Another Respiratory Culture Nudge Improves Pneumonia Prescribing

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Introduction

Lower respiratory tract infections (LRTI) are an important target for antimicrobial stewardship programs due to their frequency, diagnostic uncertainty, and association with antibiotic overuse; however, gaps in effective stewardship strategies to improve prescribing in LRTI remain. The development of pragmatic, easy-to-implement, and impactful antimicrobial stewardship interventions are desperately needed to improve appropriate antibiotic utilization and optimize patient outcomes in LRTI and other disease states. Nudging with purposeful, interpretive microbiology comments appears to improve antibiotic prescribing. The purpose of this study was to compare prescribing patterns before and after initiation of an automated microbiology beta-lactamase comment following a respiratory culture growing *Moraxella catarrhalis* or *Haemophilus influenzae*.
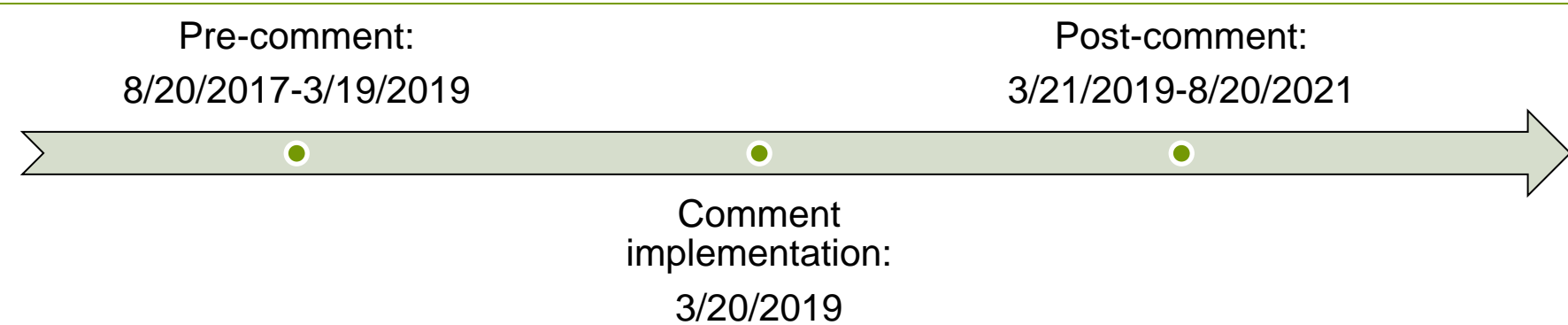
Methods

Study Design and Objectives

This was a quasi-experimental study conducted at Henry Ford Health System located in southeast Michigan. The study was approved by the Henry Ford Hospital Institutional Review Board. The study objective was to assess prescribing habits before and after a β-lactamase interpretative comment for *H. influenzae* and *M. catarrhalis* LRTIs

Subjects

Inclusion Criteria	Exclusion Criteria
• ≥ 18 years of age • *H. influenzae* or *M. catarrhalis* LRTI	• Non-LRTI/polymicrobial infections • Patients on antibiotic prophylaxis • IgE-mediated β-lactam allergy

Pre-comment: 8/20/2017-3/19/2019
Post-comment: 3/21/2019-8/20/2021
Comment implementation: 3/20/2019

Data Collection and Endpoints

Data was collected from electronic medical records using a standardized case report form.

Primary Endpoint:
- Proportion of patients who received directed therapy as received by the comment "β-lactamase negative or positive"
  - Beta-lactamase negative: ampicillin, amoxicillin
  - Beta-lactamase positive: amoxicillin/clavulanate, ampicillin/sulbactam

- **Secondary Endpoints**:
  - Turnaround time in days from comment prompt to de-escalation
  - Clinical success, defined as resolution or improvement in signs and symptoms without further antibiotics from initiation of antibiotics to completion with no need for antibiotics after discontinuing therapy
  - Days of antibiotic treatment

Analysis

Descriptive measures (incidence, proportions, measures of central tendency and dispersion) were used to evaluate patient baseline demographics. To assess the impact of an automated microbiology comment for *M. catarrhalis* and *H. influenzae* respiratory cultures, bivariate comparative tests were used. Categorical data was compared using Chi-square tests, continuous data was compared with the Mann-Whitney U test. Patients with the greatest likelihood of achieving optimal antibiotic de-escalation, variables associated with the outcome (*P*<0.2) from bivariate analysis were entered into a multivariable model using a backwards, stepwise approach. All tests were two-sided; a *P*-value of <0.05 was considered significant. Statistical analysis was completed with SPSS version 26.0.

Results

Intervention and Baseline Patient Characteristics

Before Implementation:

Susceptibility
Moraxella catarrhalis
Antibiotic	Interpretation	Value	Method
Beta Lactamase	Resistant	Positive	BLC (BETA LACTAMASE)

Haemophilus influenzae
Antibiotic	Interpretation	Value	Method
Beta Lactamase	Susceptible	Negative	BLC (BETA LACTAMASE)

After Implementation:

Susceptibility
Haemophilus influenzae
Antibiotic	Interpretation	Value	Method
Beta Lactamase	Negative		BLC (BETA LACTAMASE)
Beta Lactamase		This organism is predictably susceptible to Ampicillin IV or Amoxicillin oral.	BLC (BETA LACTAMASE)

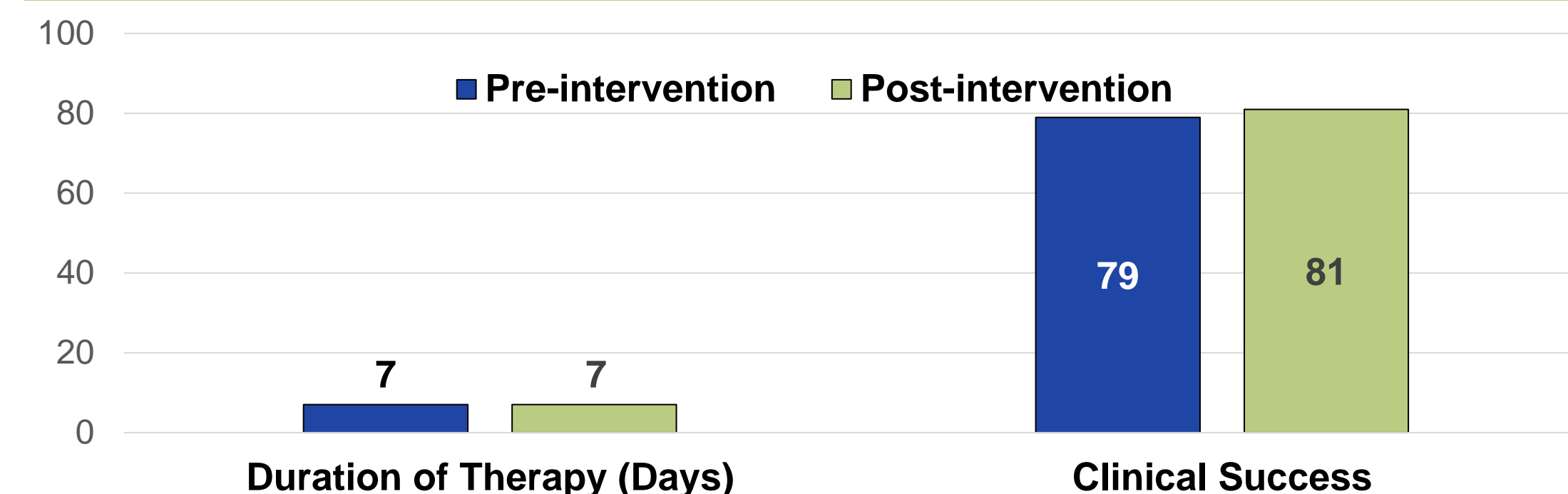| Baseline Characteristics Median (IQR), or n (%)	Pre-Intervention (*n*=100)	Post-Intervention (*n*=101)	*P*-value
Age (years)	63 (42, 84)	62.5 (45.5, 79.5)	0.404
Male Sex	61 (61)	65 (64.4)	0.623
Persons who inject drugs	7 (7)	5 (5)	0.540
β-lactam Allergy (non-IgE mediated)	4 (4)	7 (6.9)	0.361
Community acquired pneumonia	63 (63)	74 (73.2)	0.118
Charlson Comorbidity Index	4 (3, 8)	4 (2, 6)	0.115
Infectious Diseases Consult	16 (16)	18 (17.8)	0.730
H. influenzae	81 (81)	78 (77.2)	0.511

Primary Endpoint

- The primary outcome of optimal de-escalation occurred in 19 (19%) patients in the pre-intervention group and 51 (51%) patients in the post-intervention group (*P*<0.001).

■ Optimal ■ Sub-optimal

Pre-Intervention: 19 (19%) Optimal | 81 (81%) Sub-optimal
Post-Intervention: 50 (50%) Optimal | 50 (50%) Sub-optimal

(scale: 0 20 40 60 80 100)
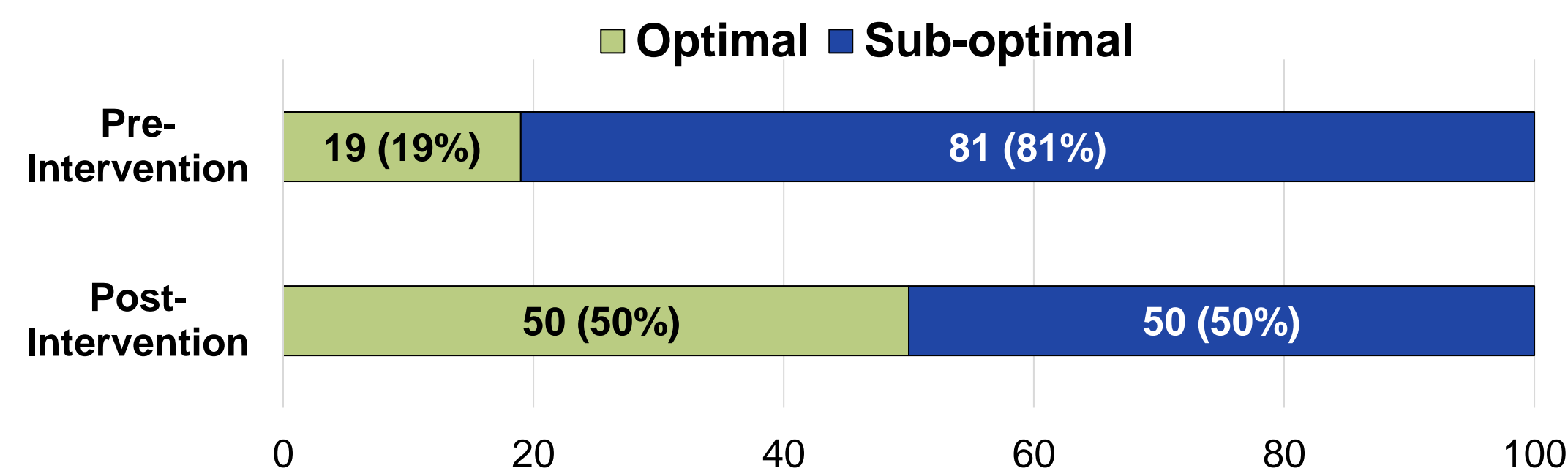
Variable	Pre-Intervention	Post-Intervention	*P*-value
DVT prophylaxis – *n* (%)	93 (93)	82 (81.2)	0.013

Secondary Endpoints

■ Pre-intervention ■ Post-intervention

Duration of Therapy (Days): Pre-intervention 7, Post-intervention 7
Clinical Success: Pre-intervention 79, Post-intervention 81

Variable Median (IQR), or n (%)	Pre-intervention	Post-intervention
Time to De-escalation, days	1 (0-2)	0 (0-1)
C. difficile infection	4 (4)	2 (2)
Continued broad-spectrum antibiotic	33 (33)	32 (32)

Variables Associated with Optimal De-escalation

Variable n (%)	Optimal De-escalation	UnAdjOR (95%CI)	*P*-value	AdjOR (95%CI)
β-lactamase interpretative comment	51 (50.5)	4.348 (2.307-8.196)	<0.001	5.034 (2.567-9.871)
Persons Who Inject Drugs	1 (1.4)	0.158 (0.020-1.251)	0.075	0.145 (0.071-1.216)
Hospital acquired pneumonia	16 (22.9)	1.747 (0.833-3.661)	0.063	2.171 (0.958-4.922)
Sputum culture	35 (50)	0.578 (0.321-1.041)	0.026	0.480 (0.251-0.917)

Summary

- An automated, interpretive β-lactamase nudge was associated with a significant reduction in definitive broad-spectrum antibiotic use
- Leveraging the electronic medical record for stewardship efforts is an effective and efficient means of intervention.