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Mini Root Cause Analysis Reveals Opportunities for Reducing *C. difficile* Infection Rates

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Background

- *C. difficile* remains the single most common pathogen among healthcare-associated infections. Diagnostic stewardship informs proper estimation of incidence rates, while antimicrobial stewardship plays a key role in *C. difficile* prevention.
- We conducted a multi-center, prospective cohort study using on-site, root cause analyses to identify opportunities for reducing hospital-onset *C. difficile* infection rates (HO-CDI).

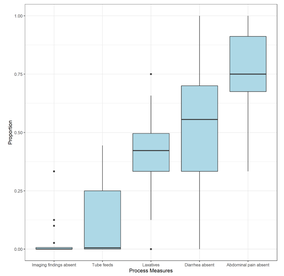
Methods

- Multicenter (n=20) prospective cohort study enrolling inpatients with HO-CDI admitted in the southeastern United States from July 2019 to June 2020.
- For each HO-CDI case, mini root cause analyses were conducted by on-site physicians, infection preventionists, or stewardship pharmacists to assess appropriateness of *C. difficile* testing and inpatient antibiotic use from the 30 days preceding HO-CDI diagnosis.
- Opportunities for antibiotic stewardship improvement were categorized by duration, indication (e.g., whether or not diagnosis was correctly confirmed), or spectrum (whether or not a more targeted agent could have been used).
- We constructed a logistic regression model to assess for association between particular indications or antibiotic classes and inappropriate antibiotic use.

Results – Diagnostic Stewardship

- RCAs were submitted for 608 of 692 possible cases (an 88% completion rate)
- Overall, 208 (34%) of tests were adjudicated potentially inappropriate and a further 66 (10.9%) were of uncertain appropriateness
- Among inappropriate tests, absence of diarrhea, absence of abdominal pain, and laxative receipt were cited as the most common issues

Figure 1: Reasons for Inappropriate Testing



Results – Antibiotic Stewardship

- 1,783 total antibiotic use adjudications were submitted and evaluated.
- UTI was the indication most strongly associated with inappropriate antibiotic use contributing to the development of *C. difficile* infection (OR 1.7, 95% CI 1.3-2.3).

Figure 2: Opportunities for Improvement by Indication

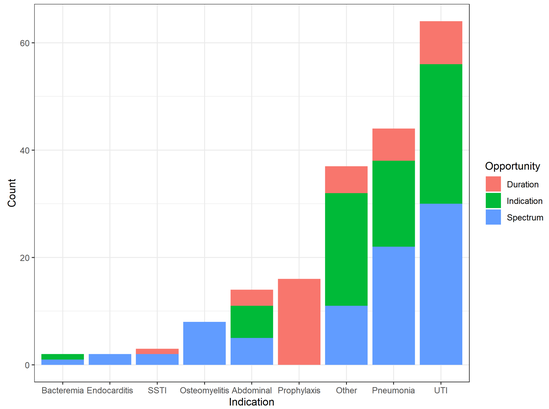


Table 1: Summary of Antibiotic Appropriateness by Indication

Indication	Inappropriate Antibiotic Use	OR_{inappr} (95% CI)
Urinary Tract	118/238 (49.6)	1.7 (1.3-2.3)
Bone/Joint	15/45 (33.3)	0.9 (0.5-1.7)
Pneumonia	72/298 (24.2)	0.5 (0.4-0.7)
Prophylaxis	30/133 (22.6)	0.5 (0.3-0.7)
Skin/Soft Tissue	13/58 (22.4)	0.5 (0.3-0.9)
Abdominal	41/197 (20.8)	0.4 (0.3-0.6)
Bacteremia	24/159 (15.1)	0.3 (0.2-0.4)

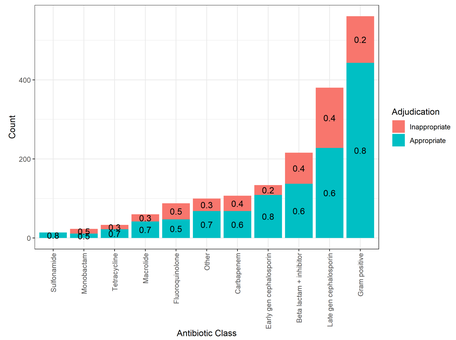
Results – Antibiotic Stewardship (continued)

- Among potentially inappropriate antibiotic uses, spectrum and indication comprised leading opportunities for pneumonia and UTI.
- Late generation cephalosporins and Gram positive agents were among the most frequently used agents. Late-generation cephalosporins, beta lactam/beta lactamase inhibitor combinations, carbapenems, monobactams, and fluoroquinolones were all associated with an increased odds of inappropriate use.

Table 2: Summary of Antibiotic Appropriateness by Antibiotic Class

Antibiotic Class	Inappropriate Antibiotic Use	OR_{inappr} (95% CI)
Monobactam	12/23 (52.2)	4.8 (1.9-12.0)
Fluoroquinolone	41/88 (46.6)	3.8 (2.1-7.0)
Late gen cephalosporin	152/280 (39.9)	2.9 (1.8-4.7)
Beta lactam+inhibitor	79/216 (36.6)	2.5 (1.4-4.5)
Carbapenem	39/107 (36.4)	2.5 (1.4-4.5)
Tetracycline	11/33 (33.3)	2.2 (0.9-5.1)
Other	32/100 (32.0)	2.1 (1.1-3.8)
Macrolide	18/60 (30.0)	1.9 (0.9-3.8)
Gram positive	118/561 (21.3)	1.2 (0.7-1.9)
Early gen cephalosporin	25/134 (18.7)	Ref

Figure 3: Antibiotic Appropriateness by Antibiotic Class



Conclusions

- Mini-RCAs can identify high-yield opportunities for CDI risk reduction.
- Laxative receipt and inconsistent documentation of diarrhea remains significant opportunities for improvement in diagnostic stewardship.
- The indication most strongly associated with inappropriate antibiotic receipt among CDI cases was urinary tract infection.
- The antibiotics most strongly associated with inappropriate antibiotic receipt among CDI cases were fluoroquinolones, monobactams, carbapenems, late generation cephalosporins, and beta lactam+inhibitor combinations.

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