# Evaluation of a Rapid Blood Culture Assay for Phenotypic Antimicrobial Susceptibility Testing of Gram-negative Bacteria on Antimicrobial Use in Children

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## Introduction

- Rapid identification and antimicrobial susceptibility testing (AST) from positive blood cultures can decrease the time to optimal therapy and reduce the use of broad-spectrum agents.
- The Accelerate Pheno Blood Culture panel (Pheno) provides AST of select on-panel Gram-negative organisms directly from positive blood cultures.
- We sought to determine the performance and the clinical impact of Pheno at our pediatric hospital compared to the BD Phoenix AST system (reference).

## Methods

- We conducted chart review on a total of 100 cases tested by conventional AST directly from positive blood culture cell pellet during the period of May 2018 - April 2019 and a total of 97 cases tested by Pheno during May 2019 - March 2021. A total of 183 patients were tested.
- Pheno results in the test group were compared to the BD Phoenix AST system in the reference group.
- Duration of therapy, time to optimal therapy, and length of stay were calculated.

## Results

**Table 1.** Demographics and clinical outcomes

| | Pre-implementation | Post-implementation | p value |
|---|---|---|---|
| **Demographics** | (n = 90) | (n = 93) | |
| Median age | 6.4 | 2.3 | 0.16 |
| Female | 40 (44.4) | 40 (43.0) | 0.88 |
| Immunocompetent | 6 (6.7) | 17 (18.3) | 0.02 |
| | | | |
| **Chart review** | (n = 100) | (n = 97) | |
| Mean length of stay | 17.0 days | 14.0 days | |
| 30 day mortality | 4 (4.0) | 7 (7.2) | 0.37 |
| CVAD line removal | 28 (28.0) | 22 (22.7) | 0.42 |
| Community-onset | 56 (56.0) | 63 (64.9) | 0.24 |
| Hospital-onset | 44 (44.0) | 34 (35.1) | 0.19 |
| | | | |
| **Antimicrobial duration** | (n = 100) | (n = 97) | |
| Meropenem | 47.7 hours | 25.2 hours | <0.01 |

**Figure 1.** Median time to AST and optimization of therapy from time of receipt in laboratory

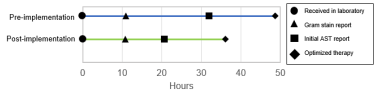
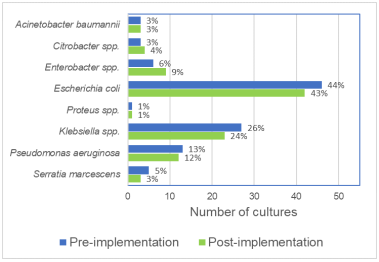



**Figure 2.** Organisms identified in blood cultures




## Results

**Figure 3.** Category of antimicrobial change after susceptibility testing results

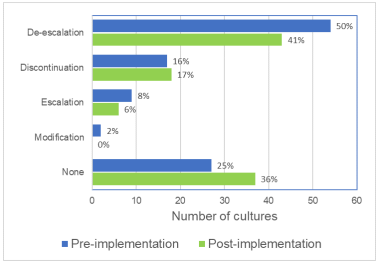



**Table 2.** Antimicrobial susceptibility agreement between Pheno and reference method

| Antibiotic | Minor errors (%) | Major errors (%) | Very major errors (%) |
|---|---|---|---|
| Amikacin | 0 | 0 | 0 |
| Ampicillin-sulbactam | 20.7 | 1.7 | 1.7 |
| Aztreonam | 2.6 | 0 | 0 |
| Cefazolin | 16.1 | 5.4 | 0 |
| Cefepime | 6.8 | 0 | 0 |
| Ceftazidime | 16.1 | 2.3 | 0 |
| Ceftriaxone | 0 | 1.3 | 0 |
| Ciprofloxacin | 3.4 | 0 | 0 |
| Ertapenem | 1.4 | 0 | 0 |
| Gentamicin | 4.6 | 2.3 | 0 |
| Meropenem | 4.6 | 0 | 0 |
| Minocycline | 0 | 0 | 0 |
| Piperacillin-tazobactam | 14.9 | 0 | 0 |
| Tobramycin | 4.6 | 0 | 0 |
| **Total** | **7.56** | **0.94** | **0.10** |

## Results

Differences in categorical agreement

- 72 minor errors
  - Overcalling
    - 26.4% (R) when reference was (I)
    - 61.1% (I) when reference was (S)
  - Undercalling
    - 5.6% (I) when reference was (R)
    - 6.9% (S) when reference was (I)
- 9 major errors
  - 1 ampicillin-sulbactam, 3 cefazolin, 2 ceftazidime, 1 ceftriaxone, 2 gentamicin
- 1 very major error (ampicillin-sulbactam in Klebsiella pneumoniae)
- 9 of 12 ampicillin-sulbactam minor errors were due to overcalling resistance in *Escherichia coli* when the reference method was intermediate

## Conclusions

- Pheno had accurate performance compared to the reference method. The majority of the minor errors were due to overcalling intermediate resistance when the reference was susceptible.
- The median time to initial AST report and optimal therapy decreased significantly after Pheno implementation.
- There was no significant impact on clinical outcomes such as 30-day mortality or central venous access device removal.
- There were significantly more immunocompetent patients in the post-implementation group, potentially impacting these results.
- The median duration on broad-spectrum meropenem decreased by 22.5 hours after Pheno implementation (P<0.01).

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