Antimicrobial Use in Patients with Bloodstream Infections from 4 Hospitals in the IOAS Study: A Quasi-Experimental Multicenter Study of the Accelerate PhenoTest® BC Kit

Contact: Shawn MacVane
smacvane@axdx.com
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S. H. MacVane[1], A. A. Bhalodi[1], R. M. Humphries[2], M. A. Ben-Aderet[3], J. Kolev[3], M. Madhusudhan[3], M. A. Morgan[3], B. Ford[4], D. Ince[4], P. M. Kinn[4], K. M. Percival[4], D. N. Bremmer[5], D. R. Carr[5], T. L. Walsh[5], K Wolfe[6], E. R. Rosenbaum[6], R. K. Dare[6]

[1]Accelerate Diagnostics, Inc., [2]Vanderbilt University Medical Center, [3]Cedars-Sinai Med. Ctr., [4]Univ. Of Iowa., Iowa City, IA, [5]Allegheny Health Network, Pittsburgh, PA, [6]Univ. of Arkansas for Med. Sci.

ABSTRACT

Background: Measuring impact of diagnostic technologies on clinically relevant metrics can be complex. For hospitals with established antimicrobial stewardship programs, initiatives focused on improving quality of care are key and can be demonstrated through antimicrobial use metrics. Effect of antibiotic optimization for patients with bloodstream infections (BSI) was evaluated in the Accelerate PhenoTest® BC kit (AXDX) registry program as part of the Improving Outcomes and Antibiotic Stewardship (IOAS) study

Materials/methods: This multicenter, quasi-experimental study compares clinical and antimicrobial stewardship metrics, prior to and after implementation of AXDX, to evaluate the impact this technology has on patients with BSI. Laboratory and clinical data from hospitalized patients with BSI (excluding contaminants) were compared between two groups, one that underwent testing on AXDX and one that underwent alternative organism identification and susceptibility testing (SOC). Interim analysis of data collected from 4 centers was performed. SOC methods utilized were MALDI-TOF MS (n=3 centers), VITEK®2 (n=3), BD Phoenix™ (n=2), Sensititre™ (n=1), and Verigene® (n=1). All institutions had active antimicrobial stewardship programs throughout the study period.

Results: 760 patients with BSI (385 SOC, 375 AXDX) were included in this analysis. Patient demographics, comorbidities, and severity of illness were similar between groups, as were distributions of gram-negative (65%) and gram-positive (28%) BSI. The most prevalent organisms were *E. coli* (28%), *Klebsiella* spp. (11%), and *S. aureus* (9%). Median time to optimal therapy was 40.9 hours (interquartile range [IQR], 21.1-58.4) in the SOC group and 23.2 hours (IQR, 10.2-36.6) in the AXDX group (p<0.0001). Median time to first antibiotic intervention occurred 10.7 hours faster in the AXDX vs. SOC [14.5 (4.9-31.3) vs 25.2 (7.2-46.9)], p=0.0004. Median hours to first antibiotic de-escalation was significantly faster in the AXDX vs. SOC group [27.6 (13.2-44.0) vs 35.3 (15.5-52.7); p=0.0032].

Conclusions: Implementation of AXDX significantly improved antimicrobial stewardship metrics for patients with BSI through reductions in time to optimal therapy and time to first antibiotic intervention. These findings highlight the clinical utility of rapid phenotypic AST for BSI across a diverse population of patients and healthcare settings.

BACKGROUND

- The Accelerate Pheno™ system provides fast ID and AST of organisms that cause bacteremia. From a positive blood culture, the system identifies organisms within ~2 hours, and provides AST results in an additional ~5 hours.

OBJECTIVES

- To compare data prior to, and following implementation, of the AXDX system to determine the effects of the AXDX system in treating bacteremia.
- Performance of an interim analysis of antimicrobial use in patients with bloodstream infections from 4 hospitals in the IOAS study.

METHODS

- Laboratory and clinical data from hospitalized patients with BSI (excluding contaminants) were compared between two groups, one that underwent testing on AXDX and one that underwent alternative organism identification and susceptibility testing (SOC).

Inclusion Criteria
- ✓Positive blood culture deemed not to be a contaminant
- ✓Hospitalized at the time of positive blood culture

Exclusion Criteria
- × Positive blood culture < 14 days prior to positive blood culture collection that contained the same organism
- × Patient expired < 48 hours of positive blood culture

RESULTS

- Patient demographics, comorbidities, and severity of illness (Table 1) were similar between groups, as were distributions of gram-negative (65%) and gram-positive (28%) BSI.
- The most prevalent organisms: *E. coli* (28%), *Klebsiella* spp. (11%), and *S. aureus* (9%).
- Median time to optimal therapy (TTOT; Figure 1) and time to first antibiotic intervention (Figure 2) occurred faster in the AXDX arm.
- Time to first antibiotic de-escalation was significantly faster in the AXDX [27.6 h (13.2-44.0)] vs. SOC [35.3 h (15.5-52.7); *P*=0.0032].

Table 1. Patient Demographics and Comorbidities

Variable	SOC (n=385)	AXDX (n=375)	*P*
Age, y, mean ± SD	58.0 ± 20.7	58.6 ± 22.0	0.70
Charlson Score, mean ± SD	5.2 ± 3.6	5.2 ± 3.7	0.91
Pitt Bacteremia Score, mean ± SD	2.2 ± 2.3	2.4 ± 2.1	0.43
ICU admission, n (%)	116 (30.1)	99 (26.4)	0.25

RESULTS

Fig 1. Kaplan-Meier analysis of time to optimal therapy

Median TTOT was 40.9 h (IQR, 21.1-58.4) in the SOC group and 23.2 h (IQR, 10.2-36.6) in the AXDX group

Log-rank P < 0.0001
Wilcoxon P < 0.0001

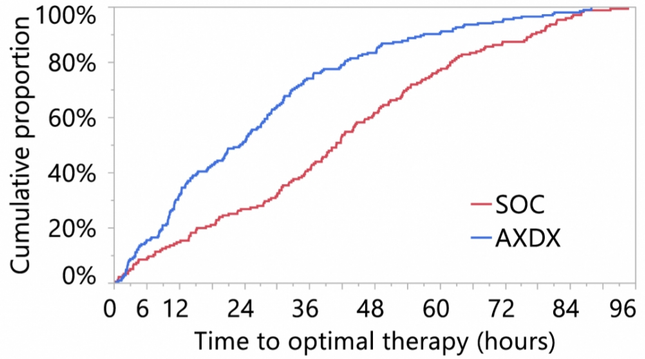
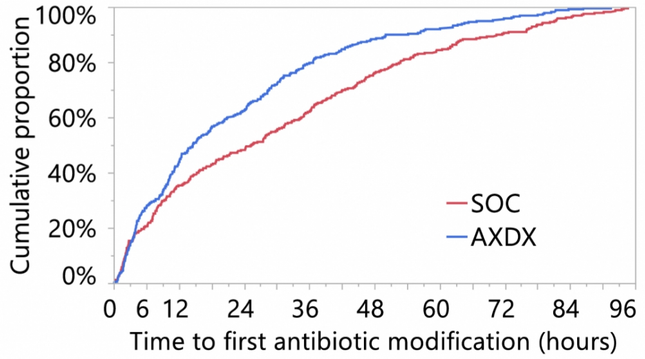


Fig 2. Kaplan-Meier analysis of time to first antibiotic intervention

Median time to first antibiotic intervention occurred 10.7 hours faster in the AXDX vs. SOC [14.5 (4.9-31.3) vs 25.2 (7.2-46.9)]

Log-rank *P* < 0.0001
Wilcoxon *P* = 0.0004



CONCLUSIONS

Implementation of AXDX significantly improved antimicrobial stewardship metrics for patients with BSI through reductions in time to optimal therapy and time to first antibiotic intervention.

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