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Original Article

Antibiotic prescribing for acute respiratory infections in New York City: A model for collaboration

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Abstract

Objective: To assess the status of antibiotic prescribing in the ambulatory setting for adult patients with acute respiratory infections (ARIs) and to identify opportunities and barriers for outpatient antibiotic stewardship programs (ASPs).
Design: Mixed methods including point prevalence using chart reviews, surveys, and collaborative learning.
Setting: Hospital-owned clinics in the New York City area.
Participants/Patients: In total, 31 hospital-owned clinics from 9 hospitals and health systems participated in the study to assess ARI prescribing practices for patients >18 years old.
Interventions: Each clinic performed a survey of current stewardship practices, retrospective chart reviews of prescribing in 30 randomly selected ARI patients from October 2015 to March 2016, and surveys of provider characteristics and knowledge. Clinics participated in collaborative learning with peers and experts in antibiotic stewardship and collected data from June 2016 to August 2016. Sites received data reports by individual clinic, aggregated by hospital, and were compared among participating clinics.
Results: Few sites had outpatient stewardship activities. The retrospective review of 1,004 ARI patients revealed that 37.3% of ARI patients received antibiotics, with significant variation in prescribing practices among sites (17.4%–71.0%; $P < .001$). Macrolides were the most commonly prescribed antibiotics. Most of the 302 respondents recognized the need for tools to assist in prescribing.
Conclusions: This collaborative study establishes a baseline assessment of the status of outpatient ASPs in New York City. It provides hospitals, health systems, and individual clinics with specific data to inform their development of stewardship interventions targeting ARIs.

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Antibiotic resistance is a major threat to patient safety, leading to an estimated 2 million infections and 23,000 deaths per year in the United States.[1] Antibiotic stewardship programs (ASPs) coordinate interventions directed toward curbing inappropriate antibiotic use and improving overall antibiotic prescribing practices.[2,3] Despite advances in antibiotic stewardship programs in the acute-care setting, it is widely acknowledged that most organizations do not have formal outpatient ASPs.[2] This is true even in institutions with robust inpatient ASPs. Annually, 154 million ambulatory visits result in an antibiotic prescription, and ~30% of antibiotic use in outpatient settings is inappropriate.[4]

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In terms of targeted stewardship efforts in the ambulatory arena, the need for improved prescribing for acute respiratory infections (ARIs) is a fruitful starting point.[5–7] An estimated 44% of all outpatient antibiotic prescriptions are written for ARIs (eg, sinusitis, otitis media, pharyngitis, and bronchitis),[4] many of which are caused by viruses and often resolve without antibiotics. Outpatient prescribing practices vary based on geography, patient population, insurance, and provider specialty.[8,9] Although New York City is the most densely populated metropolitan area in the United States and one with substantial antibiotic resistance, to our knowledge, a widespread assessment of ambulatory prescribing practices there has not been published.

In 2016, United Hospital Fund, an independent nonprofit organization whose mission is to develop a more effective health care system for every New Yorker, issued a request for proposals to engage hospital-owned outpatient practices in a grant-funded initiative to better elucidate the current state of outpatient antibiotic stewardship and to describe factors influencing antibiotic prescribing practices, with a focus on adult patients with ARIs. Stage 1 of this initiative sought to assess the status of outpatient ASPs in New York City, focusing on ARI antibiotic prescribing patterns; stage 2 is using the information from stage 1 to assist and direct participating organizations implementing site-specific plans to improve outpatient prescribing practices. This report describes the findings of stage 1.

Methods

This mixed-methods study was designed to assess current practices around outpatient prescribing of antibiotics. The Biomedical Research Alliance of New York Institutional Review Board reviewed the study protocol and deemed it exempt from review. Individual health systems received local institutional review board approval if appropriate. The collaborative activities occurred from May 2016 through January 2017.

Surveys and data collection tools were developed in consultation with an advisory group including members from UHF,[10] the New York State Department of Health, the Greater New York Hospital Association, the Centers for Disease Control and Prevention,[11] and inpatient and outpatient clinicians from most of the participating hospitals and health systems. The tools and a description of the tools are included as supplemental materials. These include an assessment of current outpatient stewardship practices, a chart abstraction tool, and a survey of providers.

The participating clinics piloted and tested the tools prior to data abstraction. In addition, throughout the initiative, a collaborative approach was used: subject matter advisors educated and provided guidance through a series of in-person meetings and webinars. The UHF staff provided technical assistance and individual feedback to clinics to improve consistency and accuracy of abstraction.

Data were collected at each of the participating clinics and were entered into a web-based survey tool (SurveyMonkey, San Mateo, CA). Each clinic was asked to use codes from the *International Classification of Diseases, Tenth Revision* to select possible charts for review. If >30 charts met these criteria, each site chose charts randomly. The method of randomization was chosen by each site's principal investigator. One site elected to use the ordering of diagnostic testing (eg, respiratory viral panel and/or sputum culture) to select potential charts rather than primary or secondary diagnosis codes. Patient-level data from chart abstraction were deidentified prior to submission. Data from the assessment of the current practices, survey of prescribers, and chart review were aggregated across the clinics and by hospital or health system. Sites received results comparing clinic-specific data to the aggregate for all sites.

Chart abstraction data were analyzed in aggregate and are shown in Table 1. Descriptive statistical analysis was performed using SAS version 9.4 software (SAS Institute, Cary, NC). Univariate associations were compared using the χ^2 or the Mantel-Haenszel χ^2 when applicable. Those factors achieving a P value of $< .10$ were included in a stepwise multivariable logistic regression model to identify potential independent predictors of antibiotic prescribing.

Results

Participant demographics and current state of outpatient stewardship

In total, 31 clinics representing 9 hospitals or health systems participated. They represented diverse patient and provider populations and were located throughout the New York City region: Manhattan (n = 7), Queens (n = 9), Bronx (n = 4), Brooklyn (n = 8), Long Island (n = 2), and Westchester (n = 1) (Tables 1 and 2). The payer mix varied by site; the median percentage covered by Medicare was 22%, by Medicaid 29%, by commercial payers 24%, and by other/unknown 0.5%; 5% were uninsured.

Overall, 68% of practices responded that there were ASPs in their health system. Although 25% of practices reported having institutional guidelines for antibiotic use and selection for ARIs as part of their program, only 11% had any ambulatory-specific guidance. A high proportion of providers, close to 40%, stated that there was an identified leader for outpatient ASP. Although all the practices stated they had an electronic health record system, only 7% reported embedded computer decision support for antibiotic use in that system.

Antibiotic prescribing practices

Across the clinics, 1,004 charts were reviewed; all clinics provided chart reviews. Moreover, 37% of patients diagnosed with an ARI received a prescription for antibiotics. Statistically significant variation was observed in the rate of prescribing based on the hospital or health system in which the patient sought treatment, with prescribing rates ranging from 17.4% to 71.0% ($P < .001$) (Fig. 1).

Among patients with a diagnosis of ARI, the diagnoses associated with the highest antibiotic prescribing rates were sinusitis (83.3%) and bronchitis (62.9% bronchitis-unspecified, 66.7% acute bronchitis). The rate of antibiotic prescribing varied based on patient-level characteristics including primary spoken language, insurance type, and number of comorbid conditions. Patients who reported their preferred language as English were more likely to be prescribed an antibiotic than non-English speaking patients ($P < .001$). In addition, patients with commercial insurance were more likely to receive a prescription than patients with Medicare, Medicaid, or no insurance ($P = .016$). The presence of 3 or more comorbidities also increased the likelihood that a patient would be prescribed an antibiotic ($P = .003$). We detected no difference in prescribing rates based on patient age or sex. In multivariable analysis, having commercial insurance and speaking English were both independent predictors of receiving a prescription.

In this sample, attending physicians prescribed antibiotics more often than other prescribing providers. While attending physicians comprised 35.6% of providers across all sites, the charts reviewed in the sample indicated that 74.1% of the antibiotics were prescribed by attending physicians when they were not overseeing a resident. The remaining prescriptions were written by nurse practitioners, physician assistants, and resident physicians in training.

Furthermore, 58% of patients receiving an antibiotic prescription were prescribed a macrolide, and 17% were prescribed amoxicillin or clavulanic acid. Fewer patients were prescribed fluoroquinolones (10.4%) or other antibiotics. Of those patients receiving an antibiotic prescription, 56.7% were prescribed the antibiotic for <5 days, 27.0% were prescribed the antibiotic for 6–9 days, and 12.3% were prescribed the antibiotic for ≥10 days.

In addition, 45% of patients received education on their diagnosis and/or treatment, and follow-up was recommended in nearly 62% of cases. However, fewer than 44% of patient records included documentation of any follow-up.

Survey of provider knowledge, attitude, and perceptions

The findings from the provider survey (Table 2) are based on 302 surveys received, representing all 31 clinics. The total number of

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Table 1. Demographic and Clinical Characteristics for Antibiotic Prescribing for Acute Respiratory Infections in All Participating Outpatient Practices[a]

Characteristic	Antibiotic Prescription (n = 1,004)		Univariable *P* Value	Multivariable Odds Ratio (95% CI)	Multivariable *P* Value
	Yes, No. (%)	No, No. (%)			
Total ARI Patients	374 (37.3)	618 (61.6)			
Patient age			.11		
18–39 y	106 (33.0)	213 (66.4)			
40–59 y	164 (40.6)	238 (58.9)			
60 or older	104 (37.3)	167 (59.9)			
Patient language			< .0001		
English	300 (41.9)	408 (57.0)		1.58 (1.07–2.36)	< .0001
Spanish	31 (26.5)	84 (71.8)			
Other	22 (32.6)	45 (66.2)			
Unknown	21 (20.4)	81 (78.6)		0.38 (0.19–0.78)	.007
Patient sex			.50		
Female	232 (36.6)	395 (62.3)			
Male	141 (38.2)	223 (60.4)			
Payor mix			.016		
Medicare	54 (37.2)	91 (61.8)			
Medicaid	85 (35.7)	153 (64.3)			
Commercial	203 (41.3)	289 (58.7)		1.53 (1.12–2.07)	.007
Uninsured	6 (19.4)	25 (80.7)			
Unknown/Other	26 (31.3)	57 (68.7)			
Primary or secondary ARI diagnosis					
J06.9 Acute URI	153 (27.9)	389 (71.0)	< .0001	0.51 (0.32–0.81)	.006
J02 Acute pharyngitis	41 (37.3)	67 (60.9)	.95		
J01 Acute sinusitis	70 (83.3)	14 (16.7)	< .0001	7.64 (3.70–15.78)	< .0001
J40 Bronchitis, unspecified	44 (62.9)	26 (37.1)	< .0001	2.12 (1.09–4.13)	< .0001
J00 Acute nasopharyngitis	2 (4.4)	43 (95.6)	< .0001	0.07 (0.02–0.31)	.001
J03 Acute tonsillitis	10 (76.9)	2 (23.2)	.003	5.06 (1.28–20.10)	.0001
J20 Acute bronchitis	40 (66.7)	20 (33.3)	< .0001	3.05 (1.51–6.15)	< .0001
Other[b]	14 (20.0)	56.0 (80.0)	.002	0.22 (0.10–0.46)	.022
No. of patient comorbidities			.003	1.26 (1.10–1.45)	.011
0	90 (35.6)	162 (64.0)			
1	96 (33.0)	192 (66.0)			
2	84 (35.4)	153 (64.6)			
≥ 3	104 (48.4)	111 (51.6)			

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Table 1. (*Continued*)

Characteristic	Antibiotic Prescription (n = 1,004) Yes, No. (%)	No, No. (%)	Univariable *P* Value	Multivariable Odds Ratio (95% CI)	Multivariable *P* Value
Antibiotic prescribed[c]					
Macrolide	219 (58.2)				
Amoxicillin/Clavulanic acid	64 (17.0)				
Fluoroquinolones	39 (10.4)				
Other[d]	54 (14.4)				
Duration of antibiotic prescribed					
≤ 5 d	212 (56.7)				
6–9 d	101 (27.0)				
≥ 10 d	46 (12.3)				

Note. ARI, acute respiratory infection; URI, upper respiratory infection.
[a]n = 1,004 patient encounters from 31 clinics.
[b]Case selection was based on ordering of diagnostic testing (eg, respiratory viral panel and/or sputum culture) and not by a primary diagnosis code.
[c]In several cases, an individual patient was prescribed >1 type of antibiotic. The types of antibiotic prescribed should not be considered mutually exclusive categories.
[d]Penicillin, cephalosporins, clindamycin, and other.

providers (eg, attending physicians, residents, nurse practitioners, and physician assistants) at all sites was 1,029; the response rate was 29.3%. Providers responding to the survey consisted largely of attending physicians (42.1%) and residents (50.7%).

In terms of provider knowledge, most respondents acknowledged the difference between broad- and narrow-spectrum antibiotics, and most considered spectrum of activity in prescribing. In response to a clinical vignette in which current guidelines would not support antibiotic prescribing, 24% of respondents indicated they would prescribe an antibiotic.

When asked to select the top 3 factors in the decision to prescribe antibiotics, severity of illness, clinical practice guidelines, and patient comorbidities were the most frequently selected. Moreover, 35% percent of providers identified "concern for antibiotic resistance" as one of the top 3 considerations, and 7% of providers cited patient request or satisfaction as a concern.

When asked to choose methods or tools that would likely improve decision making and antibiotic prescribing for ARIs in their practice, providers were most interested in reference guides and clinical guidelines, educational materials for patients and families, and decision support tools.

Discussion

We sought to better define the current outpatient antibiotic prescribing landscape in the greater NYC area by assessing provider perceptions and prescribing patterns for adult ARIs among diverse clinics associated with 9 hospitals and healthcare systems. We found very little activity directed specifically toward improving outpatient antibiotic use, and none of the clinics had outpatient-specific strategies in place to improve antibiotic prescribing.

Antibiotic prescribing for the treatment of bronchitis and sinusitis was high, with nearly 67% of patients with acute bronchitis and >80% of patients with acute sinusitis prescribed an antibiotic, despite guidelines and endorsed metrics against routine use for these indications.[9,12,13]

Interestingly, as in previous studies,[14] provider knowledge or experience did not appear to influence prescribing; most antibiotic prescriptions were authored by attending physicians. One motivation for antibiotic prescribing may be these clinicians' long-standing relationships with patients and perception of patient pressure or satisfaction.[11,15] However, the provider survey did not identify this as a major contributor to antibiotic prescribing.

Previous studies have suggested that patients of certain ethnicities are more likely to desire antibiotics for ARIs.[16,17] In our sample, patients who were English-speaking or commercially insured were more likely to be prescribed an antibiotic; further investigation into potential confounding by clinic or provider is needed.

Even more disconcerting was the use of broad-spectrum agents to treat ARIs and the variability in duration of antibiotic prescribed. Macrolides are not the first-line agent for any of the diagnoses included in our sample, but they were the most commonly prescribed antibiotic. Despite public health concerns, provider concern for antibiotic resistance was not reported as a major factor impacting prescribing. It remains unclear whether the pervasive reliance on macrolides results from gaps in knowledge of antibiotic spectrum and the common causes of ARIs or the convenience of macrolides.

The New York State Department of Health and the Centers for Disease Control and Prevention have identified a need for targeted interventions that can improve public knowledge of appropriate antibiotic use.[18,19] Our review showed that only 45.3% of patients diagnosed with an ARI received directed patient education. Of the 61.8% where follow-up was recommended, only 43.5% received follow-up. While our assessment did not address the reasons for this lack of education and follow-up, the discrepancy raises concerns about patient education and continuity of care that may warrant further attention.

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Table 2. Provider Characteristics and Antibiotic and Prescribing Knowledge

Provider Characteristic	All Outpatient Practices, (n = 302)%
Provider mix	
Attending physician	42.1
Resident physician	50.7
Nurse practitioner	2.3
Physician assistant	3.0
Other	2.0
Direct patient care	
< 50% of time	32.5
≥ 50% of time	67.5
Years practicing	
< 5 y	55.6
5–10 y	13.3
11–20 y	12.6
21–30 y	11.6
≥ 31 y	6.0
Clinical vignette, prescribed antibiotic[a]	23.8
Factors that influence prescribing[b]	
Illness severity	91.4
Clinical practice guidelines	83.4
Patient medical history and/or comorbidities	74.5
Concern for antibiotic resistance	35.4
Patient request/satisfaction	6.6
Patient compliance	5.6
Time pressure	2.0
Sample access	1.3
Methods to improve prescribing, of interest to providers	
Access to a quick reference guide for each diagnosis, including indications	69.2
Improved use of clinical practice guidelines for selection, dose and duration	68.2
Access to better educational materials for patients and families	65.9
Improved methods for using EHRs and clinical decision support	60.9
Improved access to antibiotic resistance data for local areas	53.6
Access to CDC "Get Smart" materials	44.7
Data showing antibiotic prescribing practices among providers	42.4
Communication skills training to address benefits and harm of antibiotics	42.1
Delayed antibiotic prescribing, ie, "wait and watch" prescribing	33.1
Use of shared decision-making tool in your practice	30.5

Note. EHR, electronic health record; CDC, Centers for Disease Control and Prevention.
[a]The vignette in the survey of antibiotic prescribers described a healthy, 36-year-old patient with fever and nasal discharge for 5 days with a temperature <37.7°C (<100°F), erythematous and enlarged nasal turbinates, cloudy discharge on the right, and tenderness over the right maxillary sinus.
[b]Results from the "often impacts decision to prescribe" category was included in the aggregate response for all outpatient practices. Providers were allowed to select >1 response.

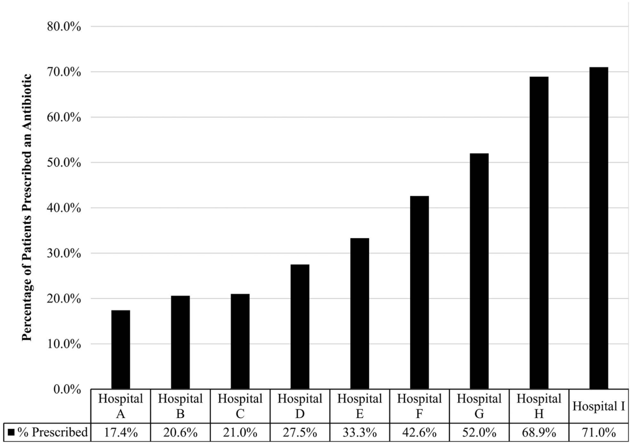

Fig. 1. Percent of patient visits prescribed an antibiotic for an acute respiratory infection. Reflects the percentage of patients with adult acute respiratory infection that received an antibiotic from participating hospital or health system, which varied significantly (17·4%–71·0%; $P < .001$).

Despite a low response rate, results from the provider survey do provide some direction for participating institutions to consider next steps. In general, providers recognized the need to improve antibiotic prescribing practices and were open to utilizing tools that will improve their practice. They expressed interest in a quick reference guide for each major diagnosis including antibiotic indication; improved use of established clinical practice guidelines for selection, dose, and duration; and clinical decision support.

Limitations of the study

Despite the overall sample size, the individual clinics reviewed a median of 30 charts (range, 28–124). There were site-specific variations in methodologies employed to randomly select charts for abstraction, which may have led to sampling bias. In addition, we hypothesize that coding bias may also have affected the findings; it is possible that physicians prescribing antibiotics may have utilized diagnosis codes for which antibiotic prescribing is not clearly contraindicated (eg, sinusitis). In addition, there were some limitations in identifying specific ARI codes where the ARI may not have been recorded as the primary diagnosis. The overall provider survey response rate was low. The discrepancy between the findings of the sampled charts and the provider survey may reflect social biases (ie, the perceived desirability of certain answers). The provider surveys may have been skewed by particular health systems with higher response rates, which may limit generalizability to the broader population. Our study was observational and largely descriptive. Although we have described the variations in prescribing practices observed in our data, we were not able to fully explore many of the underlying factors that may contribute to these differences.

In conclusion, despite evidence-based recommendations, outpatient antibiotic prescribing for ARIs continues to be high, even in hospitals and health systems with established inpatient ASPs. Using local data on antibiotic prescribing, we have been able to increase provider and leadership awareness of the importance of outpatient antibiotic stewardship for improving local ambulatory prescribing practices We remain far from resolving the problem of inappropriate antibiotic use for ARIs; however, this initiative has provided (1) a useful assessment of current outpatient antibiotic prescribing in NYC outpatient clinics, (2) a framework for site-specific and responsive actions, and (3) tools to assess the impact of improvement efforts after implementation of those actions.

Supplementary material. To view supplementary material for this article, please visit https://doi.org/10.1017/ice.2018.227

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Conflicts of interest. All authors report no conflicts of interest relevant to this article.

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