

Inpatient and Discharge Antibiotic Use for Hospitalized Patients Growing Multi-Drug Resistant Bacteria in Urine Cultures

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ABSTRACT

Background: MDRO infections are a threat to public health. UTIs are the most common type of MDRO infection and are responsible for a significant proportion of antibiotic use. Studies demonstrate both duration and type of antibiotics prescribed to patients with MDRO UTIs are inappropriate. The objective of this study is to characterize inpatient and outpatient antibiotic durations to describe burden of antibiotic use for hospitalized patients with MDROs isolated from urine specimens.

Methods: Retrospective cohort study conducted at Barnes-Jewish Hospital from 11/7/2012 through 11/7/2017. Demographics, comorbidities, culture data, and antibiotics were collected from the BJC Healthcare Informatics database for hospitalized patients with MDROs isolated from urine specimens. MDROs were defined according to European and US CDC guidelines.

Results: A total of 1052 patients had MDROs in urine cultures. Of these patients, 747 (71.0%) were discharged on oral antibiotics for a mean duration of 6.7 days, while 135 (12.8%) were discharged on IV antibiotics for a mean of 10.9 days. The five most commonly administered inpatient antibiotics after urine cultures returned were IV ceftriaxone, IV vancomycin, PO ciprofloxacin, IV cefepime, and PO TMP-SMX (Figure 1). The five most commonly prescribed antibiotics at discharge were PO ciprofloxacin, PO TMP-SMX, PO nitrofurantoin, PO cephalixin, and PO doxycycline (Figure 2).

Conclusion: Patients with MDROs in urine cultures receive prolonged durations of inpatient and outpatient antibiotics, longer than what is recommended by current evidence and guidelines.

INTRODUCTION

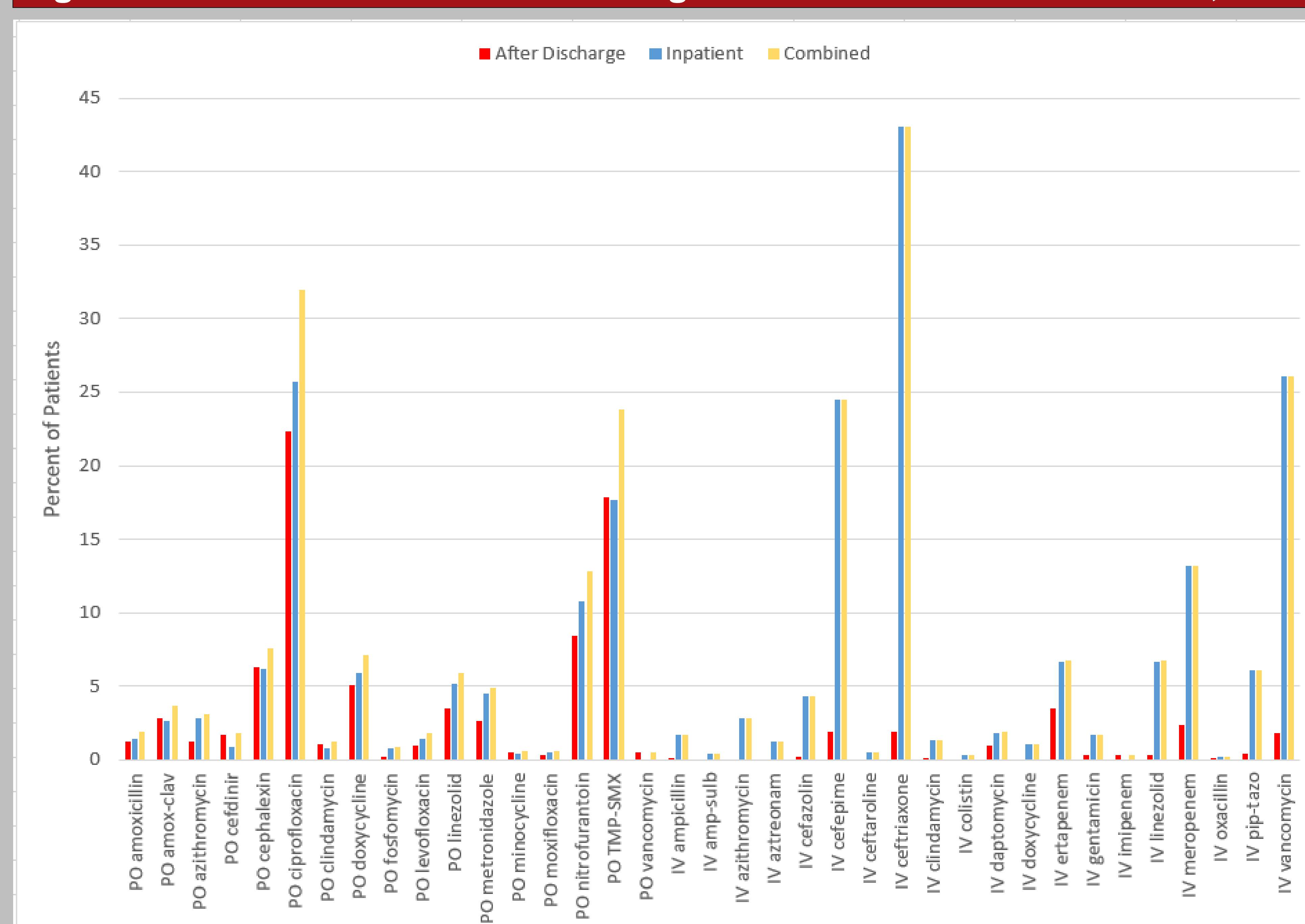
- MDRO infections are a threat to public health. UTIs are the most common type of MDRO infection and are responsible for a significant proportion of antibiotic use.
- Inpatient and outpatient (after an inpatient stay) antibiotic durations for hospitalized patients with MDROs in urine cultures were characterized.

METHODS

- Design: Retrospective cohort from Barnes-Jewish Hospital, a 1266-bed academic medical center in St. Louis, MO
- IRB approved
- Study period: November 7, 2012 through November 7, 2017
- Inclusion criteria: Adults ≥ 18 years old with a positive urine culture for an organism that met criteria for a MDRO during their index hospitalization and no other positive bacterial cultures during their hospitalization
- Data was collected via data pulls from and chart review of the BJC Healthcare Informatics database
- Data of interest: Antibiotic setting and route, antibiotic name, duration of antibiotic administration
- US and European CDC definitions for MDROs were utilized:
 - Highly drug resistant: Non-susceptible to ≥1 agent in all 5 of the following antimicrobial categories: extended-spectrum cephalosporins, fluoroquinolones, aminoglycosides, carbapenems, piperacillin-tazobactam
 - Carbapenem resistant: Resistant to imipenem, meropenem, doripenem, or ertapenem by standard susceptibility testing methods
 - Extended-spectrum beta lactamase Enterobacteriaceae: *K. pneumoniae*, *K. oxytoca*, or *E. coli* with ceftazidime, aztreonam, cefotaxime, or ceftriaxone MIC of ≥ 2 µg/mL
 - Multidrug resistant: Non-susceptible to ≥ 1 agent in ≥ 3 of the following antimicrobial categories to which there was no species intrinsic resistance: aminoglycosides, antipseudomonal penicillins + β-lactamase inhibitors, anti-MRSA cephalosporins (only *K. pneumoniae*, *K. oxytoca*, or *E. coli*), carbapenems, non-extended spectrum cephalosporins, 1st and 2nd generation cephalosporins, cephamycins, fluoroquinolones, folate pathway inhibitors, glycolcyclines, monobactams, penicillins, penicillins + β-lactamase inhibitors, phenicols, phosphonic acids, polymyxins, tetracyclines
 - Vancomycin resistant enterococci: *E. faecalis*, *E. faecium*, or *Enterococcus* species unspecified (those not identified to species level) that is resistant to vancomycin by standard susceptibility testing methods
 - Methicillin-resistant *S. aureus*: *S. aureus* oxacillin, cefoxitin, or methicillin resistant by standard susceptibility testing or an FDA-approved laboratory test for MRSA detection
 - Vancomycin intermediate *S. aureus*: *S. aureus* with vancomycin MIC of 4 or 8 µg/mL
 - Multidrug resistant *S. aureus*: *S. aureus* that is MRSA (as above) or non-susceptible to ≥ 1 agent in ≥ 3 of the following antimicrobial categories: aminoglycosides, ansamycins, anti-MRSA cephalosporins, anti-staphylococcal β-lactams, fluoroquinolones, folate pathway inhibitors, fucidanes, glycopeptides, glycolcyclines, lincosamides, lipopeptides, macrolides, oxazolidinones, phenicols, phosphonic acids, streptogramins, tetracyclines

RESULTS

Figure 1: Percent of Patients Receiving Each Antibiotic* N = 1,052



*This graph shows the percentage of patients to whom each individual antibiotic was provided as an inpatient, after discharge, or in both of these settings after urine culture data had returned. Note that after discharge refers to the outpatient setting immediately following discharge after an inpatient stay.

Table 1: Antibiotic Administration by Setting* N = 1,052

Antibiotic Setting and Route	Percentage of Patients (N)
After Discharge [†] PO	71.01 (747)
After Discharge [†] IV	12.83 (135)
Inpatient PO	68.25 (718)
Inpatient IV	83.37 (877)
Combined [‡] PO	82.6 (869)
Combined [‡] IV	83.37 (877)

*This table shows the percentage (and number) of patients who received antibiotics according to setting (after discharge, inpatient, or both / combined) as well as route (PO or IV) after urine culture data had returned

[†]This refers to the outpatient setting immediately following discharge after an inpatient stay

[‡]Combined refers to both the inpatient and outpatient (after discharge) settings

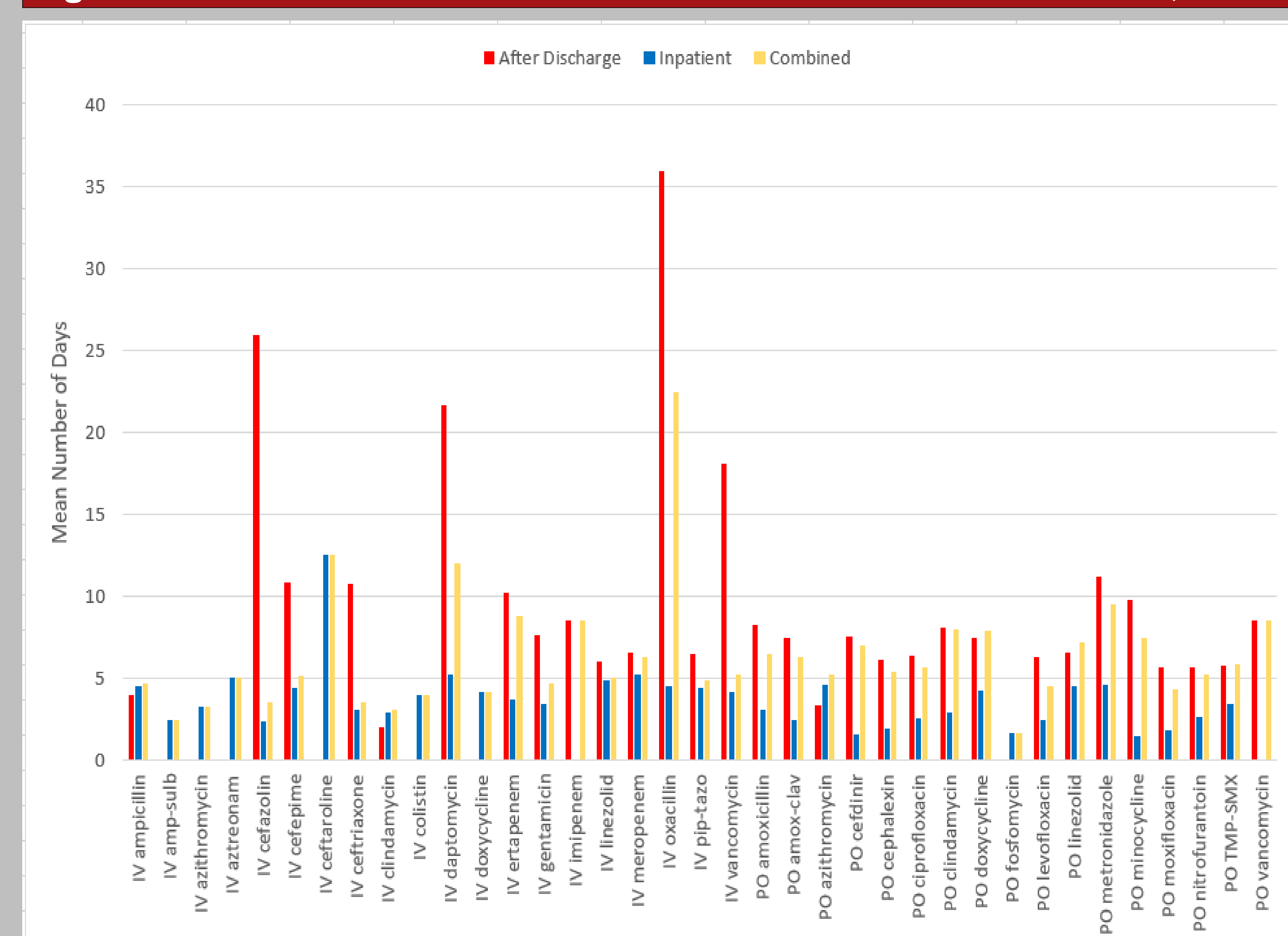
LIMITATIONS

- Single, academic, tertiary care center
- Inability to differentiate true UTI from asymptomatic bacteriuria
- Possibility of concomitant infections (i.e. pneumonia, osteomyelitis, etc.)

ACKNOWLEDGEMENTS

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Figure 2: Mean Duration of Antibiotic Administration* N = 1,052



*This graph shows the mean number of days each individual antibiotic was provided as an inpatient, after discharge, or in both of these settings after urine culture data had returned. Note that after discharge refers to the outpatient setting immediately following discharge after an inpatient stay.

Table 2: Mean Duration of Antibiotics* N = 1,052

Antibiotic Setting and Route	Mean Number of Days
After Discharge [†] PO	6.71
After Discharge [†] IV	10.9
Inpatient PO	3.62
Inpatient IV	5.04
Combined [‡] PO	7.49
Combined [‡] IV	6.67

*This table shows the mean number of days patients received antibiotics according to setting (after discharge, inpatient, or both) as well as route (PO or IV) after urine culture data had returned

[†]This refers to the outpatient setting immediately following discharge after an inpatient stay

[‡]Combined refers to both the inpatient and outpatient (after discharge) settings

CONCLUSIONS

- Patients with MDROs in urine cultures receive prolonged durations of antibiotics, longer than what is recommended by current evidence and guidelines.
- Further research is needed to delineate antibiotic burden in other hospital systems and to determine safe methods to shorten antibiotic durations.

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