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The role of race and ethnicity in Antibiotic Prescribing practices for Inpatient Urinary Tract Infection cases

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2022

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An abstract of

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University

in partial fulfillment of the requirements for the degree of
Master of Public Health in Epidemiology

2025

Abstract

The role of race and ethnicity in Antibiotic Prescribing practices for inpatient Urinary Tract Infection cases

By Olga Capurro

Background

This study aimed to examine the use of anti-pseudomonal antibiotics among a diverse inpatient population to identify potential biases in prescribing practices for urinary tract infection (UTI) patients. Despite growing evidence of disparities in outpatient care, the relationship between race, ethnicity, and inpatient antibiotic prescribing remains unclear.

Methods

This retrospective observational cohort study utilized electronic medical record (EMR) data from patients admitted to hospital medicine services across four Emory University hospitals between January 1, 2019, and June 30, 2022. Patients included were aged 18 or older, received at least one antibiotic during hospitalization, and had a discharge diagnosis of UTI or urosepsis (based on ICD-10-CM codes). Baseline characteristics were assessed using univariate logistic regression stratified by race. Multivariate logistic regression with backward selection ($p < 0.05$ for retention) identified predictors of antibiotic prescribing patterns, focusing on anti-pseudomonal antibiotic use.

Results

The study analyzed 7,283 unique inpatient encounters. After adjusting for independent predictors, race remained a borderline significant factor in predicting receipt of any days of therapy with anti-pseudomonal antibiotics. Compared to Non-Hispanic White patients, adjusted odds ratios were 0.89 (95% CI: 0.79–1.01) for Non-Hispanic Black individuals, 1.31 (95% CI: 0.91–1.86) for Hispanic or Latino individuals, and 1.12 (95% CI: 0.86–1.46) for individuals identifying with other racial or ethnic groups.

Conclusion

Key findings reveal variations in anti-pseudomonal antibiotic prescribing for inpatient UTI patients across racial and ethnic groups, aligning with prior research and highlighting potential disparities in medical treatment, While these differences did not reach statistical significance, the observed trends warrant further investigation to confirm their validity and assess their clinical relevance in the context of healthcare equity.[2122]

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Table of Contents

Introduction:

Antibiotics play a vital role in treating and managing of infectious diseases. When treating an infection, healthcare professionals assess key risk factors, including recent hospitalizations, surgeries, and medical devices (e.g., catheters or ventilators). A comprehensive physical examination further informs the patient's condition and infection severity, guiding antibiotic selection according to clinical guidelines. However, recent studies indicate that approximately 30% of hospitalized patients receive clinically unsupported antibiotic treatment.[1] This suboptimal treatment contributes to antibiotic resistance, increased healthcare costs, and adverse effects, including allergic reactions, as well as gastrointestinal, neurological, and psychiatric disorders.[2] In 2021, 4.71 million deaths were associated with bacterial antimicrobial resistance, with projections suggesting this number may rise to 8.22 million by 2050.[3]

Urinary Tract Infections (UTIs) are among the most prevalent bacterial infections in the United States, accounting for over 480,000 hospitalizations, and more than 13,000 deaths annually[4]. Empiric antibiotic therapy is critical for UTI management; however, effective treatment necessitates a multifaceted approach. Up to 40% of patients receive suboptimal extended-spectrum antibiotics, often due to clinician concern regarding multi-drug-resistant organisms (MDROs)[5]-- microorganisms resistant to one or more classes of antimicrobial agents.[6] The unnecessary use of these antibiotics can increase the risk of colonization with multi-drug resistant uropathogens and subsequent reinfection with a pathogen resistant to first line therapy,[7]

Hospital-acquired urinary tract infections (HAUTIs) account for more than 30% of hospital-associated infections in the United States.[8] Among all Hospital-acquired infections, approximately 15% are caused by non-glucose-fermenting gram-negative bacteria (NGFGN), such as *Pseudomonas Aeruginosa*, the most prevalent of these pathogens.[9] These bacteria are increasingly acquiring antibiotic resistance to multiple classes of antibiotics, complicating treatment options. As a result, broad-spectrum antibiotics, often referred to as anti-Pseudomonal antibiotics, are frequently administered empirically for all HAUTIs, even when the specific pathogen is unknown. This approach, while intended to cover a wide range of potential infections, can lead development of multi-drug-resistant organisms, and a cycle of continued antibiotic use, making future treatment increasingly difficult.[9]

Antibiotic stewardship programs (ASPs) are essential for reducing unnecessary empiric antibiotic prescribing while maintaining effective treatments of UTIs, as they guide best practices in the appropriate use of antibiotics[10(p5)]. These programs aim to address suboptimal antibiotic use by promoting the selection of the most appropriate drug regimens tailored to the specific infection. They achieve this by providing evidence-based guidelines, which help clinicians make informed decisions and ensure that prescribed antibiotics are targeted and effective.[11] ASPs focus on optimizing the 5 Ds of antibiotic stewardship for UTI, Diagnosis, Drug, dose, duration of treatment, and de-escalation, to ensure patients receive the most effective therapy while minimizing unnecessary exposure to

antibiotics[10(p5)]. In doing so, these programs play a critical role in reducing the risk of antibiotic resistance, improving patient outcomes, and reducing healthcare costs[12].

Although antibiotic stewardship programs are designed to be agnostic to race or ethnicity of the patients, inherent bias or differences in approaches to managing infections between race or ethnic groups have been documented in ambulatory settings. However, despite the call to action, data on such disparities in inpatient settings remain limited.[13]. A study utilizing data from 928 hospitals in the Premier Healthcare Database revealed that black patients were 13% less likely to receive broad-spectrum therapy compared to their white counterparts. Similarly, Asian patients were 10% less likely, and individuals of other racial and ethnic groups were 6% less likely to receive broad-spectrum antibiotics.[14] Additionally, patients residing in areas of greater socioeconomic deprivation, regardless of race and ethnicity, were less likely to receive an antibiotic prescription overall. Researchers acknowledged that potential confounders, which could not be fully controlled for during the analysis, might contribute to these differences. However, they also suggested that provider bias might play a significant role in these observed disparities. Furthermore, a recent systematic review, mostly composed of studies conducted in the outpatient setting, found that minority groups are less likely to be diagnosed with conditions that warrant antibiotic treatment, less likely to receive antibiotics overall, and are less likely to be prescribed optimal broad-spectrum antibiotics, despite clear indications of illness, compared to their White counterparts. [15]

There are significant gaps and inconsistencies in the existing literature regarding the impact of racial and ethnic disparities on antibiotic prescribing practices, particularly in inpatient settings, inpatient UTI cases, and related conditions. While a recent study explored these issues among inpatient pneumonia patients, discrepancies in antibiotic administration for UTI patients in inpatient settings remain largely unexamined. These gaps highlight the need for further research to better understand healthcare disparities and develop strategies to improve health equity in inpatient care. This study aims to evaluate the role of race and ethnicity in antibiotic prescribing for inpatient urinary tract infections, by estimating the differences in antibiotic prescribing choices between racial groups. By identifying potential inequities in antibiotic treatment, the research aims to provide insights that can inform future interventions, promote equitable healthcare practices, and improve patient outcomes.

Methods:

Study Design:

This study employs a retrospective observational cohort design, leveraging electronic medical record (EMR) data from patients admitted to the hospital medicine service across Emory Healthcare inpatient facilities, including Emory University Hospital, Emory John's Creek Hospital, Emory University Hospital Midtown, and Emory St. Joseph's Hospital. These institutions represent key components of the healthcare infrastructure in Atlanta, serving a large and demographically diverse patient population.

Study Population:

Inpatient encounter data was extracted from electronic medical records of patients admitted to the hospital medicine services of the four Emory University hospitals between January 1, 2019, and June 30, 2022, and discharged before June 30, 2022. The study cohort included individuals aged 18 years and older who received at least one dose of antibiotics during their hospitalization with an International Classification of Diseases, tenth Edition, Clinical Modification (ICD-10-CM) for urinary tract infection or urosepsis. Patients with any intensive care unit (ICU) admission during their hospital stay were excluded from the analysis. Data was de-identified by a data analyst prior to distribution to the research team to ensure patient confidentiality and compliance with data privacy regulations.

Variables of interest:

Antibiotic Days of Therapy (DOT) per 1,000 patient days, is a standardized measure quantifying antibiotic exposure by accounting for total antibiotic use relative to the cumulative number of patient days. This metric is widely recognized as a reliable indicator for monitoring antibiotic utilization patterns. An antibiotic day of therapy is defined as any amount of a specific antimicrobial agent administered in a calendar day to a particular patient as documented in the electronic medical administration record. [16] Additionally, DOT per 1,000 patient days was analyzed for three specific antibiotic classifications: Anti-Methicillin-resistant Staphylococcus aureus (anti-MRSA), Broad-spectrum Hospital onset (Anti-Pseudomonal antibiotics), and Broad-spectrum community-onset (BS-CO) DOT. These antibiotic classifications were established by the Centers for Disease Control and Prevention (CDC)'s National Healthcare Safety Network (NHSN) to standardize antimicrobial surveillance.[16] Due to significant right-skewness in their distributions, these variables were dichotomized into "received antibiotic" and "did not receive antibiotic" categories to enhance the interpretability and robustness of statistical analyses.

The primary outcome of interest is the binary classification of anti-pseudomonal antibiotic administration initiated during hospitalization as these antibiotics are among the most frequently overprescribed in hospitalized patients with urinary tract infections (UTIs)[17]. Covariates of interest include sociodemographic and clinical characteristics extracted from electronic medical records. These include race and ethnicity—categorized as Non-Hispanic White, Non-Hispanic Black, Hispanic or Latino, and Other—sex, age (grouped as <65, 65–75, 76–85, and >85), insurance status, pre-existing comorbidities and co-infections --such as Pneumonia, and Skin and Soft Tissue Infections (SSTI)-- infection severity --Bacteremia and Sepsis-- and laboratory culture test results.

Comorbidities, defined as the total burden of illness unrelated to the principal diagnosis, play a crucial role in minimizing confounding in research and were grouped under

two variables, Elixhauser comorbidity scale, which represents the total number of comorbidities a patient has based on ICD-10 codes.[18]

Additional Patient outcomes of interest include Readmission within 90 days, a dichotomous variable that has been identified as a risk factor in developing resistant infections and sepsis,[19] and *Clostridium difficile* infection (CDI), a complication linked to the disruption in patient microbiome due to antibiotic exposure and may increase the risk of subsequent sepsis.[20]

Data Analysis:

Baseline descriptive characteristics were assessed using univariate logistic regression stratified by race to evaluate crude associations. Multivariate logistic regression was then performed using a backward selection approach, with a significance threshold of $p < 0.05$ for variable retention, to identify the optimal model for predicting the choice of antibiotic agents used.

Certain variables were excluded from eligibility to be included in the final model due to their limited incremental contribution to model performance and collinearity considerations. These excluded variables included bacteremia (co-linear with sepsis), and select comorbidities (e.g., renal failure, complicated diabetes, liver disease, and cumulative antibiotic-prone UI) due to co-linearity with the summary co-morbidity index. In addition, the antibiotic exposure metric of days of therapy for community-onset broad spectrum agents was excluded since exposure to these agents occur at rates inverse to anti-pseudomonal agents by definition (providers often choose from one group or the other). In addition, we excluded anti-MRSA antibiotic metrics because these are driven by an unmeasured confounder, surveillance test positivity for MRSA. Finally, patient outcomes (e.g., 90-day readmission and *Clostridioides difficile* infection diagnosis) were excluded since these occur after the event of interest (UTI treatment)

The final model adjusted for age categories, prior *Pseudomonas aeruginosa* colonization, sex, hospitalization within the preceding 90 days, sepsis, pneumonia, skin and soft tissue infection (SSTI), and Elixhauser unweighted comorbidity score categories. Race and ethnicity were categorized into mutually exclusive groups: Non-Hispanic White, Non-Hispanic Black, Hispanic or Latino, and Other. All statistical analyses were conducted using R version 4.3.1.

Results:

During the study period, 31,923 unique inpatient UTI encounters that were discharged from hospital medicine service were identified at Emory Healthcare hospitals

Only encounters with ICD-10 codes for UTI were selected for inclusion. As a result, 7,283 unique inpatient encounters for adult (≥18 years age) inpatients who received at least one antibiotic during their inpatient hospitalization and were discharged from the hospital medicine service with an ICD-10-CM code for urinary tract infection or urosepsis registered at discharge and included in the analysis. Among these, 2% of patients identified as Hispanic or Latino, 38% as non-Hispanic Black, 56% as non-Hispanic White, and 4% as belonging to another racial or ethnic group. Most patients were female (63%), with a mean age of 73 years (18–106). Insurance coverage varied across encounters, with 68.3% of patients covered by Medicare, 10.8% by Medicaid, 19.6% by private insurance, and 1.3% by other insurance types (Table 1).

Of the 7,283 encounters, 2,604 (37.1%) involved the administration of at least one dose of anti-pseudomonal antibiotics, 6,265 (86.0%) involved at least one dose of broad-spectrum community-onset antibiotics, and 2,062 (28.3%) involved at least one dose of anti-MRSA antibiotics. Comorbid conditions varied across encounters, with renal failure (27.7%), complicated diabetes (22.4%), and liver disease (9.8%) being the most common. Conditions associated with infection severity included sepsis (29%) and bacteremia (14.7%). Additional factors that may have influenced antibiotic prescription included co-infections such as pneumonia (14.6%) and skin and soft tissue infections (3.7%). Factors that might impact the choice of antibiotics ordered include a history of positive *Pseudomonas aeruginosa* cultures within the 12 months prior to the encounter (4.7%) and previous hospitalization within the past 90 days (18.7%). Table 1 summarizes patient demographic characteristics, comorbidities of interest, infection severity, and antibiotic administration metrics, figure 1.2 provides an expanded overview of all underlying illnesses present within the cohort.

The univariate analysis identified several factors influencing the prescription of anti-pseudomonal antibiotics, including patient demographics, comorbidities, co-infections, infection severity, prior *Pseudomonas aeruginosa* infections, and the use of other types of antibiotics. Relative to Non-Hispanic White individuals, the odds of receiving any days of therapy with anti-pseudomonal antibiotics were 1.04 (95% CI: 0.94–1.15) for Non-Hispanic Black individuals, 1.39 (95% CI: 1.01–1.91) for Hispanic or Latino individuals, and 1.24 (95% CI: 0.98–1.57) for individuals identifying with other racial or ethnic groups (Table 3). Infection severity was also a significant determinant of anti-pseudomonal antibiotic prescribing. The odds of receiving an anti-pseudomonal antibiotic were 4.58 (95% CI: 4.11–5.10) times higher in septic patients and 2.8 (95% CI: 2.53–3.29) times higher in patients with bacteremia compared to non-septic patients and those without bacteremia, respectively. Co-infections, such as pneumonia and skin and soft tissue infections (SSTI), also affected prescribing practices. Patients with pneumonia had 2.02 (95%CI: 1.77–2.30) times the odds,

and SSTI patients had 2.43 (95% CI: 1.90–3.11) times the odds of receiving anti-pseudomonal antibiotics compared to patients without these co-infections (Table 3).

Furthermore, anti-pseudomonal antibiotic administration was associated with negative patient outcomes on unadjusted analysis. Patients readmitted to the hospital within 90 days had 1.57 (95% CI: 1.38–1.80) times the odds of receiving anti-pseudomonal antibiotics compared to patients who were not readmitted within 90 days. Additionally, patients with a *Clostridium difficile* (CDI) infection had 1.59 (95% CI: 1.19–2.14) times the odds of receiving anti-pseudomonal antibiotics compared to patients without CDI infections, as shown in Table 3.

In the adjusted generalized estimating equation (GEE) model, patient age, sex, co-infections, sepsis diagnosis, higher severity of illness scores, and hospitalization within the prior 90 days, all remained independent predictors of anti-pseudomonal antibiotic administration (Table 3). Additionally, a positive *Pseudomonas aeruginosa* culture within the past year was a strong independent predictor of receiving anti-pseudomonal agents (OR: 10.85, 95% CI: 8.07–14.83)(Table 3). After adjusting for these independent predictors, race remained a borderline significant factor for the lower likelihood of receipt of any days of therapy with anti-pseudomonal antibiotics. Compared to Non-Hispanic White individuals, the adjusted odds ratios were 0.89 (95% CI: 0.79–1.01) for Non-Hispanic Black individuals, 1.31 (95% CI: 0.91–1.86) for Hispanic or Latino individuals, and 1.12 (95% CI: 0.86–1.46) for individuals identifying with other racial or ethnic groups. The multivariate analysis also indicated that male patients had 1.36 times the odds of receiving an anti-pseudomonal antibiotic compared to female patients, while increasing age was associated with a reduced likelihood of receiving anti-pseudomonal therapy (Table 3).

Discussion:

This study examined the role of race and ethnicity in prescribing patterns of anti-pseudomonal antibiotics for inpatient UTIs managed by the Hospital Medicine Service across Emory Healthcare hospitals. While infection severity, prior hospitalization, and co-infections emerged as strong predictors of prescribing agents with activity against *Pseudomonas aeruginosa*, race and ethnicity were no longer statistically significant predictors after adjusting for these clinical factors. However, race and ethnicity remained a borderline significant, with Hispanic and Latino patients having slightly higher odds of receiving broad-spectrum antibiotics compared to Non-Hispanic White patients. Conversely, Non-Hispanic Black patients showed a trend toward a lower likelihood of receiving these antibiotics. Our key findings reveal variations in anti-pseudomonal antibiotic prescribing for inpatient UTI patients across racial and ethnic groups, aligning with prior research and highlighting potential disparities in medical treatment, while these differences did not reach statistical

significance, the observed trends warrant further investigation to confirm their validity and assess their clinical relevance in the context of healthcare equity.[2122] Prior research has documented comparable trends, highlighting persistent disparities in antibiotic prescribing across various healthcare settings. These inequities often manifest as deviations from guideline-adherent antibiotic prescribing, underscoring the systemic nature of these patterns and their potential impact on patient outcomes.[21]

These findings are built upon prior research highlighting racial and ethnic disparities in antibiotic prescribing, particularly in outpatient settings.[22] While previous studies have documented lower rates of broad-spectrum antibiotic prescriptions for minority populations among outpatients, our study extends this analysis to hospitalized UTI patients, underscoring potential differences in inpatient antibiotic decision-making. Incorporating a range of clinical and demographic variables into our modeling process, we were able to evaluate the nuanced and individualized nature of UTI treatment. Given that such treatment requires personalized therapeutic decisions, any influence of race or ethnicity on prescribing practices may contribute to the amplification of existing healthcare disparities.

However, there are limitations to this analysis. The accuracy of race and ethnicity reporting could not be independently verified for each patient. Additionally, the relatively small number of encounters among Hispanic patients and individuals of other racial and ethnic groups limited the ability to conduct more detailed subgroup analyses. This highlights the need for future studies to further explore disparities in inpatient antibiotic prescribing across a broader range of racial and ethnic populations. While our study did not directly assess the appropriateness of antibiotic prescribing practices, our risk prediction models incorporated factors suggestive of empiric use of agents with *P. aeruginosa* coverage, acknowledging the complexity and clinical judgment involved in empiric therapy decisions. Only a minority of patients treated with these agents had documented indications, suggesting that other unaccounted-for factors may be influencing clinicians' prescribing decisions. Furthermore, our definition of infection syndromes was based on billing data (i.e., ICD-10 codes), which often lack the specificity and sensitivity required to identify definitive clinical infections. A substantial proportion of patients had codes for multiple infections (e.g., pneumonia and SSTI), and because the timing of antibiotic administration relative to each diagnosis was not captured, our predictive models lacked specificity in determining which agents were used specifically to treat UTIs.

Conclusion and public health implications:

Overall, the results of the multivariable models highlight the influence of host factors, illness severity, and a history of *Pseudomonas* from clinical cultures on antibiotic

prescribing practices. While not diminishing the importance of individual health and clinical context, the models suggest that race and ethnicity may also play a role in influencing the prescription of anti-pseudomonal antibiotics within this specific population. These findings underscore the need for a multifaceted approach in evaluating antibiotic selection, incorporating both demographic and clinical considerations.

Tables and Figures

Table 1. Characteristics of inpatient Encounters of Urinary Tract infection Related Hospitalizations and Discharged by Hospital Medicine Service, by Race & Ethnicity, Emory Healthcare, January 1, 2019, to June 30, 2022.

Characteristics	**Hispanic or Latino**	**Non-Hispanic or Latino Black**	**Non-Hispanic or Latino White**	**Overall**
	(N=161)	**(N=2760)**	**(N=4061)**	**(N=7286)**
Age				
Mean (SD)				72.9 (16.9)
Median [Min, Max]				76.0 [18.0, 106]
Sex				
Female	101 (62.7%)	1742 (63.1%)	2566 (63.2%)	4587 (63.0%)
Male	60 (37.3%)	1018 (36.9%)	1495 (36.8%)	2699 (37.0%)
Insurance Type				
Medicaid	28 (17.4%)	512 (18.6%)	179 (4.4%)	787 (10.8%)
Medicare	87 (54.0%)	1582 (57.3%)	3142 (77.4%)	4974 (68.3%)
Other	6 (3.7%)	58 (2.1%)	30 (0.7%)	97 (1.3%)
Private	40 (24.8%)	608 (22.0%)	710 (17.5%)	1428 (19.6%)
Pseudomonas Aeruginosa Culture last 12 Months	5 (3.1%)	121 (4.4%)	201 (4.9%)	339 (4.7%)
Prior90days	20 (12.4%)	529 (19.2%)	771 (19.0%)	1359 (18.7%)
Bacteremia	24 (14.9%)	422 (15.3%)	555 (13.7%)	1072 (14.7%)
Sepsis	49 (30.4%)	822 (29.8%)	1125 (27.7%)	2110 (29.0%)
Pneumonia	30 (18.6%)	399 (14.5%)	588 (14.5%)	1064 (14.6%)
SSTI	6 (3.7%)	90 (3.3%)	174 (4.3%)	272 (3.7%)
Elixhauser Comorbidity Index Count				
Mean (SD)	4.97 (2.63)	5.56 (2.53)	5.26 (2.40)	5.35 (2.47)
Median [Min, Max]	5.00 [0, 12.0]	5.00 [0, 16.0]	5.00 [0, 15.0]	5.00 [0, 16.0]

Renal Failure	46 (28.6%)	896 (32.5%)	1020 (25.1%)	2021 (27.7%)
Diabetes Complicated	39 (24.2%)	823 (29.8%)	701 (17.3%)	1630 (22.4%)
Any DOT of Broad-Spectrum Hospital Onset	69 (42.9%)	990 (35.9%)	1423 (35.0%)	2604 (35.7%)
Any DOT of Broad-Spectrum Community Onset	138 (85.7%)	2372 (85.9%)	3497 (86.1%)	6265 (86.0%)
Any DOT of Anti-MRSA	51 (31.7%)	799 (28.9%)	1131 (27.9%)	2062 (28.3%)
Antibiotic DOT per 1000 Patient Days				
Mean (SD)	1200 (672)	1020 (637)	1100 (646)	1080 (645)
Median [Min, Max]	1180 [51.0, 3550]	973 [24.0, 5460]	1050 [19.0, 8330]	1030 [19.0, 8330]
Cdiff	5 (3.1%)	65 (2.4%)	108 (2.7%)	182 (2.5%)
Readmission Within 90 Days	27 (16.8%)	411 (14.9%)	581 (14.3%)	1060 (14.5%)

Table 1.2. Prevalence of Comorbidities Among Inpatient Encounters for Urinary Tract Infection–Related Hospitalizations Discharged by the Hospital Medicine Service, Emory Healthcare, January 1, 2019, to June 30, 2022.

All Underlying Illnesses	Hispanic or Latino	Non-Hispanic or Latino Black	Non-Hispanic or Latino White	Overall
	(N=161)	(N=2760)	(N=4061)	(N=7286)
Congestive Heart Failure	29 (18.0%)	769 (27.9%)	1098 (27.0%)	1949 (26.8%)
Cardiac Arrhythmias	37 (23.0%)	913 (33.1%)	1630 (40.1%)	2651 (36.4%)
Valvular Disease	31 (19.3%)	287 (10.4%)	861 (21.2%)	1234 (16.9%)
Pulmonary Circulation Disorder	8 (5.0%)	125 (4.5%)	198 (4.9%)	342 (4.7%)
Peripheral Vascular Disease	24 (14.9%)	262 (9.5%)	412 (10.1%)	715 (9.8%)
Hypertension Uncomplicated	83 (51.6%)	1599 (57.9%)	2248 (55.4%)	4101 (56.3%)
Hypertension Complicated	51 (31.7%)	1211 (43.9%)	1538 (37.9%)	2889 (39.7%)
Paralysis	8 (5.0%)	299 (10.8%)	185 (4.6%)	514 (7.1%)
Other Neurological Disorders	51 (31.7%)	1032 (37.4%)	1454 (35.8%)	2620 (36.0%)
Chronic Pulmonary Disease	21 (13.0%)	492 (17.8%)	750 (18.5%)	1296 (17.8%)
Diabetes Uncomplicated	52 (32.3%)	907 (32.9%)	901 (22.2%)	1983 (27.2%)
Hypothyroidism	33 (20.5%)	301 (10.9%)	1100 (27.1%)	1487 (20.4%)
Liver Disease	28 (17.4%)	259 (9.4%)	383 (9.4%)	711 (9.8%)
Peptic Ulcer Disease	2 (1.2%)	34 (1.2%)	52 (1.3%)	94 (1.3%)
AIDS/HIV	1 (0.6%)	80 (2.9%)	19 (0.5%)	100 (1.4%)
Lymphoma	1 (0.6%)	42 (1.5%)	81 (2.0%)	126 (1.7%)
Metastatic Cancer	9 (5.6%)	226 (8.2%)	262 (6.5%)	523 (7.2%)
Solid Tumor without Metastasis	21 (13.0%)	403 (14.6%)	537 (13.2%)	1009 (13.8%)
Rheumatoid Arthritis	12 (7.5%)	170 (6.2%)	215 (5.3%)	409 (5.6%)
Coagulopathy	16 (9.9%)	273 (9.9%)	500 (12.3%)	825 (11.3%)
Obesity	23 (14.3%)	346 (12.5%)	394 (9.7%)	776 (10.7%)
Weight Loss	23 (14.3%)	720 (26.1%)	751 (18.5%)	1554 (21.3%)
Fluid and Electrolyte Disorders	94 (58.4%)	1723 (62.4%)	2455 (60.5%)	4470 (61.4%)
Blood Loss Anemia	6 (3.7%)	54 (2.0%)	57 (1.4%)	120 (1.6%)
Deficiency Anemia	15 (9.3%)	393 (14.2%)	445 (11.0%)	906 (12.4%)
Alcohol Abuse	5 (3.1%)	116 (4.2%)	108 (2.7%)	230 (3.2%)

Drug Abuse	3 (1.9%)	134 (4.9%)	92 (2.3%)	233 (3.2%)
Psychoses	4 (2.5%)	106 (3.8%)	69 (1.7%)	184 (2.5%)
Depression	24 (14.9%)	339 (12.3%)	855 (21.1%)	1251 (17.2%)
Other Underlying Illnesss/Comorbidities	41 (25.5%)	782 (28.3%)	867 (21.3%)	1726 (23.7%)
Cystic Fibrosis	6 (3.7%)	67 (2.4%)	95 (2.3%)	175 (2.4%)

Table 2. Characteristics of Inpatients Administered Broad-Spectrum Hospital-Onset Antibiotics for Urinary Tract Infection, by Race and Ethnicity, Emory Healthcare, January 1, 2019, to June 30, 2022.

Characteristics	Hispanic or Latino		Non-Hispanic or Latino Black		Non-Hispanic or Latino White		Overall	
	No (N=92)	Yes (N=69)	No (N=1770)	Yes (N=990)	No (N=2638)	Yes (N=1423)	No (N=4682)	Yes (N=2604)
AgeCategory								
<65	34 (37.0%)	30 (43.5%)	597 (33.7%)	425 (42.9%)	326 (12.4%)	269 (18.9%)	994 (21.2%)	766 (29.4%)
>85	11 (12.0%)	10 (14.5%)	275 (15.5%)	114 (11.5%)	922 (35.0%)	408 (28.7%)	1243 (26.5%)	554 (21.3%)
65-75	22 (23.9%)	15 (21.7%)	469 (26.5%)	242 (24.4%)	561 (21.3%)	328 (23.0%)	1099 (23.5%)	605 (23.2%)
76-85	25 (27.2%)	14 (20.3%)	429 (24.2%)	209 (21.1%)	829 (31.4%)	418 (29.4%)	1346 (28.7%)	679 (26.1%)
Sex								
Male	35 (38.0%)	25 (36.2%)	557 (31.5%)	461 (46.6%)	872 (33.1%)	623 (43.8%)	1527 (32.6%)	1172 (45.0%)
Insurance								
Medicare	53 (57.6%)	34 (49.3%)	1022 (57.7%)	560 (56.6%)	2069 (78.4%)	1073 (75.4%)	3246 (69.3%)	1728 (66.4%)
Other	18 (19.6%)	16 (23.2%)	353 (19.9%)	217 (21.9%)	123 (4.7%)	86 (6.0%)	532 (11.4%)	352 (13.5%)
Private	21 (22.8%)	19 (27.5%)	395 (22.3%)	213 (21.5%)	446 (16.9%)	264 (18.6%)	904 (19.3%)	524 (20.1%)
P. Aeruginosa Culture last 12 Months	1 (1.1%)	4 (5.8%)	22 (1.2%)	99 (10.0%)	31 (1.2%)	170 (11.9%)	57 (1.2%)	282 (10.8%)
Prior90days	10 (10.9%)	10 (14.5%)	295 (16.7%)	234 (23.6%)	406 (15.4%)	365 (25.7%)	724 (15.5%)	635 (24.4%)
Bacteremia	12 (13.0%)	12 (17.4%)	153 (8.6%)	269 (27.2%)	253 (9.6%)	302 (21.2%)	455 (9.7%)	617 (23.7%)
Sepsis	17 (18.5%)	32 (46.4%)	307 (17.3%)	515 (52.0%)	451 (17.1%)	674 (47.4%)	823 (17.6%)	1287 (49.4%)
Pneumonia	12 (13.0%)	18 (26.1%)	201 (11.4%)	198 (20.0%)	296 (11.2%)	292 (20.5%)	530 (11.3%)	534 (20.5%)
Skin & Soft Tissue Infections	2 (2.2%)	4 (5.8%)	31 (1.8%)	59 (6.0%)	85 (3.2%)	89 (6.3%)	118 (2.5%)	154 (5.9%)

Elixhauser Unweighted Score								
Mean (SD)	4.85 (2.46)	5.13 (2.86)	5.40 (2.47)	5.84 (2.62)	5.18 (2.36)	5.42 (2.44)	5.23 (2.42)	5.55 (2.53)
Median [Min, Max]	4.00 [0, 12.0]	5.00 [1.00, 12.0]	5.00 [0, 15.0]	6.00 [0, 16.0]	5.00 [0, 15.0]	5.00 [0, 14.0]	5.00 [0, 15.0]	5.00 [0, 16.0]
Renal Failure	22 (23.9%)	24 (34.8%)	576 (32.5%)	320 (32.3%)	633 (24.0%)	387 (27.2%)	1266 (27.0%)	755 (29.0%)
Diabetes Complicated	19 (20.7%)	20 (29.0%)	508 (28.7%)	315 (31.8%)	456 (17.3%)	245 (17.2%)	1019 (21.8%)	611 (23.5%)
Liver Disease	16 (17.4%)	12 (17.4%)	159 (9.0%)	100 (10.1%)	252 (9.6%)	131 (9.2%)	449 (9.6%)	262 (10.1%)
Broad-Spectrum Hospital-Onset DOT Per 1000 Patient DAYS								
Mean (SD)	0 (0)	914 (439)	0 (0)	691 (433)	0 (0)	761 (459)	0 (0)	747 (454)
Median [Min, Max]	0 [0, 0]	1000 [57.0, 1770]	0 [0, 0]	638 [35.0, 4170]	0 [0, 0]	714 [32.0, 3330]	0 [0, 0]	690 [32.0, 4170]
Any DOT of Broad-Spectrum CO	89 (96.7%)	49 (71.0%)	1750 (98.9%)	622 (62.8%)	2594 (98.3%)	903 (63.5%)	4615 (98.6%)	1650 (63.4%)
Any DOT of Anti MRSA Antibiotic DOT per 1000 Patient Days	20 (21.7%)	31 (44.9%)	233 (13.2%)	566 (57.2%)	414 (15.7%)	717 (50.4%)	694 (14.8%)	1368 (52.5%)
Mean (SD)	926 (523)	1570 (673)	875 (572)	1270 (667)	970 (582)	1350 (686)	936 (576)	1330 (683)
Median [Min, Max]	970 [51.0, 3000]	1480 [293, 3550]	833 [24.0, 5460]	1220 [63.0, 5000]	976 [19.0, 7140]	1280 [96.0, 8330]	919 [19.0, 7140]	1280 [63.0, 8330]
Cdiff	3 (3.3%)	2 (2.9%)	31 (1.8%)	34 (3.4%)	61 (2.3%)	47 (3.3%)	97 (2.1%)	85 (3.3%)

Readmis-sion Within 90 Days	15 (16.3%)	12 (17.4%)	239 (13.5%)	172 (17.4%)	309 (11.7%)	272 (19.1%)	583 (12.5%)	477 (18.3%)

Table 3. Univariate and Multivariate Models Estimating the Independent Effects of Patient and Illness Characteristics on Receipt of Any Day of Therapy with Anti-Pseudomonas Agents During 7,286 Inpatient Hospitalizations for Urinary Tract Infections.

Characteristics	Received Anti-Pseudomonas			Univariate Analysis			Multivariate Analysis		
	No (N=4682)	Yes (N=2604)	All (N=7286)	Odds Ratio	Confidence Intervals	P-Value	Odds Ratio	Confidence Intervals	P-Value
Demographics									
Age									
<65	994 (21.2%)	766 (29.4%)	1760 (24.2%)		**Ref**			**Ref**	
65-75	1099 (23.5%)	605 (23.2%)	1704 (23.4%)	0.714	0.62, 0.82	<0.001	0.67	0.57, 0.78	<0.001
76-85	1346 (28.7%)	679 (26.1%)	2025 (27.8%)	0.655	0.57, 0.75	<0.001	0.64	0.55, 0.74	<0.001
>85	1243 (26.5%)	554 (21.3%)	1797 (24.7%)	0.578	0.50, 0.66	<0.001	0.56	0.47, 0.65	<0.001
Sex									
Male	1527 (32.6%)	1172 (45.0%)	2699 (37.0%)	1.69	1.53, 1.86	<0.001	1.36	1.22, 1.53	<0.001
Insurance Type									
Medicare	3246 (69.3%)	1728 (66.4%)	4974 (68.3%)		**Ref**			**Ref**	
Other	532 (11.4%)	352 (13.5%)	884 (12.1%)	1.24	1.07, 1.44	0.036	*N		
Private	904 (19.3%)	524 (20.1%)	1428 (19.6%)	1.08	0.96, 1.23	0.01	*N		
Race & Ethnicity							*N		
Non-Hispanic or Latino White	2638 (56.3%)	1423 (54.6%)	4061 (55.7%)		**Ref**			**Ref**	
Non-Hispanic or Latino Black	1770 (37.8%)	990 (38.0%)	2760 (37.9%)	1.04	0.94, 1.15	0.4822	0.89	0.79, 1.01	0.075
Hispanic or Latino	92 (2.0%)	69 (2.6%)	161 (2.2%)	1.39	1.01, 1.91	0.0427	1.31	0.917, 1.86	0.134

Other	182 (3.9%)	122 (4.7%)	304 (4.2%)	1.24	0.98, 1.57	0.0738	1.123	0.86, 1.46	0.39
Pseudomonas Aeruginosa Culture last 12 Months	57 (1.2%)	282 (10.8%)	339 (4.7%)	9.85	7.38, 13.16	<0.001	10.85	8.07, 14.835	<0.001
Admission in the Last 90 Days	724 (15.5%)	635 (24.4%)	1359 (18.7%)	1.763	1.56, 1.99	<0.01	1.48	1.29, 1.69	<0.001
Bacteremia	455 (9.7%)	617 (23.7%)	1072 (14.7%)	2.885	2.53, 3.29	<0.001	N		
Sepsis	823 (17.6%)	1287 (49.4%)	2110 (29.0%)	4.58	4.11, 5.10	<0.001	4.44	3.96, 4.97	<0.001
Pneumonia	530 (11.3%)	534 (20.5%)	1064 (14.6%)	2.02	1.77, 2.30	<0.001	1.85	1.61, 2.91	<0.001
SSTI	118 (2.5%)	154 (5.9%)	272 (3.7%)	2.43	1.90, 3.11	<0.001	2.22	0.59, 0.8	<0.001
Cystic Fibrosis	106 (2.3%)	69 (2.6%)	175 (2.4%)	1.17	0.86, 1.59	0.306			
Elixhauser Unweighted Score Category									
Low	1215 (26.0%)	591 (22.7%)	1806 (24.8%)		**Ref**			**Ref**	
Medium	2097 (44.8%)	1148 (44.1%)	3245 (44.5%)	1.13	0.99, 1.27	0.0572	1.21	1.05, 1.39	0.005
High	1370 (29.3%)	865 (33.2%)	2235 (30.7%)	1.29	1.34, 1.48	<0.001	1.45	1.25, 1.68	<0.001
Renal Failure	1266 (27.0%)	755 (29.0%)	2021 (27.7%)	1.13	1.03, 1.27	0.0446	*N		
Complicated Diabetes	1019 (21.8%)	611 (23.5%)	1630 (22.4%)	1.13	0.99, 1.28	0.056	*N		
Sum of antibiotic prone underlying illness									
Mean (SD)	1.32 (1.16)	1.40 (1.18)	1.35 (1.17)			<0.001	*N		
Median [Min, Max]	1.00 [0, 7.00]	1.00 [0, 6.00]	1.00 [0, 7.00]						

Liver Disease	449 (9.6%)	262 (10.1%)	711 (9.8%)	1.05	0.89, 1.23	0.516	*N
Any DOT of Broad-Spectrum Community Onset	4615 (98.6%)	1650 (63.4%)	6265 (86.0%)	0.026	0.020, 0.03	<0.001	*N
Any DOT of Anti-MRSA	694 (14.8%)	1368 (52.5%)	2062 (28.3%)	4.49	3.96, 5.10	<0.001	*N
Readmission within 90 days	583 (12.5%)	477 (18.3%)	1060 (14.5%)	1.576	1.38, 1.8	<0.001	*N
Cdiff	97 (2.1%)	85 (3.3%)	182 (2.5%)	1.59	1.19, 2.14	0.00216	*N

**N – Indicates a variable that was not selected for inclusion in the multivariate analysis.*

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