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Original Article

Sociodemographic differences in treatment of acute respiratory infections in pediatric urgent cares

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Abstract

Objective: To determine whether differences exist in antibiotic prescribing for respiratory infections in pediatric urgent cares (PUCs) by patient race/ethnicity, insurance, and language.

Design: Multi-center cohort study.

Setting: Nine organizations (92 locations) from 22 states and Washington, DC.

Participants: Patients ages 6 months–18 years evaluated April 2022–April 2023, with acute viral respiratory infections, otitis media with effusion (OME), acute otitis media (AOM), pharyngitis, community-acquired pneumonia (CAP), and sinusitis.

Methods: We compared the use of first-line (FL) therapy as defined by published guidelines. We used race/ethnicity, insurance, and language as exposures. Multivariable logistic regression models estimated the odds of FL therapy by group.

Results: We evaluated 396,340 ARI encounters. Among all encounters, 351,930 (88.8%) received FL therapy (98% for viral respiratory infections, 85.4% for AOM, 96.0% for streptococcal pharyngitis, 83.6% for sinusitis). OME and CAP had the lowest rates of FL therapy (49.9% and 60.7%, respectively). Adjusted odds of receiving FL therapy were higher in Black Non-Hispanic (NH) (adjusted odds ratio [aOR] 1.53 [1.47, 1.59]), Asian NH (aOR 1.46 [1.40, 1.53], and Hispanic children (aOR 1.37 [1.33, 1.41]), compared to White NH. Additionally, odds of receiving FL therapy were higher in children with Medicaid/Medicare (aOR 1.21 [1.18–1.24]) and self-pay (aOR 1.18 [1.1–1.27]) compared to those with commercial insurance.

Conclusions: This multicenter collaborative showed lower rates of FL therapy for children of the White NH race and those with commercial insurance compared to other groups. Exploring these differences through a health equity lens is important for developing mitigating strategies.

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Introduction

Antibiotic overuse contributes to increased antibiotic resistance and healthcare costs and is a serious public health threat.[1] The American Academy of Pediatrics (AAP) identified urgent care clinics as an important target for antimicrobial stewardship[2] because of their high rate of antibiotic use.[3] Respiratory infections in particular comprise the majority of indications for antibiotic prescribing among pediatric patients and provide a target for improvement efforts.[4] National guidelines give recommendations on the preferred first-line (FL) antibiotic agent for the routine treatment of common pediatric respiratory infections such as acute otitis media (AOM),[5] group A streptococcal (GAS) pharyngitis,[6] community-acquired pneumonia (CAP),[7] and acute bacterial rhinosinusitis.[8] However, the guidelines acknowledge that alternative agents may be appropriate in certain situations (e.g., reported allergy to FL agent, treatment failure, concomitant infections).

Reports from primary care clinics, urgent care clinics, and emergency departments show high rates of antibiotic use and non-FL antibiotic use in White non-Hispanic children compared to other races and ethnicities.[9–12] These reports evaluate differences at a single-center or at a state level. A recent systematic scoping review identified clinician- and patient-level markers that likely

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contribute to health inequities in outpatient antibiotic prescribing behaviors.[13] Antimicrobial stewardship programs (ASPs) have been successful in reducing antibiotic overuse while improving patient outcomes.[14] However, differences in management of patients with common infections have been shown to persist across race,[11,15] ethnicity,[11,15] insurance status,[11] and language[15] despite successful ASP practices. These differences in antibiotic use suggest that health inequities may exist. Because the national guidelines acknowledge situations where non-FL agents would be indicated, the goal of this study is not to assign designations of "better" or "worse" care. Instead, we aim to characterize antibiotic prescribing behaviors for respiratory infections in pediatric urgent cares (PUCs) in relation to race and ethnicity, insurance, and language through a large multicenter collaborative.

Methods

Study design and setting

This cross-sectional multicenter national study evaluated use of FL antibiotic therapy for acute respiratory infections (ARIs) in children 6 months to 18 years of age treated in PUC centers across the United States between April 2022 and April 2023. Institutions were invited to participate through listservs from the Society for Pediatric Urgent Care and the Sharing Antimicrobial Reports for Pediatric Stewardship (SHARPS). Participating PUCs formed a large national quality improvement collaborative with the main aim of decreasing sociodemographic differences in antibiotic use for common respiratory infections. This report describes baseline data from the collaborative. Individual PUC centers completed institutional board review approvals and data user agreements per their institutional requirements. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[16]

Participating centers

Every participating PUC center completed an intake survey delineating their yearly patient volumes, patients' demographics, methods of collection of demographics, and antimicrobial and health equity endeavors. The 92 geographically distinct PUC sites were grouped into 28 PUC centers based on the availability of a local project leader for each center. We use the "center" as our unit of analysis for the study, which for some organizations represents one PUC site, and for others, represents a cluster of PUC sites.

Patient-level data

We included patients 6 months to 18 years of age with ARI diagnoses, with *International Classification of Diseases, 10th Revision* (ICD-10) codes divided into tiers based on their likelihood of requiring antibiotic therapy.[14,17,18] Tier 1 comprised diagnoses typically requiring antibiotics, including CAP and GAS pharyngitis. Tier 2 encompassed diagnoses for which antibiotics may be indicated, and included AOM, unspecified otitis media, acute pharyngitis, and sinusitis. Tier 3 comprised diagnoses for which antibiotics are not recommended and included viral respiratory infections and otitis media with effusion (OME) (eTable 1).

Defining first-line therapy

We defined FL therapy for tier 3 diagnoses (acute viral respiratory infections and OME) as no antibiotic use. For tier 1 and 2 diagnoses, we used national guidelines to define FL therapy: amoxicillin and penicillin for pharyngitis,[6] amoxicillin and amoxicillin-clavulanate for sinusitis[8] and AOM,[5] and amoxicillin for CAP.[7] We included no antibiotics as an appropriate option for AOM and acute pharyngitis (eTable 2).[19] If a patient had multiple respiratory diagnoses, we evaluated FL treatment using the diagnosis allowing broader antibiotics (FL therapy for a patient with both CAP and AOM would be amoxicillin or amoxicillin-clavulanate).

We excluded patients who were transferred from the PUCs to a higher level of care such as emergency departments or were admitted to the hospital, those who left without being seen or against medical advice, and those with concomitant non-respiratory diagnoses (e.g., urinary tract infection) that may have required systemic antibiotics, thus possibly biasing the antibiotic prescribed for the condition of interest.[20] We also excluded encounters with a primary diagnosis of CAP, GAS, or sinusitis not associated with an antibiotic prescription (eTable 2).

Data collection

Each center developed an electronic health record (EHR) report that identified all PUC encounters that fit the inclusion criteria. The report included visit month and year, the ARI ICD-10 diagnosis codes along with secondary ICD-10 diagnosis codes, demographic variables (age, race and ethnicity, language, insurance), penicillin allergy, and oral antibiotics prescribed. All included centers used the family's self-report to collect race, ethnicity, and language in the EHR. We evaluated only prescriptions for oral antibiotics and did not include topical antibiotics or systemic antibiotics that may have been administered in-house. Each institution uploaded data from April 2022 through April 2023 to a Research Electronic Data Capture (REDCap)® site[21] managed by the coordinating center that compiled and analyzed the data.

Study variables

The primary outcome measure was the overall use of FL therapy. The different sociodemographic variables were the exposure variables. We analyzed our outcome measure for all diagnoses combined as a composite metric. We also evaluated FL therapy for each individual diagnosis.

Statistical analysis

We compared the proportion of patients receiving FL therapy across sociodemographic factors using descriptive statistics. We performed unadjusted and multivariable logistic regression models to calculate the odds ratio (OR) of FL therapy by diagnosis, age, race and ethnicity, language, and insurance type. All logistic models were run as multi-level models with the PUC center designated as a random effect. During regression modeling, the detailed race and ethnicity data were categorized into groups listed by the US Census. However, our modeling predated the new Office of Management and Budget standards published in March 2024.[22] Races reported that were not listed in the US Census were classified as "Other" (eTable 3). Categorizations of self-reported insurance and language are included as eTables 4 and 5, respectively. As a sensitivity analysis, to minimize race-centering, we ran the model with the overall group mean as the reference group rather than the largest group (White NH). All analyses were completed using SAS software (version 9.4; SAS Institute Inc.; Cary, NC).

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Results

Center characteristics

We recruited 9 large healthcare organizations with 92 individual PUC sites, from 22 states and Washington, DC (eFigure 1). One organization spanning 16 states and Washington, DC, combined all the PUC sites within each state into one center, while one organization with 3 PUCs within 2 states combined their sites into one center (eTable 6). Our analysis therefore included 28 PUC centers that were mostly suburban (n = 20, 71.4%). Most centers were freestanding, either part of a private group or affiliated with a larger hospital (n = 25, 89.3%). Twenty-three centers (82.1%) reported an active outpatient ASP, although 27 (96.4%) had ASP initiatives, particularly clinical practice guidelines (n = 27, 96.4%), data reporting (n = 23, 82.1%), and clinical decision support tools (n = 23, 82.1%). Most centers (n = 27, 96.4%) had guidelines for the management of common respiratory infections. Health equity resources varied by center, but most had resources available in multiple languages (n = 27, 96.4%), implicit bias training (n = 23, 82.1%), and a health equity officer (n = 22, 78.6%) (Table 1).

Encounter results

We evaluated 411,455 patient records from the 28 centers. We excluded 15,115 records total (7,617 tier 1 diagnoses with no associated antibiotic prescription, and 7,498 with secondary diagnoses possibly requiring antibiotics). Our final study cohort included 396,340 ARI encounters (Figure 1).

The median age of our cohort was 51 months (IQR 25, 87). Our cohort included 139,134 (35.1%) White NH children, 99,159 (25.0%) Hispanic children, 36,345 (9.2%) Black NH children, and 25,552 (6.4%) Asian NH children. The race and ethnicity were unknown in 82,395 (20.7%) children. Primary language was English in 155,868 (39.3%), Spanish in 10,001 (2.5%), and other languages in 8,283 (2.1%) encounters. Language was unknown in 222,188 (56%) encounters. Most patients had commercial insurance (n = 221,281, 55.8%), followed by government insurance (Medicaid/Medicare) (n = 146,619, 37%) (Table 2).

First-line therapy

Of 396,340 ARI encounters, 168,549 (42.5%) were acute viral respiratory infections, 154,353 (38.9%) AOM, 44,499 (11.2%) streptococcal pharyngitis, 10,860 (2.7%) sinusitis, 10,700 (2.7%) OME, 8,841 (2.2%) pharyngitis, and 7,538 (1.9%) CAP. 9,000 (2.3%) encounters had more than one ARI diagnoses. Among all encounters, 351,930 (88.8%) received FL therapy (98.0% for viral respiratory infections, 85.4% for AOM, 96.0% for streptococcal pharyngitis, 83.6% for sinusitis). OME and CAP were the diagnoses with the lowest rates of FL therapy (49.9% and 60.7%) (Table 2). Of the 206,049 encounters where antibiotics were prescribed, the most prescribed antibiotics included amoxicillin and penicillin (n = 141,285, 68.6%), followed by amoxicillin-clavulanate (n = 30,825, 15.0%), and cefdinir (n = 23,807, 11.5%). Azithromycin was rarely prescribed in our cohort (n = 4,535, 2.2%).

Age

Compared to children < 2 years of age, all other age groups had lower odds of receiving FL therapy, particularly the 5–12-year-old age group (adjusted odds ratio [aOR] 0.76, 95% confidence interval [CI] [0.74, 0.78], P <0.001) (Table 3).

Race and ethnicity

Adjusted odds of receiving FL therapy were higher in Black Non-Hispanic (NH) (aOR 1.53 [1.47, 1.59]), Asian NH (aOR 1.46 [1.40, 1.53]), and Hispanic children (aOR 1.37 [1.33, 1.41]) compared to White NH children (Table 3). Even when using the overall mean as our reference group, we found similar trends, with White NH children having lower odds of FL therapy compared to the mean, while most children of other races and ethnicities had higher odds of receiving FL therapy (eTable 7 A).

Language

Compared to English-speaking families, the adjusted odds of receiving FL therapy were higher in patients who spoke Spanish (aOR 1.21, CI 1.12, 1.30, P <0.001) but not significantly different for those who spoke other languages (Table 3). With multiple sites having nearly all their data categorized as unknown (i.e., "missing") language, a reporting bias for patient language may have been introduced. However, when we compare those sites with a large proportion of unknown language to sites having a low proportion of unknown language, the difference in FL therapy for all ARI diagnoses is <1% (89.2% and 88.3%, respectively).

Insurance

Compared to patients on commercial insurance, the odds of FL therapy were higher in patients on Medicaid/Medicare (aOR 1.21, CI 1.18, 1.24, P <0.001) and patients who self-pay (aOR 1.18, CI 1.1, 1.27, P <0.001) (Table 3).

Penicillin allergy

Data on penicillin allergy were available from only 25 centers. Of 381,688 (92.8%) encounters where allergy was assessed, only 12,377 (3.2%) had a penicillin allergy recorded. Since not all centers were able to provide allergy data, and we were not able to perform validation on those that did, we did not include penicillin allergy in our logistic regression model. Even when we excluded all patients with known or unspecified penicillin allergy, the primary results remained statistically significant: Black NH children (aOR 1.48 [1.42, 1.55]), Hispanic (aOR 1.34 [1.3, 1.9]) and Asian NH (aOR 1.38 [1.31, 1.45]) children had higher odds of FL therapy compared to White NH children. Similar trends continued to be seen for insurance and language (eTable 7 B).

Center variability

To evaluate whether our findings were biased by centers with higher number of encounters, we calculated the predicted probabilities of receiving FL therapy from our multi-level, multivariable logistic models. The association between these probabilities and the number of encounters is shown graphically in eFigure 2. Twenty-two (78.6%) of the 28 centers had a median predicted probability of FL therapy between 0.85 and 0.95, implying that the findings are not influenced by a few larger centers.

Discussion

In this cross-sectional study of almost 400,000 PUC encounters for respiratory infections, we found that children evaluated in PUCs have low rates of antibiotic use for viral respiratory infections and high rates of FL antibiotic use for common infections such as AOM, sinusitis, and pharyngitis. This finding is consistent with

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Table 1. Center characteristics

n = 28 centers		n (%)
Center description	Freestanding private groups	20 (71.4%)
	Freestanding PUCs affiliated with larger hospital	5 (17.9%)
	PUCs located inside an emergency department or attached to a hospital and affiliated with a larger hospital	2 (7.1%)
	Private group located inside an emergency department or attached to a hospital	1 (3.6%)
Academic affiliation		6 (21.4%)
Location	Suburban	20 (71.4%)
	Urban	8 (28.6%)
ASP	Active outpatient ASP	23 (82.1%)
	ASP initiatives	27 (96.4%)
	Clinical practice guidelines	27 (96.4%)
	Quality Improvement Projects	27 (96.4%)
	Data report	23 (82.1%)
	Clinical decision support tools	23 (82.1%)
	Commitment letters	21 (75%)
	National Collaborations	18 (64.3%)
	Pharmacy presence	3 (10.7%)
	Formulary restriction	1 (3.6%)
Guidelines Availability	Guidelines for management of streptococcal pharyngitis	27 (96.4%)
	Guidelines for management of AOM	25 (89.3%)
	Guidelines for management of CAP	24 (85.7%)
	Guidelines for management of sinusitis	22 (78.6%)
Health equity resources	Implicit bias training	23 (82.1%)
	Health equity officer	22 (78.5%)
	Courses focused on health equity	21 (75%)
	Collaborations with community organizations	4 (14.3%)
	Universal social determinants of health screening	2 (7.1%)
	Diverse patient and family representatives that provide direct feedback to the group	2 (7.1%)
	Data reports stratified by social determinants of health	1 (3.6%)
	Commitment to health equity letters	0 (0%)
Language	Resources for patients available in multiple languages	27 (96.4%)
	Available interpreters	28 (100%) Audiovisual - 26 (92.8%) In-person - 5 (17.8%) Audio only - 3 (10.7%)
Method of collection of race/ethnicity	Self-reported, verbal	21 (75%)
	Self-reported filled by patient/family	25 (89.3%)
PUC encounter numbers as reported in intake survey	Approximate number of PUC encounters in 2022 (median, range)	35,000 (9,176–367,927)
	Approximate number of PUC encounters of children ≤18 years in 2022 (median, range)	35,000 (800–348,772)

what has been published, showing relatively high rates of guideline-concordant management for children evaluated in pediatric-specific settings.[4,23] However, we identified differences in rates of FL therapy among sociodemographic groups. Rates of FL therapy were higher in Black NH, Hispanic, and Asian children compared to White NH children, in children speaking Spanish compared to English, and in children with Medicaid/Medicare or self-pay compared to commercial insurance. These results remained unchanged even when excluding patients with penicillin allergies. While the differences reported in our study are relatively

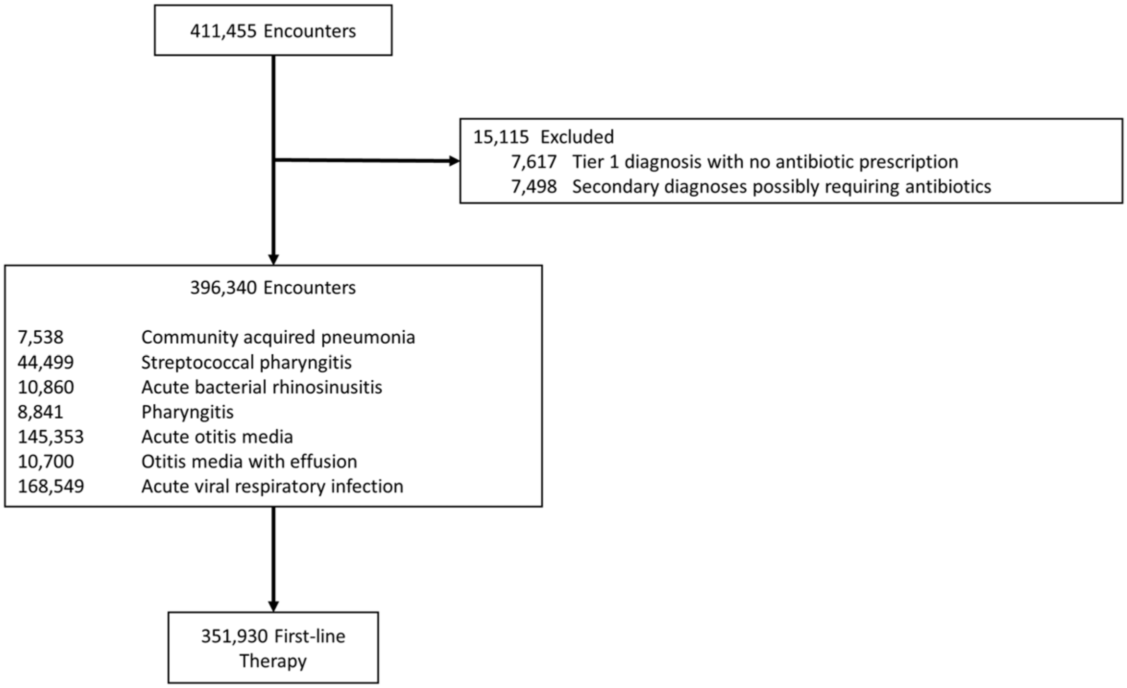

Figure 1. Flow diagram of included encounters.

small, they are potentially clinically significant and are persistent across centers and diagnoses.[24,25]

We recognize that social constructs and their influence on prescribing behavior are complex. These results are not intended to assign designations of "better" or "worse" care for certain groups. However, these differences persist across a large multicenter cohort. These findings are congruent with previous studies that show people in groups that have been economically or socially marginalized are more likely to receive the recommended treatment when the recommendations are for fewer resources or less treatment. Studies report this pattern for antibiotic prescribing patterns in multiple care settings.[5–7,9] These findings extend outside of antimicrobial use, with studies reporting lower rates of resource use for febrile infants and children diagnosed with bronchiolitis in groups that have been marginalized.[26,27] Conversely, studies on pain management for appendicitis in the emergency department demonstrate that children in groups that have been marginalized are less likely to have their pain adequately controlled and more likely to have a delay in diagnosis compared to children in groups that have not been marginalized.[28] This consistent pattern suggests that groups that have been marginalized may be at risk for chronic under-receipt of healthcare, while other groups may be at risk for over-treatment and unnecessary care.

Understanding the factors contributing to health inequity is an important step toward healthcare quality improvement.[29] Although the reasons for the differences in antibiotic prescribing are likely multifactorial, one proposed explanation is differences in rates of penicillin allergy. Studies have reported higher rates of penicillin allergy in White patients.[22,23] Additionally, a recent study of PUC encounters demonstrated a negative correlation between area deprivation index and odds of penicillin allergy labels.[30] Although we could not evaluate penicillin allergy rate for 3 PUC centers and could not validate severity or accuracy, we found that, even when excluding patients with known penicillin allergy (who almost always receive non-FL therapy), we continued to observe a difference in the rate of FL therapy among the different races. Additionally, while genetic factors may play a role in adverse drug reactions, the differences in rates of penicillin allergy labels are unlikely to be rooted in biological differences but are likely another sociological consequence of healthcare inequity.[30] Further investigation is needed to understand this complex problem.[31]

Limitations

Despite the multi-state representation and rigorous methodology, our study has limitations. First, the study included PUCs with high rates of FL therapy when compared to national data.[4] The ASP and health equity resources available at the included PUCs may not be representative of all PUCs. Therefore, these results may not be generalizable to all PUCs or care settings. Although our study included sites from 22 states and Washington, DC, most of our sites were suburban, and were concentrated in the Northeast, so our findings may not be representative of rural settings or the entire United States. Additionally, the amoxicillin shortage, which was reported in late 2022, may have affected individual sites to varying degrees, impacting FL therapy rates; we may have overestimated FL therapy for patients who may have received intramuscular ceftriaxone in-house and no antibiotics for otitis media.[32] Furthermore, this study relied on an EHR report, which in turn relied on accurate final diagnoses and data capture. We had missing information due to limitations in some organizations' data report (for race and ethnicity, and language in particular), which complicates data interpretation. Some racial and ethnic groups or types of insurance may have been more reflective of specific sites (e.g., higher military insurance in centers with locations serving the military; specific races may be more concentrated in specific areas). We have, however, evaluated data by institution, center, and site, and the findings are consistent across the different centers. Finally, some centers could not provide penicillin allergy data, and even among those that did, the penicillin allergy rate was low, which

Table 2. Proportion of patients receiving first-line therapy

	Number of Encounters	Encounters with First-line Therapy ***n*** **(%)**
Total encounters	396,340	351,930 (88.8%)
Diagnosis		
Tier 1		
Community acquired pneumonia	7,538	4,574 (60.7%)
Streptococcal pharyngitis	44,499	35,245 (79.2%)
Tier 2		
Sinusitis	10,860	9,079 (83.6%)
Acute pharyngitis	8,841	8,480 (95.9%)
Acute otitis media/unspecified otitis media	145,353	124,073 (85.4%)
Tier 3[a]		
Otitis media with effusion	10,700	5,340 (49.9%)
Acute viral respiratory infection	168,549	165,139 (98.0%)
Age		
<24 months	90,612	82,283 (90.8%)
24–59 months	132,731	117,685 (88.7%)
5–12 years	149,434	130,831 (87.6%)
>12 years	23,563	21,131 (89.7%)
Race and Ethnicity		
American Indian or Alaska Native- NH	654	592 (90.5%)
Asian-NH	25,552	22,919 (89.7%)
Black-NH	36,345	32,561 (89.6%)
Hispanic	99,159	89,163 (89.9%)
Native Hawaiian or Pacific Islander-NH	892	807 (90.5%)
Other-NH[b]	12,209	11,073 (90.7%)
White-NH	139,134	121,336 (87.2%)
Unknown race/ethnicity	82,395	73,479 (89.2%)
Language		
English	155,868	137,392 (88.1%)
Spanish	10,001	9,124 (91.2%)
Other[c]	8,283	6,934 (83.7%)
Not specified	222,188	198,479 (89.3%)
Insurance		
Commercial	221,281	194,981 (88.1%)
Medicaid/ Medicare	146,619	131,162 (89.5%)
Military	4,262	3,626 (85.1%)
Self-pay	8,736	7,920 (90.7%)
Other	4,745	4,292 (90.5%)
Unknown[d]/ Refused	10,697	9,949 (93.0%)

[a]Two centers did not submit OME or viral respiratory infections records because they were not able to include encounters without antibiotic prescriptions due to EHR limitations.
[b]Other races reported: Abenaki, Afghanistani, Arab, Armenian, Asian Indian, Chinese, Dominican, English, Gila River Pima Maricopa, Irish, Israeli, Mexican American Indian, Middle Eastern or North African, Multiracial, Other, Pakistani, Spanish American Indian, Vietnamese.
[c]Other languages: Abkhazian, Afar, Akan, Albanian, Algerian Arabic, American Sign Language, Amharic, Arabic, Aramaic, Armenian, Bambara, Bengali, Berber, Brazilian Portuguese, Bulgarian, Burmese, Cambodian, Cantonese, Creole, Chamorro, Chibcha, Chinese, Chuukese, Croatian, Dari, Elamite, Fanti, Farsi, Finno-Ugrian, French, Fulani, Georgian, German, Greek, Gujarati, Hausa, Hebrew, Hindi, Hungarian, Igbo, Indic, Indonesian, Iraqi Arabic, Italian, Japanese, Kabyle, Kannada, Kazakh, Khmer, Kikuyu, Kinyarwanda, Kirundi, Korean, Kosraean, Kru, Kunama, Kurdish, Lao, Lingala, Luo, Macedonian, Maithili, Mandar, Mandarin, Mandingo, Marathi, Marshallese, Mongolian, Nepali, Oromo, Other, Palauan, Panjabi, Pashto, Persian, Philippine, Polish, Portuguese, Punjabi, Pushto, Quechua, Romanian, Rundi, Russian, Sami, Samoan, Sinhalese, Somali, Soninke, Swahili, Sylheti, Tagalog, Tamil, Telugu, Thai, Tigre, Tigrinya, Toishanese, Tongan, Turkish, Turkmen, Twi, Ukrainian, Urdu, Uzbek, Vietnamese, Wolof, Yoruba, Zomi.
[d]Other insurances reported: Auto/Third-Party Liability, Other, Other Government, Workers Compensation.

Table 3. Results of multivariable logistic regression analyses evaluating the odds of first-line therapy

	Unadjusted		Adjusted	
	OR (95% CI)	*P* value	OR (95% CI)	*P* value
Patient age				
<24 months	-ref-	—	-ref-	—
24–59 months	0.82 (0.79, 0.84)	<0.001	0.82 (0.79, 0.84)	<0.001
5–12 years	0.76 (0.74, 0.79)	<0.001	0.76 (0.74, 0.78)	<0.001
>12 years	0.93 (0.89, 0.98)	0.003	0.93 (0.89, 0.98)	0.004
Race and ethnicity				
White-NH	-ref-	—	-ref-	—
American Indian or Alaska Native-NH	1.43 (1.10, 1.86)	0.008	1.38 (1.06, 1.80)	0.018
Asian-NH	1.49 (1.42, 1.55)	<0.001	1.46 (1.40, 1.53)	<0.001
Black-NH	1.62 (1.56, 1.69)	<0.001	1.53 (1.47, 1.59)	<0.001
Hispanic	1.48 (1.44, 1.53)	<0.001	1.37 (1.33, 1.41)	<0.001
Native Hawaiian or Pacific Islander-NH	1.24 (0.99, 1.56)	0.059	1.20 (0.96, 1.51)	0.108
Other-NH	1.26 (1.18, 1.34)	<0.001	1.22 (1.14, 1.30)	<0.001
Unknown race and ethnicity	1.33 (1.29, 1.37)	<0.001	1.29 (1.25, 1.32)	<0.001
Insurance				
Commercial	-ref-	—	-ref-	—
Medicaid/ Medicare	1.32 (1.29, 1.35)	<0.001	1.21 (1.18, 1.24)	<0.001
Military	0.96 (0.88, 1.05)	0.424	0.97 (0.89, 1.07)	0.567
Self-pay	1.25 (1.16, 1.34)	<0.001	1.18 (1.10, 1.27)	<0.001
Other	1.02 (0.93, 1.13)	0.630	1.02 (0.92, 1.13)	0.679
Unknown/ Refused	1.32 (1.19, 1.47)	<0.001	1.21 (1.09, 1.35)	<0.001
Preferred language				
English	-ref-	—	-ref-	—
Spanish	1.39 (1.29, 1.50)	<0.001	1.21 (1.12, 1.30)	<0.001
Other	1.29 (1.20, 1.38)	<0.001	1.05 (0.97, 1.12)	0.218
Unknown/ Refused	1.18 (1.06, 1.32)	0.004	1.17 (1.05, 1.31)	0.006

[a]Other races reported: Abenaki, Afghanistani, Arab, Armenian, Asian Indian, Chinese, Dominican, English, Gila River Pima Maricopa, Irish, Israeli, Mexican American Indian, Middle Eastern or North African, Multiracial, Other, Pakistani, Spanish American Indian, Vietnamese.
[b]Other languages: Abkhazian, Afar, Akan, Albanian, Algerian Arabic, American Sign Language, Amharic, Arabic, Aramaic, Armenian, Bambara, Bengali, Berber, Brazilian Portuguese, Bulgarian, Burmese, Cambodian, Cantonese, Creole, Chamorro, Chibcha, Chinese, Chuukese, Croatian, Dari, Elamite, Fanti, Farsi, Finno-Ugrian, French, Fulani, Georgian, German, Greek, Gujarati, Hausa, Hebrew, Hindi, Hungarian, Igbo, Indic, Indonesian, Iraqi Arabic, Italian, Japanese, Kabyle, Kannada, Kazakh, Khmer, Kikuyu, Kinyarwanda, Kirundi, Korean, Kosraean, Kru, Kunama, Kurdish, Lao, Lingala, Luo, Macedonian, Maithili, Mandar, Mandarin, Mandingo, Marathi, Marshallese, Mongolian, Nepali, Oromo, Other, Palauan, Panjabi, Pashto, Persian, Philippine, Polish, Portuguese, Punjabi, Pushto, Quechua, Romanian, Rundi, Russian, Sami, Samoan, Sinhalese, Somali, Soninke, Swahili, Sylheti, Tagalog, Tamil, Telugu, Thai, Tigre, Tigrinya, Toishanese, Tongan, Turkish, Turkmen, Twi, Ukrainian, Urdu, Uzbek, Vietnamese, Wolof, Yoruba, Zomi.
[c]Other insurances reported: Auto/Third-Party Liability, Other, Other Government, Workers Compensation.

may be reflective of the lower age group of our cohort but may also be attributed to inaccurate allergy labels in the EHR.

Although our study evaluates factors beyond race and ethnicity, it is still limited in its scope as it does not evaluate deeper socioeconomic factors. This is due to the limitation of what is available in the EHR. There continues to be a need to go beyond demographics and investigate socioeconomic factors, such as childhood opportunity index or area deprivation index measures, that may provide additional insight into the contributing factors of these observed differences in antibiotic prescribing.[31] Encouraging clinicians to use Z-code documentation to identify social determinants of health can help capture these data.[33] These factors, in addition to those identified through qualitative research and patient engagement, would allow for quality improvement projects that could help reduce the differences and improve health equity in pediatric antibiotic prescribing. Additionally, evaluating patient-prescriber race or language concordance could provide more insight into antibiotic prescribing habits.[34]

Conclusions

This multicenter cross-sectional study shows that children evaluated in PUC centers often receive FL therapy for common respiratory infections. However, we found lower rates of FL-recommended therapy for White NH children, children who use English for their care, and those with commercial insurance compared to other groups. Understanding the causative factors contributing to the differences in antibiotic prescribing behaviors will be helpful in developing strategies for equitable antibiotic stewardship. Additionally, using balancing measures to track

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existing disparities helps mitigate the differential impact of interventions.

Data sharing statement. Deidentified individual participant data will not be made available.

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References

1. Centers for disease control and prevention. Antibiotic resistance threats in the United States 2019. 2019. https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf. Accessed July 07, 2021.
2. Gerber JS, Jackson MA, Tamma PD, Zaoutis TE, Committee on Infectious Diseases, Pediatric Infectious Diseases Society. Antibiotic stewardship in pediatrics. *Pediatrics* 2021;147:e2020040295.
3. Palms DL, Hicks LA, Bartoces M, *et al.* Comparison of antibiotic prescribing in retail clinics, urgent care centers, emergency departments, and traditional ambulatory care settings in the United States. *JAMA Intern Med* 2018;178:1267–1269.
4. Hersh AL, King LM, Shapiro DJ, Hicks LA, Fleming-Dutra KE. Unnecessary antibiotic prescribing in US ambulatory care settings, 2010-2015. *Clin Infect Dis* 2021;72:133–137.
5. Lieberthal AS, Carroll AE, Chonmaitree T, *et al.* The diagnosis and management of acute otitis media. *Pediatrics* 2013;131:e964–999.
6. Shulman ST, Bisno AL, Clegg HW, *et al.* Clinical practice guideline for the diagnosis and management of group A streptococcal pharyngitis: 2012 update by the infectious diseases society of America. *Clin Infect Dis* 2012;55:1279–1282.
7. Bradley JS, Byington CL, Shah SS, *et al.* The management of community-acquired pneumonia in infants and children older than 3 months of age: clinical practice guidelines by the Pediatric infectious diseases society and the infectious diseases society of America. *Clin Infect Dis* 2011;53:e25–76.
8. Wald ER, Applegate KE, Bordley C, *et al.* Clinical practice guideline for the diagnosis and management of acute bacterial sinusitis in children aged 1 to 18 years. *Pediatrics* 2013;132:e262–280.
9. Goyal MK, Johnson TJ, Chamberlain JM, *et al.* Racial and ethnic differences in antibiotic use for viral illness in emergency departments. *Pediatrics* 2017;140.
10. Gerber JS, Prasad PA, Localio AR, *et al.* Racial differences in antibiotic prescribing by primary care pediatricians. *Pediatrics* 2013;131:677–684.
11. Nedved AC, Lee BR, Wirtz A, *et al.* Socioeconomic differences in antibiotic use for common infections in pediatric urgent-care centers-A quasi-experimental study. *Infect Control Hosp Epidemiol* 2023;44:2009–2016.
12. Wattles BA, Feygin Y, Jawad KS, *et al.* Use of the child opportunity index to examine racial variations in outpatient antibiotic prescribing to children. *J Pediatr* 2023;261:113572.
13. Kim C, Kabbani S, Dube WC, *et al.* Health equity and antibiotic prescribing in the united states: a systematic scoping review. *Open Forum Infect Dis* 2023;10:ofad440.
14. Nedved A, Lee BR, Hamner M, Wirtz A, Burns A, El Feghaly RE. Impact of an antibiotic stewardship program on antibiotic choice, dosing, and duration in pediatric urgent cares. *Am J Infect Control* 2023;51:520–526.
15. Seibert AM, Hersh AL, Patel PK, *et al.* Impact of an antibiotic stewardship initiative on urgent-care respiratory prescribing across patient race, ethnicity, and language. *Infect Control Hosp Epidemiol* 2024;45:530–533.
16. von Elm E, Altman DG, Egger M, *et al.* Strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *BMJ* 2007;335:806–808.
17. Fleming-Dutra KE, Hersh AL, Shapiro DJ, *et al.* Prevalence of inappropriate antibiotic prescriptions among US ambulatory care visits, 2010-2011. *JAMA* 2016;315:1864–1873.
18. King LM, Tsay SV, Hicks LA, Bizune D, Hersh AL, Fleming-Dutra K. Changes in outpatient antibiotic prescribing for acute respiratory illnesses, 2011 to 2018. *Antimicrob Steward Healthc Epidemiol* 2021;1:1–8.
19. Table 4.12. System-based Treatment Table. In: Committee on infectious diseases, American academy of pediatrics, Kimberlin DW, Barnett ED, Lynfield R, Sawyer MH, eds. *Red Book 2021-2024 Report of the Committee on Infectious Diseases*. Itasca, IL: American Academy of Pediatrics; 2021:990–1002.
20. El Feghaly RE, Burns A, Goldman JL, Myers A, Purandare AV, Lee BR. Novel outpatient antibiotic prescribing report of respiratory infections in a pediatric health system's emergency departments and urgent care clinics. *Am J Infect Control* 2021;49:398–400.
21. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)–a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42:377–381.
22. United States Census Bureau. What Updates to OMB's Race/Ethnicity Standards Mean for the Census Bureau. 2024. https://www.census.gov/newsroom/blogs/random-samplings/2024/04/updates-race-ethnicity-standards.html. Accessed August 08, 2024.
23. Poole NM, Shapiro DJ, Fleming-Dutra KE, Hicks LA, Hersh AL, Kronman MP. Antibiotic prescribing for children in United States emergency departments: 2009–2014. *Pediatrics* 2019;143:e20181056.
24. Hampton LL, DeBoy JT, Hornik CP, White MJ, Nazareth-Pidgeon KM. Association of sociodemographic factors with reported penicillin allergy in pediatric inpatients. *Hosp Pediatr* 2022;12:625–631.
25. Taylor MG, Joerger T, Li Y, *et al.* Factors associated with penicillin allergy labels in electronic health records of children in 2 large US pediatric primary care networks. *JAMA Netw Open* 2022;5:e222117.
26. Gutman CK, Aronson PL, Singh NV, *et al.* Race, ethnicity, language, and the treatment of low-risk febrile infants. *JAMA Pediatr* 2024;178:55–64.
27. Honcoop AC, Poitevien P, Kerns E, Alverson B, McCulloh RJ. Racial and ethnic disparities in bronchiolitis management in freestanding children's hospitals. *Acad Emerg Med* 2021;28:1043–1050.
28. Goyal MK, Kuppermann N, Cleary SD, Teach SJ, Chamberlain JM. Racial disparities in pain management of children with appendicitis in emergency departments. *JAMA Pediatr* 2015;169:996–1002.

29. Nundy S, Cooper LA, Mate KS. The quintuple aim for health care improvement: a new imperative to advance health equity. *JAMA* 2022;327: 521–522.
30. Siddiqui Z, Lee BR, Nedved A, *et al.* Pediatric penicillin allergy labels: Influence of race, insurance, and area deprivation index. *Pediatr Allergy Immunol* 2024;35:e14126.
31. Trinidad S, Brokamp C, Mor Huertas A, *et al.* Use Of area-based socioeconomic deprivation indices: a scoping review and qualitative analysis. *Health Aff (Millwood)* 2022;41:1804–1811.
32. Poole NM, Lee BR, Kronman MP, *et al.* Ambulatory amoxicillin use for common acute respiratory infections during a national shortage: results from the SHARPS-OP benchmarking collaborative. *Am J Infect Control* 2024;52:614–617.
33. Heidari E, Zalmai R, Richards K, Sakthisivabalan L, Brown C. Z-code documentation to identify social determinants of health among Medicaid beneficiaries. *Res Social Adm Pharm* 2023;19:180–183.
34. Shaver AL, Jacobs DM, LaMonte MJ, Noyes K. Antibiotic prescribing for acute respiratory tract infections in the United States outpatient setting. *BMC Fam Pract* 2019;20:91.