Optimizing Blood Culture Use in Critically Ill Children: Year One of a Multi-Center Diagnostic Stewardship Collaborative

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INTRODUCTION

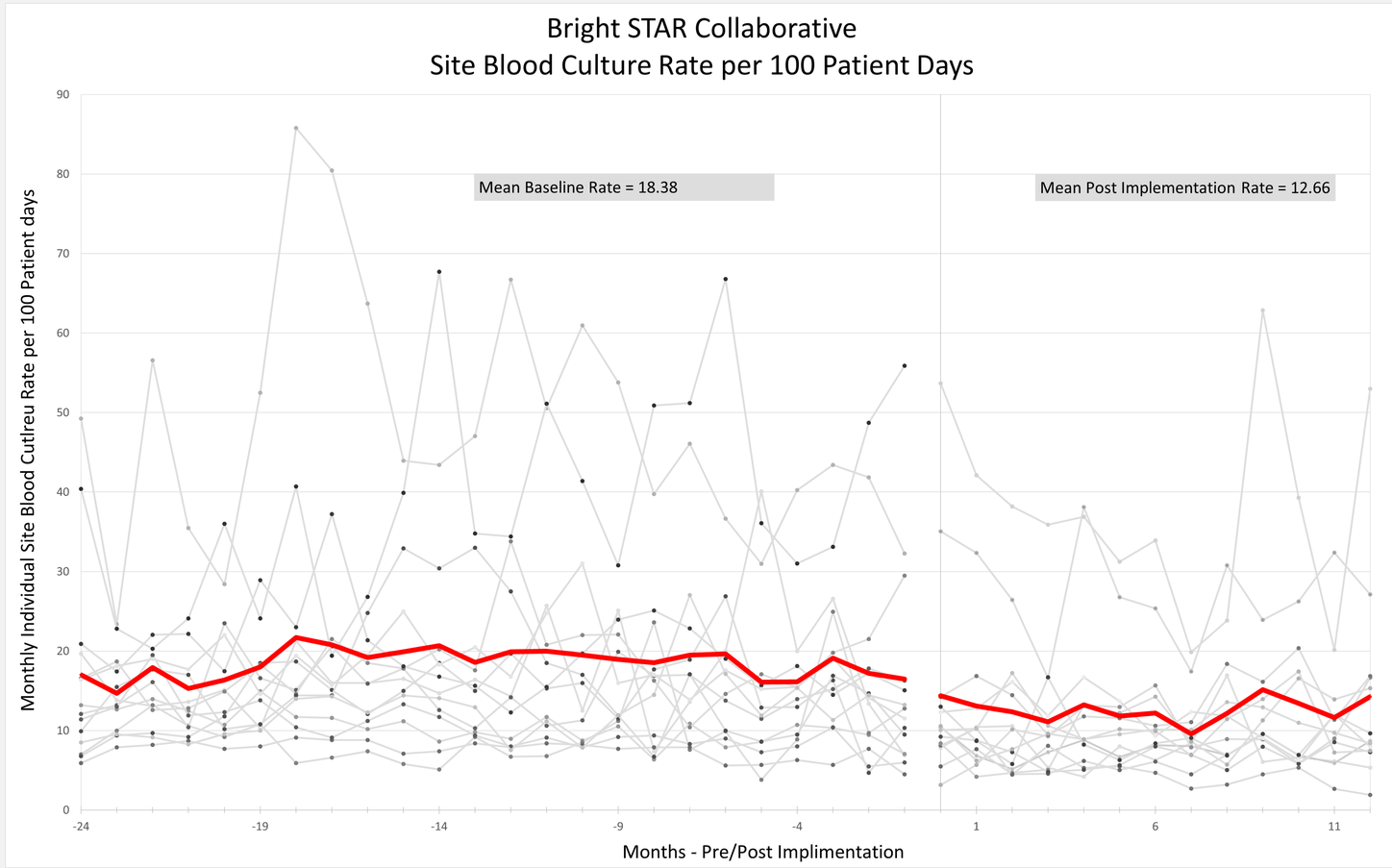
- Blood cultures are fundamental in the diagnosis and treatment of sepsis.
- Culture practices vary widely, and overuse can lead to false positive results and unnecessary antibiotics.
- Our objective was to describe the implementation of a multi-site quality improvement collaborative to reduce unnecessary blood cultures in pediatric intensive care unit (PICU) patients, and its 12-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 reviewed existing evidence for safe reduction of unnecessary blood cultures and assessed local practices and barriers to change.
- 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 measure.
- We compared 24 months of baseline data to post-implementation data (2-14 months) using a Poisson regression model accounting for the site-specific patient days and correlation of culture use within a site over time.

RESULTS

FIGURE 1: SITE BLOOD CULTURE RATE PER 100 PATIENT DAYS



- Pre-implementation: 41,986 blood cultures collected over 238,182 PICU patient days
- Mean pre-implementation blood culture rate: 18.38 cultures/100 patient days (site-specific rate range 9.59 to 48.18 cultures/100 patient days)
- Post-implementation: 21,706 blood cultures collected over 198,431 PICU patient days
- Mean post-implementation blood culture rate: 12.66 cultures/100 patient days (site-specific rate range 4.96 to 39.56 cultures/100 patient days), 33% decrease in rate post- vs. pre-implementation (relative rate 0.67, 95% CI: 0.57, 0.79, p = < 0.001).
- 677 positive blood cultures reviewed, and only one suspected delay in culture collection, possibly attributable to the site's blood culture reduction program.

TABLE 1: CHARACTERISTICS OF PARTICIPATING PICUs[a]

Characteristic	**Median (range)**
Patient Days	6,250 (2,000–9,700)
Unit size (number of beds)	37 (12-60)
Characteristic	**Median (IQR)**
Baseline blood culture rate (total cultures per 100 patient-days)	14.7 (10.4-17.4)[b]
Characteristic	**No. of Sites (%)**
Hematopoietic stem cell transplants	11/14 (79)
Solid-organ transplants	11/14 (79)
Cardiac surgical patients	6/14 (43)
Extracorporeal membrane oxygenation	13/14 (93)
Pediatric critical care fellowship program	13/14 (93)
Advanced practice nurses	14/14 (100)
Bedside nurses perform peripheral venipuncture	11/14 (79)
Phlebotomy team performs peripheral venipuncture	12/14 (86)

[a] Site characteristics were collected at the start of the project period.
[b]Two sites were noted to be outliers for baseline blood culture rate, with rates of 38.68 and 48.05, but were not excluded from analysis.

CONCLUSIONS

Multidisciplinary quality improvement teams facilitated a 33% average reduction in blood culture use in critically ill children at 14 hospitals, without evidence of compromised safety. 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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