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The Right Prescription: Assessing Potentially Inappropriate Use of Antibiotics Among New York's Medicaid Population

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June 2018

The Medicaid Institute at United Hospital Fund is working to improve the Medicaid program in New York by providing information and analysis and developing a shared vision for change.

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Funded by the New York State Department of Health

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Introduction and Background

The potentially inappropriate use of antibiotics has gained widespread attention as a cause of antibiotic-resistant infections affecting all sectors of health care. Nationally, antibiotic-resistant bacteria cause over two million infections each year, resulting in approximately 23,000 deaths.[1] In addition, antibiotics are responsible for nearly 20% of emergency department visits for adverse drug events such as allergic reactions or development of the diarrheal symptoms indicative of *Clostridium difficile* infection (CDI).[2] Clinical guidelines advise the use of antibiotics only when a bacterial infection is established, but while these policies are, increasingly, garnering better adherence in the inpatient setting, many outpatient providers continue to prescribe antibiotics for viral infections.[3] Learned provider prescribing practices, perceived patient expectations, patient–provider communication, and the historical rejection of antibiotic marketplace regulation all contribute to an environment in which antibiotic prescription rates vary greatly between and within outpatient practices.[4]

President Obama's National Action Plan for Combating Antibiotic-Resistant Bacteria calls for a 50% reduction of inappropriate antibiotic use by 2020, requiring a 15% decrease for outpatient antibiotic prescribing.[5] In pursuit of this goal, acute respiratory infections (ARIs) have been a key focus, as they often prompt potentially inappropriate antibiotic prescription in outpatient settings. This overprescription is largely due to the viral origins of ARIs like acute bronchitis or the common cold, which display symptoms like those of bacterial respiratory infections but cannot be cured with antibiotics. Analyses conducted by the Pew Charitable Trusts found that over 30% of antibiotics prescribed for all conditions in the outpatient setting in the United States were unnecessary, with a large portion of unnecessary use attributed to ARIs.[6] When examining antibiotic prescribing rates for adult Medicaid recipients with ARIs nationwide, researchers found that 52% of patients received a potentially inappropriate prescription in 2007.[7]

The Centers for Disease Control and Prevention is working to reduce antibiotic prescribing through the "Get Smart: Know When Antibiotics Work" program, aimed at supporting and informing national and state antibiotic stewardship efforts. The New York State Get Smart program encourages appropriate use of antibiotics with

educational tools, guidelines and state-specific data analyses for health care providers. A study of New York's adult Medicaid population in 2013 established regional rates of antibiotic prescription for ARI in order to locate specific intervention targets, identifying 11 high-risk counties with antibiotic prescribing rates over 55%.[8] New York also tracks performance on this issue through the use of a quality measure capturing the percentage of providers who avoid antibiotic treatment in adults with acute bronchitis (higher percentages are better).[9] In 2015, providers in New York's Medicaid managed care plans avoided antibiotic therapy for only 30% of adults with acute bronchitis, compared to a national average of 28%. This indicates that there is still significant progress to be made in New York and nationally, as avoidance of antibiotic therapy for acute bronchitis should approach 100%.[10] To accurately describe the prevalence of potentially inappropriate antibiotic prescribing in the New York Medicaid program, and aid targeted reduction efforts, this analysis examines the percentage of adults' ARI episodes that were followed by an antibiotic prescription.

To determine which populations were affected most by potentially inappropriate use of antibiotics, prescribing rates were examined by patient and plan characteristics. The most commonly prescribed antibiotics were evaluated by type of antibiotic, dosage, and diagnosis.

Methods

Data for this analysis were extracted from the Medicaid Data Warehouse, accessed by New York University's Wagner School of Public Policy, encompassing all fee-for-service claims and managed care encounters for individuals enrolled in New York's Medicaid program during the study period.

Inclusion Criteria

The cohort for this analysis included adult Medicaid beneficiaries age 18 to 64 with a principal diagnosis of ARI (acute bronchitis, acute nasopharyngitis, acute sinusitis, acute pharyngitis, acute upper respiratory infection, acute laryngitis, bronchitis unspecified, and acute tonsillitis) recorded during an outpatient visit between 2011 and 2015 (evaluation and management visit for primary care, specialty care, or an OB/GYN clinician, excluding the emergency department). The cohort members were followed longitudinally across the study period to establish temporality between an ARI episode

and subsequent prescription of antibiotics. To be included, cohort members had to be continuously enrolled in the Medicaid program from three months before the ARI episode to four months after it.

Exclusion Criteria

Individuals were excluded from the cohort if they met any of the following criteria: diagnosis for specified chronic conditions that may have justified antibiotic use in the year prior to an ARI episode (see Appendix for a list of conditions); diagnosis for bacterial infections, like pneumonia or urinary tract infection, that occurred during the same ARI episode (see Appendix for a list of conditions); and enrollment in Medicare before, during or up to four months after an ARI episode (i.e., individuals dually eligible for Medicare and Medicaid were excluded). The exclusion criteria for pre-existing and same-day conditions were modeled off a study looking at outpatient antibiotic prescribing for ARI through the Veterans Affairs health care system.[11]

Analysis

An ARI episode was defined as the period from the first primary diagnosis of ARI to the last diagnosis that occurred within 30 days of an ARI diagnosis (see Appendix for a list of ARIs). For example, a patient with ARI diagnoses recorded on June 1st and June 15th would count as one ARI episode, but a patient with ARI diagnoses recorded on June 1st and July 3rd would count as two separate ARI episodes. Once an ARI episode was identified, subsequent orally administered antibiotic prescriptions were counted if the fill occurred at any point during the ARI episode (i.e., the same day as the initial diagnosis of ARI triggering the episode through the last ARI diagnosis in the episode), up to 14 days after the ARI episode (see Appendix for a list of antibiotics).

Antibiotic prescriptions were identified when a Medicaid pharmacy claim or encounter was generated, indicating that the prescription was filled for that Medicaid member. It is important to note that the term "prescription" used in this paper is a proxy for provider prescribing: it does not capture situations in which antibiotics were prescribed for a member who did not then fill the prescription. Further, a filled prescription does not necessarily indicate that the member followed the prescription correctly, or even took it at all. Not all prescription fills in the cohort may have been inappropriate, and in this report they are considered "potentially inappropriate," as extenuating circumstances may

have warranted a prescription. For example, there may have been co-existing chronic conditions, suspected presence of bacterial infection, or details not recorded in the available claims data that contributed to the physician's rationale for prescribing antibiotics.

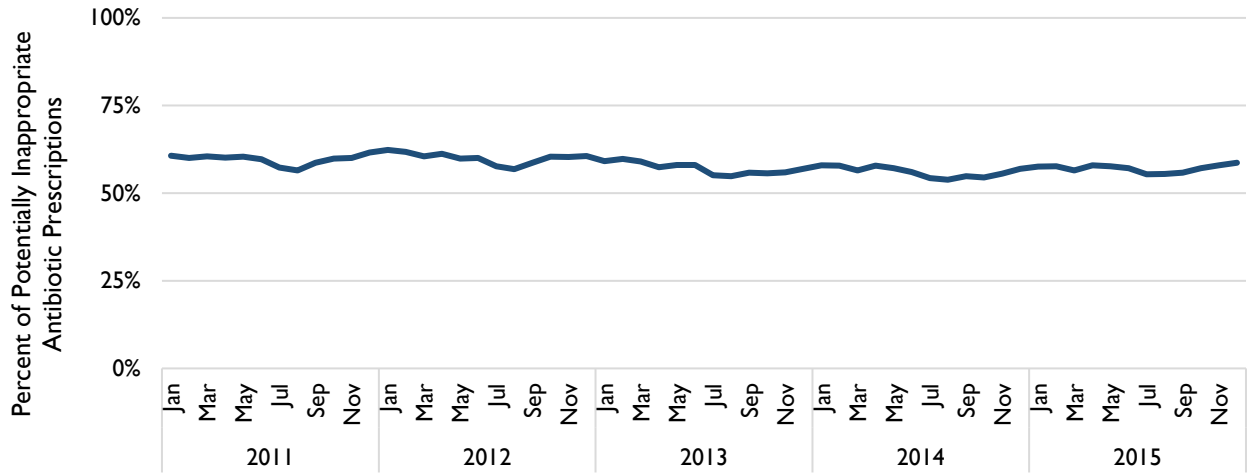
ARI episodes (and antibiotic prescriptions that followed) were assigned to patient county or ZIP code of residence and patient health plan at the time each ARI episode occurred. In these analyses, patient county or ZIP code of residence acted as a proxy for prescriber geography. These analyses require the assumption that patient residence and health plan remained constant over the course of the ARI episode and following antibiotic prescription. The names of individual health plans were redacted, and they are referred to as "MMC Plan A," "MMC Plan B," etc.

Crude rates of potentially inappropriate antibiotic prescribing were calculated by dividing the number of ARI cases receiving an antibiotic during or shortly after the episode by the total number of ARI episodes from 2011 to 2015. Adjusted rates were created using standard logistic regression techniques to account for differences in age, sex, and race/ethnicity. It is possible that cohort members may have received multiple antibiotic prescriptions within an ARI episode, but this is not reflected in the rate of antibiotic prescribing (i.e., the rate numerator indicates only the presence or absence of any antibiotic prescription for an ARI episode, and the denominator includes the total number of ARI episodes).

Findings

Overall, there were 1,273,300 ARI episodes among 761,783 individuals (1.67 episodes per patient on average) meeting the inclusion criteria from 2011 to 2015, and among these episodes 58.2% received antibiotic prescriptions (740,877 prescriptions) [Table 1—see page 14]. Statewide, average annual and monthly prescription rates fluctuated between 56% and 60% during the period, though not in a linear fashion [Figure 1].

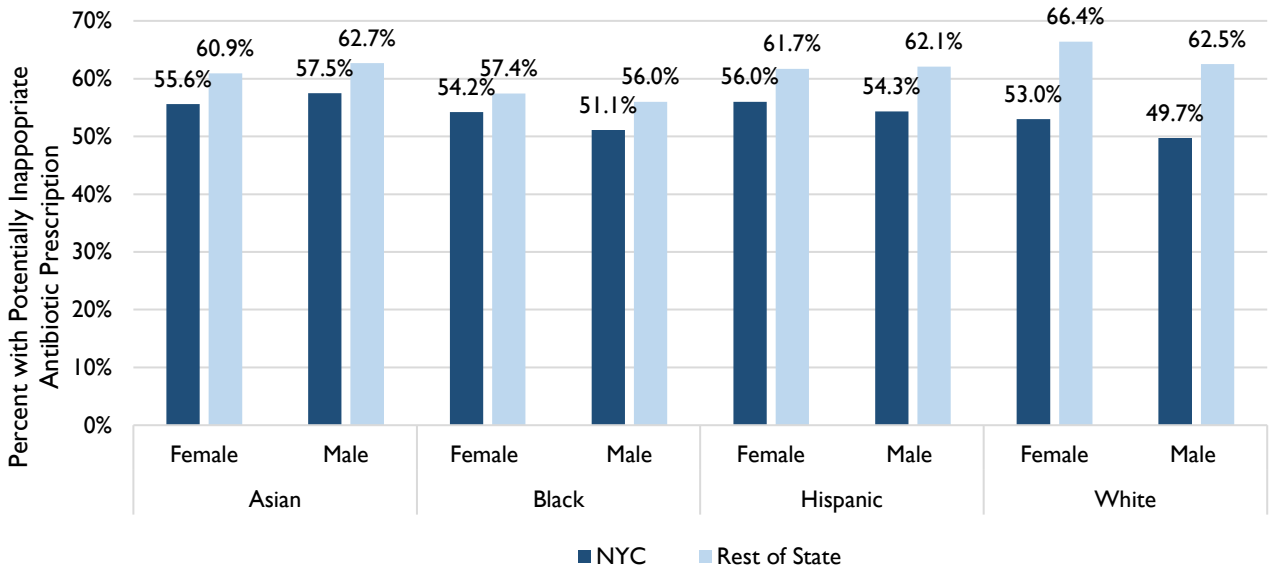
Figure 1. Percent of Potentially Inappropriate Antibiotic Prescriptions by Month, 2011–2015



Note: The figure displays unadjusted percentages on the basis that statewide, population-based rates do not require adjustment for patient mix.

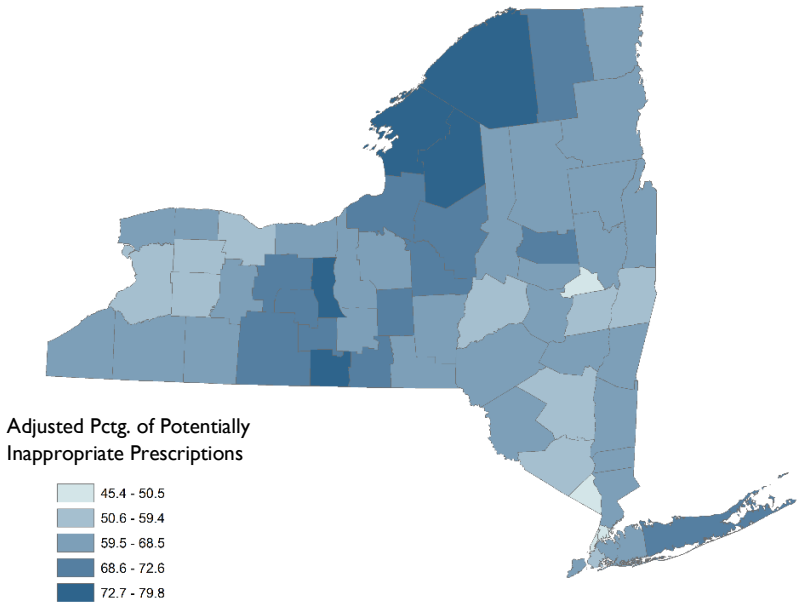
Antibiotic prescribing rates were notably different based on patient demographics, county of residence, and individual insurance plan. Medicaid members who identified as white, lived outside of New York City, or were enrolled in plans outside of New York City had the highest percentages of potentially inappropriate antibiotic prescription. When stratified by multiple demographic factors, subpopulation prescription rates were even more divergent. For example, white women living outside of New York City received an antibiotic prescription in 66.4% of ARI episodes, while white men living in New York City received an antibiotic prescription in 49.7% of episodes [Figure 2].

Figure 2. Percent of Potentially Inappropriate Antibiotic Prescriptions by Patient Gender, Race/Ethnicity, and Region of Residence, 2011–2015



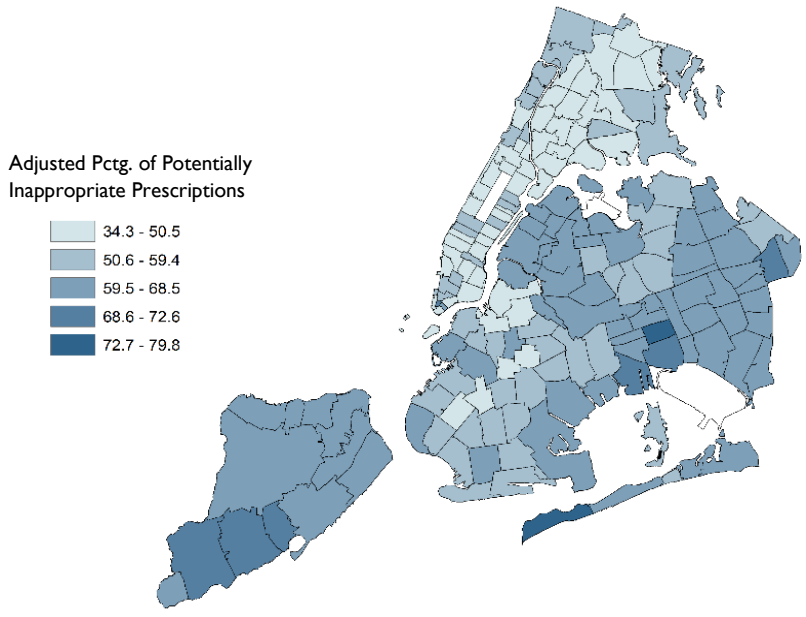
Prescribing rates varied widely by patient county of residence, with higher prescribing rates in upstate counties, Staten Island, and Long Island. Counties outside New York City had a higher average percentage of antibiotic prescribing (adjusted for age, gender, and race/ethnicity) when compared to the overall New York City average (63.0% versus 54.8%) [Table 1]. However, when those percentages were analyzed by individual county, Richmond (Staten Island), Nassau, and Suffolk counties had prescription rates higher than the average across upstate counties (65.1%, 68.4%, and 70.9%, respectively, compared to 63.0% upstate) [Table 2, Figure 3]. Members who received services through fee-for-service Medicaid versus Medicaid managed care plans did not have markedly different rates of prescription (53.8% versus 58.5%), but there was notable variance by individual managed care plan [Table 1]. For instance, members in the plan with the highest rate of antibiotic prescribing (MMC Plan A, 75.4%) were prescribed antibiotics nearly twice as often as members in the plan with the lowest prescription rate (MMC Plan W, 43.4%) [Table 3]. It is important to note that while plans' antibiotic prescribing rates were adjusted by age, gender, and race/ethnicity to adjust for possible differences in plan patient mix, they were not adjusted by geography—meaning that a portion of this variation is likely driven by geographic differences in coverage.

Figure 3. New York State: Potentially Inappropriate Antibiotic Prescriptions by Patient County of Residence, 2011–2015



Note: Percentages are adjusted by patient gender, age and race/ethnicity and data ranges include all New York State counties.

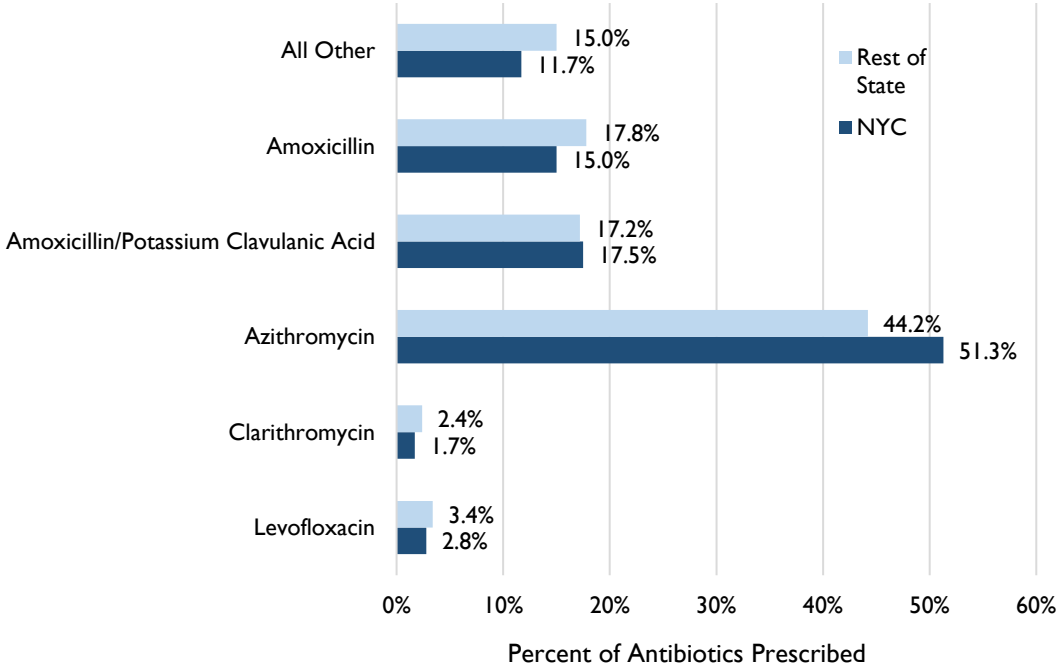
Figure 4. New York City: Potentially Inappropriate Antibiotic Prescriptions by Patient ZIP Code of Residence, 2011–2015



Note: Percentages are adjusted by patient gender, age, and race/ethnicity, and data ranges used are statewide.

Lastly, there were striking differences in the types of antibiotic prescriptions filled and the diagnoses for which they were written. The largest numbers of potentially inappropriate prescriptions were written for diagnoses of acute pharyngitis or acute upper respiratory infection (nearly 50% of all potentially inappropriate prescriptions), but acute sinusitis had the largest percentage of prescriptions per episode (83.7% of episodes had a prescription) [Table 1]. Over 80% of antibiotics prescribed were from three types: azithromycin, amoxicillin, and the combination of amoxicillin and clavulanic acid. Prescribing patterns did not necessarily hold by geographic region, however; azithromycin was prescribed more in New York City than elsewhere in the state (51.3% of all prescriptions in New York City versus 44.2% outside of New York City), and amoxicillin was prescribed slightly less in New York City (15.0% in New York City versus 17.8% outside of New York City) [Figure 5].

Figure 5. Potentially Inappropriate Antibiotic Prescriptions by Frequency of Antibiotic Type in New York City vs. Rest of State, 2011–2015



Note: Includes unadjusted percentages, as the figure displays the frequency of antibiotic type among antibiotics prescribed.

Discussion

The inappropriate use of antibiotics has steadily contributed to the increased persistence of antibiotic-resistant infections, increasing overall health care costs as treatments become costlier for bacterial infections that no longer respond to first-line antibiotics. To address the underlying causes of this issue and to create targeted intervention strategies, it is important to consider which populations may be more predisposed to receiving inappropriate antibiotic prescriptions. The findings of this analysis illuminate the distribution of potentially inappropriate antibiotic prescribing for adults with ARIs in New York's Medicaid program, and raise important questions about various patient, provider, and plan-level factors that may be contributing to inappropriate antibiotic use.

Patient-Level Considerations

Because this analysis focuses on a Medicaid population, it inherently controls for patient-level effects of income and insurance type, focusing on the differences in potentially inappropriate antibiotic prescribing by patient age, race, sex, county of residence, and managed care plan. Previous studies have shown the value of patient education and patient-provider communication initiatives to increase health literacy and reduce the likelihood that patients may ask for antibiotics from their provider.[12] [13] When patients are aware that antibiotics may not cure their respiratory infection—and may put them at risk for more harmful antibiotic resistant infections in the future—they may be less likely to seek antibiotic treatment.

As indicated by the findings above, patient education interventions that target high-risk geographic areas may be most helpful for communities on Staten Island and Long Island, and in upstate counties like Jefferson, St. Lawrence, and Seneca. Existing education models may require adaptation to address specific challenges faced by New York's diverse, low-income Medicaid population—such as lower levels of health literacy, or language and cultural barriers.[14] Persistent differences by patient characteristics, like county of residence, race/ethnicity, and insurance plan, may be proxies of underlying patient, provider, and plan factors influencing whether a patient receives antibiotics. These factors should not be used to draw conclusions about the direct relationships between those characteristics and antibiotic use without more research.

Provider-Level Considerations

To reduce the number of inappropriate antibiotic prescriptions, it is crucial that providers know the appropriate type, dosage, and duration of antibiotics to prescribe, and the diagnoses for which they are appropriate. Prior research exploring provider knowledge and attitudes around antibiotic selection has found that many providers believe that non-recommended antibiotics are more likely to cure infection; fear that patient satisfaction will decrease if antibiotics are not prescribed; and worry that infectious complications might create medical malpractice events.[15]

The types of antibiotics prescribed in the New York Medicaid findings above, and the diagnoses for which they were prescribed, hint at practical interventions with which to engage outpatient Medicaid providers. Azithromycin made up nearly 50% of antibiotic prescriptions, with 92% of azithromycin prescriptions written for a three-day course (250 mg tablets). Azithromycin is a broad-spectrum antibiotic, which means that it can eliminate the largest array of bacteria in the gut, creating an internal environment more readily colonized by antibiotic-resistant bacteria.[16] Short-duration, broad-spectrum antibiotics may be widely distributed because of provider beliefs that they will ameliorate a broad array of irritating symptoms quickly, increasing patient satisfaction with treatment.

Over half of the antibiotic fills in this analysis were prescribed after an individual was diagnosed with acute pharyngitis or acute upper respiratory infection (URI), unspecified—conditions for which antibiotics are not generally recommended (except for a minority of acute pharyngitis cases).[17] Symptoms for these conditions are vague, described as an infectious process in the upper respiratory tract that may lead to congestion, sneezing, coughing, fever, and sore throat. Non-specific symptoms and difficulty testing for bacterial causes may make these diagnoses difficult to audit for potentially inappropriate antibiotic prescription. These findings reveal a larger need for evidence-based, provider-level interventions specific to commonly diagnosed ARIs and commonly prescribed antibiotics. Previously successful interventions have included provider-peer comparisons,[18] communication training,[19] clinical decision support,[20] and public commitment posters[21] in the examination room.

Plan-Level Considerations

While most of the responsibility for antibiotic stewardship has fallen to providers and public health officials within the CDC or state or local agencies, Medicaid managed care plans may also play an important role in efforts to reduce inappropriate antibiotic prescribing. In this analysis, antibiotic prescription rates varied substantially by individual Medicaid plan, broadly coinciding with observed geographic patterns (such as lower antibiotic prescribing rates in New York City than in the rest of the state). Medicaid managed care plans are currently responsible for one related quality measure for adults as part of the Quality Incentive Program: avoidance of antibiotic therapy for adults diagnosed with acute bronchitis. The findings above, however, indicate that there may also be significant issues with antibiotic use for diagnoses like pharyngitis and URI, diagnoses that do not currently have any quality incentive payments attached to them for adults (though a pediatric measure exists for appropriate treatment of children with URI). Plans have the unique opportunity to improve quality for their members and reduce cost by encouraging appropriate antibiotic use, thereby preventing the costly complications of antibiotic-resistant infections. Medicaid managed care plans could join current efforts by sharing clinician performance on established reduction goals, incentivizing antibiotic stewardship through quality-based payments like avoidance of antibiotic therapy in acute bronchitis, or assisting in clinician auditing by tracking potentially inappropriate antibiotic prescribing via claims data.[22]

Current Initiatives, Policies, and Future Solutions

While the inpatient setting has historically been the focus of antibiotic stewardship efforts, outpatient antibiotic stewardship initiatives have begun to garner greater attention and support in New York and across the nation. The New York State Department of Health, through the Get Smart initiative, has gathered data on potentially inappropriate antibiotic use to engage local health departments and outpatient clinics in counties with high prescribing rates. Examples of work addressing high-prevalence areas include the targeted dissemination of educational materials, adaptation of clinical guidelines for outpatient practices, and new initiatives that provide peer-to-peer counseling with other prescribers.

In 2016, the United Hospital Fund worked with nine New York City health care systems and 31 of their outpatient clinics to identify provider knowledge, beliefs, and

prescribing practices surrounding antibiotic use. The data from this effort helped outpatient clinics assess their current performance, as well as their own interest in and need for antibiotic stewardship, leading to the development and implementation of numerous antibiotic stewardship strategies.[23] In the fall of 2017, the IPRO-led Atlantic Quality Innovation Network also began antibiotic stewardship projects with outpatient clinics in New York, South Carolina, and the District of Columbia, aiming to implement and assess policies and practices to improve antibiotic prescribing.[24] While these examples indicate a positive trend in focusing on potentially inappropriate prescribing in the outpatient setting, an issue that transcends insurance type, there is not much focus on Medicaid-specific strategies for reducing potentially inappropriate antibiotic prescriptions. Medicaid strategies could include the development of provider-level metrics for potentially inappropriate prescribing, sharing data with providers more publicly, using appropriate metrics and quality improvement targets for value-based payment arrangements, implementation of payment penalties for overprescribing outliers, or implementing policies that require diagnoses to be recorded on electronic drug prescription forms.

Limitations and Future Research

This analysis has several limitations. First and foremost, it is limited in terms of generalizability. The results cannot be assumed across populations with different payers because the claims were drawn only from the Medicaid population in New York. Additionally, pharmacy claims make it difficult to determine whether the antibiotic prescription was taken by the Medicaid member, only capturing the fact that a prescription was filled for a prescribed antibiotic. Pharmacy claims also cannot capture instances in which a provider prescribed an antibiotic but the patient didn't fill the prescription; though the extent to which this occurs and the impact it would have on this analysis are unknown. This analysis also requires the assumption that the outpatient ARI diagnosis was associated with the subsequent antibiotic prescription fill due to proximity (14 days) after the visit, because documentation of diagnosis is not included on the pharmacy claim.

While this analysis identifies broad patterns in potentially inappropriate prescribing, more detailed analysis of subsequent infections, patient and provider causes, and

associated costs may help New York determine more effective targets for future antibiotic stewardship in the outpatient setting.

This analysis followed cohort members prescribed antibiotics forward two months to assess development of CDI (a specific antibiotic-resistant infection), but found a surprisingly limited number of cases. The paucity of CDI onset following antibiotic prescriptions in this cohort was possibly attributed to the exclusion of individuals dually eligible for Medicare or who had selected chronic conditions. Studying a younger and healthier population of adults may have eliminated much of the risk for CDI, or cases may not have been diagnosed and recorded through the claims data because they were not severe enough to warrant formal treatment. Overall, this study was not adequate to draw conclusions regarding the connection between potentially inappropriate antibiotic prescribing and development of CDI. Future analyses may begin with a cohort of CDI diagnosed individuals, compared to a cohort without CDI, and look backward to investigate how many individuals in each cohort received antibiotics pre-infection, and for which conditions.

Follow-up studies may also include analyses that investigate the health trajectory of individuals with repeated ARI episodes and their likelihood for developing antibiotic-resistant infection. Future research may explore the bivariate and multivariate relationships among multiple patient- and provider-level variables contributing to potentially inappropriate prescriptions, to determine which of those variables have the largest effect on predicting inappropriate prescriptions. Though this study uses patient prescription fills as a proxy for provider prescribing, it may be particularly advantageous to conduct a study that directly assesses the level of prescribing variability among providers in the state. Finally, additional analysis could assess the potential cost savings associated with lowering the rate of potentially inappropriate antibiotic prescribing, calculating not only the costs associated with avoidable pharmaceutical expenditures, but also the costs of treating CDIs and antibiotic-resistant infections.

Tables

Table 1. Percentage of Potentially Inappropriate Antibiotic Prescriptions by Patient Demographics and ARI Diagnoses, 2011–2015 (n=761,783 patients contributing to 1,273,300 ARI episodes)

Patient Characteristic	ARI Episodes		Percent with Potentially Inappropriate Rx
	Potentially Inappropriate Rx	Total Episodes	
All Patients	740,877	1,273,300	58.2%
Gender			
Female	503,478	854,205	58.9%
Male	237,399	419,095	56.6%
Age			
18-29	263,522	493,382	53.4%
30-39	200,342	331,127	60.5%
40-49	145,909	234,137	62.3%
50-64	131,104	214,654	61.1%
Race/Ethnicity			
Asian	132,663	233,723	56.8%
African American	66,315	121,080	54.8%
Hispanic	94,223	164,382	57.3%
White	332,653	550,449	60.4%
Other	25,831	44,133	58.5%
Unknown	89,192	159,533	55.9%
*Borough/County of Residence**			
Non-NYC	329,254	516,489	63.0%*
All NYC	411,623	756,811	54.8%*
Bronx	39,700	83,928	48.3%*
Brooklyn	183,676	351,234	52.7%*
Manhattan	36,137	73,004	49.9%*
Queens	132,078	218,081	61.0%*
Staten Island	20,032	30,564	65.1%*
*Managed Care Status**			
Medicaid Managed Care	701,974	1,200,679	58.5%*
Fee-for-Service	38,903	72,621	53.8%*
ARI Diagnosis †			
Acute Pharyngitis	172,039	308,867	55.7%
Acute URI	168,193	387,542	43.4%
Acute Bronchitis	101,575	133,126	76.3%
Acute Sinusitis	99,400	118,758	83.7%
Bronchitis, unspecified	53,984	73,951	73.0%
Acute Tonsillitis	24,051	30,522	78.8%
Acute Nasopharyngitis	15,775	43,698	36.1%

* County/borough and managed care status percentages are adjusted for patient gender, age, and race/ethnicity.

† ARI diagnoses exclude ARI cases from 10/1/15 to 12/31/15 due to the exclusive use of ICD-9 diagnosis codes despite the transition from ICD-9 to ICD-10 codes in October 2015.

Table 2. Adjusted Percentage of Potentially Inappropriate Antibiotic Prescriptions by Patient County of Residence, (n=761,783 Patients Contributing to 1,273,300 ARI Episodes), 2011–2015

County	ARI Episodes		Adjusted Percentage with Potentially Inappropriate Rx*
	Potentially Inappropriate Rx	Total Episodes	
Albany	7,883	14,517	54.0%
Allegany	2,504	4,026	60.2%
Bronx	39,700	83,928	48.3%
Broome	12,392	18,829	64.3%
Cattaraugus	3,508	5,244	64.9%
Cayuga	8,858	12,618	68.4%
Chautauqua	4,903	7,631	62.7%
Chemung	6,533	8,720	72.9%
Chenango	2,497	3,592	67.4%
Clinton	2,503	3,564	68.1%
Columbia	2,080	3,279	62.1%
Cortland	697	987	69.1%
Delaware	2,962	4,338	66.4%
Dutchess	6,423	9,457	67.1%
Erie	19,287	32,134	59.4%
Essex	964	1,536	60.7%
Franklin	1,793	2,483	70.3%
Fulton	5,612	7,894	69.9%
Genesee	1,994	3,435	56.4%
Greene	2,159	3,237	64.7%
Hamilton	130	200	63.3%
Herkimer	5,231	7,612	67.5%
Jefferson	8,489	10,346	79.8%
Kings	183,676	351,234	52.7%
Lewis	1,477	1,953	72.9%
Livingston	2,767	4,005	67.1%
Madison	3,164	4,437	69.0%
Monroe	21,584	40,124	53.7%
Montgomery	649	951	66.1%
Nassau	29,054	42,734	68.4%
New York	36,137	73,004	49.9%
Niagara	4,935	7,433	64.9%
Oneida	7,002	9,908	69.9%
Onondaga	14,313	21,433	66.6%
Ontario	5,167	7,342	68.8%
Orange	15,098	28,471	52.7%
Orleans	1,308	2,025	62.8%
Oswego	5,123	7,207	68.7%
Otsego	710	1,195	57.5%
Putnam	1,325	1,951	66.4%
Queens	132,078	218,081	61.0%
Rensselaer	4,146	7,196	56.8%
Richmond	20,032	30,564	65.1%
Rockland	14,368	31,571	45.4%
St. Lawrence	3,558	4,621	74.5%
Saratoga	6,150	9,282	64.3%
Schenectady	1,048	2,091	50.3%
Schoharie	280	457	59.5%
Schuyler	1,942	2,636	71.6%
Seneca	2,277	2,980	74.5%
Steuben	2,834	3,830	71.5%
Suffolk	36,952	51,759	70.9%
Sullivan	2,607	4,210	61.5%
Tioga	1,867	2,628	69.0%
Tompkins	1,987	3,046	64.0%
Ulster	4,566	7,803	57.3%
Warren	2,278	3,703	59.7%
Washington	2,165	3,246	64.7%
Wayne	1,098	1,603	66.6%
Westchester	13,539	22,767	60.3%
Wyoming	647	1,057	59.3%
Yates	685	972	68.6%

*Percentages are adjusted for patient gender, age and race/ethnicity.

Table 3. Adjusted Percentage of Potentially Inappropriate Antibiotic Prescriptions by Patient County of Residents, (n=761,783 Patients Contributing to 1,273,300 ARI Episodes), 2011–2015

Medicaid Managed Care Plan and Status	ARI Episodes		Adjusted Percentage with Potentially Inappropriate Rx*
	Potentially Inappropriate Rx	Total Episodes	
All Patients	740,877	1,273,300	58.2%
Fee-for-Service Patients	38,903	72,621	53.8%
All MMC Plan Patients	701,974	1,200,679	58.5%
MMC Plan A	591	761	75.4%
MMC Plan B	6,617	9,425	69.9%
MMC Plan C	5,396	7,933	67.7%
MMC Plan D	7,263	10,763	66.5%
MMC Plan E	8,239	12,291	65.9%
MMC Plan F	45,782	69,377	64.8%
MMC Plan G	17,821	27,920	64.0%
MMC Plan H	1,672	2,665	62.7%
MMC Plan I	2,971	4,766	62.0%
MMC Plan J	12,053	19,993	61.3%
MMC Plan K	15,402	25,747	60.8%
MMC Plan L	42,089	69,902	60.3%
MMC Plan M	16,936	27,706	60.1%
MMC Plan N	6,867	11,353	59.9%
MMC Plan O	157,504	263,008	59.6%
MMC Plan P	28,816	47,473	59.5%
MMC Plan Q	54,421	93,060	59.1%
MMC Plan R	30,722	53,435	58.4%
MMC Plan S	33,040	58,738	57.1%
MMC Plan T	95,190	168,018	56.3%
MMC Plan U	14,624	26,861	55.1%
MMC Plan V	91,563	175,270	52.8%
MMC Plan W	5,608	12,589	43.4%
All Other MMC Plans	787	1,625	47.0%

*Percentages are adjusted for gender, age, race/ethnicity

Sources

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