



Background

Carbapenems are broad spectrum, last line antimicrobials that maintain activity against pathogens that are resistant to many alternatives. Carbapenem-resistant *Acinetobacter* spp. and carbapenem-resistant Enterobacterales have been deemed urgent threats, the highest level threat, in the 2019 CDC’s Antibiotic Resistance Threats report. Therefore, carbapenems are a primary target for antimicrobial stewardship programs. Comparative carbapenem usage data may aid institutions in identifying opportunities for carbapenem stewardship.

Methods

To help facilitate carbapenem benchmarking, a report was compiled from institutions comprising the KASIC advisory board. Data gathered included hospital and antimicrobial stewardship program characteristics and 2022 carbapenem days of therapy. Carbapenem utilization data was adjusted by patient days. Only one facility included pediatric data in their utilization, though use was noted to be negligible. All other sites were adult utilization only.

Executive Summary

- Median carbapenem days of therapy for 2022 was 17.5 days of therapy per 1000 patient days. The interquartile range was 9.4 – 27 indicating of substantial variability in carbapenem use across KASIC advisory board hospitals.
- Average rate of ceftriaxone-resistant *E. coli* (surrogate for ESBL production) was 14.5% at KASIC advisory board sites. Higher rates of resistance are associated with higher carbapenem utilization.

Full Results

Table 1. Resistance Trends and Hospital Formulary

Ceftriaxone-resistant <i>E. coli</i> percent, mean \pm SD	14.5 % \pm 6.5%
Ceftriaxone-resistant <i>E. coli</i> percent, median [IQR]	13% [12% – 14%]
Hospital Formulary	
Meropenem on formulary	100% (21/21)
Meropenem restricted	48% (10/21)
Ertapenem on formulary	81% (17/21)
Ertapenem restricted	53% (9/17)

No hospitals reported doripenem or imipenem/cilastatin was on formulary

Table 2. Total carbapenem days of therapy (DOT) normalized to 1000 patient days (PD) (n=21 hospitals)

Month	Median [IQR]	Mean \pm SD
January	17.4 [7.4 – 26.9]	21.5 \pm 17.8
February	15.5 [8.5 – 33.3]	22.6 \pm 18.3
March	19 [11.3 – 23]	21 \pm 14.9
April	15.8 [10.7 – 25.2]	20.9 \pm 16
May	18.75 [10.7 – 28.4]	22.9 \pm 16.9
June	15.7 [8.4 – 22.9]	17.2 \pm 12.7
July	14.6 [9 – 28]	18.4 \pm 14.4
August	15.9 [8.6 – 27]	19.7 \pm 15.5
September	18.5 [9 – 28.3]	21.4 \pm 15.8
October	18.3 [9.7 – 24]	22.1 \pm 17.3
November	21.1 [14.2 – 29.3]	22.5 \pm 12.8
December	19.2 [11.3 – 22.4]	19.2 \pm 11.4
All of 2022	17.5 [9.4 – 27.0]	20.8 \pm 15.2

Table 3. Meropenem days of therapy (DOT) normalized to 1000 patient days, (n=20 hospitals)

Month	Median [IQR]	Mean ± SD
January	16.5 [4.4 – 26.1]	19 ± 16.8
February	15.3 [7 – 25.7]	20.2 ± 17
March	17.1 [6.6 – 21.1]	17.3 ± 12.4
April	14.5 [8.7 – 21.9]	17.6 ± 13.2
May	16.3 [9 – 25.4]	19.7 ± 15.1
June*	12 [7.4 – 22.1]	15.3 ± 10.4
July	13.6 [7.3 – 23.7]	16 ± 13.7
August	11.6 [7.5 – 27]	17.7 ± 15.5
September	18 [8.1 – 26.5]	19 ± 14
October	12.9 [8.2 – 25.7]	18.6 ± 14.4
November	16.5 [11.1 – 26.1]	18.9 ± 11.3
December	14.6 [9.9 – 19.8]	15.6 ± 12.4
All of 2022	14.7 [7.7 – 24.4]	17.9 ± 13.8

*1 hospital not reporting

Table 4. Ertapenem days of therapy (DOT) normalized to 1000 patient days, (n=16 hospitals)

Month	Median [IQR]	Mean ± SD
January	3.84 [1.4 – 6.5]	4.4 ± 4.4
February	2.5 [0 – 6.4]	4.4 ± 6.6
March	3.5 [0.8 – 4.4]	6.0 ± 10.7
April	1.8 [0.6 – 9.7]	5.4 ± 6.9
May	2.6 [0.8 – 6.6]	5.5 ± 7.6
June	2.4 [0.8 – 6.7]	4.4 ± 5.7
July	2.3 [0.6 – 6]	4.2 ± 4.7
August	3 [0.7 – 5.4]	3.8 ± 3.6
September	2.9 [0.2 – 6.9]	4.3 ± 4.8
October	2.5 [0.6 – 7.5]	5.8 ± 7.1
November	3.2 [0.3 – 9.1]	5.9 ± 7.2
December	4.9 [0.9 – 6.7]	4.4 ± 3.8
All of 2022	2.4 [0.3 – 7.4]	5.1 ± 6.7

Figure 1: Meropenem Use Compared to Ceftriaxone-Resistant *E. coli* Rates

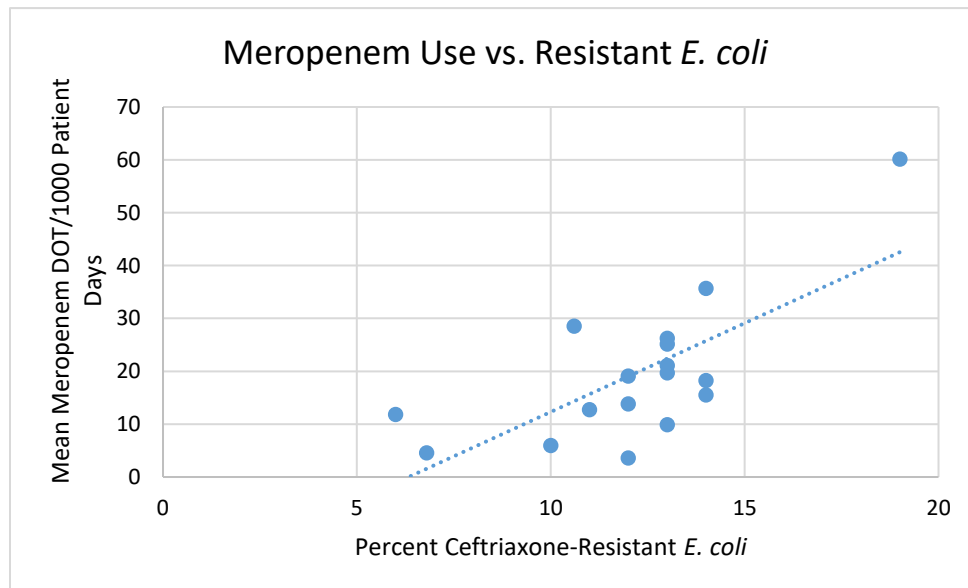


Table 5: Hospital and Staff Descriptions

Hospital size, n (%)	N=21
≤ 25 beds	0 (0%)
26 – 100 beds	2 (10%)
101 – 300 beds	9 (43%)
301 – 500 beds	7 (33%)
≥ 501 beds	3 (14%)
ICU beds, n (%)	
≤ 12 beds	5 (24%)
13 – 25 beds	7 (33%)
25 – 50 beds	4 (19%)
≥ 51 beds	5 (24%)
ID consult available, n (%)	18 (86%)
Antimicrobial stewardship pharmacist FTE, median [IQR]	1 [0.5 – 1.4]
PGY-2 Trained ID pharmacist FTE, n (%)	
0 FTE	8 (38%)
0.5 FTE	2 (10%)
1 FTE	8 (38%)
> 1 FTE	3 (14%)
ID certificate pharmacist FTE, n (%)	
0 FTE	5 (24%)
0.5 FTE	2 (10%)
1 FTE	5 (24%)
>1 FTE	9 (43%)

ICU: intensive care unit, ID: infectious diseases; FTE: Full-time equivalent; IQR: Interquartile range; PGY-2 ID: ID pharmacist completed post-graduate year 2 specialized clinical pharmacy training; ID certificate: ID pharmacist completed infectious diseases certificate training (e. g. Society of Infectious Diseases Pharmacists)

Summary

- Median carbapenem days of therapy for 2022 from reporting hospitals in Kentucky was 17.5 days of therapy per 1000 patient days.
 - The wide IQR [9.4 – 27.0] is indicative of substantial variability in carbapenem use across reporting hospitals
 - Overall carbapenem use did not appear to vary substantially month to month throughout 2022
 - Meropenem was used far more commonly than ertapenem at reporting hospitals
- In general, it appears that hospitals reporting higher rates of ceftriaxone resistant *E. coli* (used as a surrogate for extended spectrum beta-lactamase producing Enterobacterales) also report higher use of meropenem. Local susceptibility patterns are an important consideration when evaluating meropenem use for appropriateness.
- In a comparison of hospitals that restricted carbapenems to those who do not, no clear trends emerged.
 - These data do not necessarily suggest carbapenem restrictions are ineffective, as they do not account for trends at hospitals over time or specific restriction criteria.
 - Individual institutions should consider utilizing or revising existing carbapenem restrictions on a case-by-case basis.
- These data may aid in contextualizing meropenem use at healthcare institutions throughout Kentucky and beyond.