2097. Antimicrobial Stewardship Programs in Missouri Hospitals: Facilitators, Barriers, and Complexity of Implementation

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Session: 240. Antibiotic Stewardship: Regional
Saturday, October 5, 2019: 12:15 PM

Background. Antibiotic stewardship programs (ASPs) in acute care hospitals reduce unnecessary antibiotic use and attendant complications. In the state of Missouri, all hospitals are required to have an ASP. Additionally, the Joint Commission mandates ASP implementation for accreditation based on core elements defined by the Centers for Disease Control (CDC). No studies have evaluated the uptake of ASP since the Missouri state law and Joint Commission mandate. Furthermore, data are limited examining barriers to implementation across hospitals with variable resources. We evaluated ASP uptake across Missouri hospitals, assessed differences in program complexity, and identified facilitators and barriers to implementation.

Methods. A 94-question survey was administered electronically in the spring of 2019 to 130 Missouri hospitals. Information was collected regarding implementation details of CDC-defined ASP core elements and tools used to overcome implementation barriers. Results were self-reported by the stewardship pharmacist, the director of pharmacy, or the person most familiar with antimicrobial stewardship if the former were not available.

Results. Preliminary results have been collected from 37 hospitals ranging in size from 15 to 1303 beds (IQR: 54, 274). 16% were critical access hospitals. 54% of hospitals had ASPs adherent to all 7 CDC core elements. Another 27% had implemented 6 of the core elements, with all of those reporting that they lacked a single pharmacist leader. All facilities had implemented at least some measures to improve antibiotic use, ranging from 4 to 13 measures. 45% of programs used state-based antimicrobial stewardship collaboratives, and 52% of those found such programs to be "very" or "extremely" useful.

Conclusion. All hospitals surveyed are performing ASP activities in concordance with Missouri state law. However, only half contain the 7 core elements required by the Joint Commission. Furthermore, ASP implementation and activities vary widely. While physician leadership was commonly defined, appropriate pharmacist support was frequently lacking. State-based collaboratives are the most widely used resource, and at least half who use them find them to be helpful.

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2098. Applying Antimicrobial Consumption Metrics to Characterize Inpatient Stewardship Opportunities

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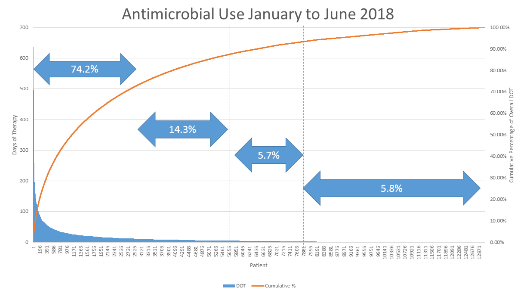
Session: 240. Antibiotic Stewardship: Regional
Saturday, October 5, 2019: 12:15 PM

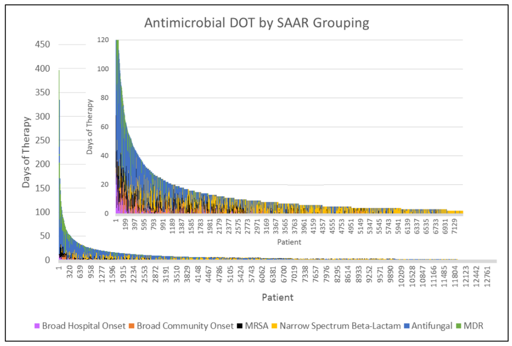
Background. The purpose of this study was to evaluate antimicrobial consumption metrics as a means for differentiating patient populations and antimicrobial stewardship (AMS) opportunities.

Methods. This single-center, retrospective, descriptive study included all patients from January 1, 2018 to June 30, 2018 that received ≥1 day of therapy (DOT) of any antimicrobial included in the National Healthcare Safety Network Antimicrobial Use and Resistance (NHSN AUR) module. The cohort was then grouped into 4 quartiles based on DOT (Q1 lowest; Q4 highest). The primary outcome was a Lorenz Curve of DOT per patient over the study period. Secondary outcomes included a comparison of patient characteristics and number/type of AMS-related opportunities present (using a randomized convenience sample of 25 patients per quartile). AMS opportunities were defined as any unnecessary, inappropriate, or suboptimal antimicrobial use with pharmacist intervention or potential for intervention occurring 24 hours after the antimicrobial initiation.

Results. During the 6 month study period, 24,743 patients accounted for 163,859 days present, and 13,039 (52%) received ≥ 1 DOT. After dividing the population into quartiles of antimicrobial use, median (range) DOT were as follows: Q1 [2 (1–2)], Q2 [4 (3–4)], Q3 [7 (5–10)], Q4 [20 (11–636)] (Figure 1). The top 24% of patients according to antimicrobial use accounted for 74% of total antimicrobial DOT. Patient-level DOT data are displayed by SAAR grouping in Figure 2. In the cohort of 100 patients, differences between quartiles included Infectious diseases consultation in 76% of patients in Q4 compared with 4–24% in other quartiles, ICU admission during hospitalization in 68% in Q4 compared with 28–40% in other quartiles, and any surgical procedure in 88% in Q1 compared with 48–60% in Q2–4. The number of AMS opportunities present were 4 (0.5/1000 DOT) in Q1, 13 (1.6/1000 DOT) in Q2, 28 (1.4/1000 DOT) in Q3, and 86 (0.8/1000 DOT) in Q4. The most common type of AMS opportunity differed by quartile: inappropriate prophylaxis for Q1-3, and de-escalation in Q4.

Conclusion. Evaluating antimicrobial consumption from a patient-level perspective at a large academic medical center reveals heterogeneity and variable AMS opportunities across quartiles





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2099. Use of Infectious Diseases Source-Specific Electronic Sepsis Order Sets is associated with Improved Survival in Sepsis: An Evaluation of 46 Hospitals in a Large Health Care System

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Session: 241. Antibiotic Stewardship: Sepsis
Saturday, October 5, 2019: 12:15 PM

Background. Compliance with evidence-based treatment bundles in patients with sepsis can lead to improved survival in persons with sepsis or septic shock. A way to ensure the adoption of best practices is the early use standardized order sets based on suspected source of infection.

Methods. The patient population was built by connecting electronic health record (EHR) to administrative data. In the EHR, we identified patients who had a sepsis discharge diagnosis code based on the International Statistical Classification of Disease and Related Health Problems (ICD–10), from August 1, 2018 to February 28, 2019. We evaluated the empiric use of sepsis order sets and patient outcomes. We adjusted for age, gender, Elixhauser Comorbidity Score (ECS), intensive care unit (ICU) status, and admission type. For the analysis, we included patients age 18 and older from facilities where we were able to match greater than 70 percent of patients. Matching was done by facility on medical record number and discharge date.

Results. There were 26,604 patients included in the analysis. The overall mortality rate was 10.67% ($n = 2{,}839$). Mortality associated with sepsis in patients that had a sepsis order set used was 8.92% (791/8,872), while for those whom a sepsis order set was not used was 11.55% (2,048/17,732). When mortality data were adjusted for age, gender, ECS, ICU status, admission type and hospital size, the use of sepsis order sets was associated with an adjusted odds ratio of 0.793 (95% CI 0.722, 0.868). In addition, in all sepsis patients who had an ICU admission, the use of the sepsis order sets was associated with an adjusted odds ratio of 0.804 (95% CI 0.725, 0.890). Similarly, in all sepsis patients who did not have an ICU admission, the use of the sepsis order sets was associated with an adjusted odds ratio of 0.688 (95% CI 0.556, 0.847).

Conclusion. The use of the standardized sepsis order sets in patients with sepsis was associated with a 20.7% relative risk reduction in mortality. In conjunction with rapid recognition of sepsis, early initiation of the sepsis order sets may lead to improved mortality in patients with sepsis.

Figure 1: Sepsis Order Set Impact on Inpatient Mortality for Patients with Sepsis

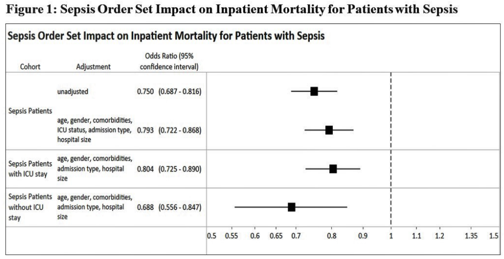

Table 1. Baseline Characteristics (N=26,604, age > 18, with sepsis ICD code)

Characteristic	Sepsis Order Set Used N (%)	Order Set Not Used N (%)
Number of patients	8,872	17,732
Age (Mean, SD)	65.4 (17.1)	64.9 (17.6)
Male Gender (%)	49.4	50.1
ICU Admission (%)	55.2	50.5
Elixhauser Comorbidity Score (Mean)	43.3	43.7
LOS (Median, IQR)	5 (3 – 9)	6 (3 – 10)

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2100. A Retrospective Chart Review of Emergent Antibiotic Use

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Session: 241. Antibiotic Stewardship: Sepsis
Saturday, October 5, 2019: 12:15 PM

Background. The need for responsible antibiotic stewardship can be difficult to reconcile with the clinician's task of quickly recognizing and treating sepsis. Empiric antibiotics are often given in patients with any suspicion of infection, yet antibiotics carry non-trivial risks including antibiotic resistance and susceptibility to other infections, such as Clostridium difficile.

Methods. This retrospective chart review includes 200 patients who were admitted to the hospital and administered antibiotics while in the Emergency Department (ED). From clinical documentation several clinical data points were gathered such as: changes to (including discontinuation of) antibiotics by the admitting team, final culture data, discharge diagnosis, vital signs and routine laboratory values.

Results. Our study finds that the majority of patients administered antibiotics in the ED of our academic community hospital were not diagnosed with sepsis (67%) and did not meet SIRS (62.5%) nor qSOFA (88%) criteria prior to administration of antibiotics. Vancomycin (39.7%) and piperacillin–tazobactam (22.2%) were the most frequent empiric antibiotics started. Antibiotics were stopped completely on admission by the admitting team in 22.2% of included patients. A wide variety of sources of infection were suspected, pneumonia (33%), cellulitis (15%), and cystitis (18%) being the most common. The overall mortality rate for this group during the admission was 4.5%, which was comparable to all-cause hospital mortality during the same time period. Infection was ruled out by discharge in 91 of the included 200 patients (45.5%). At least 37.5% of all included patients had received antibiotics within the last 3 months. Intriguingly, recent exposure was nearly twice as common (47.8%) among infected patients than in those without infections (24.7%), with a relative risk of 1.48 (CI 1.0993–2.0014).

Conclusion. These findings suggest that an opportunity exists for increased antibiotic stewardship in the emergency department in the management of suspected sepsis and/or infection. Stable patients in whom infection cannot be definitively ruled out may benefit more from prompt, thorough evaluation by an admitting team prior to the initiation of empiric antibiotics.

***Disclosures.* All authors:** No reported disclosures.

2101. Impact of "Code Sepsis" on Antimicrobial Utilization at an Academic Medical Center

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Session: 241. Antibiotic Stewardship: Sepsis
Saturday, October 5, 2019: 12:15 PM

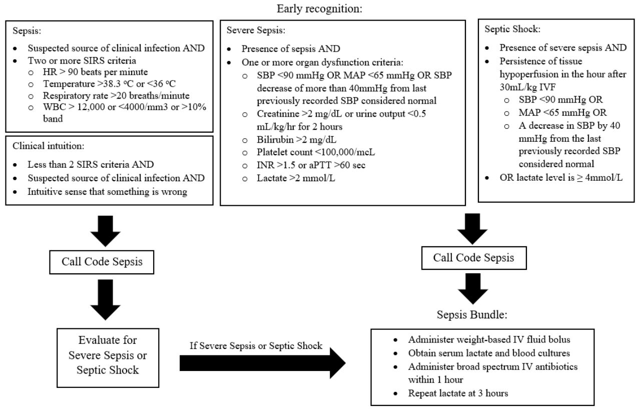
Background. Balancing antimicrobial stewardship with sepsis management is a challenge. At our academic medical center, a "Code Sepsis" was implemented as a nursing driven initiative to improve early recognition and management of sepsis. Per protocol, Code Sepsis is activated in patients who meet two or more systemic inflammatory response syndrome (SIRS) criteria due to a suspected infection to allow for early implementation of the sepsis bundle, which includes laboratory testing, fluid resuscitation, and antibiotic administration (Figure 1). We analyzed the impact that Code Sepsis had on antimicrobial use among hospitalized patients over a six month period.

Methods. We reviewed the electronic medical records of hospitalized patients with Code Sepsis activation between January 1, 2018 and June 30, 2018 to determine whether antibiotics were "escalated" or "not escalated." Among patients who had antibiotic escalation, escalation was classified as "indicated" or "not indicated" (Figure 2). A logistic regression model was used to identify characteristics, SIRS or organ dysfunction criteria predictive of indicated antimicrobial escalation.

Results. Code Sepsis was activated in 529 patients with antibiotics escalated in 247 (47%) and not escalated in 282 (53%) (Table 1). Among patients whose antibiotics were escalated, 64% (152) had an indication. In 36% (89), escalation was not indicated as Code Sepsis was due to a suspected noninfectious source, known infectious source already on appropriate antimicrobials, or a suspected infectious source in which diagnostic results had already shown the absence of the infection (Figure 2). Odds of indicated antibiotic escalation increased with the number of SIRS and organ dysfunction criteria (Table 2).

Conclusion. In our efforts to improve sepsis outcomes, we focused on early recognition (Code Sepsis) and intervention (sepsis bundle). However, our Code Sepsis inadvertently led to antibiotic overutilization. By refocusing Code Sepsis on early recognition of severe sepsis and septic shock, we hope to optimize resource utilization and improve patient outcomes.

Figure 1: Key aspects of code sepsis



SIRS, systemic inflammatory response syndrome; HR, heart rate; WBC, white blood cell; SBP, systolic blood pressure; MAP, mean arterial blood pressure; IVF, intravenous fluid

Figure 2: Code Sepsis analysis

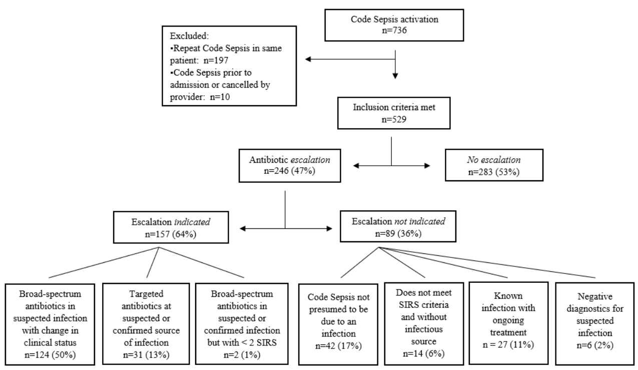


Table 1 Characteristic of patients with Code Sepsis

		Total n=529 (%)	Antibiotic Escalation n=247		No escalation n=282 (%)
			Indicated n=152 (%)	Not indicated n=93 (%)	
Gender	Male	306 (58)	86 (55)	41 (46)	179 (63)
Age	mean ± SD	54.5 ± 18.1	56.2 ± 19.5	56.9 ± 17.1	52.8 ± 17.4
SIRS criteria	Number of criteria with HR (mean ± SD)	2.60 ± 0.92	2.75 ± 0.87	2.37 ± 1.03	2.58 ± 0.90
Organ dysfunction	Number of criteria (mean ± SD)	1.02 ± 1.05	1.21 ± 1.05	1.11 ± 1.07	0.88 ± 1.02
Antibiotics prior to Code Sepsis	None Broad-spectrum Miscellaneous	186 (35) 139 (26) 204 (39)	79 (60) 16 (10) 62 (40)	40 (45) 11 (12) 38 (43)	67 (24) 112 (40) 104 (37)

Table 2 Predictors of indicated antimicrobial escalation

	Unadjusted		Adjusted	
Predictor	**Odds ratio (95% CI)**	**P-value**	**Odds ratio (95% CI)**	**P-value**
Age	1.01 (0.99, 1.02)	0.16		
DM	1.72 (1.09, 2.71)	0.02	1.70 (1.04, 2.76)	0.03
Post-op	0.50 (0.23, 1.09)	0.08		
Number of SIRS criteria	1.31 (1.06, 1.62)	0.01		
Temp >38.3°C or <36°C	1.61 (1.10, 2.36)	0.02	1.92 (1.26, 2.93)	0.03
WBC >12,000 or <4,000/mm^3	1.57 (1.07, 2.31)	0.02	1.72 (1.13, 2.60)	0.01
Number of Organ Dysfunction Criteria	1.27 (1.07, 1.52)	0.01		
Creatinine >2 mg/dL	1.75 (0.98, 3.13)	0.06	1.97 (1.07, 3.63)	0.03
Bilirubin >2 mg/dL	2.04 (1.08, 3.85)	0.03		
Lactate >2 mmol/L	1.73 (1.17, 2.56)	0.01	2.05 (1.35, 3.11)	<0.01

Univariable analysis performed but not retained in model as alpha >0.20 include: gender, ethnicity, HIV, solid organ malignancy, hematologic malignancy, HSCT, ESRD, SOT, CHF, cirrhosis, HR >90 beats/min, respiration >20 per minute, SBP <90 or MAP <65mmHg, platelet count <100,000/mm^3, INR >1.5 or aPTT >60 sec

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2102. Does Monitoring Procalcitonin Levels in Septic and Septic Shock Patients Decrease the Use of Antibiotics and Predict Length of Hospital Stay?

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