampered by lack of detailed multicenter data on the primary drivers and classes of antibiotic use. We conducted a retrospective study to identify the types and indications for antibiotic prescribing in 6 different acute-care facilities.

### Methods:

Cross-sectional study using retrospective chart review of 1,200 adult inpatients, hospitalized (>24hrs) in Veterans Affairs (n=1), teaching (n=2), non-teaching hospitals (n=3), and receiving ≥1 antibiotic doses on 4 index dates chosen at equal intervals through a 1-year study period (9/2009-10/2010). Infectious disease specialists recorded patient demographics, comorbidities, microbiological and radiological work-up, and dose, duration and indication for antibiotic prescriptions (rxs). Prescriptions were categorized as: 1) prophylactic (e.g. perioperative, organ transplant, AIDS); 2) therapeutic, divided into pathogen-directed at start, and empiric (including empiric throughout, and subsequently pathogen-directed).

### Results:

On the index dates 4,119/6,812 inpatients (59.8%) were receiving antibiotics. Of these, 1,200 adult cases were randomly selected for review, receiving 2,528 antibiotic rxs (average: 2.1 per patient), 30% of which were administered in combination; 540 (21.4%) of rxs were prophylactic and 1,988 (78.6%) were therapeutic; of these, 372 (18.7%) were pathogen-directed at start and 1,616 (81.3%) were started as empiric; of empiric starts, 382 (23.7%) were subsequently pathogen-directed, and 1,232 (76.3%) remained empiric. Use was primarily for respiratory (27.6% of rxs and 28.8% of therapy days) followed by gastro-intestinal (13.1% and 14.8%) and bloodstream (10.8% and 12.8%) infections. Fluoroquinolones, vancomycin and antipseudomonal penicillins were the most frequently prescribed antibiotics, together accounting for 47.3% of therapy days and 47% of therapeutic rxs.

### Conclusion:

Use of broad-spectrum empiric therapy is prevalent in US acute care facilities, and in the majority of cases is not subsequently pathogen-directed. Prophylactic use accounted for 1/5 of antibiotic prescriptions. ASPs targeted at appropriate utilization of vancomycin, fluoroquinolones, and piperacillin/tazobactam hold the greatest potential to reduce antibiotic use.

## OBJECTIVES

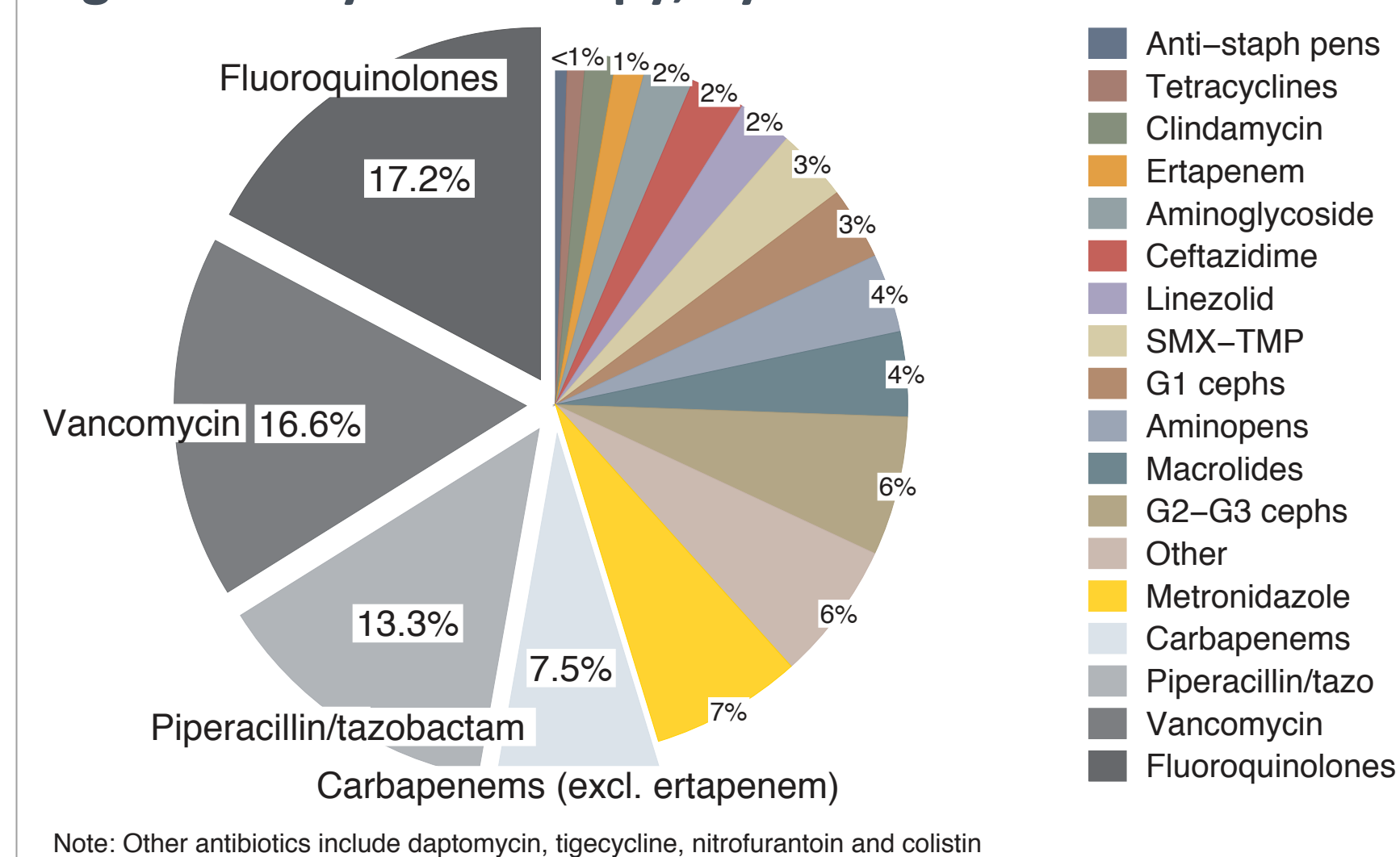
- To conduct a multi-center study on the pharmaco-epidemiology of antimicrobial use.
- To characterize quantitative and qualitative aspects of antimicrobial prescribing and clinical information at six diverse hospitals.

## METHODS

- Six hospitals of diverse size, type, and location were included: two university-affiliated teaching hospitals, a VA hospital, and three tertiary-care community hospitals
- Charts were randomly selected from all inpatient admissions between Oct 2009 and Sep 2010.
- Four index dates were chosen at equal intervals through the study period.
- A randomly selected antibiotic prescription active on the index day served as the enrollment trigger.
- For each index date and site, Infectious Diseases physicians abstracted data on 50 adult inpatients using a standardized electronic data entry form.
- Data captured included demographics, drug name, dose, duration (days of therapy), indication, and clinical data.
- Prescriptions were categorized as : 1) prophylactic (e.g. perioperative, organ transplant, AIDS); 2) therapeutic, divided into pathogen-directed at start, and empiric (including empiric throughout, and subsequently pathogen-directed).

## RESULTS

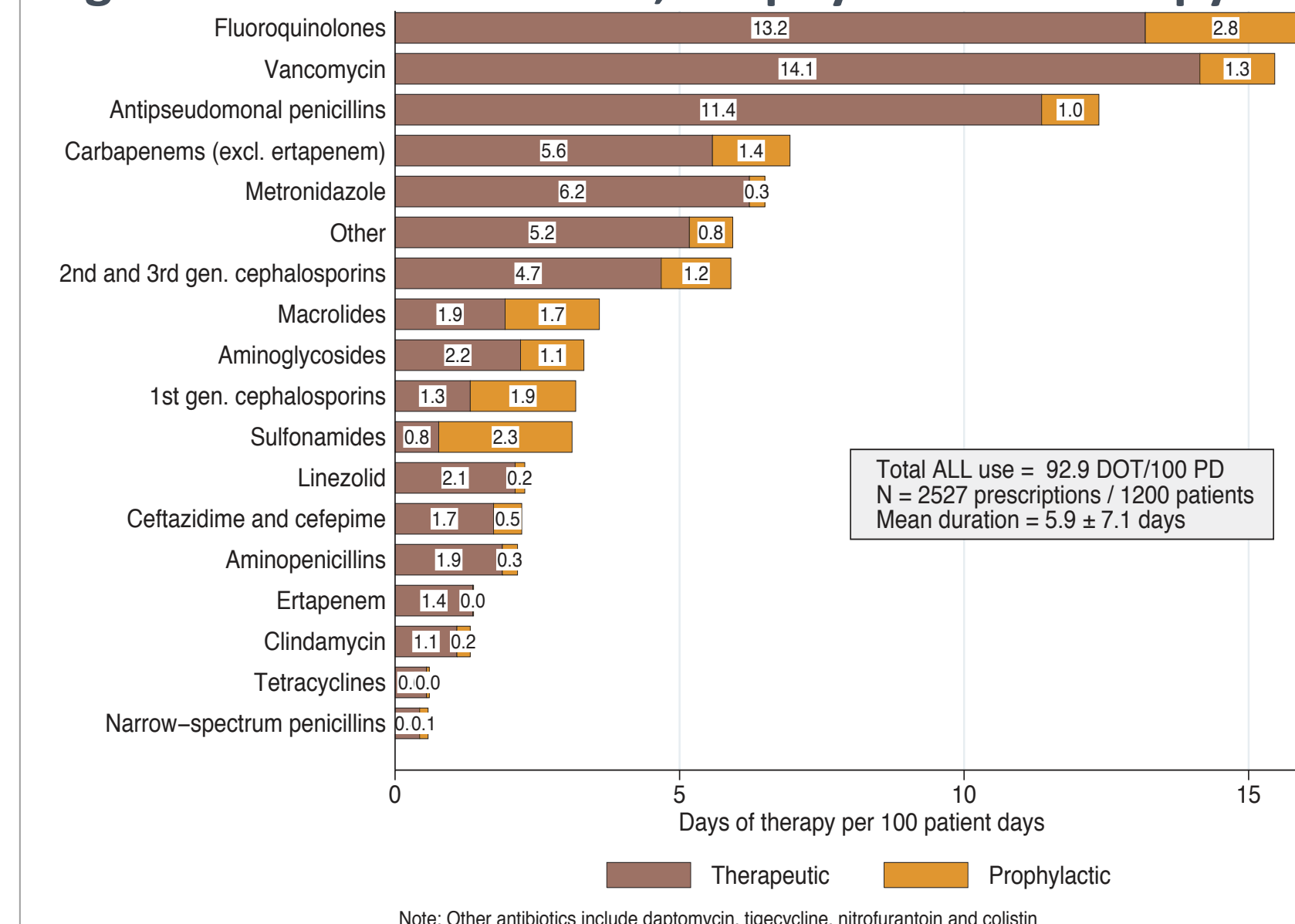
**Figure 1: Days of Therapy, by Antibiotic Class**



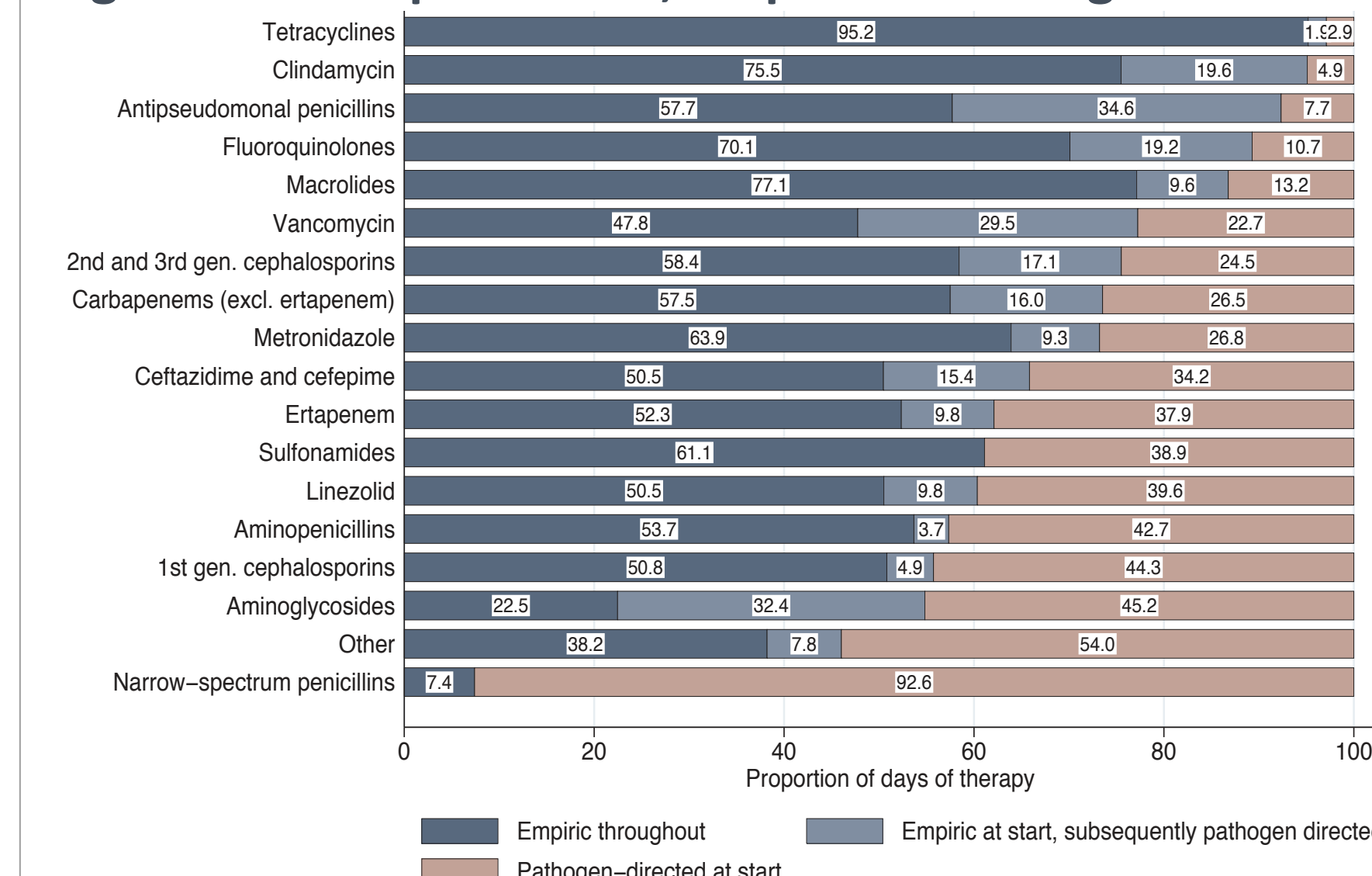
## RESULTS

- 1,200 total patients were enrolled in the study, with 2,529 prescriptions
- The mean age was 61.9 years (±18)
- 26% had antibiotic allergies recorded
- Mean length of stay was 14.7 days (±22.9)
- 12.5% were immunocompromised, including AIDS (9), active chemotherapy (82), bone marrow transplant (8), solid organ transplant (31), or other conditions (33)
- In-hospital mortality was 3.3% (39 patients)

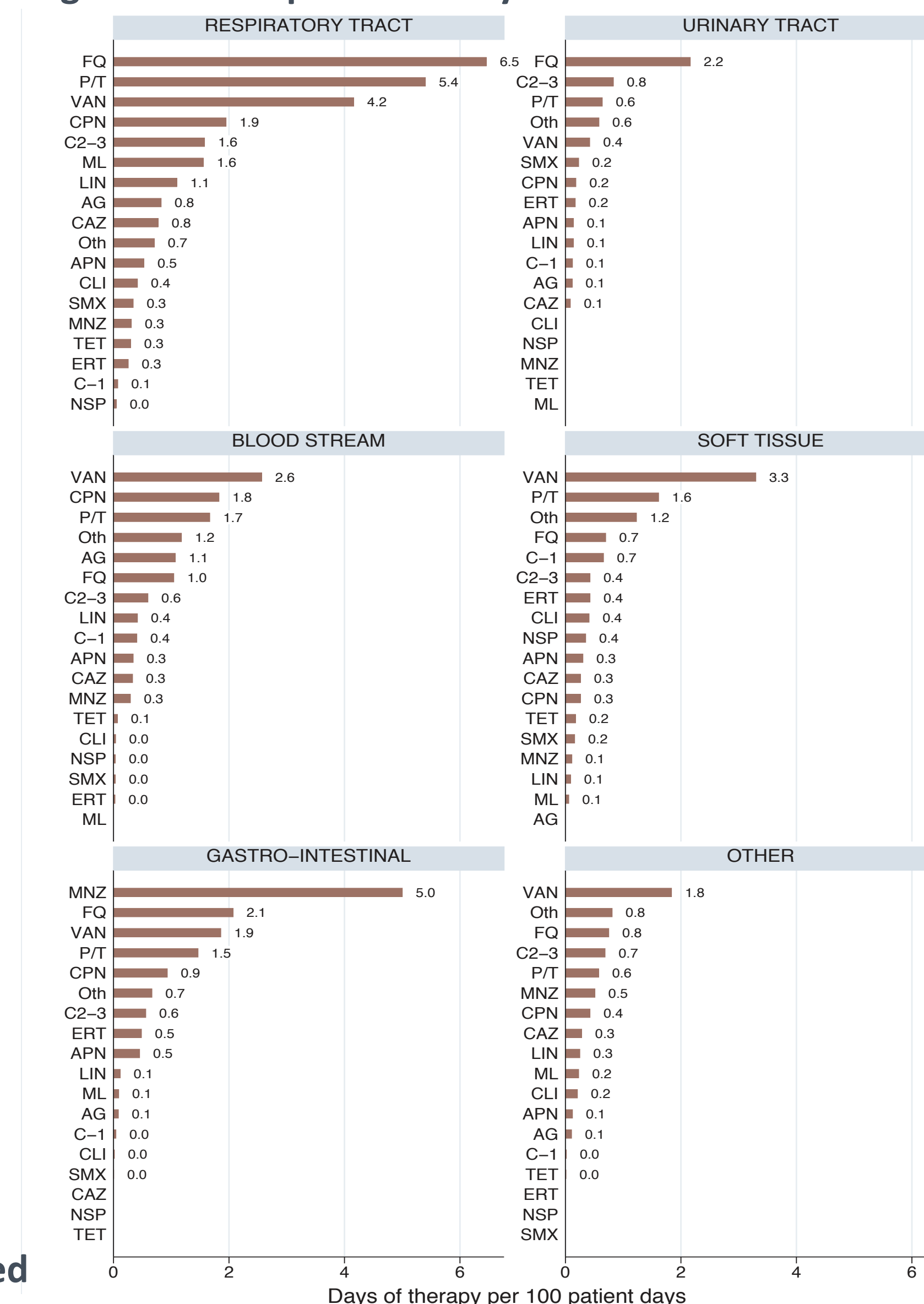
**Figure 2: Antibiotics Used, Prophylaxis vs Therapy**



**Figure 3: Therapeutic Use, Empiric vs Pathogen-Directed**



**Figure 4: Therapeutic Use by Infection Site**



Note: AG – aminoglycosides, APN – aminopenicillins, C1-3 – 1st-3rd gen cephalosporins, CAZ – ceftazidime and ceftipime, CPN – carbapenems (excl ertapenem), ERT – ertapenem, FQ – fluoroquinolones, ML – macrolides, LIN – linezolid, MNZ – metronidazole, NSP – narrow-sp. penicillins, P/T – antipseudomonal penicillins, SMX – sulfonamides, TET – tetracyclines, VAN – vancomycin, Oth – Other (includes daptomycin, tigecycline, nitrofurantoin and colistin)

- 21% of prescriptions were for prophylaxis (pneumocystis, surgical prophylaxis, neutropenia, etc) and 79% for therapy
- 29% of prescriptions were for pneumonia, 15% for sepsis/bacteremia, 13% for abdominal infections, and 12% for urinary tract infections.
- Fluoroquinolones, vancomycin, and antipseudomonal penicillins combined accounted for 47% of therapy days. 48%-70% of that use was empiric throughout the duration of the course.

## RESULTS (continued)

- Respiratory tract infections accounted for the largest share of antibiotic therapy days (29.3%) and number of prescriptions.
- Fluoroquinolones were the most widely used class for respiratory and urinary tract infections, and were used empirically in 70% of cases.
- Vancomycin was widely used for skin/soft tissue and bloodstream infections, but was more likely to be subsequently pathogen directed or pathogen-directed at the start.

## CONCLUSIONS

- This study represents the largest evaluation of the pharmaco-epidemiology of antimicrobial use in three decades.
- Use of broad-spectrum empiric antibiotics was prevalent in US acute care facilities.
- A large share of broad-spectrum empiric use was not subsequently pathogen-directed.
- Programs targeted at appropriate use of fluoroquinolones, vancomycin, and antipseudomonal penicillins, particularly for respiratory indications, hold the greatest potential to improve antibiotic use.

## REFERENCES

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