Impact of Accelerate Pheno™ Rapid Blood Culture Detection System with Real Time Notification versus Standard Antibiotic Stewardship on Clinical Outcomes in Bacteremic Patients

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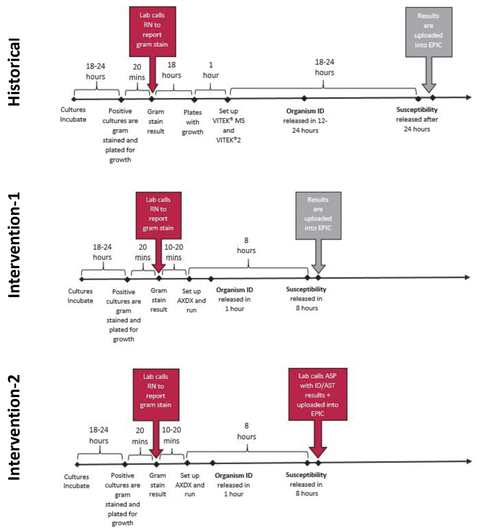
INTRODUCTION

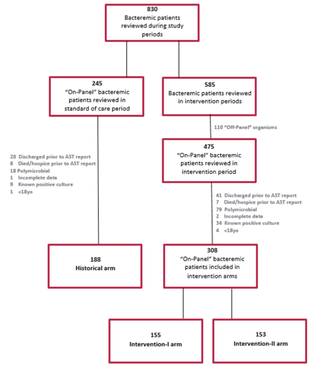
- Rapid diagnostic testing is an important tool in antibiotic stewardship with several available platforms.
- Accelerate Pheno™ blood culture detection system (AXDX) has the advantage of providing both identification (ID) and antimicrobial susceptibility testing (AST) within 8 hours of growth in blood culture.
- We previously reported length of stay (LOS), time to optimal therapy (TTOT), and antimicrobial days of therapy (DOT) decrease following AXDX implementation alongside an active antimicrobial stewardship program (ASP).
- Our objective was to evaluate if real time notification (RTN) of results further improves outcomes.

METHODS

- Design: Single center, quasi-experimental study of bacteremic adult inpatients before and after implementation of AXDX.
- **Historical cohort:** 01/2017-06/2017.
- **Intervention cohorts:** Utilized on an alternating weekly basis during the study (02/2018-09/2018) with AXDX performed 24-7.
  - Intervention-1= Results reviewed as part of normal workflow.
  - Intervention-2= RTN to ASP 7 days per week 9a-5p with batch notification of overnight results to ASP at 9a.
- Exclusion criteria: polymicrobial or off-panel isolates, known prior positive culture, and patients not admitted at time of AST.
- Clinical characteristics and outcomes among the 3 groups were compared using Kruskal Wallis and Chi^2/ fisher exact tests while pairwise comparisons were performed using Wilcox rank-sum and Chi^2 analysis.



RESULTS



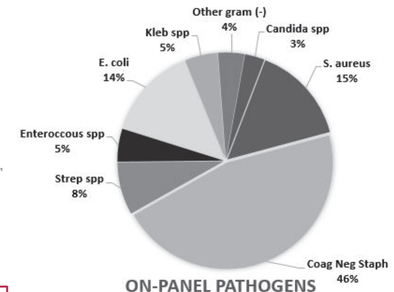


Table One: Baseline demographic and clinical characteristics.

Characteristics	Historical N = 188	Intervention-1 N = 155	Intervention-2 N = 153	p-value comparing three groups
Age (mean +- SD)	60.7 (16.6)	58.9 (16.9)	56.3 (17.2) [a]	**0.05***
Female (N %)	91 (48.4)	82 (52.9)	76 (49.7)	0.70
Race (N %)				0.32
Black	51 (27.1)	58 (37.4)	48 (31.4)	
White	129 (68.6)	89 (63.4)	97 (63.4)	
MEWS (N %)				0.48
<4	70 (37.2)	67 (43.2)	56 (36.6)	
≥4	117 (62.3)	88 (56.8)	97 (63.4)	
ICU admission (N %)	88 (46.8)	61 (39.4)	70 (45.8)	0.34
Death during admit (N %)	15 (8.0)	11 (7.1)	12 (7.8)	0.95
Comorbidities (N %)				
Coronary heart disease	38 (20.2)	19 (12.3)	20 (13.1)	0.08
Congestive heart failure	24 (12.8)	13 (8.4)	14 (9.2)	0.35
Chronic Kidney disease	34 (18.1)	23 (14.8)	24 (15.7)	0.70
Immunosuppressed	71 (37.8)	52 (33.6)	55 (36.0)	0.72
Diabetes	58 (30.9)	43 (27.7)	36 (23.5)	0.32
Cerebrovascular Disease	20 (10.6)	12 (7.7)	18 (11.8)	0.48
Pathogen identified (N)	188	155	153	0.32
Source of bacteremia (N %)				
Contaminant	61 (32.5)	67 (43.2)	72 (47.1) *	**0.02***
Other ‡	54 (28.7)	39 (25.2)	29 (19.0)	0.11
Line Infection	30 (16.0)	13 (8.4) *	14 (9.2)	**0.05***
Pyelonephritis or cystitis	17 (9.0)	17 (11.0)	20 (13.1)	0.50
Bone or joint infection	13 (16.9)	8 (5.2)	8 (5.2)	0.73
Pulmonary infection	10 (5.3)	4 (2.5)	4 (2.6)	0.26
SSTI	5 (2.7)	6 (3.9)	5 (3.3)	0.82
Cardiac device	1 (0.5)	1 (0.7)	0 (0.0)	0.33

MEWS: Modified Early Warning Score; ICU: Intensive Care Unit; *: statistically significant compared to Historic cohort; ‡ intraabdominal, CNS, or unknown; *statistical significance (p value ≤0.05)

Table Two: Primary and secondary outcomes.

Characteristics	Historical N = 188	Intervention-1 N = 155	Intervention-2 N = 153	p-value comparing three groups
LOS (days ±SD)	11.9 (10.6)	9.5 (9.8) [a]	10.1 (11.0) [a]	**<0.01***
LOS after culture collection (days ±SD)	9.0 (8.1)	7.6 (6.7) [a]	8.4 (8.9) [a]	**<0.01***
ICU LOS after culture collection (days ±SD)	3.9	4.4	4.5	0.80
TTOT after culture collection (days ±SD)	2.3 (1.9)	1.5 (1.5) [a]	1.4 (1.3) [a]	**<0.01***
Optimal Tx achieved (N %)	159 (84.6)	145 (93.6) [a]	146 (95.4) [a]	**<0.01***
Total DOT after culture collection (days ±SD)	8.84 (6.8)	7.23 (5.6) [a]	8.0 (6.6) [a]	**0.01***

LOS: total hospital length of stay; ICU LOS: intensive care unit length of stay; TTOT: time to optimal therapy; Tx: treatment; Optimal Tx Achieved: directed therapy based on organism ID and AST; DOT: Duration of therapy; SD: standard deviation; [a]: statistically significant compared to Historic cohort;*statistical significance (p value ≤0.05)

Table Three: Antibiotic utilization after blood culture collection.

Characteristics	Historical N = 188	Intervention-1 N = 155	Intervention-2 N = 153	p-value comparing three groups
Broad gram positive (days ±SD)	4.9 (5.1)	4.2 (4.6)	3.9 (4.7) [a]	**0.05***
Vancomycin	5.16 (4.5)	4.69 (4.6)	4.33 (4.4) [a]	**0.03***
Daptomycin	5.0 (6.9)	3.75 (4.9)	4.6 (4.6)	0.85
Linezolid	5.22 (4.7)	4.80 (2.7)	5.25 (6.2)	0.81
Broad gram negative (days ±SD)	6.2 (7.6)	4.5 (5.1) [a]	4.7 (6.7) [a]	**<0.01***
Meropenem	6.31 (4.7)	4.88 (2.8)	4.79 (5.5)	0.15
Ertapenem	1.33 (0.6)	1.2 (0.4)	1.25 (0.5	0.92
Cefepime	4.3 (3.4)	4.2 (4.1)	3.9 (3.5)	0.27
Piperacillin/tazobactam	4.9 (5.6)	3.5 (2.9)	4.5 (4.2)	0.14
Levofloxacin	2.9 (2.8)	2.6 (1.7)	4.3 (7.3)	0.82
Ciprofloxacin	2.8 (3.5)	2.4 (2.2)	3.8 (2.8)	0.70
Narrow Beta lactams (days ±SD)	2.0 (3.3)	2.2 (3.8)	3.0 (4.6) [a]	**0.05***
Ceftriaxone	3.33 (3.0)	3.75 (3.5)	4.38 (4.7)	0.29
Cefazolin	5.02 (4.4)	4.08 (3.8)	5.86 (5.7)	0.80
Ampicillin/Sulbactam	3.5 (0.7)	5.8 (589)	4.2 (2.5)	0.90
Ampicillin	2.5 (1.3)	4.5 (2.9)	5.25 (5.3)	0.44

DOT: days of therapy; BGP: broad gram-positive (vancomycin, daptomycin, linezolid); BGN: broad gram-negative (cefepime, piperacillin/tazobactam, levofloxacin, ciprofloxacin, meropenem, ertapenem, amikacin, tobramycin, gentamicin); NBL: narrow beta lactams (ampicillin, ampicillin/sulbactam, cefazolin, ceftriaxone); SD: standard deviation; *statistical significance (p value ≤0.05)

CONCLUSIONS

- Following our implementation of AXDX, clinical outcomes including LOS, TTOT, total DOT, BGN DOT, and frequency of achieving optimal therapy were significantly improved compared to a historical cohort.
  - The addition of RTN for AXDX results in the setting of an already active ASP did not further improve these metrics.
- Compared to historical arm, AXDX with RTN did significantly impact specific subsets of antibiotic use (broad gram positive duration of therapy) while AXDX alone did not.
  - This may be due to earlier vancomycin de-escalation.
- These results support the benefit of integration of AXDX into healthcare systems with an active ASP even without the resources to include real time notification.