Impact of an Automated Sepsis Alert on Empiric Antibiotics

Alex Stumphauzer, Pharm.D.
St. Louis College of Pharmacy
Mercy Hospital St. Louis
PGY1 Pharmacy Practice Resident

ST. LOUIS COLLEGE of PHARMACY

Mercy

Background

- Sepsis CMS Core Measure (SEP-1) criteria used by CMS for reimbursement
  - Performance period began October 2016
- Protocolization of treatment is prevalent
  - Use of remote sepsis alerts, associated countdown, prescribing bundles, and order sets
- Anti-Pseudomonal and anti-MRSA coverage increasingly more common as empiric therapy at Mercy Hospital St. Louis to meet SEP-1 criteria

Sepsiscoordinatornetwork.org. (2019). *Specifications Manual for Hospital Inpatient Quality Measures*.

Background

- Pressure on providers to address sepsis aggressively
  - Quick to prescribe broad-spectrum antibiotics
- Potentially has impact on de-escalation
  - Leads to adverse consequences (resistance, C. diff)
- Limited quantification of consequences related to SEP-1 criteria

Previous Literature

- Antibiotics within 3 hours of sepsis diagnosis significantly improves mortality outcomes
- Efficacy of another sepsis best practice alert did not significantly improve mortality
- Each additional day of anti-pseudomonal coverage is associated with a higher risk of resistant bacteria

N Engl J Med. 2017;376(23):2235-2244
Am J Med. 2019;132(7):862-868.
Pharmacotherapy. 2019;39(3):261-270.

SEP-1 Broad-Spectrum Antibiotic Options

Option 1: Monotherapy

- Carbapenems (meropenem, ertapenem)
- Beta-lactam/Beta-lactamase Combinations (Piperacillin/Tazobactam, Ampicillin/Sulbactam)
- Fluoroquinolones (levofloxacin, moxifloxacin)
- 3rd Gen or Higher Cephalosporins (cefepime, ceftazidime, ceftriaxone)

Sepsiscoordinatornetwork.org. (2019). *Specifications Manual for Hospital Inpatient Quality Measures*.

SEP-1 Broad-Spectrum Antibiotic Options

Option 2: Combination Therapy	
• Aminoglycoside • Aztreonam • Ciprofloxacin	+ • 1st/2nd Gen Cephalosporin • Clindamycin • Daptomycin • Glycopeptides • Linezolid • Penicillins

Sepsiscoordinatornetwork.org. (2019). *Specifications Manual for Hospital Inpatient Quality Measures*.

ST. LOUIS COLLEGE of PHARMACY

Mercy

Sepsis Alert

- Alerts physicians to rule out sepsis or start prescribing bundles within allotted time
- Fires following 2 SIRS criteria met in chart
  - Temp >38°C (100.4°F) or < 36°C (96.8°F)
  - Heart rate > 90 bpm
  - Respiratory rate > 20 rpm or $PaCO_2$ < 32 mm Hg
  - WBC > 12,000/mm^3, < 4,000/mm^3, or > 10% bands

J Thorac Dis. 2017;9(4):943-945.

Objective

To determine the effect of sepsis alert implementation on Mercy Hospital St. Louis' use of empiric antibiotics

Primary Outcome

Percent of appropriate empiric antibiotics in patients pre versus post sepsis alert implementation

- Appropriateness based upon guideline-based, source-specific risk factors

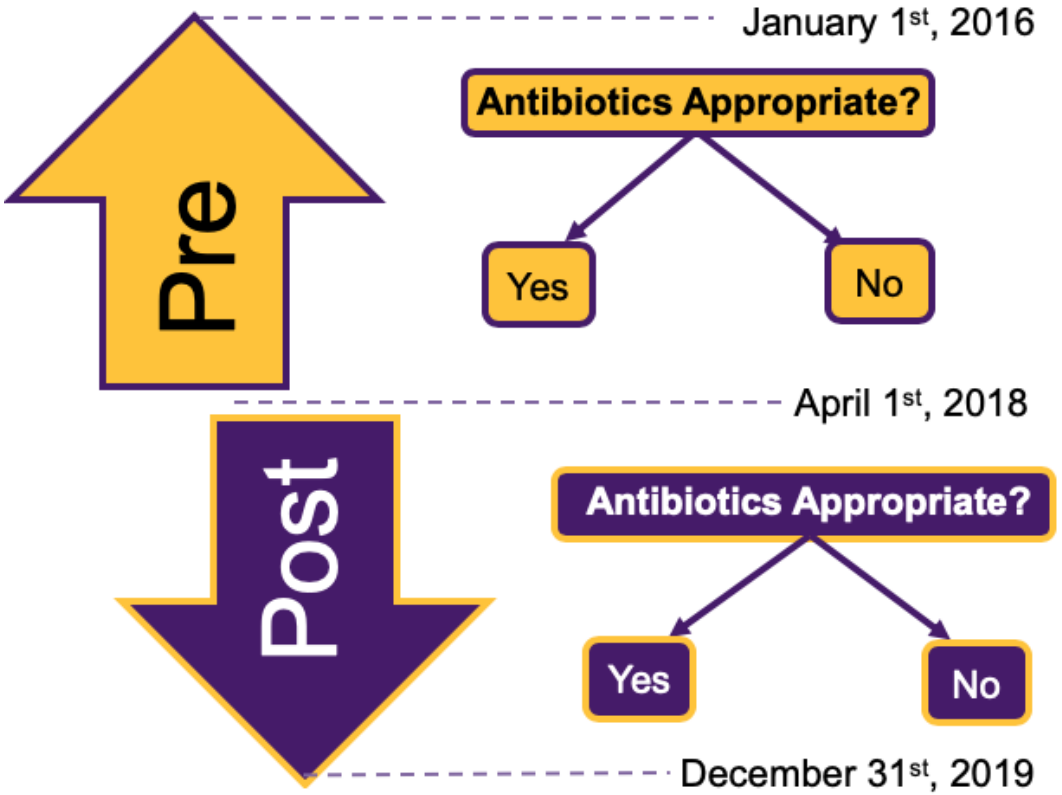
Secondary Outcomes

- Hospital length of stay (LOS) in days
- Antibiotic days of therapy (DOT)
- Time to de-escalation of antibiotics
  - Removal of broad-spectrum coverage

Inclusion and Exclusion Criteria

Inclusion	Exclusion
• Adults ≥ 18 years of age • Admitted between January 1st, 2016 and December 31st, 2019 • Pre-implementation group: diagnosis coding of sepsis or severe sepsis • Post-implementation group: identified by sepsis alert system	• Known pregnancy • Identified as sepsis with shock per diagnosis coding or sepsis alert system

Figure 1: Trial design



Power Calculation

- Power calculation:
  - 154 total patients needed for 90% power, alpha value set at 0.05
  - Calculated based on expected appropriateness difference of 25%

Statistical Analysis

Chi-Squared Test	Appropriateness of empiric antibiotics pre versus post sepsis alert implementation
Mann-Whitney U Test	LOS, days to de-escalation, antibiotic DOT, SOFA scores
Descriptive Statistics	Demographics, adverse effects

Baseline Characteristics

Characteristic	Pre-Alert Group (n=77)	Post-Alert Group (n=77)
Age (y), mean ± SD	62.0 ± 22	61.7 ± 22
Female – n (%)	37 (48.1)	42 (54.5)
Race – n (%)		
White	67 (87.0)	60 (77.9)
Black	4 (5.2)	11 (14.3)
Other	6 (7.8)	6 (7.8)

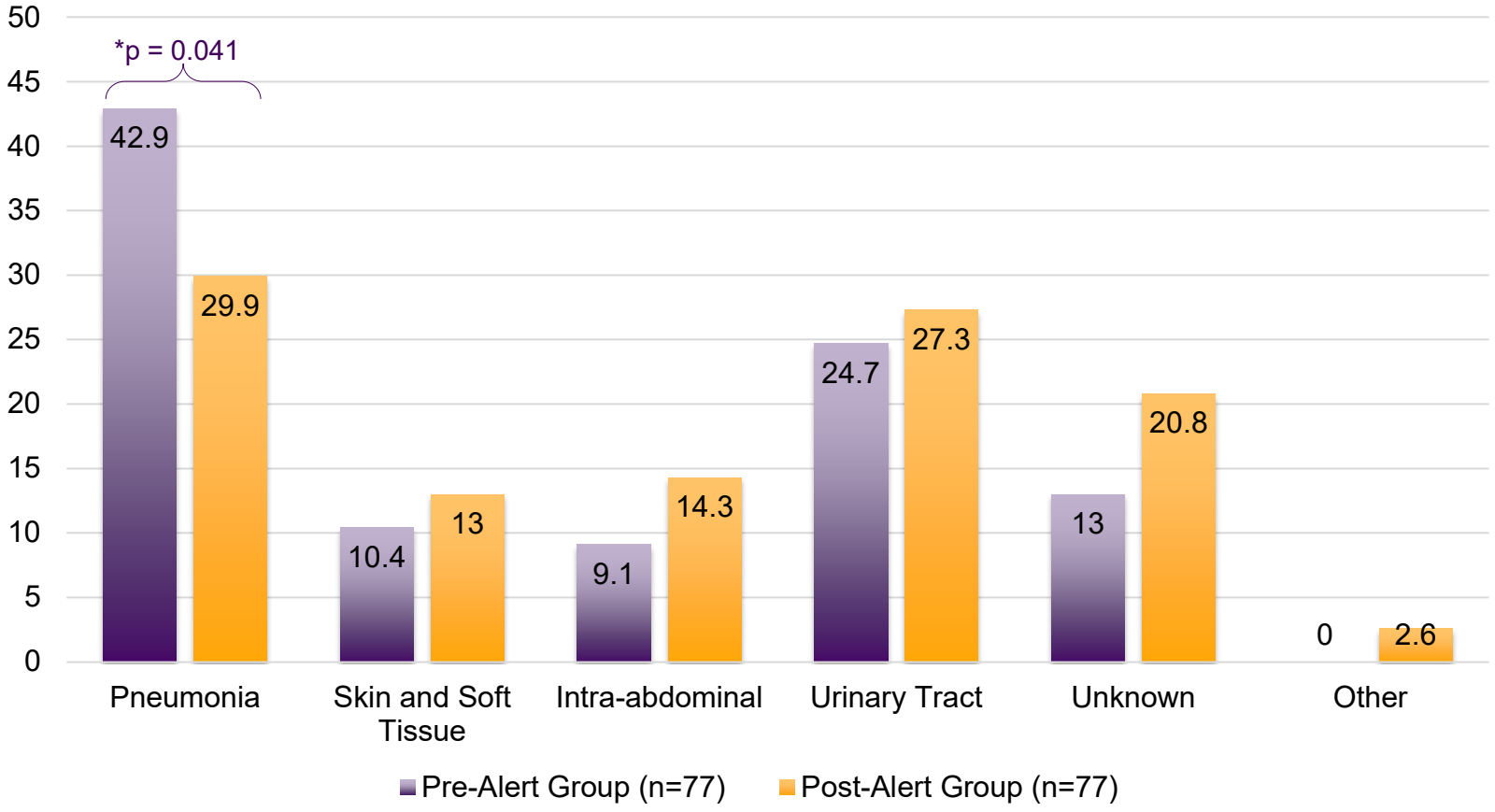
*No statistically significant differences in baseline characteristics

Baseline Characteristics

Characteristic*	Pre-Alert Group (n=77)	Post-Alert Group (n=77)
Location – n (%)		
ED	34 (44.2)	35 (45.4)
Floor	32 (41.6)	26 (33.8)
ICU	11 (14.2)	16 (20.8)
SOFA Score, median (IQR)	2 (1 – 3.5)	2 (1 – 5)

*No statistically significant differences in baseline characteristics

Suspected Infection Source (%)



ST. LOUIS COLLEGE of PHARMACY

Results – Primary Outcome

Outcome	Pre-Alert (n=77)	Post-Alert (n=77)	p-value
Use of appropriate empiric antibiotics – n (%)	46 (58.4)	49 (63.6)	0.62

Results – Secondary Outcomes

Outcome	Pre-Alert (n=77)	Post-Alert (n=77)	p-value
LOS (days) – median (IQR)	4 (3 – 6.5)	6 (4 – 11)	0.005*
Days to de-escalation – median (IQR)	3 (1 – 4)	2 (1 – 3)	0.13
Antibiotic DOT – median (IQR)	4 (3 – 6.5)	5 (3 – 9)	0.29

Results – Adverse Effects

Adverse Effect*	Pre-Alert (n=77)	Post-Alert (n=77)
CDI – n (%)	1 (1.3)	5 (6.5)
AKI – n (%)	9 (11.7)	13 (16.9)
Drug Rash – n (%)	1 (1.3)	0 (0)

*No statistically significant differences seen in adverse effects

Conclusions

- Alert implementation had no significant impact on empiric antibiotic appropriateness
- LOS longer in post-alert group, suggesting a higher severity of illness
  - Non-statistically different SOFA scores
- AKI most common adverse effect, minimal occurrence of CDI or drug rash
  - Alert not having impact here either

Analysis

Strengths

- Use of rigid criteria to assess appropriateness
- Well-matched based on demographics, location

Weaknesses

- Gradual change?
- Possible higher severity in post-alert group (longer LOS)

Anticipated Benefits of Research

- Educational material on how to appropriately interpret alerts
  - Emphasize source-driven antibiotics
  - Broad spectrum not universally needed
- Future analysis could examine larger population or specific suspected source

Impact of an Automated Sepsis Alert on Empiric Antibiotic Use

Alex Stumphauzer, Pharm.D.
St. Louis College of Pharmacy
Mercy Hospital St. Louis
PGY1 Pharmacy Practice Resident

ST. LOUIS COLLEGE of PHARMACY

Mercy