2062. Improving Antibiotic Prescribing in the Ambulatory Care Setting—Stewardship through Influenza Vaccination, US Flu VE Network 2013–2014 Through 2017–2018

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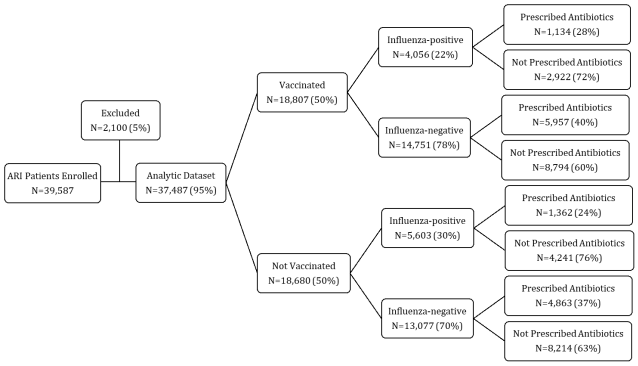
Session: 238. Antibiotic stewardship: Non-Inpatient Settings
Saturday, October 5, 2019: 12:15 PM

Background. Improving antibiotic use is a key strategy to combat antibiotic resistance and improve patient safety. Acute respiratory illness (ARI) is a common cause of outpatient visits and accounts for ~41% of antibiotics used in the United States. We sought to determine the proportion of antibiotic prescriptions (Rx) prescribed among outpatients with ARI that can be potentially averted through influenza vaccination.

Methods. From 2013–2014 through 2017–2018 influenza seasons, we enrolled patients aged ≥6 months with ARI in the US Influenza Vaccine Effectiveness (VE) Network of >50 outpatient clinics. Antibiotic Rx and diagnosis codes were collected from medical records. Study influenza test results were not available to treating clinicians at most sites, and clinical influenza testing was infrequently performed (a), prevalence of influenza among unvaccinated ARI patients (*b*), prevalence of antibiotic Rx among unvaccinated influenza-positive ARI patients (*c*) and prevalence of antibiotic Rx among ARI patients overall (*d*), we derived estimates of the proportion of ARI antibiotic Rx that can be averted by influenza vaccination [$(a \times b \times c)/d$].

Results. Among 37487 outpatients with ARI, 13,316 (36%) were prescribed an antibiotic and 9,689 (26%) tested positive for influenza. Of those positive, 2,496 (26%) were prescribed an antibiotic. Adjusted VE against influenza-associated ARI was 35% (95% confidence interval (CI), 32 to 39). Among unvaccinated patients with ARI, 30% were influenza-positive and 24% received antibiotics. Based on these estimates, we determined that influenza vaccination may prevent 10.6% of all ARI syndromes and may avert 1 in 14 or 7.3% of antibiotic Rx among ARI patients.

Conclusion. By preventing influenza-associated ARI syndromes, influenza vaccination may substantially reduce antibiotic prescribing. Increasing influenza vaccine coverage and improving protection may facilitate national goals to improve antibiotic use and reduce the global threat of antibiotic resistance.



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2063. Using Twitter Data and Machine Learning to Identify Outpatient Antibiotic Misuse: A Proof-of-Concept Study

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Session: 238. Antibiotic stewardship: Non-Inpatient Settings
Saturday, October 5, 2019: 12:15 PM

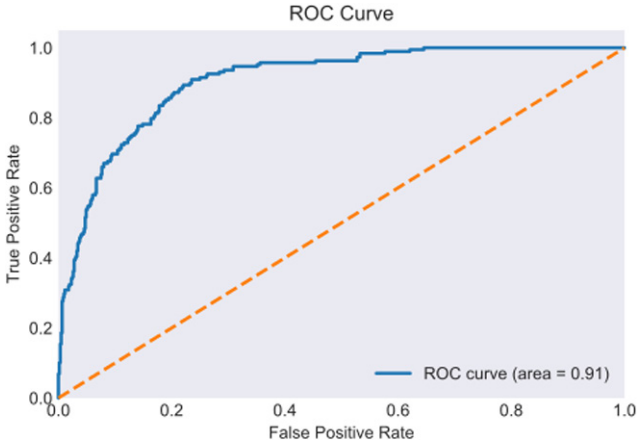
Background. Outpatient antibiotic misuse is common, yet it is difficult to identify and prevent. Novel methods are needed to better identify unnecessary antibiotic use in the outpatient setting.

Methods. The Twitter developer platform was accessed to identify Tweets describing outpatient antibiotic use in the United States between November 2018 and March 2019. Unique English-language Tweets reporting recent antibiotic use were aggregated, reviewed, and labeled as describing possible misuse or not describing misuse. Possible misuse was defined as antibiotic use for a diagnosis or symptoms for which antibiotics are not indicated based on national guidelines, or the use of antibiotics without evaluation by a healthcare provider (Figure 1). Tweets were randomly divided into training and testing sets consisting of 80% and 20% of the data, respectively. Training set Tweets were preprocessed via a natural language processing pipeline, converted into numerical vectors, and used to generate a logistic regression algorithm to predict misuse in the testing set. Analyses were performed in Python using the scikit-learn and nltk libraries.

Results. 4000 Tweets were included, of which 1028 were labeled as describing possible outpatient antibiotic misuse. The algorithm correctly identified Tweets describing possible antibiotic misuse in the testing set with specificity = 94%, sensitivity = 55%, PPV = 75%, NPV = 87%, and area under the ROC curve = 0.91 (Figure 2).

Conclusion. A machine learning algorithm using Twitter data identified episodes of self-reported antibiotic misuse with good test performance, as defined by the area under the ROC curve. Analysis of Twitter data captured some episodes of antibiotic misuses, such as the use of non-prescribed antibiotics, that are not easily identified by other methods. This approach could be used to generate novel insights into the causes and extent of antibiotic misuse in the United States, and to monitor antibiotic misuse in real time.

Diagnoses/situations defined as possible antibiotic misuse	Diagnoses/situations defined as not antibiotic misuse
The common cold	Pneumonia
Influenza infection	Post-influenza bacterial infection
Any other viral infection	Sinusitis
Upper respiratory tract infection	Otitis media
Asthma exacerbation	Pharyngitis
Bronchitis	Urinary tract infection
Cough without pneumonia	Skin and soft tissue infection
Use of leftover antibiotics without healthcare provider evaluation	Bacteremia
Use of another person's antibiotics	Any inpatient antibiotic administration
Any other use of non-prescribed antibiotics without healthcare provider evaluation	All other infections



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2064. Applying Human Factors and Ergonomics to Inform a Successful Fluoroquinolone Restriction Intervention: A Mixed Methods Pilot Study

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Session: 238. Antibiotic stewardship: Non-Inpatient Settings
Saturday, October 5, 2019: 12:15 PM

Background. Antimicrobial stewardship programs (ASPs) can reduce the incidence of hospital-onset *Clostridioides difficile* infection (HO-CDI) by limiting unnecessary exposure to high-risk antibiotics, including fluoroquinolones (FQ). However, restriction policies are challenging to implement and sustain. In a mixed methods study, we explored the barriers, facilitators and efficacy of an FQ restriction policy to reduce HO-CDIs among high-risk patients.

Methods. Our ASP instituted a pilot FQ restriction policy in our ICU and solid-organ transplant wards. We evaluated 24 months of pre- and post-intervention data, including: FQ and alternative agent use, length of stay (LOS), readmission rate, mortality and HO-CDI. We conducted 12 semi-structured interviews with front-line providers, applying the Systems Engineering Initiative for Patient Safety framework to examine perceptions of FQ use, prescribing indications, perceived relationships between FQ use and HO-CDI, and barriers imposed by FQ restrictions. Time-series analysis was performed to evaluate FQ and HO-CDI data.

Results. FQ use decreased from an average of 111.6 days of therapy (DOT) per 1,000 patient-days pre-intervention to 19.8 DOT/1,000 patient-days ($P < 0.0001$). Average readmission rate, LOS on pilot units, total antibiotic use, and use of cefepime decreased after FQ restriction. Conversely, use of ceftriaxone, aminoglycosides and piperacillin–tazobactam all increased. The average HO-CDI rate was significantly lower post-intervention, although time series analysis showed a post-intervention increase in the trend in infection rate compared with the pre-intervention trend. Qualitative analysis of interviews revealed β-lactam allergy and pending discharge were barriers to FQ restriction; a patient's history of CDI and pharmacist involvement in antimicrobial decision-making facilitated FQ restriction.

Conclusion. An FQ restriction policy significantly decreased FQ use without adversely affecting readmission rate, LOS or mortality. Knowledge of barriers and facilitators to FQ use optimization among front-line staff can inform future successful ASP interventions. Further investigation into the effect of FQ restriction on HO-CDI is needed.

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2065. Reducing Inappropriate Antibiotic Prescriptions in the Primary Care Setting

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Session: 238. Antibiotic stewardship: Non-Inpatient Settings
Saturday, October 5, 2019: 12:15 PM

Background. In 2015, the CDC established the National Action Plan for Combating Antibiotic-Resistant Bacteria, with the goal of reducing inappropriate outpatient antibiotic use by 50% by 2020. Upper respiratory infections, (URIs) account for one of the top three diagnoses prompting outpatient visits, and despite viral pathogens being the etiology of most URIs, many patients are treated with antibiotics. This study aimed to reduce inappropriate antibiotics prescribing for URIs at Cooper Primary Care offices.

Methods. Using the electronic medical record, we analyzed office visits (OVs) of 63 primary care providers during the influenza season (November 1, 2017–February 28, 2018) that were associated with a URI diagnosis code and resulted in an antibiotic prescription. The intervention was a personalized digital URI score card (Figure 1) emailed to each primary care physician. It included (1) Cooper Hospitals' Primary Care Department Average Rate of Antibiotic Prescribing for URI OVs and (2) each physician's average rate of antibiotic prescribing for URI office visits. Data were collected post-intervention (November 1, 2018–February 28, 2019) to evaluate for changes in antibiotic prescribing patterns.

Results. Using Fischer's Exact test we analyzed the pre vs. post-intervention rate of antibiotic prescribing for URI OVs. There were 7,295 total pre-intervention office visits. Of these, 41.03% resulted in an antibiotic prescription. There were 6,642 total post-intervention office visits. Of these, 35.85% resulted in an antibiotic prescription. There was a 5.18% overall decrease in antibiotics prescribed for all URI office visits ($P < 0.001$) (see Figure 2).

Conclusion. Increasing providers' awareness of their own prescribing patterns compared with their department's prescribing patterns utilizing a single report card decreased the rate of antibiotics prescribed for URIs by 5.18% for all URI-related office visits. Specifically, there was 10.19% decrease in antibiotics prescribed for bronchitis, which is by definition, of viral etiology. This is significant given the potential side-effects of unnecessary antibiotics, and the emergence of antibiotic resistance. Limitations include a lack of certainty in "true" inappropriate prescriptions and diagnosis coding.

Physician Rate of URI Antibiotic Prescribing Score Card: 2017-2018

Physician: Internal Medicine – Smith, John				
	Cooper Physician's Average Rate of Antibiotic Prescribing for URI Ovs '17-'18	Your Average Rate of Antibiotic Prescribing for URI Ovs	Total # of OV associated with URIs	Total # of OV associated with URI with ABX RX
Smith, John	41.03%	25.00%	100	25%

Pre vs. Post-Intervention: Percent of Office Visits Resulting in an Antibiotic

	Pre-Intervention 2017-2018	Post-Intervention 2018-2019	% Change	P-value
All URI-Associated Diagnosis Codes	41.03%	35.85%	-5.18%	< 0.001
Bronchitis	40.84%	30.65%	-10.19%	< 0.001
Influenza	14.45%	8.98%	-5.47%	0.0414
Pharyngitis	40.30%	33.62%	-6.68%	0.006
Sinusitis	53.49%	48.32%	-5.17%	0.002

**excluded bronchiolitis,sore throat and tonsills/aden given P values*

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2066. Development and Implementation of Prescribing Algorithms for Antibiotics on Discharge from the Emergency Department

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Session: 238. Antibiotic stewardship: Non-Inpatient Settings
Saturday, October 5, 2019: 12:15 PM

Background. In the emergency department (ED), rapid decision-making and frequent distractions are often challenging to implementing effective antimicrobial stewardship. The purpose of this project is to improve guideline adherence and promote optimal use of outpatient antibiotic therapy for community-acquired infections.

Methods. Prescribing algorithms were developed to integrate clinical practice guideline recommendations with emergency department-specific antibiogram data. Algorithms for treating community-acquired pneumonia (CAP), skin and soft-tissue infections (SSTI), and urinary tract infections (UTI) were made available throughout the ED. Outcomes were evaluated through a chart review of patients prescribed empiric outpatient antibiotics for CAP, SSTI, or UTI by ED providers. Patients were excluded if they were <18 years old, pregnant, or taking antibiotics prior to arrival. The primary outcome was rate of adherence to clinical practice guidelines, defined as the selection of an appropriate antibiotic agent, dose, and duration of therapy for each patient discharged. Secondary outcomes included the rate of fluoroquinolone use, as well as all-cause 30-day returns to the ED or urgent care.

Results. When compared with patients discharged from the ED prior to algorithm implementation ($N = 325$), the post-implementation group ($N = 172$) received more antibiotic prescriptions that were completely guideline adherent (57.0% vs. 11.7%, $P < 0.01$). Post-implementation discharge orders demonstrated improvement in the selection of an appropriate agent (86.6% vs. 45.5%, $P < 0.01$), dose (89.0% vs. 77.2%, $P < 0.01$), and duration of therapy (63.4% vs. 39.1%, $P < 0.01$). Additionally, fluoroquinolone prescribing rates in this population were reduced (2.9% vs. 12.3%, $P < 0.01$). In the post-implementation patients who presented at least 30 days prior to analysis ($N = 124$), a reduction in all-cause 30-day returns to the ED or urgent care was observed (12.9% vs. 21.5%, $P < 0.05$).

Conclusion. Implementation of antibiotic prescribing algorithms improved guideline adherence in the outpatient treatment of CAP, SSTI, and UTI. By developing prescribing algorithms, pharmacists may reduce the unnecessary use of broad-spectrum antibiotics and prevent patient returns to the ED.

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2067. Improving Outpatient Antimicrobial Prescribing for Respiratory Tract Infections

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