

Antibiotic Prescribing in New York State Medicare Part B Beneficiaries Diagnosed With Cystitis Between 2016 and 2017

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Background. Statewide tracking and reporting is an outpatient antimicrobial stewardship tool that may be useful for many stakeholders. However, to date, these evaluations have been limited. This study aimed to track and report outpatient antibiotic prescribing in Medicare Part B enrollees diagnosed with cystitis in the outpatient setting.

Methods. This was a retrospective, cohort study of Medicare Part B enrollees in New York State. Inclusion criteria include outpatient visit in 2016 or 2017, cystitis diagnosis code, and oral antibiotic prescription ≤ 3 days after diagnosis of cystitis. Antibiotics were categorized as first-line, oral β -lactams, fluoroquinolones, or other per Infectious Diseases Society of America acute uncomplicated cystitis guidelines. Data were stratified by sex. Annual prescriptions proportions were compared using χ^2 test or Fisher's exact test as appropriate.

Results. A total of 50 658 prescriptions were included. For females' prescriptions, first line increased (41.5% vs 43.8%, $P < .0001$), oral β -lactams increased (17.8% vs 20.5%, $P < .0001$), fluoroquinolones decreased (34.1% vs 29.1%, $P < .0001$), and other increased (6.5% vs 6.6%, $P = .76$) in 2017. For males' prescriptions, first line increased (25.2% vs 26.7%, $P = .11$), oral β -lactams increased (23.1% vs 26.2%, $P = .0003$), fluoroquinolones decreased (44.0% vs 39.3%, $P < .0001$), and other remained unchanged (7.8% vs 7.8%, $P = .92$) in 2017.

Conclusions. Guideline concordant therapy prescribing for cystitis increased among Medicare Part B beneficiaries in New York State between 2016 and 2017. However, there was still a high prevalence of fluoroquinolone prescribing. These data highlight the need for additional outpatient antimicrobial stewardship efforts in New York State.

Keywords. antibiotic prescribing; New York State; outpatient antimicrobial stewardship; urinary tract infection.

Outpatient antibiotic stewardship (OAS) is an area of growing interest to many clinicians and regulatory bodies [1–3]. To support OAS, the Centers for Disease Control and Prevention (CDC) proposed 4 core elements of OAS [1]. Currently, outpatient core elements are not tied to regulations, accreditation, or payor status. However, if outpatient facilities follow inpatient antimicrobial stewardship trends, these elements may eventually be tied to regulation, accreditation, and payment.

Tracking and reporting is one of the CDC's core elements of OAS. The CDC defines this element as "Monitor[ing] antibiotic prescribing practices and offer[ing] regular feedback

to clinicians, or hav[ing] clinicians assess their own antibiotic prescribing practices themselves." [1] Successful tracking and reporting is essential to assessing progress and improving antibiotic prescribing practices. To date, there have been limited studies evaluating large-scale outpatient antimicrobial tracking and reporting [2, 3], especially for urinary tract infections (UTIs) in older adults.

Urinary tract infections in older adults are particularly important for several reasons. These infections are highly prevalent and therefore can be a major driver of antibiotic use [4, 5]. Older adults are also at increased risk for inappropriate antimicrobial prescribing for asymptomatic bacteriuria compared with younger patients [6]. Older age group may also be a risk factor for increased susceptibility to fluoroquinolone-associated disability [7]. Fluoroquinolone-associated disability has recently been the focus of much research and has contributed to the US Food and Drug Administration's (FDA) labeling change that warns against the use of fluoroquinolones in acute uncomplicated cystitis [8]. Finally, the prevalence of infections due to antimicrobial-resistant organisms increases with age [9, 10]. From these data, it is clear that older adults with UTI are an important population for OAS. However, to date, there are limited

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large-scale OAS evaluations of UTI in the elderly. Hence, this study aimed to address this gap by evaluating statewide trends in antimicrobial prescribing for older adults diagnosed with cystitis in the outpatient setting in New York State (NYS).

METHODS

Inclusion/Exclusion Criteria

Medicare fee for service beneficiaries were included if they (1) presented to an outpatient setting from January 1, 2016 to December 31, 2017, (2) had a diagnosis code of cystitis in Part B claims, and (3) had an oral antibiotic prescription ≤ 3 days after diagnosis of cystitis in Part D claims. Optum360, 2016 *International Classification of Diseases, Tenth Revision* (ICD-10) codes N30.90, N30.91, N30.00, N30.20, N30.21, or N30.01 in any of the primary or secondary diagnoses fields were used to identify cases (Appendix A). Only unique antibiotic prescription claims with dates within 3 days after a visit with a cystitis diagnosis were included. Medicare fee-for-service beneficiaries who were eligible for Medicare End Stage Renal Disease program were excluded.

Study Definitions

The NYS Department of Health, Population Health Improvement Program Regional Map (Appendix B) was used to define regions. The New York City Region was further stratified into its counties (New York, Kings [Brooklyn], Queens, Richmond [Staten Island], and Bronx) due to large individual population sizes.

Antibiotic categories were defined according to the Infectious Diseases Society of America (IDSA) guidelines for acute uncomplicated cystitis for women [11]. Nitrofurantoin, trimethoprim-sulfamethoxazole, and fosfomycin were categorized as first-line agents. Amoxicillin/clavulanate, cefdinir, cefaclor, cefpodoxime, and cephalexin were categorized as oral β -lactams. Ciprofloxacin, gemifloxacin, levofloxacin, moxifloxacin, and ofloxacin were categorized as fluoroquinolones. Antibiotics not listed as first line, oral β -lactams, or fluoroquinolones were all categorized as other. These categories were used (regardless of sex) for ease of recognition and may not necessarily reflect the authors' clinical preferences for agents used to treat cystitis in older adults.

Data Analysis

Data were summarized using counts and proportions to describe the year-specific overall prescribing rate for each antibiotic category within NYS. Data were further stratified by sex and geographic region. The χ^2 tests were used to assess changes in antibiotic prescribing patterns, adherence to the IDSA guidelines, and quinolone prescribing rates in NYS from 2016 to 2017 (SAS version 9.3). Heat maps were used to describe the relative change between-years for antimicrobial prescribing within specific regions. To derive a color index for each map, both years

were used for a specific sex and antibiotic category combination. Risk of receiving an antibiotic within a category in a specific year was defined as total number of antibiotics within the antibiotic category for the year divided by the total number of antibiotics prescribed for that year (eg, total number of fluoroquinolone prescriptions in 2016/total number of antibiotics in 2016). Relative risk and 95% confidence intervals of antibiotic prescribing in 2017 were defined by the risk of receiving an antibiotic category in 2017 divided by the risk of receiving the same antibiotic category in 2016. $P < .05$ were considered statistically significant.

RESULTS

Baseline Characteristics and Overall Prescribing Patterns

There were 23 981 and 26 677 prescriptions written for Medicare beneficiaries with discharge diagnoses for cystitis across NYS in 2016 and 2017, respectively. A majority of beneficiaries included in the study (81.2%) were female. Baseline demographics are presented in Table 1 and Supplemental Table 1.

The overall prescribing patterns changed significantly in NYS between 2016 and 2017 for both men and women ($P < .001$, Table 2). In general, guideline concordant (ie, first-line or oral β -lactam) treatment increased, fluoroquinolone use decreased, and other treatment remained stable. Female patients were more likely to receive guideline concordant therapy in 2017 versus 2016 (64.3% vs 59.3%, $P < .001$). This finding was accompanied by a concurrent decrease in fluoroquinolone antibiotic prescribing (34.1% vs 29.1%, $P < .001$) and a relatively small change for other antibiotic prescribing (6.6% vs 6.5%, $P = .76$). Male patients also had a higher prevalence of guideline concordant therapy in 2017 versus 2016 (52.9% vs 48.3%, $P < .001$), a decrease in prevalence of fluoroquinolone prescribing (39.3% vs 44.0%, $P < .001$), and no change in the other prescribing rate (7.8% vs 7.8%, $P = .92$).

Geographical Antimicrobial Prescribing Patterns in Females

A total of 14 755 and 16 187 female patients received prescriptions for cystitis in 2016 and 2017, respectively. For these patients, the type of antibiotics (prescribing prevalence range by geographic areas) were first line (32.6%–55.5%), oral β -lactam (9.8%–26.9%), fluoroquinolone (26.2%–40.2%), and other (4.4%–10.0%) in 2016 and first line (34.0%–53.4%), oral β -lactam (13.5%–29.8%), fluoroquinolone (20.7%–37.8%), and other (4.9%–11.6%) in 2017. Between 2016 and 2017, 8 (53%) geographic areas had significant changes in antibiotic prescribing for females (Supplemental Table 2).

Figure 1 depicts the between-year changes for antimicrobial prescribing in the states' geographical areas. The areas that had the highest prevalence of first-line antibiotic prescribing were North Country Region (55.5%), New York County (48.5%), and Mohawk Valley Region (45.8%) in 2016 and North Country

Table 1. Baseline Characteristics^a

Characteristics	Females		Males	
	2016 (n = 14 755)	2017 (n = 16 187)	2016 (n = 3657)	2017 (n = 3974)
Area				
Bronx	324 (2.2)	359 (2.2)	91 (2.5)	87 (2.2)
Capital District	608 (4.1)	593 (3.7)	120 (3.3)	123 (3.1)
Central New York	838 (5.7)	893 (5.5)	204 (5.6)	210 (5.3)
Finger Lakes	846 (5.7)	947 (5.9)	208 (5.7)	263 (6.6)
Kings	1091 (7.4)	1327 (8.2)	352 (9.6)	376 (9.5)
Long Island	3911 (26.5)	4279 (26.4)	890 (24.3)	956 (24.1)
Mid-Hudson	2693 (18.3)	3169 (19.6)	656 (17.9)	738 (18.6)
Mohawk Valley	274 (1.9)	316 (2.0)	69 (1.9)	73 (1.8)
New York	974 (6.6)	1040 (6.4)	246 (6.7)	293 (7.4)
North Country	289 (2.0)	257 (1.6)	87 (2.4)	67 (1.7)
Queens	1046 (7.1)	1053 (6.5)	260 (7.1)	277 (7.0)
Richmond	214 (1.5)	273 (1.7)	58 (1.6)	86 (2.2)
Southern Tier	617 (4.2)	639 (4.0)	149 (4.1)	151 (3.8)
Tug Hill Seaway	351 (2.4)	406 (2.5)	85 (2.3)	86 (2.2)
Western New York	679 (4.6)	636 (3.9)	182 (5.0)	188 (4.7)
Age				
<65	2148 (14.6)	2216 (13.7)	549 (15.0)	629 (15.8)
65–74	5970 (40.5)	6578 (40.6)	1338 (36.6)	1482 (37.3)
75–84	4344 (29.4)	4885 (30.2)	1219 (33.3)	1302 (32.8)
85+	2293 (15.5)	2508 (15.5)	551 (15.1)	561 (14.1)

^aData are N (%).

Region (53.4%), New York County (49.2%), and Western New York Region in 2017. The areas with the lowest prevalence of first-line antibiotic prescribing were Central New York (32.6%), Southern Tier Region (33.7%), and Kings County (37.3%) in 2016 and Central New York Region (34.0%), Kings County (36.8%), and Queens County (39.1%) in 2017. For fluoroquinolone antibiotic prescriptions, the areas with the largest prescribing prevalence were Bronx County (40.2%), Tug Hill Seaway (40.2%), and Richmond County (39.1%) for 2016 and Kings County (37.9%), Richmond County (35.5%), and Tug Hill Seaway Region (34.1%) for 2017. The geographic areas with the lowest prevalence of fluoroquinolone antibiotic prescribing were New York County (15.1%), Central New York Region (26.9%), and North Country Region (13.5%) in 2016 and Central New York Region (24.6%), Finger Lakes County (24.1), and North Country Region (20.7%) in 2017. Additional

data regarding the relative between-year changes for antimicrobial prescribing within each region for females can be found in the [Supplemental Data](#).

Geographical Antimicrobial Prescribing Patterns in Males

Figure 2 depicts the various geographic regions' relative changes between the study years among male patients. For males, the type of antibiotics (prescribing prevalence range by region) were first line (35.2%–21.9%), oral β -lactam (7.6%–29.6%), fluoroquinolone (35.1%–62.3%), and other (4.9%–14.3%) in 2016 and first line (23.2%–39.1%), oral β -lactam (18.5%–39.1%), fluoroquinolone (32.4%–47.7%), and other (14.4%–3.9%) in 2017. Between 2016 and 2017, 3 (20%) geographic areas had significant changes in antibiotic prescribing for males ([Supplemental Table 3](#)).

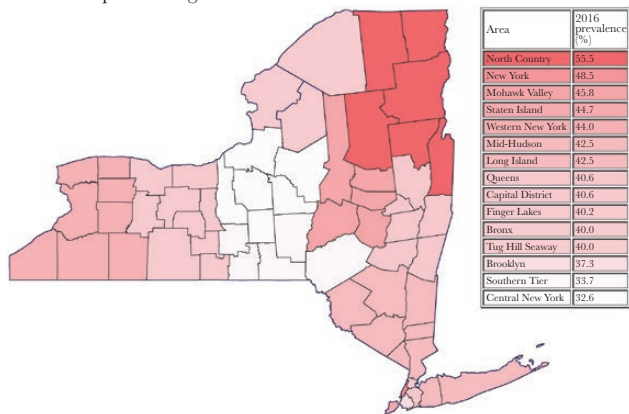
The areas that had the highest prevalence of first-line antibiotic prescribing were North Country Region (35.2%), Finger

Table 2. New York State Prescribing Patterns^a

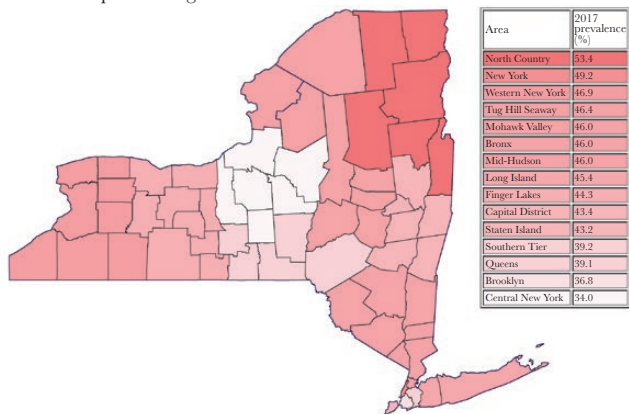
Antibiotic Category	Females				Males			
	2016 (n = 19 451)	2017 (n = 21 682)	Pairwise PValue	Overall PValue	2016 (n = 4530)	2017 (n = 4995)	Pairwise PValue	Overall PValue
First Line	8071 (41.5)	9494 (43.8)	<.0001	< .01	1143 (25.2)	1333 (26.7)	.1059	<.01
Oral β -lactams	3470 (17.8)	4437 (20.5)	<.0001		1044 (23.1)	1310 (26.2)	.0003	
Fluoroquinolones	6637 (34.1)	6316 (29.1)	<.0001		1991 (44.0)	1961 (39.3)	<.0001	
Other	1273 (6.5)	1435 (6.6)	.7633		352 (7.8)	391 (7.8)	.9169	

^aFirst-line agents were nitrofurantoin, trimethoprim-sulfamethoxazole, and fosfomycin; P values are for χ^2 test for 4 × 2 tables.

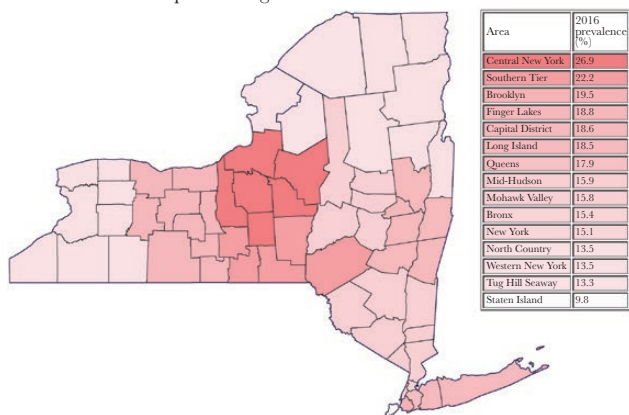
A First line prescribing 2016



B First line prescribing 2017



C Oral beta-lactam prescribing 2016



D Oral beta-lactam prescribing 2017

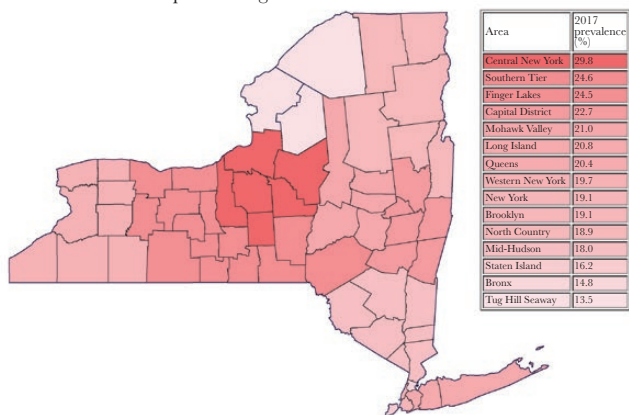


Figure 1. Geographic antimicrobial prescribing patterns for females.

Lakes Region (30.4%), and Mohawk Valley Region (29.6%) in 2016 and Mohawk Valley Region (39.1%), Western New York Region (30.2%), and New York County (28.8%) in 2017. The areas with the lowest prevalence of first-line antibiotic prescribing were Southern Tier Region (22.3%), Central New York Region (22.2%), and Long Island Region (21.9%) in 2016 and Southern Tier Region (24.2%), Queens County (23.8%), and Kings County (23.2%) in 2017.

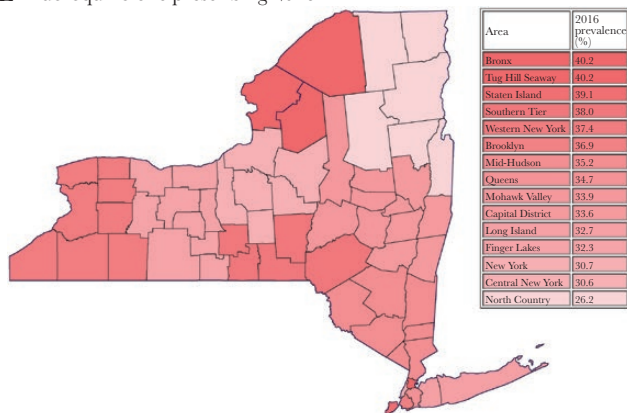
For fluoroquinolone antibiotic prescriptions, the areas with the largest prescribing prevalence were observed in Bronx County (62.3%), Tug Hill Seaway Region (56.2%), and Southern Tier Region (51.4%) for 2016 and Kings County (47.7%), Southern Tier Region (46.2), and Western New York (42.6%) in 2017. The geographic areas with the lowest prevalence of fluoroquinolone antibiotic prescribing were North Country Region (20.4%), Richmond County (20.0%), and Finger Lakes Region (23.6%) in 2016 and Long Island Region (7.4%), Finger Lakes Region (8.8%), and Central New York Region (14.4%) in 2017. Additional data regarding the relative between-year changes for antimicrobial prescribing within each region for males can be found in the [Supplemental Data](#).

DISCUSSION

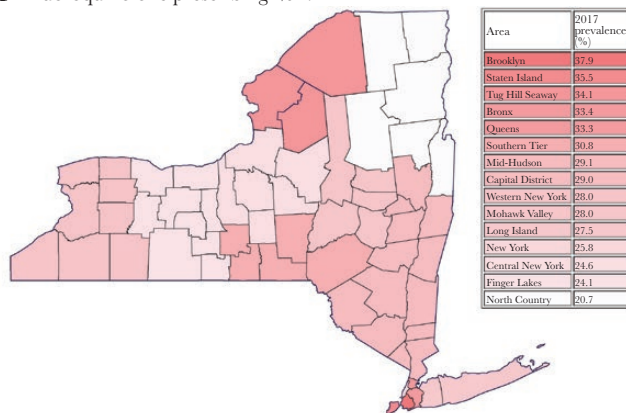
To our knowledge, this is the largest statewide, disease-specific evaluation of antimicrobial prescribing in older adults for cystitis. In general, there was low utilization of first- and second-line agents in both male and female patients. Approximately one third of patients received a fluoroquinolone, and 1 in 10 patients received an “other” antibiotic. Between 2016 and 2017, these patterns seemed to improve in a favorable direction with increased utilization of first- and second-line agents and a decline in fluoroquinolone use. Nonetheless, these data clearly highlight various opportunities for additional outpatient antimicrobial stewardship in NYS.

The observation of prescribing that was discordant with the local resistance patterns [9] may have several contributing factors. Clinicians may still be uncomfortable prescribing nitrofurantoin because it was previously on the Beers List of Potentially Inappropriate Medications in the Elderly [12]. This recommendation was recently changed; however, it is unclear whether this change has influenced clinicians’ behavior. Another possible contributing factor to the low nitrofurantoin use is the concern for non-*Escherichia coli* species causing UTIs. Rank et al

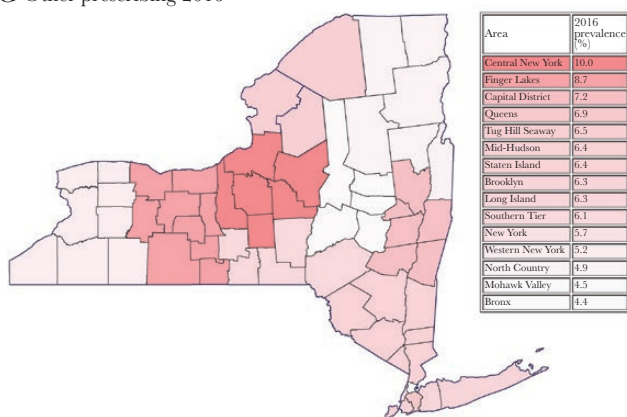
E Fluoroquinolone prescribing 2016



F Fluoroquinolone prescribing 2017



G Other prescribing 2016



H Other prescribing 2017

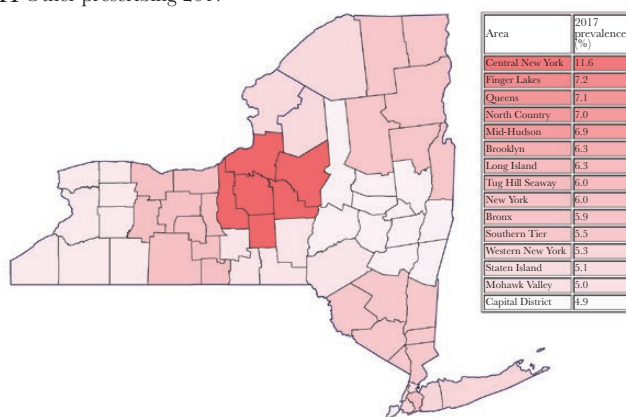


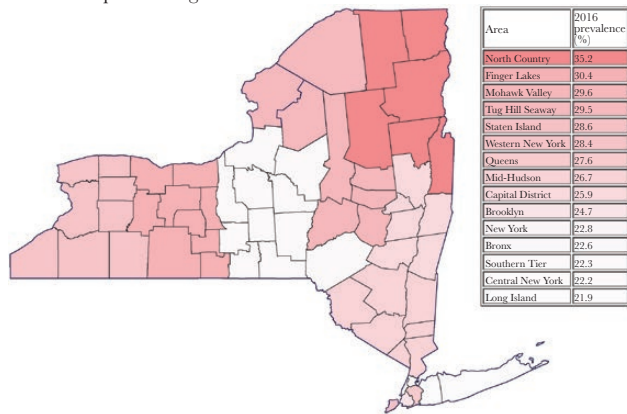
Figure 1. Continued.

[9] suggested that in NYS, *Klebsiella pneumoniae* accounted for approximately 18.4% of all isolates recovered in female patients aged >64 years, and only 21% of those isolates were susceptible to nitrofurantoin. This concern is valid from an individual perspective; however, on a population level, more than three fourths from the Rank et al [9] evaluation of the isolates recovered within the age group were susceptible to nitrofurantoin. As such, nitrofurantoin appears to still be a reasonably safe and effective empiric choice for cystitis in the elderly, especially in patients with no known history of *K pneumoniae*. Clinicians may also be hesitant to prescribe trimethoprim-sulfamethoxazole in the elderly for cystitis. Recently, the 2019 Beers List has added trimethoprim-sulfamethoxazole to its “use with caution” list due to concerns of exacerbation of hyperkalemia and/or worsening renal failure in patients being treated with angiotensin-converting enzyme inhibitors or angiotensin receptor blockers [12]. In addition, trimethoprim-sulfamethoxazole resistance is prevalent and has increased over the last 10 years [9, 10]. Combined, the safety and efficacy concerns may justify the low utilization of trimethoprim-sulfamethoxazole. Fosfomycin use also may have been low due to cost, lack of routine susceptibility testing availability, and

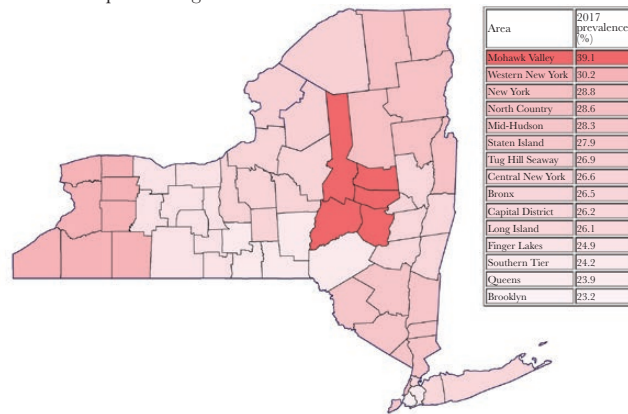
efficacy concerns [13]. All in all, the data from the first-line prescribing suggest that there is ample room for improving first-line prescribing for cystitis in elderly patients.

The utilization pattern of fluoroquinolones was incongruent with national guidance and regional antimicrobial susceptibility patterns. National guidelines for acute uncomplicated cystitis recommend that fluoroquinolones or β -lactams should be reserved for patients unable to take first-line recommended antimicrobials [11]. In recent years, additional guidance from the FDA has led to further deprioritization of fluoroquinolones as agents for outpatient treatment of acute uncomplicated cystitis. In essence, the most recent recommendations suggest that fluoroquinolones should be reserved for last-line treatment of acute uncomplicated cystitis when no other oral alternatives are available. Despite these recommendations, approximately 1 in 3 patients received a fluoroquinolone in this analysis. Unfortunately, these data do not differentiate between empiric or definitive prescribing, and we cannot evaluate the appropriateness of these prescriptions. However, the resistance patterns for uropathogens in NYS suggest that from an in vitro activity perspective, there are often alternatives to fluoroquinolones. In the case of definitive prescribing, the theoretical maximum

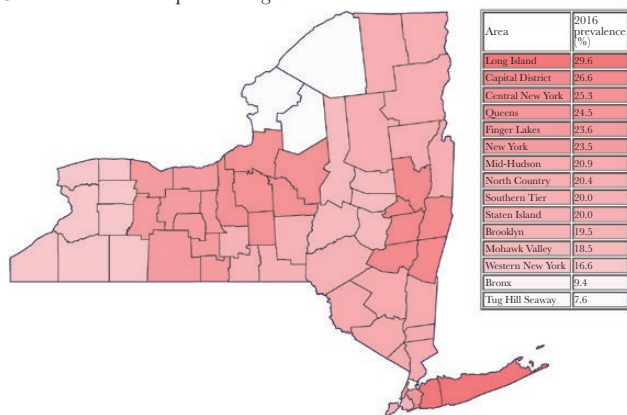
A First line prescribing 2016



B First line prescribing 2017



C Oral beta-lactam prescribing 2016



D Oral beta-lactam prescribing 2017

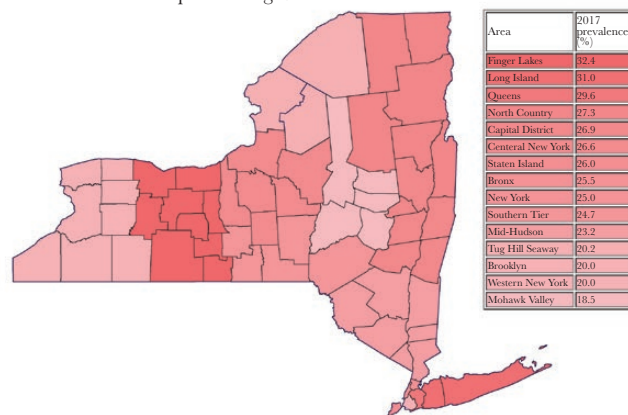


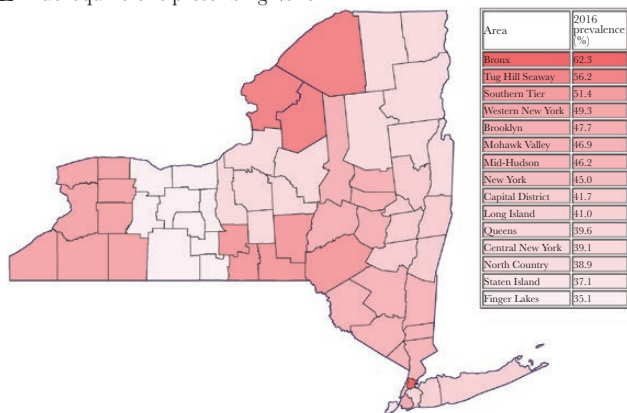
Figure 2. Geographic antimicrobial prescribing patterns for males.

prescribing proportion for fluoroquinolones should not exceed 23.5%–34.5%, the proportion of nitrofurantoin and trimethoprim-sulfamethoxazole resistant uropathogens in NYS for older adults [9]. As a whole, the fluoroquinolone prescribing rate exceeded the expected threshold for fluoroquinolone prescribing. The higher than expected fluoroquinolone prescribing rate is alarming because older adults are at high risk for treatment failure due to high prevalence of fluoroquinolone resistance and high risk for fluoroquinolone-related adverse effects. These combined safety and efficacy concerns resulted in an additional FDA warning in December 2018, which warned against using fluoroquinolones in elderly patients. It is interesting to note that the prevalence of fluoroquinolone prescribing decreased between the 2 years evaluated. This decrease in prescribing is consistent with national trends and may be an early signal indicating the success of the FDA warnings on fluoroquinolones [14]. This decrease in prescribing rate is promising because it may indicate a shift in overall prescribing practices in NYS towards a more appropriate proportion. However, these data also highlight the need for additional interventions to promote the appropriate use of fluoroquinolones within NYS. Future studies should focus on interventions to further

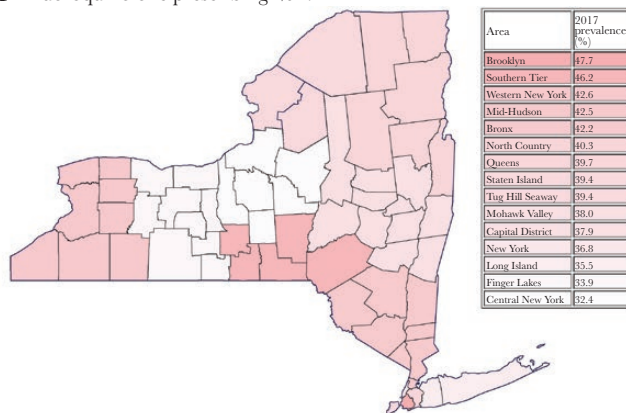
curtail the outpatient use of fluoroquinolones in elderly for cystitis and additional monitoring of the effect on a statewide level.

There are several additional evaluations that may help contextualize these findings. Kabbani et al described Outpatient Antibiotic Prescribing for Older Adults in the United States between 2011 and 2014 [15]. In their study, antibiotics of interest were prescribed at the following percentages: quinolones, 24.5%; cephalosporins, 15.3%; penicillins, 17.4%; trimethoprim-sulfamethoxazole, 0.95%; urinary tract anti-infectives, 0.76%; and β -lactams with increased spectrum of activity, 0.74%. Our study demonstrated higher proportions of each drug class likely due to the case definition for cystitis. Durkin et al also assessed UTI in women being treated for uncomplicated UTI. In their study, the antibiotic prescriptions observed were fluoroquinolones (42.8%), first-line agents (50.8%), and β -lactams (5.0%) [16]. In our study, fluoroquinolone prescribing was lower, first-line agent prescribing was lower, and β -lactam prescribing was higher. The differences between studies may be due to temporal differences and age differences between studies. These findings have numerous implications. In a recent study by the CDC, the 2016 fluoroquinolone prescribing rate for the Northeast was 92 per 1000 patients [14]. Our study calculated that for older adults with cystitis, the fluoroquinolone prescribing

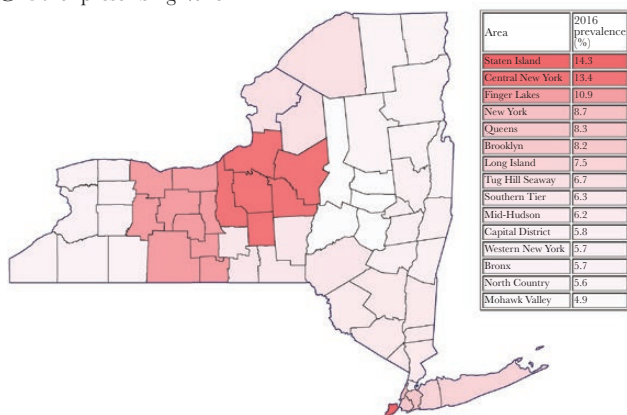
E Fluoroquinolone prescribing 2016



F Fluoroquinolone prescribing 2017



G Other prescribing 2016



H Other prescribing 2017

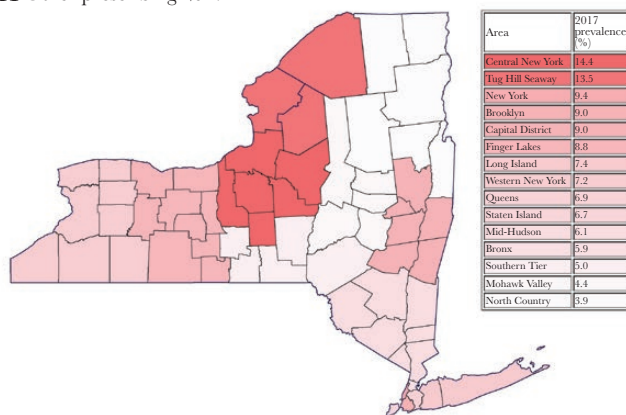


Figure 2. Continued.

rate was as high as 440 per 1000 persons. Although this rate was decreasing, the high rate has the potential for widespread negative health outcomes for older adults in NYS. From a public health perspective, these data highlight the need for additional education and interventions to improve first-line antimicrobial prescribing and to reduce fluoroquinolone prescribing. On an individual clinician level, clinicians should reflect on their own prescribing practices for cystitis in the elderly and identify methods for reducing fluoroquinolone prescribing. These data also highlight the framework for cyclical assessment of antimicrobial prescribing on a statewide level and also demonstrate how to benchmark the prescribing practice against the known local resistance patterns. As outpatient antimicrobial stewardship becomes more of a focus of regulators, accreditors, and payors, these techniques will be incredibly valuable for multiple key stakeholders.

As with any study, this evaluation is not without its limitations. There are a few aspects of the case definition that warrant additional scrutiny. The use of ICD-9/ICD-10 codes is limited by coding accuracy and may be susceptible to intercoder variability. To protect against variability within coding, multiple codes for cystitis were used. Although codes for acute cystitis, chronic cystitis, and cystitis were used, it should be noted that all the patients

in this study received antibiotics within 3 days. Furthermore, at least 89.4% of patients in the study had a code for either acute cystitis or cystitis in their discharge diagnoses codes. Therefore, it is reasonable to conclude that these data are largely representative of acute cystitis cases in this study population.

Because there are no specific guidelines for cystitis in men, the guidelines for women were used to assess therapy. Use of one guideline for both sexes was unlikely to affect the study results because the data were stratified by sex. Historically, fluoroquinolones were considered first-line agents for men due to the complicated nature of UTI in men. Application of the “complicated” designation would mean that empiric fluoroquinolone use may have been justified. However, use of fluoroquinolones in complicated UTI is less justifiable in areas where *E coli* resistance rates exceed 10%. In NYS, a recent study documented that 49% of *E coli* recovered from outpatient urinary isolates in men aged >64 years were resistant to ciprofloxacin. Taken together, these data suggest that empiric use of fluoroquinolones in these male patients was probably not justified.

The assumption that every patient with a susceptible pathogen could get a specific drug is also unlikely because allergy, cost, and tolerability may result in a reduced prescribing rate.

However, it should be noted that even if 10% of patients could not get the first-line treatment due to allergy, cost, or tolerability, none of the counties assessed came within 10% of the total potential first-line antibiotic use. Finally, previous antibiotic history, urine cultures and/or sensitivities, and specific patient factors (ie, history of structural or functional abnormalities and past urological surgical history) were not available were not available. As such, it is conceivable that fluoroquinolone use may have been warranted in specific patients.

CONCLUSIONS

In this large, statewide study of cystitis in older adults, patients were treated with a variety of antimicrobials in NYS between 2016 and 2017. The widespread prevalence of fluoroquinolone prescribing highlights the need for outpatient antimicrobial stewardship.

Supplementary Data

Supplementary materials are available at *Open Forum Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

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APPENDIX A. ICD-10 CODES USED TO IDENTIFY CYSTITIS

ICD-10 Code	
N30.90	Cystitis
N30.91	Cystitis with hematuria
N30.00	Acute Cystitis
N30.20	Chronic Cystitis
N30.21	Chronic Cystitis with hematuria
N30.01	Acute Cystitis with hematuria

APPENDIX B. NYS REGION DEFINITIONS*

Capital District	Albany, Columbia, Greene, Saratoga, Schenectady, Rensselaer
Central New York	Cayuga, Cortland, Madison, Oneida, Onondaga, Oswego
Finger Lakes	Chemung, Livingston, Monroe, Ontario, Schuyler, Seneca, Steuben, Wayne, Yates
Long Island	Nassau, Suffolk
Mid-Hudson	Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, Westchester
Mohawk Valley	Fulton, Herkimer, Montgomery, Otsego, Schoharie
New York City**	Bronx, Kings, New York, Richmond, Queens
North Country	Clinton, Essex, Franklin, Hamilton, Warren, Washington
Southern Tier	Broome, Chenango, Delaware, Tioga, Tompkins
Tug Hill Seaway	Jefferson, Lewis, St. Lawrence
Western New York	Allegany, Cattaraugus, Chautauqua, Erie, Niagara, Orleans, Genesee, Wyoming

*Based on NYS DOH Population Health Improvement Program Regional Map. https://www.health.ny.gov/community/programs/population_health_improvement/docs/contact_sheet.pdf.

**New York City Counties were kept separate due to large population and population characteristics.