

Optimizing Blood Culture Ordering: The Role of Stewardship Comments in Mitigating Bottle Shortages and Refining Future Practice

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Introduction

- Nationwide BD BACTEC blood culture bottle shortage from June 2024 -November 2024 affecting availability of blood cultures.
- The bottle shortage allowed for a rare natural experiment to evaluate blood culture utilization practices during a period of constrained laboratory resources.
- During the shortage, we implemented EMR pop-up alerts (OPA) when ordering blood cultures to reduce unnecessary blood culture ordering.
- The alert contained restriction criteria explaining when a repeat culture would be indicated (Table 1).
- The alert is still currently implemented, (status-post shortage) providing valuable long-term data for pre-shortage comparison.
- Importantly, bloodstream infections carry substantial morbidity and mortality, so it is essential to determine whether this intervention affects pathogen detection and ultimately patient safety.

Methods

- Pre- and post-OPA analysis comparing blood culture ordering patterns before and after implementation of the repeat culture alert during the BD BACTEC shortage period
- "Pre-Alert" period was defined as 1/1/2022-7/22/2024
- "Post-Alert" period was defined as 7/23/2024-3/31/2026
- Contaminants were defined as:
 - Coagulase-negative Staphylococcus (CoNS) – except *S. lugdunensis*
 - Corynebacterium species
 - Bacillus species (non-anthraxis)
 - Micrococcus species
 - Cutibacterium species
 - Propionibacterium species
- Non-contaminants were classified as "pathogen".

- Repeat cultures were defined as any culture >2 but ≤48 hours from prior culture.
- Study endpoints:
 - Overall blood culture bottle utilization
 - Frequency of repeat blood cultures within 48 hours
 - Overall culture positivity rate
 - Microbiologic yield of repeat blood cultures within 48 hours, specifically if new clinically significant organisms were identified.

Results

- Repeat blood cultures obtained ≤48 hours from initial culture were reduced pre- and post-OPA (4.5% absolute reduction, 21.4% relative reduction, $p<0.001$)
- Overall (repeat and non-repeat) clinically significant pathogen positivity rate was slightly increased pre- and post- OPA (7.90% to 8.30%, $p<0.048$).
- Repeat cultures yielding newly identified clinically significant pathogens increased pre- and post- OPA (2.48% to 3.06%, $p=0.040$)

Table 1. Alert in EMR showing restrictions regarding repeat blood cultures (i.e. blood cultures ordered within 48 hours of another culture).

Repeat blood culture restriction criteria:
Repeat blood cultures within 48 hours (unless unstable)
Pneumonia or non-severe cellulitis (non-immunocompromised)
Lower urinary tract infection (e.g. cystitis)
Isolated fever or leukocytosis in stable patient without neutropenia
Post operative fever within 48 hours of surgery
Blood cultures through a catheter to determine if lone colonization of infection

Figure 1. Blood cultures performed between 1/1/2022 and 3/1/2026

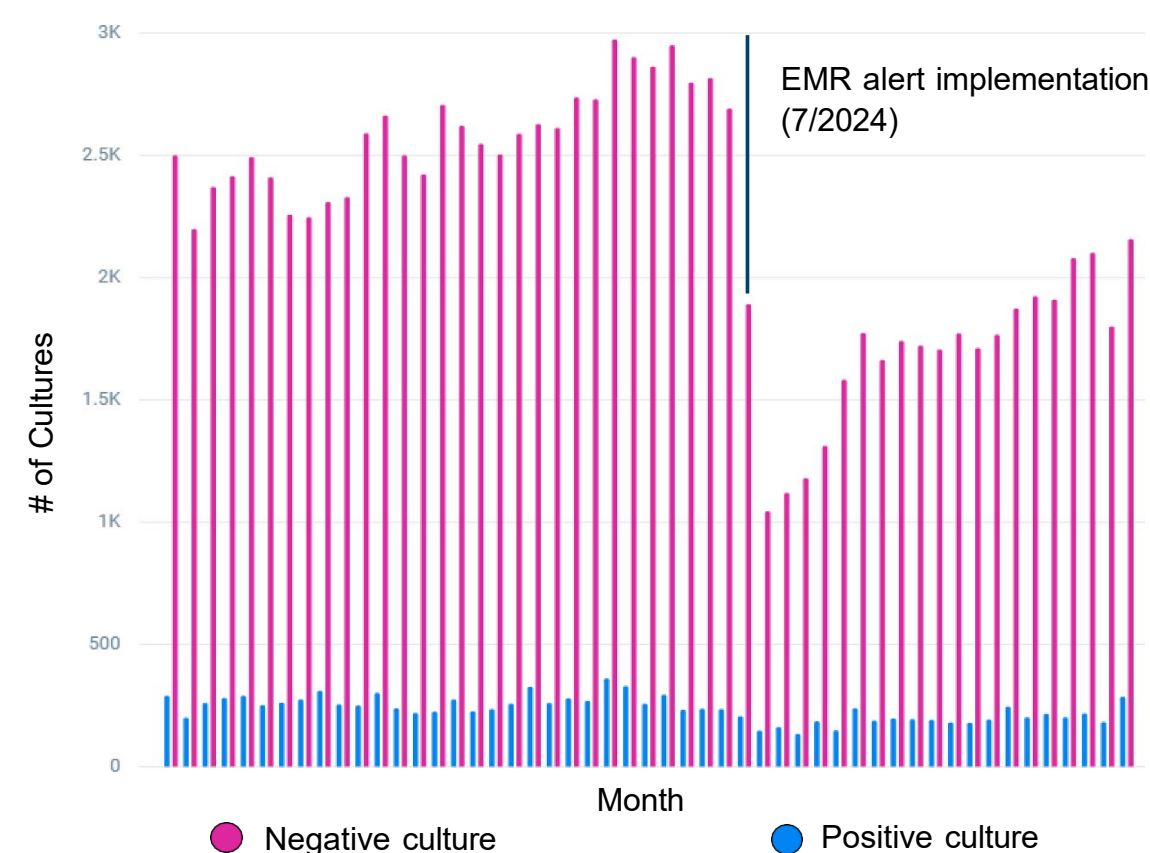


Table 2. Comparisons of blood culture rates between pre-alert and post-alert timeframes.

	Pre-Alert	Post-Alert	P-Value
Total Number of Blood Cultures	52346	27433	N/A
Repeat Blood Culture Rate	21.06%	16.56%	2.2×10^{-16}
Overall Pathogen Positivity Rate	7.90%	8.30%	0.048
Repeat Culture Rate with New Clinically Significant Pathogen Identified	2.48%	3.06%	0.040

Conclusion

- The BD BACTEC bottle shortage provided a rare opportunity to assess the clinical value of early repeat blood cultures.
- Reduced repeat culture rates in the context of increased pathogen detection provides evidence suggesting improved test selectivity and reduction of lower-yield ordering.
- These findings may support successful targeted diagnostic stewardship practices that minimize redundant blood culture collection during both shortage conditions and routine operations.
- For routine operations, continued use of this OPA may reduce healthcare cost burden. UCDH blood culture costs are as follows:
 - Inpatient - \$477.00
 - Outpatient - \$116.00

Limitations

- The OPA contains other criteria, therefore our analysis reflects ordering patterns not exclusive to repeat culture criteria.
- Generation of repeat culture data from specimen-level data is based on empiric understanding of UCDH workflows. A more data driven approach to separate true repeat cultures from delayed collections could be considered.

Future Considerations

- Further analysis should normalize blood culture utilization and clinically significant pathogen detection to patient exposure, such as patient-days. This would help determine whether reduced culture ordering was associated with preserved pathogen detection per unit of patient care.
- Patient safety evaluation pre- and post-OPA using 30-day mortality as a broad proxy.
- Financial impact analysis.