Association of Rapid Pathogen Identification and Pharmacist Intervention on Time to Optimal Antimicrobial Therapy for Patients with Bloodstream Infections at Two Community Hospitals

Bryant M. Froberg, PharmD; Nicholas P. Torney, PharmD, BCPS, BCPID; Juliet Chijioke, PharmD; Cynthia D. Nichols, PhD

MUNSON MEDICAL CENTER
MUNSON HEALTHCARE

Contact: Bryant Froberg, PharmD
Address: 1105 6th St, Traverse City, MI 49684
Email: bfroberg@mhc.net
Telephone: 231-935-3281

Background

- Bloodstream Infections (BSIs) are associated with poor patient outcomes including high mortality and extended length of hospital stay
- Delayed administration of effective antibiotics increases risk of mortality
- Use of non-optimal antibiotics may lead to reduced efficacy, increased adverse drug reactions, and/or promote resistance development
- Rapid Diagnostic Tests (RDTs) for BSIs with real-time stewardship interventions have been shown to:
  - Decrease mortality
  - Decrease time to optimal antimicrobial therapy
  - Decrease hospital length of stay
  - Decrease health-system costs
- There is a lack of evidence of the utility of RDTs with intervention at smaller community hospitals

Objective

To investigate if implementing real-time pharmacist intervention to rapid pathogen identification at two rural community hospitals is associated with improved time to optimal antimicrobial therapy as well as clinical outcomes and health-system costs for patients with BSIs.

Primary Outcome: Time to optimal antimicrobial therapy
Secondary Outcomes: In-hospital mortality, time to effective antimicrobial therapy, length of stay, admission cost, 30-day readmission

Methods

Study Design: Retrospective, quasi-experimental pre-post
Institutions Involved:

- Munson Healthcare Cadillac Hospital: 49 bed community hospital in Northern Michigan
- Munson Healthcare Grayling Hospital: 71 bed community hospital in Northern Michigan

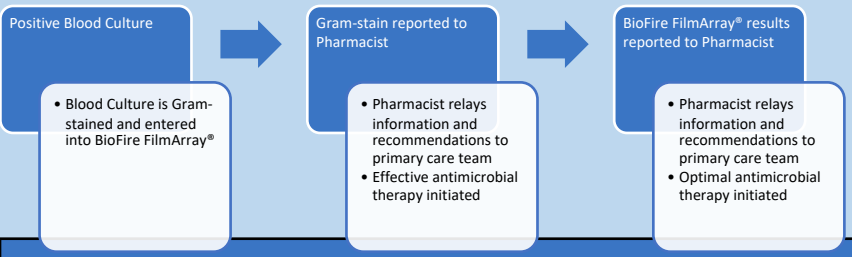
Inclusion Criteria

- 18 years of age
- Admitted to Munson Cadillac or Grayling Hospital
- At least one positive blood culture

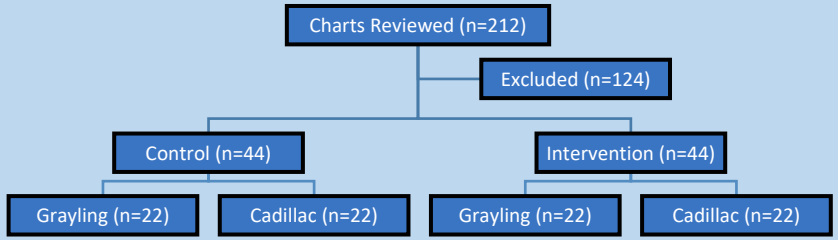
Exclusion Criteria

- Culture result known at time of admission
- Hospice/Palliative Care Consult
- Pregnant
- Polymicrobial Blood Culture
- Transplant Patient

Intervention: During pharmacy hours of operations (Grayling 60 hrs/week; Cadillac 77 hrs/week) pharmacists reported positive blood culture results and recommendations to primary care team



Review for Inclusion/Exclusion



Exclusion Criteria	Control (n=60)	Intervention (n=64)
Discharged within 24 hours	20	20
Not Admitted	16	20
Needed Higher level of care	17	19
Transferred within 24 hours	4	3
Expired prior to blood culture positivity	1	2
Polymicrobial	1	0
Hospice	1	0

Data listed as: Number (%), unless otherwise noted

Patient Demographics

Patient Demographics	Control (n=44)	Intervention (n=44)	p-value
Male	20 (46)	24 (55)	0.523
Age (mean ± SD)	68 ± 19	74 ± 13	0.1
Diabetes	15 (34)	20 (46)	0.384
Heart Failure	6 (14)	13 (30)	0.119
COPD	9 (21)	18 (40)	0.063
CKD	**8 (18)**	**18 (40)**	**0.034**
Chronic Liver Disease	5 (11)	1 (2)	0.202
Trauma	0 (0)	0 (0)	1
Obesity	11 (25)	9 (21)	0.8
qPITT Bacteremia Score (mean ± SD)	1.5 ± 1.5	1.8 ± 1.6	0.184
ICU Admission	12 (27)	18 (41)	0.261
Transfer to higher LOC	6 (14)	4 (9)	0.739

Data listed as: Number (%), unless otherwise noted

Source	Control (n=44)	Intervention (n=44)
Contaminant	14 (32)	17 (39)
Urinary	16 (36)	14 (32)
Respiratory	6 (14)	7 (16)
SSTI	3 (7)	2 (5)
Intra-abdominal	3 (7)	1 (2)
Catheter-related	1 (2)	0 (0)
Unknown	1 (2)	2 (5)
Other	0 (0)	1 (2)
Difference in Source, p-value 0.776		

Data listed as: Number (%), unless otherwise noted

Microbiologic Distribution

Organism	Control (n=44)	Intervention (n=44)
Escherichia coli	12 (27)	10 (23)
Coag-neg *Staph*	8 (18)	11 (25)
Streptococcus sp.	6 (14)	8 (18)
Micrococcus sp.	2 (5)	4 (9)
MSSA	3 (7)	2 (5)
Corynebacterium sp.	1 (2)	1 (2)
Enterococcus Faecalis	0 (0)	2 (5)
MRSA	1 (2)	0 (0)
Klebsiella pneumoniae	0 (0)	1 (2)
Other	11 (25)	5 (11)
Difference in Organisms, p-value 0.914		

Data listed as: Number (%), unless otherwise noted

Results

Outcome	Control (n=44)	Intervention (n=44)	p-value
Primary			
Time to optimal Antimicrobial Therapy, Hours; mean (SD)	27.3 (35.5)	19.4 (30)	0.265
Secondary			
Time to effective Antimicrobial Therapy, Hours; mean (SD)	1.3 (8.1)	0.7 (0.5)	0.319
In-Hospital mortality; n (%)	1 (2.3)	4 (9.1)	0.360
Admission length, Days; mean (SD)	4.2 (2.5)	5 (2.8)	0.183
Admission Cost, USD in thousands; mean (SD)	**24.6 (11.1)**	**32.7 (13.1)**	**0.013**
All-cause 30 day readmission; n (%)	4 (9.1)	7 (15.9)	0.183
Post-Hoc Analysis			
Time to optimal Antimicrobial Therapy Cadillac, Hours; mean (SD)	31.5 (42.4)	15.2 (26.3)	0.135
Time to optimal Antimicrobial Therapy Grayling, Hours; mean (SD)	23 (27.4)	23.6 (33.4)	0.955
Time to optimal Antimicrobial Therapy excluding contaminants, Hours; mean (SD)	38.7 (36.7)	31.6 (33)	0.443
Blood culture results reported to pharmacist; n (SD)	0	25 (57)	NA

Conclusion

- Coupling real-time pharmacist intervention with RDTs showed a non-significant trend towards reducing time to optimal and effective antimicrobial therapy at two community hospitals.
- The intervention was not significantly associated with any improved patient outcomes
- Future directions include intervention improvement and larger studies