# Blood Culture Identification (BCID) Performance in Polymicrobial Bacteremia

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## Introduction

The rapid multiplex PCR (rmPCR)-based FilmArray® blood culture identification (BCID) assay reduces time from positive blood culture to organism identification. Polymicrobial bacteremia is a known area of reduced diagnostic fidelity for BCID and remains incompletely characterized.

## Methods

All cases of clinically confirmed polymicrobial bacteremia at a large academic single center from a 23-month period were evaluated in a retrospective cohort analysis (figure 1). Samples were assorted into BCID/blood culture concordant and BCID/blood culture discordant groups. Clinical characteristics of the two groups were compared, missed organisms were characterized, and changes in antimicrobial regimen in response to BCID results were characterized.

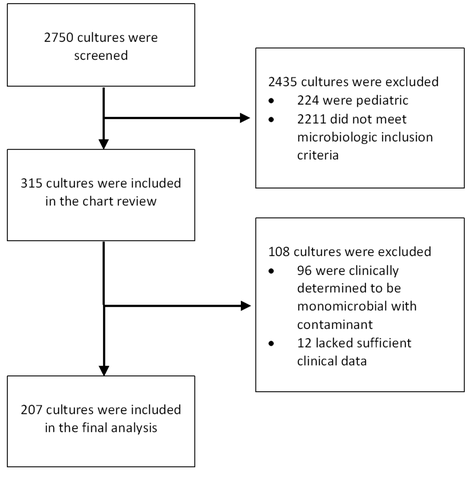


**Figure 1.** Screening and exclusion process. 207 cultures were included in final analysis from a number screened of 2750 (constituting all positive blood cultures over a 23-month period from February 2019 to January 2021).

## Results

A total of 207 samples were identified and studied. Overall, 49.3% (N=102) of polymicrobial cultures were incompletely identified by FilmArray® result. There were no significant group differences in comorbidity status, length of stay, mortality, or source between patients with polymicrobial bacteremia who had complete versus incomplete BCID identification (see table 1). In the 102 BCID discordant samples, 127 individual organisms identified on phenotyping but not on BCID were found. Many were commensal or low virulence organisms, but a total of 38 (29.9%) were identified as organisms potentially requiring prompt treatment, while 49 (38.6%) of organisms were on panel for the BCID assay (list of organisms is shown in Table 2). Of note, there were no instances of false negative results for *Pseudomonas aeruginosa*, *Neisseria meningitidis*, or *Listeria monocytogenes*, organisms requiring prompt therapy sometimes missing in empiric antibiotic regimens.

De-escalation from adequate empiric to inadequate step-down antibiotic coverage following incomplete BCID result occurred in only 8.8% (N=9) of cases (shown in table 3). No statistically significant association with mortality was seen among patients' empiric coverage (p=0.07), although this analysis was limited by the small sample size.

| | BCID/BCx Concordant (%) | BCID/BCx Discordant (%) | p value |
|---|---|---|---|
| Number of samples | 105 (50.7%) | 102 (49.3%) | --- |
| Average age of patient (mean, SD) | 58.6 (18.4) | 54.1 (18.6) | 0.08 |
| Length of stay (median, IQR) | 13.0 (18.3) | 12.0 (21.9) | 0.12 |
| Death within 100 days | 35 (33.3%) | 30 (29.4%) | 0.54 |
| Male Sex | 61 (58.1%) | 62 (60.8%) | 0.69 |
| Venue collected | | | |
| ICU | 16 (15.2%) | 10 (9.8%) | 0.22 |
| Floor | 19 (18.1%) | 27 (26.5%) | |
| ER | 68 (64.8%) | 60 (58.8%) | |
| Other | 2 (1.9%) | 5 (4.9%) | |
| Comorbidities | | | |
| Burn | 8 (7.6%) | 4 (3.9%) | 0.26 |
| Solid malignancy | 25 (23.8%) | 16 (15.7%) | 0.14 |
| Liquid malignancy | 7 (6.7%) | 13 (12.8%) | 0.14 |
| On chemotherapy | 12 (11.4%) | 15 (14.7%) | 0.48 |
| Neutropenia | 13 (12.4%) | 11 (10.8%) | 0.72 |
| Abdominal surgery within 30 days | 12 (11.4%) | 8 (7.8%) | 0.38 |
| Solid organ transplant | 2 (1.9%) | 2 (2.0%) | >0.99 |
| Hematopoietic stem cell transplant | 5 (4.8%) | 2 (2.0%) | 0.45 |
| Current TPN use | 9 (8.6%) | 6 (5.9%) | 0.46 |
| Presence of central venous catheter | 38 (36.2%) | 41 (40.2%) | 0.55 |
| Current hemodialysis | 8 (7.6%) | 7 (6.9%) | 0.83 |
| Cirrhosis | 6 (5.7%) | 8 (7.8%) | 0.54 |
| Current immunosuppressant medication use | 17 (16.2%) | 9 (8.8%) | 0.11 |
| Other comorbidity | 10 (9.5%) | 7 (6.9%) | 0.49 |
| None of the above | 33 (31.4%) | 38 (37.3%) | 0.38 |
| Presumed source | | | |
| Central line | 17 (16.2%) | 17 (16.7%) | --- |
| Gastrointestinal | 21 (20.0%) | 31 (30.4%) | --- |
| Genitourinary | 11 (10.5%) | 9 (8.8%) | --- |
| Respiratory | 2 (1.9%) | 6 (5.9%) | --- |
| Endovascular | 3 (2.9%) | 4 (3.9%) | --- |
| Bone | 3 (2.9%) | 4 (3.9%) | --- |
| Skin and soft tissue | 17 (16.2%) | 12 (11.8%) | --- |
| Other | 1 (1.0%) | 1 (1.0%) | --- |
| Multiple sources | 19 (18.1%) | 11 (10.8%) | --- |
| Unknown | 11 (10.5%) | 7 (6.9%) | --- |

**Table 1.** Comparison of the characteristics of the BCID/blood culture (BCx) concordant and BCID/BCx discordant groups.

| Organism | No. | | No. |
|---|---|---|---|
| **On-panel organisms** | 49 | **Other off-panel organisms** | 50 |
| *Enterococcus spp.* | 11 | *Achromobacter spp* | 2 |
| Viridans group streptococci | 8 | *Acinetobacter spp* | 3 |
| Coagulase negative Staphylococci | 7 | *Actinomyces spp* | 1 |
| *Staphylococcus aureus* | 6 | *Actinotignum schaelii* | 1 |
| *Klebsiella pneumoniae* | 3 | *Bacteroides spp.* | 6 |
| *Acinetobacter baumanii* | 2 | *Chryseobacterium spp.* | 5 |
| *Candida albicans* | 2 | *Corynebacterium spp.* | 2 |
| *Enterobacter cloacae complex* | 2 | *Eikenella spp* | 1 |
| *Klebsiella oxytoca* | 2 | *Gemella spp.* | 7 |
| *Proteus mirabilis* | 2 | *Granulicatella spp* | 2 |
| *Candida glabrata* | 1 | *Lactobacillus spp* | 3 |
| *Candida tropicalis* | 1 | *Micrococcus luteus* | 2 |
| *Escherichia coli* | 1 | *Mycobacterium abscessus* | 1 |
| *Streptococcus agalectiae* | 1 | *Neisseria subflavia* | 1 |
| **Off-panel organisms of high pathogenic potential** | 28 | *Parabacteroides spp.* | 1 |
| | | *Pluralibacter gergoviae* | 1 |
| *Clostridium perfringens* | 6 | *Pseudomonas putida grp* | 2 |
| *Bacillus spp.* | 4 | *Rothia mucilaginosa* | 4 |
| *Morganella morganii* | 4 | *Veilonella spp.* | 3 |
| *Corynebacterium striatum* | 3 | *Wohlfahrtimonas spp.* | 1 |
| *Aerococcus viridans* | 2 | | |
| *Candida dublinensis* | 2 | | |
| *Clostridium ramosum* | 2 | | |
| *Stenotrophomonas maltophilia* | 2 | | |
| *Fusobacterium nucleatum* | 1 | | |
| *Fusobacterium necrophorum* | 1 | | |
| *Providencia stuartii* | 1 | | |

**Table 2.** Organisms not identified by BCID but later identified on blood culture phenotyping.

| Empiric therapy | De-escalation therapy | No. (%) | 30-day mortality, no. (%) | Pooled p-value | Inpatient time to discharge, median [IQR] | Pooled p-value |
|---|---|---|---|---|---|---|
| Effective | Effective | 58 (56.9%) | 10 (17.2%) | 0.07 | 11.6 [22.0] | 0.14 |
| Effective | Did not occur | 14 (13.7%) | 6 (42.9%) | | 25.0 [27.9] | |
| Effective | Inadequate | 9 (8.8%) | 3 (33.3%) | | 8.3 [4.2] | |
| Ineffective | N/A | 21 (20.6%) | 2 (9.5%) | | 17.1 [19.5] | |

**Table 3.** Among patients with inaccurate BCIDs, antimicrobial changes and outcomes following return of BCID result are shown below. P-values comparing the four groups are shown. There was no significant association that could be seen in mortality and time to discharge and patient's empiric therapy and de-escalation therapy status.

## Conclusions

BCID frequently results in incomplete identification of blood culture results in patients with polymicrobial bacteremia, but clinical characteristics and outcomes were similar to those of patients with accurate BCID identification. Clinical team de-escalation to inappropriate antibiotic coverage following return the BCID assay was uncommon and was not clearly associated with inferior outcomes.

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