# Antimicrobial Stewardship News

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## Blood Culture Contaminants: No Joke for Stewards

### Introduction

Blood cultures are important tools for determining the etiology of bloodstream infections and sepsis. Therefore, appropriate collection and processing of blood cultures is essential for providing effective and quality patient care. Unfortunately, blood culture contamination is a well-known problem encountered within the hospital setting. Contamination of blood cultures commonly occurs during the collection process and is often attributed to the introduction of bacteria that colonize the skin.[1]

While there may be an overall low percentage of blood cultures that are contaminated (average <3%), contaminants may represent up to 50% of all positive blood cultures.[2] False-positive blood culture results may lead to a negative cascade of events, which can ultimately impact patient outcomes.

This newsletter describes potential consequences and downstream effects of blood culture contamination.

As a reminder, feel free to revisit our past DASON newsletters related to blood culture contamination and diagnostic stewardship:

- To Treat of Not to Treat? How to Identify Contaminated Blood Cultures.
  Volume 7. Number 6. June 2018
- Diagnostic Stewardship Part II: Understanding indications for collecting blood cultures for hospitalized adult patients.
  Volume 7. Number 9. September 2018.

### *Lab Workload and Workflow Consequences*

**Increased hands-on lab technician time**. Microbiology laboratory personnel process, interpret, and report blood cultures. Therefore, blood culture contamination and false-positives directly affect their processes and efficiency.[3] In discussions with laboratory technicians, the hands-on time dedicated to working up a positive blood culture ranges from 30 minutes to 1 and half hours total. Therefore, technical time alone can be substantially impacted.

**Time consulting others in blood culture assessments.** Many clinical microbiology laboratories have developed algorithms that provide criteria to determine whether a positive isolate in a blood culture can be labeled as a possible contaminant.[4-7] Many cultures however, do not easily fit these algorithms such as those with multiple bacterial species or slow growing isolates. This can complicate the workup and often requires consultation with additional laboratory personnel and/or input from providers to determine the likelihood of pathogen versus contaminant. High rates of false-positive blood cultures may result in increased time spent consulting other health care professionals, which can be disruptive to workflow for both groups.

**Time reporting the results to the treatment team.** In addition, microbiology laboratory personnel are often responsible for notifying the healthcare team of positive blood cultures. Typically, this must be done within a designated amount of time following identification of growth. Higher numbers of false-positive blood cultures translate to work interruptions and more time spent phoning and relaying results to providers, as well as documenting these interactions in the medical chart. Contacting providers disrupts workflow of laboratory personnel and of the recipients of pages and phone calls.

**Time collecting and processing repeat blood cultures.** When there is suspicion of a false-positive blood culture, repeat blood cultures are often obtained, which leads to an increased number of blood cultures collected and processed. As a result, laboratory personnel workload

increases to ensure proper collection, transportation, processing, and documentation.

### *Clinical Consequences*

**Increased antibiotic exposure.** Several studies have demonstrated that blood culture contamination events are associated with increased antibiotic exposure. Souvenir et al. demonstrated that 41% (24/59) of patients with blood culture contamination due to coagulase negative staphylococci were treated with antibiotics and 34% (20/59) of patients unnecessarily received vancomycin.[8] In patients who experienced blood culture contaminant events, the mean duration of vancomycin therapy was 6.5 days. Similarly, Lee et al. showed 41% (73/178) patients with blood culture contaminants received unnecessary antibiotics.[9]

There are many potential consequences of increased and prolonged antibiotic exposure, including adverse effects, allergic reactions, drug-drug interactions, emergence of antibiotic resistance, and increased risk of *Clostridioides difficile* infection.

Venous access must also be established and maintained to deliver intravenous antibiotics, which can result in mechanical complications, thromboembolic events, and catheter-related infections.[10]

**Search for an unknown source.** Health care teams caring for patients with a false-positive blood culture may feel obligated to search for the source as if a true bacteremia. An initial focus on the positive blood culture as the etiology for a patient's presenting clinical syndrome may also result in "anchoring bias".[3] Anchoring bias has been described as a cognitive bias in which a person focuses too heavily on an initial piece of information when making subsequent decisions. This form of bias can lead to delays in determining the correct diagnosis and starting effective therapy.

Unneeded consults may be requested for additional help evaluating a patient case with positive blood cultures and unknown source (e.g. infectious diseases consult). Additional laboratory tests and imaging may also be requested to further investigate the unknown source of positive blood culture, including CT imaging, echocardiograms, etc.

Searching for the source of bacteremia may lead to unwarranted concern over indwelling devices (e.g. pacemakers, implantable cardioverter defibrillators).[3] In some cases, it may result in removal of these devices.

### *Economic Consequences*

Contaminated blood cultures can lead to unnecessary costs to institutional laboratories due to repeat blood cultures, cultures of other sites, and additional laboratory testing. Microbiology laboratories may also perform additional organism identification tests and antimicrobial susceptibility tests, both associated with laboratory expenses. Contaminated blood cultures have also been associated with higher pharmacy costs and increased length of stay.

Bates et al. sought to investigate whether contaminant blood cultures increase resource utilization and associated costs.[2] Overall, 94 false-positive blood culture episodes were compared to 1097 negative blood culture episodes. Compared to negative blood culture episodes, false-positive episodes were associated with a longer median length of hospital stay (8 days vs. 12.5 days), higher median total charges ($8731 vs. $13116), higher median laboratory charges ($2057 vs. $1426), and higher median pharmacy charges ($798 vs. $1456). There was also an 80% increase in total microbiology charges related to episodes with contaminated blood cultures, which included a 30% increase in routine culture charges and a 40% increase in blood culture charges. False-positive blood culture episodes were also independently correlated with a 20% increase in total subsequent laboratory charges and a 39% increase in intravenous antibiotic charges.

Similarly, Alahmadi et al. conducted a retrospective case-control study to determine the impact of false-positive blood culture results on length of stay, antimicrobial costs, and laboratory costs.[11] One hundred forty-two false-positive blood culture cases were matched with 142 controls based on age, comorbidity score, and month of admission. Results showed that compared to negative blood culture cases, false-positive blood culture

cases were associated with a longer mean length of stay [5.4 days (95% CI 2.8-8.1 days), p<0.001] and higher mean total costs [$7502 (95%CI $4926 to $10079), p<0.001].

In conclusion, blood culture contaminants have a substantial impact on laboratory and pharmacy costs, hospital length of stay and other resource utilization. They impact the patient clinically and take additional time from the lab personnel's workload. Focusing on reducing rates of blood culture contamination is a worthy cause for any healthcare facility.

**Table 1.** Consequences of blood culture contaminants

| **Potential Consequences** |
|---|
| Increased laboratory workload and workflow[3-7] |
| Hands-on time to work up more positive blood culture |
| Time consulting others related to blood culture assessments |
| Time informing healthcare team of positive blood cultures |
| Time collecting and processing repeat blood cultures |
| Clinical consequences[3,8-10] |
| Increased antibiotic exposure |
| Adverse effects |
| Allergic reactions |
| Drug-drug interactions |
| Emergence of antibiotic resistance |
| Risk of *C. difficile* infection |
| Risks of maintaining venous access |
| Mechanical complications |
| Thromboembolic events |
| Catheter-related infections |
| Time and resources spent searching for an unknown source |
| Specialty consultations |
| Additional diagnostic tests |
| Concern over indwelling devices |
| Economic consequences[2,3,11] |
| Laboratory costs |
| Pharmacy costs |
| Increased length of stay |

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