cases were reported from the NICU during the investigation. A maximum likelihood phylogenetic tree of HPIV3 WGS (Figure 1) showed that sequences from the 6 HO cases clustered together separately from the 3 CO controls, suggesting a single source of transmission, and 3 CO cases were not related to the HO cases or source of the outbreak. Early diagnosis and isolation of respiratory tract viral infections is important to prevent an outbreak. Successful control of outbreak in NICU requires prompt implementation of infection prevention measures with focus on symptom screening, cohorting, and disinfection practices.

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Presentation Type:
Oral Presentation

Subject Category: Pediatrics

Results of a Multicenter Diagnostic Stewardship Collaborative to Optimize Blood Culture Use in Critically Ill Children

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Group Name: Bright STAR Authorship Group

Background: Blood cultures are fundamental in the diagnosis and treatment of sepsis. Culture practices vary widely, and overuse can lead to false-positive results and unnecessary antibiotics. Our objective was to describe the implementation of a multisite quality improvement collaborative to reduce unnecessary blood cultures in pediatric intensive care unit (PICU) patients, and its 18-month impact on blood culture rates and safety metrics. **Methods:** In 2018, 14 PICUs joined the Blood Culture Improvement Guidelines and Diagnostic Stewardship for Antibiotic Reduction in Critically Ill Children (Bright STAR) Collaborative, designed to understand and improve blood culture practices in critically ill children. Guided by a centralized multidisciplinary study team, sites first reviewed existing evidence for safe reduction of unnecessary blood cultures and assessed local practices and barriers to change. Subsequently, local champions developed and implemented clinical decision-support tools informed by local patient needs to guide new blood-culture practices. The coordinating study team facilitated regular evaluations and discussions of project progress through monthly phone calls, site visits if requested by sites or the study team, and collaborative-wide teleconferences. The study team collected monthly blood culture rates and monitored for possible delays in obtaining blood cultures using a standardized review process as a safety balancing metric. We compared 24 months of baseline data to 18 months of postimplementation using a Poisson regression model accounting for the site-specific patient days and correlation of culture use within a site over time. **Results:** Across the 14 sites, before implementation, 41,768 blood cultures were collected over 259,701 PICU patient days. The mean preimplementation site-specific blood culture rate was 15.7 cultures per 100 patient days (rate range, 9.6–48.2 cultures per 100 patient days). After implementation, 22,397 blood cultures were collected over 208,171 PICU patient days. The mean postimplementation rate was 10.4 cultures per 100 patient days (rate range, 4.7–28.3 cultures per 100 patient days), which was 33.6% lower than the preimplementation (relative rate 0.66; 95% CI, 0.65–0.68 p <0.01). In 18 months post-implementation, sites reviewed 793 positive blood cultures, and identified only one suspected delay in culture collection possibly attributable to the site's blood culture reduction program. **Conclusions:** Multidisciplinary quality improvement teams safely facilitated a 33.6% average reduction in blood culture use in critically ill children at 14 hospitals. Future collaborative work will determine the impact of blood culture diagnostic stewardship on antibiotic use and other important patient safety outcomes.

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Association of Antibiotic Duration and Outcomes among NICU Infants with Invasive *Staphylococcus aureus* Infections

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Background: *Staphylococcus aureus* is the second-leading cause of late-onset sepsis among infants in US neonatal intensive care units (NICUs). Management of *S. aureus* bacteremia and meningitis in infants varies widely due to the lack of standardized guidelines. We examined the association between initial antibiotic duration and recurrent *S. aureus* infection or death among NICU infants with *S. aureus* bacteremia and/or meningitis. **Methods:** We conducted a retrospective cohort study of infants in Pediatrix Medical Group NICUs from 1997 to 2018 with first episode of *S. aureus* bacteremia and/or meningitis, identified as having at least 1 blood or cerebrospinal fluid (CSF) culture growing only *S. aureus* at any point during their NICU stay. Excluded infants were those not started on antistaphylococcal therapy within 2 days of positive culture, those with had endocarditis or osteomyelitis, or those who died or were discharged during or up to 1 day after antibiotic cessation. Antibiotic cessation was defined as last day of antibiotic given if followed by at least 3 days without antibiotics. Multivariable logistic regression was used to analyze the association between antibiotic duration categorized as <14 or ≥14 days) and recurrent SA infection (within 12 weeks of antibiotic cessation, prior to hospital discharge), or death (within 7 days of antibiotic cessation and at discharge). **Results:** Of 4,086 infants included, 3,991 (98%) had *S. aureus* bacteremia only and 95 (2%) had meningitis ± bacteremia. Of those with bacteremia only, 2,017 (50.5%), and 17 (18%) of those with meningitis received <14 days antibiotics (Figure 1). Longer antibiotic duration was associated with lower gestational age, methicillin-resistance, severe illness and bacteremia duration of ≥4 days (Table 1).

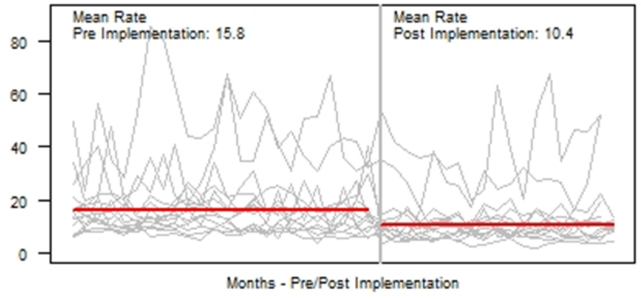
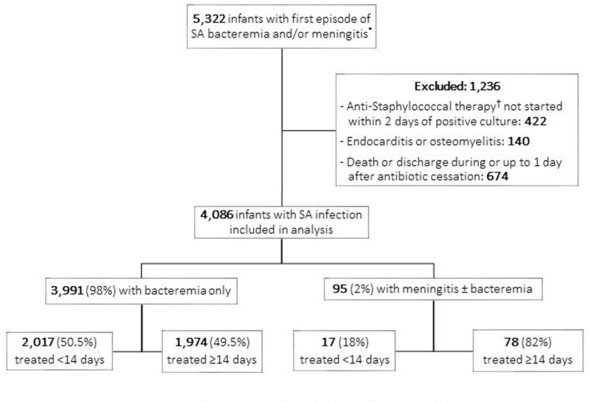


Figure 1.

Figure 1. Flow diagram of NICU infants with *Staphylococcus aureus* (SA) bacteremia and/or meningitis included in the study.



*Defined as at least one blood or cerebrospinal fluid (CSF) culture growing only *Staphylococcus aureus* at any point during NICU stay.

†Anti-Staphylococcal therapy broadly defined as MRSA-active agents (vancomycin, linezolid, clindamycin or trimethoprim-sulfamethoxazole) for infants with MRSA infection or MSSA-active agents (nafcillin, oxacillin, piperacillin-tazobactam, cloxicillin, dicloxicillin, ticarcillin-clavulanate, ampicillin-sulbactam, methicillin, or MRSA-active agents) for infants with MSSA infection.

Table 1. Characteristics of infants with *Staphylococcus aureus* bacteremia and/or meningitis by antibiotic duration.

	Bacteremia only			Meningitis ± bacteremia		
	Days of antibiotics			Days of antibiotics		
	<14 (n= 2,017)	≥14 (n=1,974)	p-value*	<14 (n= 17)	≥14 (n=78)	p-value*
Gestational age (weeks)			<0.001			0.51
- <28	53%	60%		59%	65%	
- 28- <32	30%	28%		18%	21%	
- 32- <37	12%	9%		12%	10%	
- ≥37	5%	3%		12%	4%	
Post-natal age (days)			0.31			0.42
- 0-7	11%	12%		18%	8%	
- 8-28	57%	59%		41%	42%	
- >28	32%	29%		41%	48%	
Male	56%	54%	0.41	59%	46%	0.43
Race/Ethnicity			0.06			0.06
- White	49%	46%		31%	43%	
- Black	26%	29%		13%	33%	
- Hispanic	19%	20%		50%	21%	
- Other	6%	5%		6%	3%	
Methicillin-resistance	25%	30%	0.001	29%	19%	0.34
Duration of bacteremia (days)			<0.001			
- <4	95%	66%				
- ≥4	5%	34%				
Concurrent bacteremia				29%	53%	0.11
Severe illness†	45%	56%	<0.001	59%	42%	0.28
Follow-up days‡, median (IQR)	35 (13-62)	44 (22-70)	<0.001	11 (3-67)	35.5 (13-58)	0.34

IQR: Interquartile range

*Fisher's exact test for categorical variables and Wilcoxon rank sum test for continuous variables. Significant values in bold.
†Defined as requiring mechanical ventilation, vasopressors or extracorporeal membrane oxygenation (EMCO) at the time of positive culture.
‡Time between antibiotic cessation and hospital discharge.

Table 2. Analysis of outcomes among infants with *Staphylococcus aureus* (SA) bacteremia and/or meningitis by antibiotic duration.

	Bacteremia only				Meningitis ± bacteremia		
	<14 days (n=2,017)	≥14 days (n=1,974)	OR (95% CI)	p-value*	<14 days (n=17)	≥14 days (n=78)	p-value*
Recurrent SA infection†	10%	4%	0.24 (0.18-0.32)	<0.001	18%	3%	0.04
Death within 7 days§	6%	1%	0.10 (0.06-0.17)	<0.001	15%	0	0.02
Death at discharge	11%	6%	0.33 (0.25-0.44)	<0.001	15%	7%	0.30

*Logistic regression analysis adjusted for post-natal age, gestational age, sex, methicillin-resistance, severe illness and duration of bacteremia. Significant values in bold.
†Fisher's exact test. Too few observations to perform multivariable analysis for meningitis cohort. Significant values in bold.
‡Prior to NICU discharge and within 12 weeks of antibiotic cessation, including recurrent positive blood or CSF cultures and new diagnosis of endocarditis or osteomyelitis.
§After antibiotic cessation

There was a significant association between <14 days antibiotics and recurrent infection (p = 0.04) and 7-day mortality (p = 0.02) in the meningitis cohort. Infants with SA bacteremia who received ≥14 days antibiotics had reduced odds of recurrent SA infection (OR 0.24, 95% CI 0.18-0.32) and death (OR 0.33, 95% CI 0.25-0.44), adjusting for post-natal age, gestational age, sex, methicillin-resistance, severe illness and duration of bacteremia (Table 2). **Conclusions:** In the largest study thus far examining antibiotic duration among hospitalized infants with *S. aureus* bacteremia and/or meningitis, ≥14 days antibiotics was associated with decreased odds of recurrent infection or death. Further studies are needed to define the optimal treatment duration and identify clinical factors distinguishing infants able to safely receive a shorter antibiotic duration.

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Subject Category: Surveillance/Public Health

Admission and Discharge Sampling Underestimates Multidrug-Resistant Organism (MDRO) Acquisition in an Intensive Care Unit

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Background: Identification of hospitalized patients with enteric multidrug-resistant organism (MDRO) carriage, combined with implementation of targeted infection control interventions, may help reduce MDRO transmission. However, the optimal surveillance approach has not been defined. We sought to determine whether daily serial rectal surveillance for MDROs detects more incident cases (acquisition) of MDRO colonization in medical intensive care unit (MICU) patients than admission and discharge surveillance alone. **Methods:** Prospective longitudinal observational single-center study from January 11, 2017, to January 11, 2018. Inclusion criteria were ≥3 consecutive MICU days and ≥2 rectal or stool swabs per MICU admission. Daily rectal or stool swabs were collected from patients and cultured for MDROs, including vancomycin-resistant *Enterococcus* (VRE), carbapenem-resistant Enterobacterales (CRE), third-generation cephalosporin-resistant Enterobacterales (3GCR), and extended-spectrum β-lactamase–producing Enterobacterales (ESBL-E) (as a subset of 3GCR). MDRO detection at any time during the MICU stay was used to calculate prevalent colonization. Incident colonization (acquisition) was defined as new detection of an MDRO after at least 1 prior negative swab. We then determined the proportion of prevalent and incident cases detected by daily testing that were also detected when only first swabs (admission) and last swabs (discharge) were tested. Data were analyzed using SAS version 9.4 software. **Results:** In total, 939 MICU stays of 842 patients were analyzed. Patient characteristics were median age 64 years (interquartile range [IQR], 51–74), median MICU length of stay 5 days (IQR, 3–8), median number of samples per admission 3 (IQR, 2–5), and median Charlson index 4 (IQR, 2–7). Prevalent colonization with any MDRO was detected by daily swabbing in 401 stays (42.7%). Compared to daily serial swabbing, an admission- and discharge-only approach detected ≥86% of MDRO cases (ie, overall prevalent MDRO colonization). Detection of incident MDRO colonization by an admission- or discharge-only approach would have detected fewer cases than daily swabbing (Figure 1); ≥34% of total MDRO acquisitions would have been missed. **Conclusions:** Testing patients upon admission and discharge to an MICU may fail to detect MDRO acquisition in more than one-third of patients, thereby reducing the effectiveness of MDRO control programs that are targeted against known MDRO carriers. The poor performance of a single discharge swab may be due to intermittent or low-level MDRO shedding, inadequate sampling, or transient MDRO colonization. Additional research is needed to determine the optimal surveillance approach of enteric MDRO carriage.

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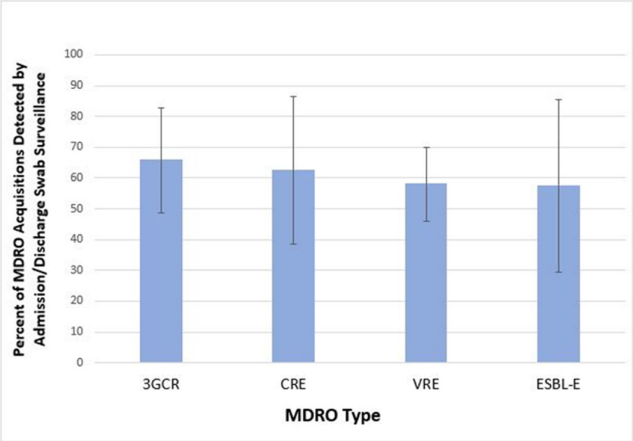

MDRO Acquired	Number of Acquisitions Detected by Daily Serial Swabbing	Number of Acquisitions Detected by Admission/Discharge Swab Surveillance	Proportion of Acquisitions Detected by Admission/Discharge Swab Surveillance (95% CI)
3GCR	73	48	0.66 (0.49-0.83)
CRE	16	10	0.63 (0.39-0.87)
VRE	69	40	0.58 (0.46-0.70)
ESBL-E	33	19	0.58 (0.30-0.86)

Figure 1. Detection of Incident MDRO Colonization (Acquisition) by Discharge Swab was Low Compared to Daily Serial Swabbing. Black-capped bars represent 95% confidence intervals. Abbreviations: MDRO, multidrug-resistant organism; VRE, vancomycin-resistant enterococcus; CRE, carbapenem-resistant Enterobacterales; 3GCR, third-generation cephalosporin-resistant Enterobacterales; ESBL-E, extended-spectrum β-lactamase-producing Enterobacterales.