

Paula A. Politis, PharmD, BCPS; Presley L. Blount, PharmD; Kristy A. Waite, DO; Jacqueline R. Ewald, PharmD, BCPS;
George Kallstrom, PhD; Thomas M. File, MD, MSc, MACP, FIDSA, FCCP
Summa Health System – Akron Campus, Akron OH

Amended Abstract

Background: Summa Health System – Akron Campus (SHS-AC) acquired rapid diagnostic technology known as FilmArray® Multiplex Polymerase Chain Reaction (PCR). The purpose of this quality improvement project was to determine the impact of the introduction of this technology on surrogate and clinical outcomes in bacteremic patients at SHS-AC.

Methods: A retrospective chart review was performed for all patients who presented to SHS-AC with confirmed bacteremias in June 2015 (pre-implementation) and November 2015 (post-implementation). Primary outcomes included time to effective and optimal antimicrobial therapy. Secondary outcomes included inpatient mortality, length of hospital and intensive care unit (ICU) stay, time to identification of primary pathogen(s), and overall cost of antimicrobial therapy.

Results: Post PCR implementation, the mean time to optimal therapy was reduced from 51.84 hours to 32.88 hours (P=0.014). Mean time to bacterial identification was reduced from 47.52 hours to 2.64 hours (P <0.001). There was a trend towards reduction in 30-day readmission rate, inpatient mortality, cost of antimicrobials per stay and day in the post-implementation group.

Conclusion: The implementation of the FilmArray® Multiplex PCR technology significantly decreased time to optimal antimicrobial therapy and microbial identification in patients who presented with bacteremias at SHS-AC.

Introduction

- 575,000 - 677,000 cases of bloodstream infections occur every year in North America.¹
- Rapid identification of organisms allows for the de-escalation of broad spectrum antibiotics to more specific therapy which may decrease antibiotic resistance, undesirable adverse effects and hospital costs.²
- The Biofire FilmArray® System, a multiplex PCR system, allows for rapid identification of pathogens and delivers results in about an hour.³

Materials and Methods

- A retrospective chart review was performed for all patients who presented to SHS-AC with confirmed bacteremias identified in June 2015 (pre-implementation of FilmArray® PCR technology) and November 2015 (post-implementation)
- Inclusion Criteria: Admitted to SHS-AC as inpatient or observation patient in June or November 2015, positive blood culture with Gram-positive, Gram-negative or anaerobic pathogen
- Exclusion Criteria: Positive blood culture for fungal pathogens

Results

Table 1: Baseline Demographics

Variable/Statistic	Pre Group (n=78)	Post Group (n=77)	P-Value
Age (Years)			0.125
Mean (SD)	67.2 (15.80)	63.6 (16.66)	
Median	68.5	65	
Range	19 - 97	19 - 94	
Gender - n (%)			0.807
Male	40 (51.3%)	41 (53.2%)	
Female	38 (48.7%)	36 (46.8%)	
Antimicrobial Stewardship Intervention n(%)	9 (11.5%)	12 (15.2%)	0.502
Contaminant present n(%)	29 (36.3%)	26 (31.0%)	0.473
Multiple organisms present n(%)	11 (13.8%)	9 (10.7%)	0.553

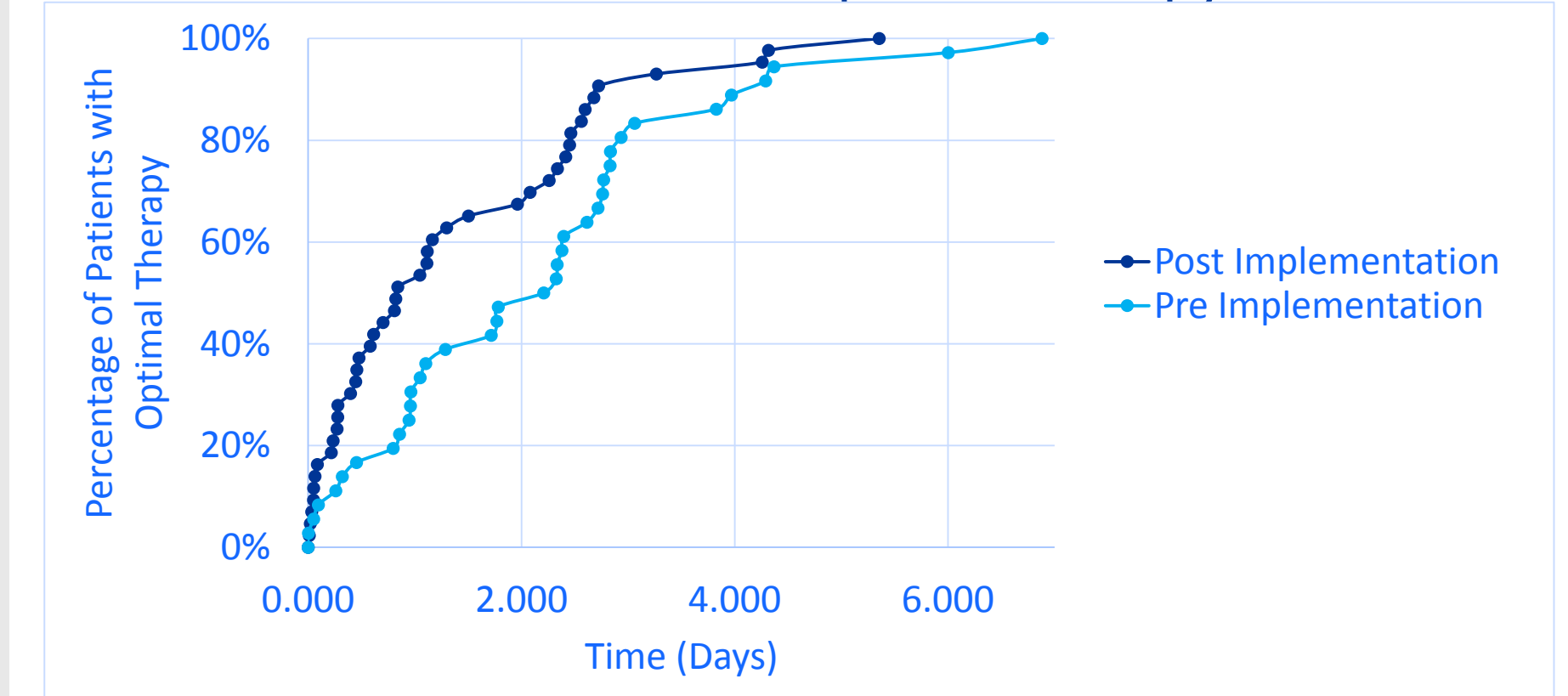
Table 2: Primary Outcomes

	Pre Group (n=78)	Post Group (n=77)	P-Value
Time to Effective Therapy (Hours)	n=26	n=27	0.306
	Mean (SD): 14.4 (13.44)	Mean (SD): 12.72 (17.04)	
	Median: 13.2	Median: 5.28	
	Range: 0.05-57.6	Range: 0.24-64.32	
Time to Optimal Therapy (Hours)	n=36	n=43	0.014
	Mean (SD): 51.84 (38.64)	Mean (SD): 32.88 (31.92)	
	Median: 54.48	Median: 20.16	
	Range: 0.07-165.12	Range: 0.24-128.4	

Table 3: Secondary Outcomes

	Pre Group (n=78)	Post Group (n=79)	P-Value
Hospital Length of Stay (Days)	Median: 7.1	Median: 7.7	0.980
	Range: 1.0-30.7	Range: 0.2-38.8	
ICU Length of Stay (Days)	n=43	n=39	0.574
	Median: 4.68	Median: 4.75	
	Range: 0.58-29.97	Range: 0.28-23.12	
Cost of Antimicrobials Per Length of Stay	Mean (SD): \$653.20 (\$1802.21)	Mean (SD): \$395.21 (\$1152.96)	0.075
	Median: \$165	Median: \$85.48	
	Range: \$0-\$11911.13	Range: \$0-\$8320	
Cost Per Day of Antimicrobials	Mean (SD): \$59.14 (\$131.16)	Mean (SD): \$37.62 (\$102)	0.095
	Median: \$16.64	Median: \$13.22	
	Range: \$0-\$791.18	Range: \$0-\$745.82	
30 Day Re-admission	17 (22.1%)	11 (13.9%)	0.185
Inpatient Mortality	14 (18.2%)	9 (11.4%)	0.232
Time to Identification of Bacteria (Hours)	n=78	n=77	<0.001
	Mean (SD): 47.52 (23.52)	Mean (SD): 2.64	
	Median: 47.52	Median: 1.68	
	Range: 0.24-175.44	Range: 0.72-28.8	

Chart 1: Time to Optimal Therapy



Discussion

Findings:

- Significant reduction in time to optimal therapy and time to bacterial identification post-implementation
- Trend towards reduction in 30-day readmission rate and cost of antimicrobials per stay and per day
- Larger more robust trials needed to further evaluate

Limitations:

- Small sample size, inclusion of contaminants, uncontrolled retrospective chart review, subjectivity of outcomes, institutional changes during implementation
- Routine for Antimicrobial Stewardship Team to evaluate all positive blood cultures, however majority of these patients had Infectious Disease consult

Conclusions

- Implementation of multiplex PCR technology at SHS-AC resulted in statistically significant reduction in time to optimal therapy and time to identification of bacteria.
- Results demonstrate a trend toward decreased 30-day readmission rate and cost, however larger trials are needed to confirm these findings.

References

1. Dixon P, Davies P, Hollingworth W, et al. A systematic review of matrix-assisted laser desorption/ionisation time-of-flight mass spectrometry compared to routine microbiological methods for the time taken to identify microbial organisms from positive blood cultures. *Eur J Clin Microbiol Infect Dis*. 2015 May;34(5):863-76.
2. Kohlmann R, Hoffmann A, Geis G, et al. MALDI-TOF mass spectrometry following short incubation on a solid medium is a valuable tool for rapid pathogen identification from positive blood cultures. *Int J Med Microbiol*. 2015 Jun-Aug;305(4-5):469-79.
3. Biofire Diagnostics, LLC. (2015). The FilmArray System - FilmArray. Retrieved August 31, 2015, from <http://filmarray.com/the-filmarray-system>.