A Model for Improving and Assessing Outpatient Stewardship Initiatives for Acute Respiratory Infections

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Running Head: Assessment of Antibiotic Prescribing after ASP Interventions in NYC

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Many hospitals have established inpatient antibiotic stewardship (AS) programs, but outpatient activities remains limited. In 2016, United Hospital Fund (UHF), an independent nonprofit working to build a more effective health care system for every New Yorker, launched a two-stage grant-funded initiative to evaluate outpatient AS, focusing on adults with acute respiratory infections (ARI). Stage I found few outpatient AS activities, variation in prescribing, macrolides as the most commonly prescribed antibiotic, and provider interest in improving prescribing [1].

In Stage II, clinics from seven hospitals and health systems in New York City implemented evidence-based interventions to reduce inappropriate prescribing. The interventions were site-specific and leveraged available resources, workflow, and perception of need.

Review and comparison of pre- and post-intervention visits were conducted to detect differences in ARI antibiotic prescribing.

Methods

Over the course of the initiative (May 2017 – June 2018), each hospital or health system engaged in a learning and sharing collaborative. UHF provided technical assistance and data analysis.

Using facility-specific data from Stage I, clinics tailored interventions applying the Centers for Disease Control and Prevention (CDC) Core Elements of Outpatient Antibiotic Stewardship[2].

This observational study aimed to assess changes in prescribing pre- and post- intervention. The Biomedical Research Alliance of New York Institutional Review Board deemed the study exempt from review. If appropriate, the site(s) received local IRB approval. Chart abstraction utilized the same randomization and data collection tools previously described[1]. Data were analyzed using SAS, version 9.4 (SAS Institute, Cary, North Carolina); chi-square tests assessed prescribing variation by patient characteristics and T-tests assessed changes in prescribing rates.

Results

Interventions Implemented

Thirty-four clinics participated in Stage II; each implemented between 3 and 13 interventions, including augmented patient and provider education, clinical decision support, provider audit and feedback, and communication skills training.

Antibiotic Prescribing Practices, Pre- and Post-Intervention

991 ARI visits pre- and 902 post-intervention were reviewed (Table 1). In aggregate, there was a significant decrease in antibiotics prescribed, from 30.6% of ARI visits to 25.5% (p=0.016). Post-intervention, there continued to be substantial variation in system-level prescribing, from 10.0% to 65.0% (p <0.0001). Five hospitals or health systems demonstrated decreased prescribing post-intervention, two of which were significant (Hospital A, p<0.0001*;* Hospital C, p=0.023). Prescribing for patients with "bronchitis, not specified" decreased from 62.0% to 43.4% (p=0.01). Though not statistically significant, prescribing for patients with acute sinusitis decreased from 77.6% to 68.0% (p=0.27).

The antibiotic prescribed shifted pre- and post- intervention. The proportion of macrolide and fluoroquinolone prescriptions decreased from 55.1% to 46.5% (p=0.05) and from 12.2% to 7.0% (p=0.038), respectively. Amoxicillin/clavulanic acid prescriptions increased from 18.8% to 27.0% (p=0.028*).*

Prescribing for patients age 40–59 decreased from 31.8% to 22.7% (p=0.007). Prescribing for Medicaid patients had a larger decline, from 30.3% to 14.7% (p<0.0001), than patients with other insurance types. Prescribing rates among Spanish-speaking patients decreased from 25.6% to 11.9% (p=0.002). When comparing cohorts based on number of comorbidities, the largest

decrease, from 28.8% to 18.1%, occurred for patients with a single comorbid condition (p=0.004).

Discussion

This collaborative sought to address a lack of outpatient AS initiatives[1] and prompt participants to institute evidence-based interventions and measure their effects. The post-intervention assessment revealed a significant decrease in aggregate ARI antibiotic prescribing, but with variation by hospital or health system.

While the overall decrease was modest, some organizations experienced larger improvements; two, however, reported increased prescribing. By self-assessment, this may have resulted from leadership and staffing disruptions, limited resources, and competing priorities.

We found the CDC Core Elements[2] to be an effective guide for outpatient AS implementation, but providing simple tools for assessment of activities is challenging in the setting of competing priorities. The role of clinical champions in promoting quality improvement is well documented[3]. Organizations with the most engaged and invested clinical and administrative leaders were successful in gaining staff buy-in, intervention implementation, and decreasing prescribing—supporting the core element, *Commitment.*

Many interventions addressed the element of *Education and Expertise* by targeting patients and providers; materials from the CDC and New York State Department of Health[4] were utilized to improve patients' knowledge of appropriate antibiotic use and antibiotic resistance.

Most clinics used communication skills training and some employed clinical decision support strategies included in the core element *Action for Policy and Practice.* Few were able to implement delayed prescribing, citing electronic prescribing as a barrier.

Data transparency is reflected in the core element of *Tracking and Reporting.* Successful implementation of provider-specific feedback varied. However, organizations able to provide meaningful provider-level data saw larger decreases in prescribing.

Due to simultaneous implementation of multiple interventions, we were unable to ascertain which interventions were most effective. Our observations suggest targeting both providers and patients worked best. Despite the review of over 900 visits, the number of visits abstracted per individual clinic were limited; thus findings may not be generalizable.

While prescribing decreases were observed for certain patient insurance types, languages, genders, and age groups, further analysis revealed that these results were likely confounded by one health system with larger proportions of these patient populations.

Likewise, the increase in amoxicillin/clavulanic acid was likely influenced by the prescribing behavior of another large health system. Nevertheless, we believe that the resources developed for this initiative[5], along with the CDC Core Elements, can be used to begin implementing and assessing outpatient AS interventions. The journey of our participants offers examples of how to assess AS needs, develop early activities, and attempt to measure their effects.

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Table 1. Pre- and Post- Intervention Antibiotic Prescribing Rates with T-Test Results

Characteristic	**Antibiotic Prescriptions**		
	Pre (%)	**Post (%)**	**T-Test (p-value)**
Total Sample	303 (30.6)	230 (25.5)	0.016
Hospital			
Hospital A	82 (28.7)	32 (10.7)	< 0.0001
Hospital B	26 (21.0)	3 (10.7)	0.101
Hospital C	46 (25.6)	28 (15.6)	0.023
Hospital D	10 (15.2)	6 (10.0)	0.369
Hospital E	52 (43.3)	80 (65.0)	0.001

Characteristic	Antibiotic Prescriptions		
	Pre (%)	Post (%)	T-Test (p-value)
Hospital F	74 (48.7)	58 (38.4)	0.098
Hospital G	13 (20.6)	23 (38.3)	0.032
Patient Age			
18-39 years	93 (28.4)	71 (26.0)	0.701
40-59 years	125 (31.8)	80 (22.7)	0.007
60 or older	85 (31.5)	79 (28.5)	0.31
Patient Language			
English	238 (32.3)	205 (28.6)	0.164
Spanish	40 (25.6)	16 (11.9)	0.002
Other	21 (29.4)	8 (19.5)	0.246
Unknown	4 (17.4)	1 (10.0)	0.538
Patient Sex			
Female	189 (29.2)	144 (22.9)	0.014
Male	114 (33.2)	86 (31.3)	0.603
Patient Insurance Status			
Commercial	145 (33.2)	117 (33.4)	0.882
Medicaid	91 (30.3)	46 (14.7)	< 0.0001
Medicare	35 (26.1)	47 (28.0)	0.809
Uninsured	5 (17.2)	3 (10.0)	0.427
Other/Unknown	27 (29.7)	17 (42.5)	0.171
Patient Diagnosis			

Characteristic	Antibiotic Prescriptions		
	Pre (%)	Post (%)	T-Test (p-value)
J00 Acute Nasopharyngitis	3 (4.9)	6 (8.1)	0.453
J01 Acute Sinusitis	45 (77.6)	34 (68.0)	0.27
J02 Acute Pharyngitis	29 (27.9)	44 (28.2)	0.73
J03 Acute Tonsillitis	10 (83.3)	3 (42.9)	0.111
J06.9 Acute URI	97 (18.9)	84 (17.3)	0.478
J20 Acute Bronchitis	38 (63.3)	22 (68.8)	0.605
J40 Bronchitis, not specified	67 (62.0)	36 (43.4)	0.01
N/A	14 (18.9)	1 (7.7)	0.188
Patient Comorbidities			
0	93 (30.4)	118 (28.8)	0.809
1	82 (28.8)	41 (18.1)	0.004
2	67 (29.4)	37 (23.6)	0.151
3+	61 (35.5)	34 (31.5)	0.461
Antibiotic Type			
Amoxicillin/Clavulanic Acid	57 (18.8)	62 (27.0)	0.028
Fluoroquinolones	37 (12.2)	16 (7.0)	0.038
Macrolides	167 (55.1)	107 (46.5)	0.05
Penicillin	28 (9.2)	27 (11.7)	0.356
Antibiotic Duration			
≤ 5 days	164 (54.1)	109 (47.4)	0.124
6-9 days	63 (20.8)	56 (24.4)	0.333

Characteristic		Antibiotic Prescriptions		
		Pre (%)	Post (%)	T-Test (p-value)
	≥ 10 days	66 (21.8)	56 (24.4)	0.488

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