

A Cross-Sectional Analysis of Inappropriate Outpatient Antibiotic Use in Children Insured by Kentucky Medicaid

Introduction

- Kentucky (KY) consistently has one of the highest rates of outpatient pediatric antibiotic prescribing
- Medicaid insures nearly half of all children in KY
- Previous analyses of antibiotic prescribing by volume have identified significant variation by geographic location, patient demographics, and provider type
- Less is known about the appropriateness of prescribing
- A previously published classification scheme¹ categorizes antibiotic prescriptions as “appropriate”, “potentially appropriate”, “inappropriate”, or “lack of diagnosis”, according to associated diagnoses
- Reliable antibiotic use outcomes are needed to support meaningful outpatient prescribing interventions
- The purpose of this study was to:
 - Identify risk factors for inappropriate outpatient antibiotic use in KY Medicaid children
 - Validate a classification scheme for infectious diagnosis codes using pediatric Medicaid data
 - Identify target populations for subsequent antimicrobial stewardship interventions

Methods

- Data source: KY Medicaid pharmacy and medical claims from 2017 for children under 20 years
- Antibiotic prescriptions were matched to medical claims within 3 days prior to fill date to identify corresponding diagnoses via ICD-10 codes
- The classification scheme was applied to categorize each antibiotic prescription to one of the four previously mentioned categories
- Chronic conditions: any diagnoses according to Feudtner’s Classification² from 2012-2017
- Multivariable logistic regression was used to describe provider risk factors and a generalized linear mixed model was used to describe patient risk factors for inappropriate prescribing

Results

- 10,787 providers wrote 779,813 antibiotic prescriptions for 328,515 children.
- 143,310 (43.6%) children filled one antibiotic, 78,609 (23.9%) filled two and 106,596 (32.5%) filled 3 or more
- The most frequent diagnoses, by category were:
 - Appropriate:** streptococcal pharyngitis (50.1%) and urinary tract infections (9.37%)
 - Potentially appropriate:** otitis media (25.4%), acute pharyngitis, not specified as streptococcal (14.3%), acute sinusitis (13.0%)
 - Inappropriate:** acute upper respiratory infection (19.1%), acute bronchitis (12.5%), and nonsuppurative otitis media (11.4%).

References:

- Chua KP, Fischer MA, Linder JA. *BMJ*. 2019 Jan 16;364:k5092.
- Feudtner C, Feinstein JA, Zhong W, Hall M, Dai D.. *BMC Pediatr*. 2014; 14:199.

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Prescription and Patient Results

Table 1. Antibiotic prescription characteristics and appropriateness categories

	Overall (%)	% of all antibiotic prescriptions			
		Appropriate	Potentially appropriate	Inappropriate	No diagnosis
Overall	779,813	19.8	45.9	21.0	13.3
Gender					
Female	414,862 (53.2)	21.9	44.0	20.5	13.6
Male	364,947 (46.8)	17.5	48.1	21.6	12.9
Age Group					
0-2 years	178,053 (22.8)	11.7	55.2	24.2	8.9
3-9 years	300,975 (38.6)	25.7	42.9	20.1	11.3
10-19 years	300,785 (38.6)	18.7	43.4	20.0	17.9
Race/ethnicity					
White, NH	600,516 (77.0)	19.8	46.0	21.1	13.0
Black, NH	57,502 (7.4)	21.4	43.4	19.9	15.3
Hispanic	27,620 (3.5)	22.5	47.4	19.6	10.6
Other	16,385 (2.1)	19.6	46.8	20.2	13.4
Not Provided	77,790 (10.0)	17.6	46.3	21.4	14.7
Residence					
Urban	312,947 (40.1)	19.9	47.2	18.9	14.0
Suburban	167,435 (21.5)	20.5	45.7	21.4	12.5
Rural	299,431 (38.4)	19.4	44.7	23.0	13.0
Chronic condition	106,164 (13.6)	18.6	42.7	25.4	13.3

Table 1. Overall column summarizes patient characteristics for each antibiotic prescription. Groups with higher percentages of inappropriate prescriptions include: age 0-2 years, rural residence, and presence of any chronic condition.

Figure 1. Top antibiotics prescribed, by category

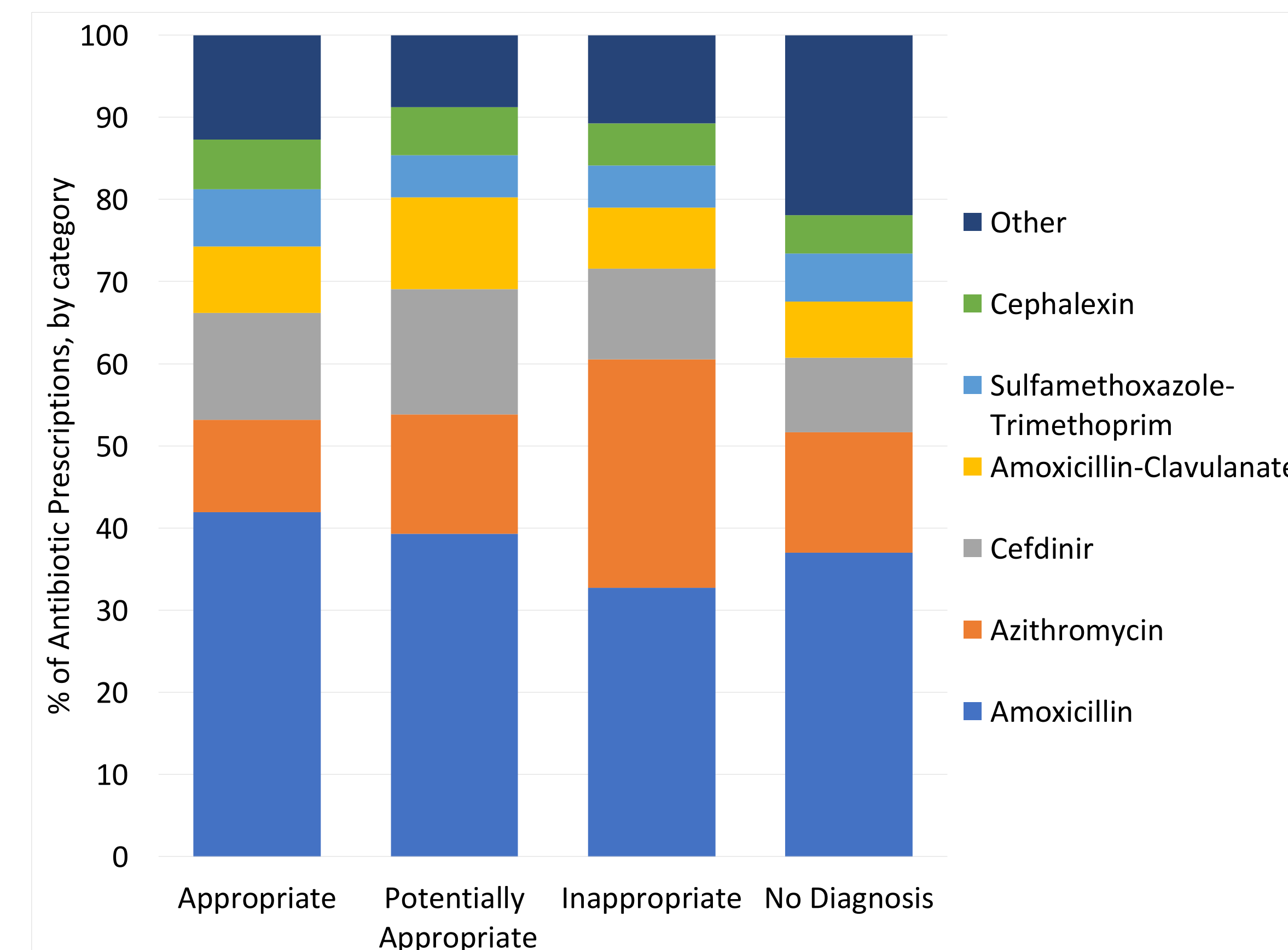


Figure 1. Amoxicillin is most frequently prescribed in all categories. Azithromycin is more common for inappropriate diagnoses. “Other” antibiotics are more common for prescriptions not associated with a diagnosis.

Provider Results

Table 2. Antibiotic appropriateness categories by provider type

	Overall (%)	% of all antibiotic prescriptions			
		Appropriate	Potentially appropriate	Inappropriate	No diagnosis
General practitioner	262,098 (33.6)	18.4	47.2	22.4	12.0
Nurse practitioner	317,710 (40.8)	22.7	47.5	19.4	10.4
Pediatrician	78,329 (10.1)	17.5	48.8	21.4	12.3
Physician Assistant	65,796 (8.4)	23.9	46.1	20.5	9.5
Other	55,595 (7.1)	8.5	26.4	23.2	41.9

GP = general practitioner; NP = nurse practitioner; PA = physician assistant

Table 2. NPs prescribe the highest number of antibiotics, by volume, but have the lowest percentage of inappropriate prescriptions. GPs and other providers are responsible for a higher percentage of inappropriate prescriptions and antibiotics without an associated medical claim.

Figure 2. Percent of inappropriate antibiotic prescriptions by provider volume

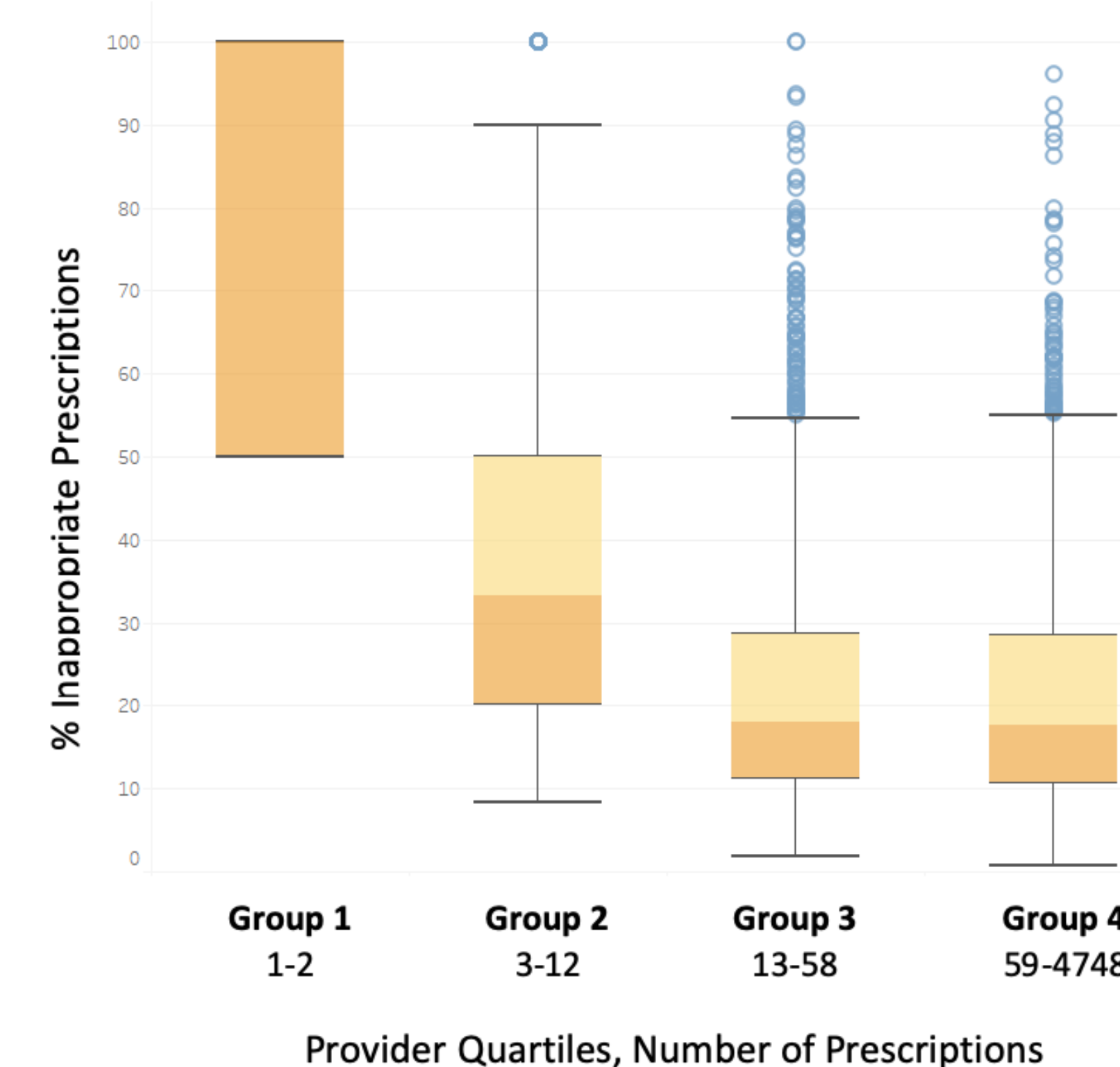


Figure 2. 25% of providers wrote only 1-2 antibiotic prescriptions in 2017, most of which were inappropriate. Groups 3 and 4 wrote at least 12 prescriptions, ~20% of which were inappropriate. Groups 3 and 4 were included in the logistic regression model.

Risk Factors

Table 3. Provider characteristics for inappropriate prescribing*

	OR	95% Confidence Limits		P-value
Geographic area				
Suburban vs Urban	1.43	1.22	1.67	<.0001
Rural vs Urban	1.56	1.37	1.79	<.0001
Provider type				
GP vs. NP	1.22	1.06	1.40	0.006
Pediatrician vs. NP	1.16	0.90	1.50	0.263
PA vs. NP	0.99	0.78	1.25	0.934
Other vs. NP	1.02	0.85	1.23	0.856
Volume prescribed	1.10	0.87	1.40	0.426

*Defined as ≥ 25% of antibiotics prescribed were inappropriate

Table 4. Patient characteristics for inappropriate prescribing*

	OR	95% Confidence Limits		P-value
Inappropriate Prescriber	4.15	4.10	4.20	<.0001
Race				
African American vs White	1.09	1.06	1.12	<.0001
Hispanic vs White	1.02	0.99	1.06	0.227
Other vs White	1.06	1.01	1.11	0.01
Not Provided vs White	1.02	0.99	1.04	0.161
Age				
0-2 yrs vs. 10-19 yrs	1.39	1.37	1.41	<.0001
3-9 yrs vs. 10-19 yrs	1.05	1.03	1.07	<.0001
Geographic area				
Suburban vs Urban	1.03	1.01	1.06	0.001
Rural vs Urban	1.09	1.07	1.10	<.0001
Sex: Male vs Female	1.06	1.04	1.07	<.0001
Chronic condition	1.31	1.28	1.33	<.0001

*Defined as receipt of inappropriate prescription

Findings: Geographic area was the most significant contributing factor for the provider analyses. Being seen by an inappropriate prescriber (>25%) was highly associated with receipt of an inappropriate antibiotic, in addition to younger age (0-2) and having a chronic condition.

Conclusions

- This classification scheme is feasible for use in pediatric patients and could serve as a valuable metric for provider feedback reports
- Inappropriate prescribing is more common among children who are younger, living in rural areas, and/or have a chronic condition
- The most significant provider factor associated with inappropriate prescriptions was practicing in a rural or suburban setting
- Children who see a high inappropriate prescriber have 4 times the odds of receiving an inappropriate antibiotic prescription
- Outpatient stewardship interventions should include all provider types and rural areas

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