Evaluation of procalcitonin laboratory reference range modification and antimicrobial utilization

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BACKGROUND

- Procalcitonin (PCT) is a biomarker that helps distinguish bacterial infections from other disease states
  - PCT guidance has shown reduced antibiotic duration of therapy and mortality in respiratory tract infections and sepsis[1-4]
- Randomized trials have established PCT thresholds associated with bacterial infections[5,6]
  - PCT is ≥0.26 ng/mL in a lower respiratory tract infections
  - PCT >2.0 ng/mL is highly predictive of sepsis
  - PCT ≤0.25 ng/mL generally safe to discontinue antibiotics in many patients
- Previously, the electronic medical record (EMR) at The University of Kansas Health System indicated that all PCT levels >0.1 ng/mL were elevated
- For this study we hypothesized that updating the EMR to be consistent with evidence-based PCT guidance would result in reduced antibiotic days of therapy

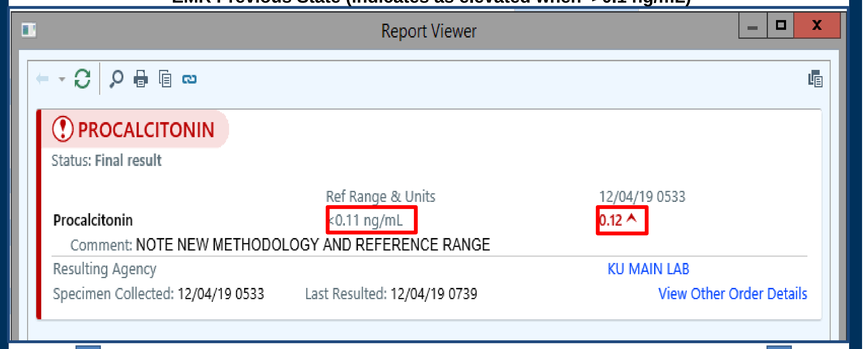
OBJECTIVES

- Evaluate the impact of a PCT laboratory report EMR update on antibiotic duration of therapy and antibiotic duration of therapy prescribed on discharge
- Compare clinical outcomes (total length of stay, ICU length of stay, and 30-day mortality) between the pre-implementation and post-implementation groups

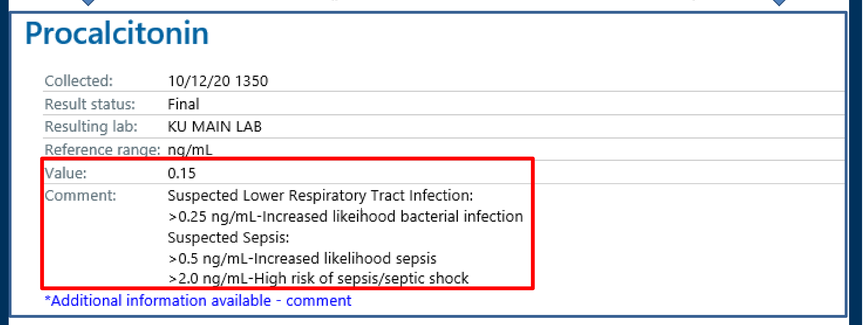
METHODS

- Quasi-experimental chart review
- Inclusion criteria:
  - PCT 0.10-0.25 ng/mL
  - ≥18 years of age
- Timeframe for data collection:
  - Pre-implementation: 6/1/2020 – 8/3/2020
  - Post-implementation: 10/02/2020 – 11/22/2020

EMR Previous State (indicates as elevated when >0.1 ng/mL)



EMR Current State (provides comment with recommendations)



RESULTS

Table 1. Characteristics

Characteristic	Pre-Implementation (n=200)	Post-Implementation (n=200)	P Value
Demographics			
Age, y, mean ± SD	60.0 ± 15.2	62.2 ± 16.3	.077
Male sex, n (%)	99 (49.5)	126 (63)	.09
Race/ethnicity, n (%)			.01
White	109 (54.5)	142 (71)	
Black	38 (19)	30 (15)	
Hispanic	32 (16)	10 (5)	
Other	21 (10.5)	18 (9)	
Clinical features			
Initial PCT, ng/mL, mean ± SD	0.17 ± 0.04	0.16 ± 0.04	.105
Charlson comorbidity index, mean ± SD	3.2 ± 2.3	3.2 ± 2.3	.437
COVID-19 positive, n (%)	54 (35.4)	99 (64.7)	.00

Figure 1. Primary Endpoint – Antibiotic Days of Therapy

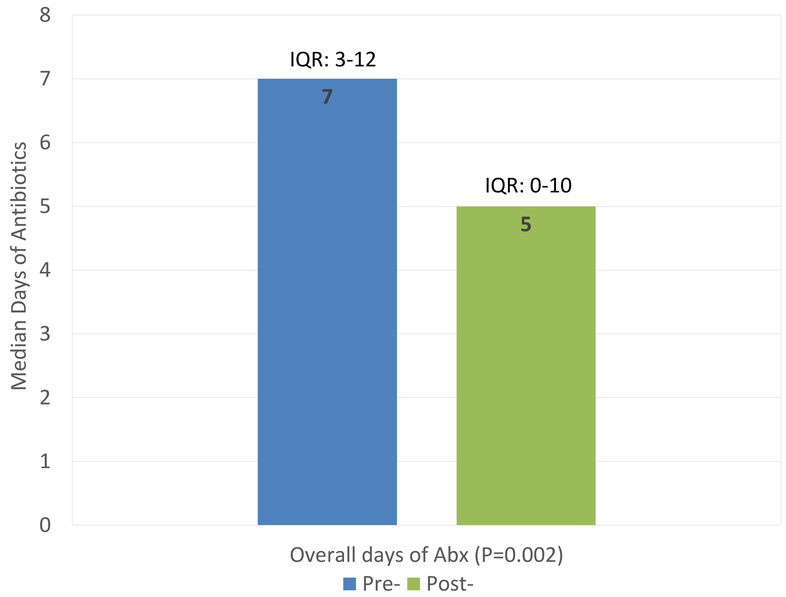
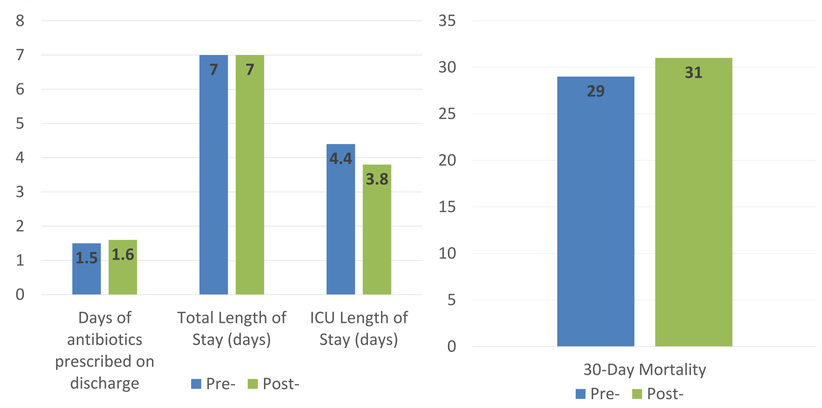
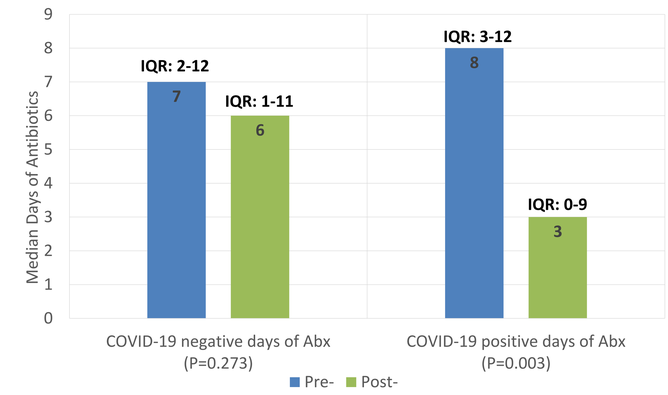


Figure 2. Secondary Endpoint



RESULTS

Figure 3. Antibiotic Days of Therapy – COVID-19 Subgroups



DISCUSSION

- There was a significant reduction in days of antimicrobial therapy in the post-implementation group
- These results may have been driven by antimicrobial use in COVID-19 positive patients, however PCT may have played a role in this observation
- Additionally, maturation bias may have been present in relation to management of COVID-19 positive patients which were less common in the pre-implementation group
- A potential safety concern with changing the PCT reference range was that it may have caused providers to not order or to discontinue antibiotics when they may have been indicated. Similar rates of length of stay, ICU length of stay, and 30-day mortality show that this was unaffected
- The results of this study are consistent with previous literature regarding EMR changes and antimicrobial stewardship[7-9]

CONCLUSIONS

- Modification of PCT display and order comment in the EMR significantly reduced days of antibiotic of therapy
- The reduction in days of antibiotic of therapy was driven by COVID-19 positive patients, of which there were more in the post-implementation group

FUTURE DIRECTIONS

- Continued examination of the impact of this EMR update will be necessary, especially as treatment strategies for COVID-19 pneumonia become more established and consistent
- Optimize the procalcitonin laboratory report in the EMR to ensure interpretation of the results remains consistent with evidence

STUDY LIMITATIONS

- Retrospective
- Maturation bias

CONTACT INFORMATION

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- References attached via QR code or available upon request.
- Authors have no disclosures to report