

resources related to ID expertise, dedicated staff, and software tools, whereas hospitals that belong to a system benefit from centralized ID expertise and technical infrastructure provided. **Conclusions:** Specific factors related to personnel, relationships and IT resources have an outsized impact on implementing multiple leading antimicrobial stewardship practices in hospitals. Hospital ASPs could benefit by targeting resources toward these areas.

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Subject Category: Antibiotic Stewardship

Systematic review of antibiotic stewardship interventions for urinary tract infection management in the ambulatory setting

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Background: Urinary tract infections (UTIs) are common indications for antibiotics in ambulatory setting, and inappropriate use is prevalent. Fluoroquinolones account for 40% of antibiotics prescribed for uncomplicated UTIs, despite clinical guidance against their use as firstline agents. We conducted a systematic review to determine which antibiotic stewardship intervention(s) are effective in improving antibiotic prescribing for UTIs in the ambulatory setting. **Methods:** Following PRISMA guidelines, English-language literature from 1995 to September 21, 2021, was searched for articles about antimicrobial stewardship, UTI, and ambulatory setting from PubMed, Embase, and Central. Additional articles were identified from authors' collections and references of pertinent articles. Studies were included if the authors implemented intervention targeting adults 18 years and older in outpatient setting (excluding emergency departments). Interventions were categorized into Guideline Development and Dissemination (GDD), Audit and Feedback, Clinical Decision Support System (CDSS), and Multimodal Interventions. **Results:** The literature search identified 1,899 papers; 14 papers were included in this review; and 4 additional papers were identified from other sources. The main interventions were GDD in 6 studies, audit and feedback in 3 studies, CDSS in 4 studies, and multimodal interventions in 5 studies. These studies had heterogeneity of the practice settings and interventions. Moreover, 11 studies targeted primary care, 2 studies targeted urgent care, 1 study targeted both primary and urgent care, 2 studies were conducted in spinal cord injury clinics, and 2 studies were conducted in hospital-wide outpatient sites. Outcomes included (1) statistically significant increase in guideline-concordant antibiotic prescribing in 12 studies (range, 4.6%–24.6%); (2) statistically significant decrease in fluoroquinolone prescriptions (range, 9.1%–86.3%) in 7 of 9 studies focusing on fluoroquinolones; (3) significant decreases in drug resistance in urine pathogens in 2 studies that evaluated this. Provider education, in conjunction with passive CDSS tools, such as integrating order sets for UTI prescriptions with prefilled instructions into electronic medical records appeared most beneficial. Several studies have investigated negative impact and have found no increase in retreatment rates or worse outcomes. **Conclusions:** Our systematic literature review identified a limited number of studies with a variety of interventions that improved antibiotic use for UTIs in the ambulatory care setting. Provider education, in conjunction with CDSS tools, can be less time-consuming than audit and feedback and can target a large number of providers and practices. Future studies need to address sustainability over longer periods and should target specialty clinic populations because they have high burden of patients with multidrug-resistant UTI organisms.

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Subject Category: Antibiotic Stewardship

Antibiotic use and impact on illness course in children with influenza-like-illness in the emergency department

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Background: Child absenteeism from childcare or school leads to economic loss from parental work absenteeism, overutilization of acute-care resources, and excess medicalization of children with minor illnesses. We sought to determine the difference in days missed from childcare or school and days of illness for children with influenza-like illness (ILI) in the emergency department (ED) who are or are not prescribed an antibiotic. **Methods:** We conducted a secondary data analysis of a prospective randomized control trial evaluating the impact of rapid molecular testing on provider decision making. The study included children aged 2 months–12 years attending childcare or school seen in the ED from December 2018 through December 2019 with ILI (CDC definition) with parental survey completion 10 days after their ED visit. The primary exposure was receipt of antibiotics over the course of illness, which was assessed by chart review and parent survey. The primary outcome was number of days missed from class. The secondary outcome was number of days of illness after initial ED visit. Wilcoxon tests were used to compare missed class days or illness days by antibiotic receipt. Multivariable negative binomial regression was used to analyze outcomes, controlling for clinically important patient characteristics. **Results:** Of 251 children included in this study, the median age was 4.2 years (IQR, 1.6–7.0); 52% were male, 40% were White, 54% were Hispanic, and 75% had government insurance. Antibiotics were prescribed in 26% of ILI encounters. There was no statistically significant association between antibiotic receipt and number missed class days (2.0 days [IQR, 1.0–4.0] vs 3.0 days [IQR, 1.0–5.0]; $P = .08$) or illness days (4.0 days [IQR, 3.0–7.0] vs 5.0 days [IQR, 3.0–7.0]; $P = .13$) after the initial ED visit. After adjusting for covariates, there was no significant difference in missed class days or illness days for patients prescribed antibiotics in relation to days sick before ED visit. The rates of missed class days and illness days were 87% and 30% greater, respectively, in patients with additional medical visits during the course of illness. **Conclusions:** Days sick prior to ED presentation and receipt of an antibiotic for ILI had no influence on child absenteeism or illness duration. However, children missed more class and received more antibiotics if they had multiple medical visits during an illness. Further study is needed on sociobehavioral factors leading to medicalization of children with minor illnesses and its impact on the unnecessary use of antibiotics.

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Subject Category: *C. difficile*

In veteran outpatients, antibiotics remain significant risk factor for community-acquired *Clostridioides difficile* infection

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Background: An estimated 30% of antibiotic prescriptions in outpatient settings may be inappropriate. Antibiotic exposure increases an individual's risk of *Clostridioides difficile* infection (CDI). To assess the prevalence of community-acquired CDI (CA-CDI) among patients without recent hospitalization and to examine the influence of outpatient antibiotic exposure on the risk of acquiring CA-CDI in this population, we examined a 2-year cohort of patients seen in primary care clinics at VA community-based outpatient clinics (CBOCs) associated with a large VA medical

Table 1.

	All	CA-CDI	no CA-CDI	p-value
Number of patients	84787	20	84767	-
Age	64.8 +/- 16.4	63.6 +/- 21.8	64.8 +/- 16.4	0.812
Charlson comorbidity index	1.24+/-1.6	1.5+/-1.9	1.24+/-1.6	0.553
Antibiotics at index visit	3533 (4%)	5 (25%)	3528 (4%)	0.001
History of CDI (prior 2 years)	76 (0%)	1 (5%)	75 (0%)	<0.001

center. **Methods:** All primary care visits and nonvisit antibiotic prescriptions were identified in calendar years 2018–2019 as encounters of interest. Encounters occurring **Results:** We identified 84,787 patients with visits meeting our criteria. In this cohort, 3,533 patients were prescribed antibiotics at their encounter of whom 5 (0.14%) developed CA-CDI. Among the 81,254 patients who were not prescribed antibiotics, 15 (0.02%) developed CA-CDI, yielding an unadjusted CA-CDI odds ratio of 7.68 (95% CI, 2.50–19.82). **Conclusions:** Although CA-CDI episodes were infrequent among VA outpatients with a CBOC visit in 2018–2019, the odds of CA-CDI were 7-fold greater in outpatients with antibiotic exposure than outpatients without antibiotic exposure. Antibiotic stewardship interventions that emphasize adverse events as a result of care provided in the outpatient setting, rather than as events limited to acute-care settings, may mitigate CDI risk.

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Subject Category: *C. difficile*

Characteristics of antibiotic exposures for surgical procedures prior to *Clostridioides difficile* diagnosis—Minnesota, 2018

Paige D'Heilly; Amanda Beaudoin; Davis Melin and Stacy Holzbauer

Background: *Clostridioides difficile* infection (CDI) is the leading cause of healthcare-associated diarrhea. Significant risk factors for CDI include antibiotic use and healthcare exposure. Antibiotics are often administered before, during and/or after surgery to prevent postsurgical infection. The contribution of surgery-related antibiotics to the overall CDI burden has not been well described, and assessment of the appropriateness of surgical antibiotic use is complicated by complex clinical guidelines. We have described surgical antibiotic prophylaxis history among adult with CDI in Minnesota in 2018. **Method:** The Minnesota Department of Health (MDH) performs 5-county active population- and laboratory-based CDI surveillance as a CDC Emerging Infections Program site. Incident CDI was defined as stool positive for *C. difficile* by toxin or molecular assay from a person aged ≥ 18 years with no positive test in the preceding 8 weeks. History of CDI was defined as having had a previous CDI episode in the 2009–2018 surveillance data set. Medical records were reviewed for 12 weeks prior to incident CDI test date to identify antibiotic prescriptions. Antibiotics with documented indication for surgical-site infection prevention or surgical prophylaxis were classified as “surgical antibiotic prophylaxis” (SPPX). SPPX type (eg, intraoperative, postoperative), appropriateness of SPPX, and clinical guideline adherence were not assessed.

Results: During 2018, 812 incident CDIs were reported to MDH among 736 patients. SPPX preceded 84 (10.3%) cases, non-SPPX antibiotic use preceded 465 cases (57.3%), and 263 cases (32.4%) had no documented prior antibiotic use. The median age of incident CDIs with preceding SPPX was 68 years (IQR, 54–79.5). In 25 incident CDI cases with preceding SPPX (29.8%), there were no other antibiotic exposures. Among incident CDIs with preceding SPPX, 11 (13.1%) had >1 surgery event with SPPX. Prior CDI was identified for 13 (15.7%) with SPPX. Among 99 procedures with preceding SPPX, orthopedic surgeries (n = 27, 27.3%), gastrointestinal surgeries (n = 26, 26.3%), and cardiovascular surgeries (n = 22, 22.2%) were most common. In total 18 SPPX prescriptions (18.2%) originated in outpatient settings. SPPX drugs included cefazolin (n = 67, 67.7%), ceftriaxone (n = 7, 7.1%), ertapenem (n = 6, 6.1%), and clindamycin (n = 6, 6.1%). Median SPPX duration was 1 day (IQR, 1–2), and the median number days between surgery and specimen collection date was 19 (IQR, 7–49). **Conclusions:** Antibiotic stewardship programs should assess surgical prescribing, including in outpatient centers. Even short antibiotic duration for surgery could put patients at risk for CDI. More data are needed to evaluate the appropriateness of SPPX prescribing and to describe the impact of SPPX on CDI.

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Subject Category: *C. difficile*

***Clostridioides difficile*: A diagnostic intervention**

Majd Alsoubani; Joshua Khuvis; Angie Rodday and Shira Doron

Background: *Clostridioides difficile* infection (CDI) is a leading cause of healthcare-associated infection and is associated with increased morbidity and mortality. Multiple strategies have been implemented to optimize the diagnostic accuracy of CDI testing algorithms. However, overdiagnosis of *C. difficile* colonization remains a challenge especially in the era of highly sensitive Nucleic acid amplification testing (NAAT). We implemented 2 interventions to reduce the rates of inappropriate *C. difficile* orders and tests. **Methods:** We performed a quasi-experimental retrospective study to examine the rates of all inpatient *C. difficile* test orders and results relative to 2 interventions between January 2018 and February 2021. We defined 3 periods: preintervention, after the first intervention, and after the second intervention. The first intervention, implemented May 2019, was a clinical decision support system (CDSS) tool to guide clinicians to order testing only if CDI criteria were met. The second intervention, implemented July 2020, was the requirement of mandatory antimicrobial team approval of PCR reflex testing for indeterminate toxin or antigen test results. This intervention included a discussion between clinicians and members of stewardship team prior to approval. To evaluate the impact of interventions on ordering appropriateness, chart review was conducted on a random subsample of 100 orders from each period. Hospital-onset CDI (HO-CDI) was calculated using CDC criteria. **Results:** In total, 3,004 *C. difficile* test orders were placed during the study period. The rates of reportable HO-CDI were significantly reduced by 57.1% ($P = .003$). We detected a significant reduction in the number of tests ordered over time from 11.6 to 7.51 per 1,000 patient days. **Conclusions:** CDSS tools target patients at high pretest probability of CDI. The restriction of PCR-reflex testing to the antimicrobial stewardship team is a novel effective measure to minimize the misdiagnosis of CDI. The incorporation of multiple strategies is necessary to improve the diagnostic accuracy of *C. difficile* testing.

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