Presentation Type:
Poster Presentation
Subject Category: Antibiotic Stewardship
Evaluating the Prevalence of Leading Practices in Antimicrobial Stewardship
Barbara Braun; Salome Chitavi; Eddie Stenehjem; Mushira Khan; David Baker and David Hyun

Background: Most hospitals have a basic infrastructure in place for antimicrobial stewardship programs (ASPs). Although this is a critical first step, we need to ensure that ASPs are working to implement effective evidence-based approaches nationally. In 2018, a group of leading antibiotic stewardship organizations met and identified specific, effective, and recommended ASP activities based on current scientific evidence and their experience (Baker et al, *Joint Comm J Qual Pat Saf* 2019;45:517–523). To determine the extent to which hospitals are currently implementing the recommended practices, we conducted an electronic questionnaire–based assessment. **Methods:** A 50-item questionnaire-based assessment was sent via QualtricsTM to the hospital's designated ASP leader. The sample comprised 992 Joint Commission accredited hospitals. The practices of interest related to (1) development of facility-specific treatment guidelines, (2) measuring appropriate use and concordance of care with these guidelines, (3) engaging clinicians while the patient is on the unit, (4) diagnostic stewardship, (5) measurement of antimicrobial utilization data, and (6) measuring hospital-acquired *Clostridioides difficile* infection (CDI) rates. Sampling weights were used to adjust the results for nonresponse using R software. **Results:** In total, 288 hospitals completed the questionnaire. Small and nonteaching hospitals were significantly less likely to respond ($p < 0.005$, p=0.01 respectively), however there were no differences by healthcare system membership or urban/rural location. 49% of respondents had the specialist term ASP or infectious disease (ID) in their title. Most hospitals (93.1%) had developed facility-specific treatment guidelines for specific inpatient conditions, often community-acquired pneumonia (85%), sepsis (81%), UTI (75%), and SSTI (69%). However, only 37% had formally assessed compliance with 1 or more of these guidelines. Also, 83% reported having a process for prospective audit and feedback, of which 43% do this 4–5 days per week. Similarly, 49% reported that they review all antimicrobials ordered. Recommendations are commonly given by the ASP pharmacist (69%) via some combination of telephone (78%), face-to-face (69%), text message (54%), and/or EHR alert (36%). Overall, 66% of hospitals had procedures in place to prevent inappropriate diagnostic testing for *C. difficile*, and 39% of hospitals had similar policies for urine specimens. Furthermore, >80% were routinely measuring days of therapy and CDI rates. **Conclusions:** Most hospitals have facility-specific treatment guidelines and measure CDI and days of therapy. Practices for active engagement with frontline staff in prospective audit and feedback vary widely. Greater understanding of barriers to assessing adherence to hospitals' treatment guidelines is critical to improving this practice.
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***Clostridioides difficile* Is Not Difficult to Predict in Hospital Settings**
Kinta Alexander; Frances Petersen and Sean Brown

Background: *Clostridioides difficile* is a gram-positive bacteria that is the most common cause of hospital-associated infectious diarrhea among traditional and nontraditional high-risk populations. Excess healthcare costs associate with *C. difficile* infection (CDI) prevalence, morbidity, and mortality is shown to economically impact the US healthcare system with at least an additional $1 billion in annual cost. Exposure to antimicrobial agents resulted in increased risk for hospital-onset CDI (HO-CDI) at an inner-city hospital during 2010 and 2011. **Methods:** A retrospective case-control study of all persons with HO-CDI in the MICU was conducted at an inner-city hospital between January 1, 2010, and December 31, 2011. A patient was considered to have developed HO-CDI if diarrhea developed after 72 hours of admission into the MICU and a confirmed laboratory stool specimen for *Clostridioides difficile* infection (CDI) was obtained. A non–HO-CDI person was randomly selected using "risk set sampling." After the application of inclusion and exclusion criteria, 88 cases were eligible for the study. Of these cases, 29 met the definition for HO-CDI, and 59 met the definition for non–HO-CDI. The relationship between antimicrobial use and the development of HO-CDI in patients in the MICU at an inner-city hospital was investigated using a logistic regression model in which the variable of total antibiotics was used as a possible predictor for predicting a positive HO-CDI. **Results:** Logistic regression was utilized to determine the relationships between selected study variables and presence or absence of HO-CDI. Total antibiotics was significantly related to HO-CDI. The results of this analysis showed that total antibiotics was a significant predictor for HO-CDI. The total value of the coefficient B for this predictor was 0.47, and the exponentiated value (exp[B]) of this coefficient was 1.60 (95% CI, 1.08–2.35). In this sample, patients who had 1 or more antibiotics were at a 60% greater risk of having a positive HO-CDI culture. There was a significant association between the use of metronidazole and HO-CDI ($p < .001$). **Conclusions:** Antimicrobial stewardship is an integral part of patient safety. The findings from this study were instrumental in the implementation of a fledging antimicrobial stewardship program and the use of evidence-based practices at this inner-city hospital.
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Clinical Characteristics and Fecal Microbiome in Recurrent Versus Nonrecurrent *Clostridioides difficile* Infection
Swapnil Lanjewar; Ashley Kates; Lauren Watson and Nasia Safdar

Background: Up to 30% of patients with *Clostridioides difficile* infection (CDI) develop recurrent infection, which is associated with a 33% increased risk of mortality at 180 days. The gut microbiome plays a key role in initial and recurrent episodes of CDI. We examined the clinical characteristics and gut microbial diversity in patients with recurrent (rCDI) versus nonrecurrent CDI at a tertiary-care academic medical center. **Methods:** Stool samples were collected from 113 patients diagnosed with CDI between 2018 and 2019. Clinical and demographic data were extracted from the electronic

Table 1

	Non-recurrent CDI (n = 58)	Recurrent CDI (n = 55)
Age in years, median (range)	58 (19 – 83)	59 (19 – 88)
Female, n (%)	38 (65.5)	30 (54.5)
Race, n (%)	Caucasian, 54 (93.1) African American, 3 (5.2) Other, 1 (1.7)	Caucasian, 50 (90.1) African American 3 (5.5) Other, 1 (1.8)
History of organ transplant, n (%)	6 (10.3)	12 (21.8)
Chronic kidney disease, n (%)	9 (15.5)	12 (21.8)
Diabetes Mellitus type 2, n (%)	8 (13.8)	11 (20)
Inflammatory bowel disease, n (%)	4 (6.9)	6 (10.9)
Appendectomy, n (%)	17 (29.3)	13 (23.6)
Smoker, n (%)	8 (13.8)	4 (7.3)
NSAID use, n (%)	17 (29.3)	16 (29.1)
PPI use, n (%)	21 (36.2)	16 (29.1)
Presence of chronic medical condition*, n (%)	36 (62.1)	34 (61.8)

* Congestive heart failure, liver cirrhosis, end stage renal disease, active malignancy, insulin dependent diabetes mellitus, autoimmune disease requiring immune suppression.

Table 2.

	Non-recurrent C Diff (58 episodes)						Recurrent C Diff (48 first episodes)					
	YES	%	NO	%	Not checked	%	YES	%	NO	%	Not checked	%
Admission	(32)	55.2	(26)	44.8			(24)	50.0	(24)	50.0		
Abdominal pain	(25)	43.1	(33)	56.9			(29)	60.4	(19)	39.6		
Fever (>38.5 C)	(9)	15.5	(49)	84.5			(5)	10.4	(43)	89.6		
Hypoalbuminemia (<3 g/dL)	(7)	12.1	(26)	44.8	(25)	43.1	(7)	14.6	(19)	39.6	(22)	45.8
ICU admission	(4)	6.9	(54)	93.1			(3)	6.3	(43)	89.6		
Abnormal CT abdomen	(5)	8.6	(5)	8.6	(48)	82.8	(8)	16.7	(6)	12.5	(34)	70.8
Leukocytosis (>15K)	(14)	24.1	(30)	51.7	(14)	24.1	(13)	27.1	(22)	45.8	(13)	27.1
AKI (Cr >1.5 times baseline)	(3)	5.2	(43)	74.1	(12)	20.7	(3)	6.3	(30)	62.5	(15)	31.3
Abdominal peritoneal signs	(1)	1.7	(57)	98.3			(0)	0.0	(48)	100.0		
Need for vasopressors on hospitalization	(1)	1.7	(57)	98.3			(2)	4.2	(46)	95.8		
Need for mechanical ventilation	(1)	1.7	(57)	98.3			(0)	0.0	(48)	100.0		
Altered mental status	(5)	8.6	(53)	91.4			(1)	2.1	(47)	97.9		

medical record (Table 1), and 16S rRNA sequencing of the v4 region was carried out on the Illumina MiSeq using 2×250 paired-end reads. Sequences were binned into operational taxonomic units (OTUs) using mothur and were classified to the genus level whenever possible using the ribosomal database project data set version 16. Alpha diversity was calculated using the Shannon diversity index. B diversity was calculated using the Bray-Curtis dissimilarity matrix. Differential abundance testing was done using DESeq to assess taxonomic differences between groups. A *P* value of .05 was used to assess significance. **Results:** In total, 55 patients had rCDI (prior positive *C. difficile* polymerase chain reaction in last 7–365 days) and 58 had nonrecurrent CDI (Table 1). Patients with rCDI had a higher frequency of organ transplant and comorbidity. No differences in α not β diversity were observed between groups. Also, 4 OTUs were more abundant in those with rCDI: *Ruminococcus* (n = 2), *Odoribacter*, and *Lactobacillus*. Patients with rCDI had microbiomes with greater proportions of Bacteroidetes (27% of OTUs) compared to the nonrecurrent group (18%) as well as fewer OTUs belonging to the *Firmicutes phyla* compared to the nonrecurrent patients (56% vs 59%). Among the rCDI patients, those experiencing 2 or more recurrences had greater abundances of Bacteroides and *Ruminococcus*, while those experiencing only 1 recurrence had significantly greater abundances of *Akkermensia*, *Ruminococcus*, *Streptococcus*, *Roseburia*, *Clostridium* IV, and *Collinsella* compared to those with only 1 recurrence (Table 2). **Conclusions:** Patients with rCDI had a more impaired microbiome than those with initial CDI. *Ruminococcus* OTUs have been previously indicated as a risk factor for recurrence and treatment failure, and they were significantly more abundant in those with rCDI and among those with multiple recurrences. The greatest differences in the microbiome were observed between those with 1 recurrence compared to those with multiple recurrences. Interventions for gut microbiome restoration should focus particularly on those with recurrent CDI.

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Impact of Two-Step Testing Algorithm on Reducing Hospital-Onset *Clostridioides difficile* Infections

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Clostridioides difficile infection (CDI) is one of the leading causes of hospital–onset infections. Clinically distinguishing true CDI versus colonization with *C. difficile* is challenging and often requires reliable and rapid molecular testing methods. At our academic center, we implemented a 2-step testing algorithm to help identify true CDI cases. The University of Mississippi Medical Center is a 700+ bed academic facility located in Jackson, Mississippi. Hospital-onset (HO) CDI was defined based on NHSN Laboratory Identified (LabID) event as the last positive *C. difficile* test result performed on a specimen using a multistep testing algorithm collected >3 calendar days after admission to the facility. HO-CDI data were collected from all inpatient units except the NICU and newborn nursery. HO-CDI outcomes were assessed based on standardized infection ratio (SIR) data. In May 2020, we implemented a 2-step testing algorithm (Figure 1). All patients with diarrhea underwent *C. difficile* PCR testing. Those with positive *C. difficile* PCR test were reflexed to undergo enzyme immunoassay (EIA) glutamate dehydrogenase antigen (Ag) testing and toxin A and B testing. The final results were reported as colonization (*C. difficile* PCR+/EIA Ag+/Toxin A/B−) or true CDI case (*C. difficile* PCR+/EIA +/Toxin A/B +) or negative (*C. difficile* PCR−). All patients with colonization or true infection were placed under contact isolation precautions until diarrhea resolution for 48 hours. During the preintervention period (October 2019–April 2020), 25 HO-CDI cases were reported compared to 8 cases in the post-intervention period (June 2020–December 2020). A reduction in CDI SIR occurred in the postintervention period (Q3 2020–Q4 2020, SIR 0.265) compared to preintervention period (Q4 2019–Q1 2020, SIR 0.338) (Figure 2). We successfully reduced our NHSN HO-CDI SIR below the national average after implementing a 2-step testing algorithm for CDI. The 2-step testing algorithm was useful for antimicrobial stewardship to guide appropriate CDI treatment for true cases and for

Figure 1: Two-Step Testing Algorithm for Diagnosing *Clostridioides difficile* infection

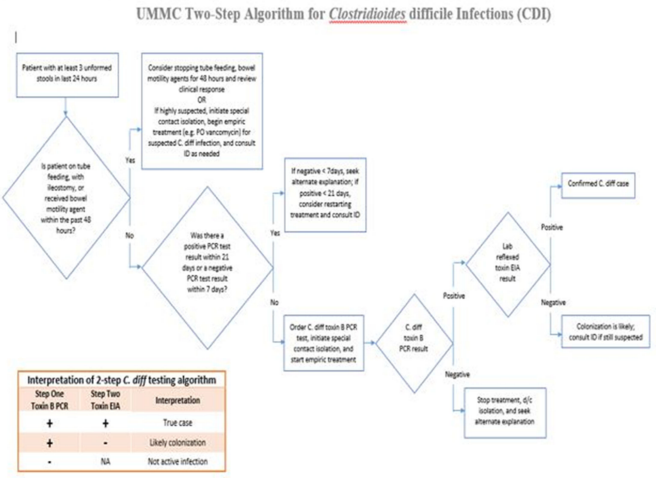

Figure 2: Comparison of pre- and post- intervention trend in Hospital-onset CDI rate