are increasingly common and antifungal resistance is more prevalent in these non-*albicans* species, including *C. glabrata*, *C. parapsilosis*, and *C. tropicalis*, which were the focus of this analysis. **Methods:** We used the PINC AI healthcare data (PHD) database to examine fluconazole resistance for inpatient isolates between 2012 and 2021 from 187 US acute-care hospitals with at least 1 *Candida* spp culture with a fluconazole susceptibility result over the entire period. We calculated annual percentage fluconazole resistance for *C. glabrata*, *C. tropicalis*, and *C. parapsilosis* isolates using the clinical laboratory interpretation for resistance. **Results:** We identified 4,264 *C. glabrata*, 2,482 *C. parapsilosis*, and 2,283 *C. tropicalis* isolates between 2012 and 2021 with susceptibility results. The percentage of *C. glabrata* isolates resistant to fluconazole doubled between 2020 and 2021 (14.6% vs 29.3%) (Fig. 1a). The percentage of *C. parapsilosis* isolates resistant to fluconazole steadily increased since 2017 (Fig. 1b), with an 82% increase in 2021 compared with 2020 (3.8% in 2020 vs 6.9% in 2021). Fluconazole resistance among *C. tropicalis* isolates varied over the years, with a 0.3% decrease in 2021 from 2020 (Fig. 1c). Of hospitals reporting at least 1 result each year 2020–2021, 44% observed an increase in the proportion of *C. glabrata* isolates resistant to fluconazole in 2021 compared to 2020. **Conclusions:** Our analysis highlights a concerning increase in fluconazole resistance among *C. glabrata* and *C. parapsilosis* isolates in 2021 compared with previous years. Further investigation of the observed increases in fluconazole resistance among these *Candida* spp could provide further insight on potential drivers of resistance or limitations in reported results from large databases. More analyses are needed to understand rates, sites of *Candida* infections, and risk factors (eg, antifungal exposure) associated with resistance.

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Subject Category: Antibiotic Stewardship
Development of a multiyear pediatric antibiogram in Georgia identifies antibiotic resistance trends

Matt Linam; Madeleine Goldstein; Robert Jerris and Mark Gonzalez

Background: Antibiograms are used to monitor antibiotic resistance trends and help guide empiric antibiotic treatment. Community pediatricians may not have access to or be comfortable using children's hospital antibiograms. Creating and disseminating a statewide pediatric antibiogram can help inform antibiotic stewardship efforts.
Objective: To develop a pediatric-specific antibiogram for the state of Georgia. **Methods:** Annual pediatric antibiograms for the 5 children's hospitals in Georgia from 2014 through 2021 were collected. All sites complied with the Clinical and Laboratory Standards Institute guidelines for antibiomicrobic breakpoints and antibiogram development. Antibiogram data were combined, and the most common bacteria were selected to incorporate into the statewide antibiogram: *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Enterococcus faecalis*, *Escherichia coli*, *Klebsiella pneumoniae*, *Enterobacter cloacae* complex, and *Pseudomonas aeruginosa*. Antibiogram data were reported as percentage susceptible and total number of isolates. Interhospital susceptibility differences were compared for methicillin-susceptible *S. aureus* (MSSA), methicillin-resistant *S. aureus* (MRSA), *E. coli*, and *K. pneumoniae* from 2018 through 2021. $P < .05$ was considered significant. The combined antibiogram data from 2014 through 2021 were used to show antibiotic susceptibility trends over time. **Results:** The 2021 antibiogram is shown in the Table. For MSSA and MRSA, clindamycin susceptibility was 80% and 85%, respectively. *K. pneumoniae* susceptibility to amoxicillin-clavulanate was 91%. For *E. coli*, using urine-specific breakpoints, susceptibility to cefazolin was 89%. A few statistically significant differences in antibiotic susceptibility were detected between hospitals, but most were unlikely to be clinically relevant (all susceptibilities ≥90% or < 80%). A notable exception was trimethoprim-sulfamethoxazole susceptibility for *K. pneumoniae*, which ranged from 74% to 98% in 2020 and from 74% to 86% in 2021. From 2014 to 2021, the percentage of MRSA decreased from 49% to 34%. Over the 8 years, susceptibility to ceftriaxone for *E. coli* ranged from 93% to 95% and from 90% to 95% for *K. pneumoniae*. Susceptibility to meropenem for *E. coli* and *K. pneumoniae* ranged from 99% to 100%. **Conclusions:** Antibiotic susceptibility for pediatric bacterial isolates in Georgia remained stable over time and supported the narrow-spectrum empiric antibiotic treatment recommended in national evidence-based guidelines for skin and soft-tissue infections, community-acquired pneumonia, and uncomplicated urinary tract infections. MRSA rates decreased over time and multidrug-resistant gram-negative bacilli were uncommon and remained stable.

Table. Combined Pediatric Antibiotic Susceptibility Data for the Cumulative Year 2021 for the State of Georgia

% susceptible (total number of isolates)	ampicillin	amox/clav	oxacillin	ceftriaxone (non-meningitis)	ceftriaxone (meningitis)	clindamycin	TMP/SMX	vancomycin	linezolid	levofloxacin	nitrofurantoin (urine)
Gram positive organisms											
Methicillin-susceptible *S. aureus*	-	-	100 (1159)	-	-	80 (1152)	99 (1154)	100 (1156)	-	-	-
Methicillin-resistant *S. aureus*	-	-	0 (592)	-	-	85 (588)	97 (592)	99 (592)	-	-	-
Enterococcus faecalis	100 (209)	-	-	-	-	-	-	99 (206)	100 (206)	-	100 (209)
Streptococcus pneumoniae	-	91 (116)	-	98 (129)	85 (122)	9 (128)	-	100 (122)	-	99 (123)	-

	ampicillin	cefazolin	ceftriaxone	ceftazidime	cefepime	pip/tazo	meropenem	gentamicin	tobramycin	amikacin	TMP/SMX	ciprofloxacin	levofloxacin	cefazolin (urine)	nitrofurantoin (urine)
Gram negative organisms															
Escherichia coli	49 (2545)	74 (2338)	94 (2545)	-	95 (2335)	98 (2545)	99 (2105)	92 (2545)	-	99 (2108)	72 (2536)	93 (408)	-	89 (2213)	99 (2604)
Klebsiella pneumoniae	-	87 (410)	92 (410)	-	96 (382)	95 (410)	100 (333)	96 (356)	95 (410)	100 (329)	83 (405)	89 (74)	-	-	34 (405)
Enterobacter cloacae complex	-	-	-	-	88 (125)	-	100 (109)	98 (138)	97 (138)	100 (101)	88 (130)	92 (25)	-	-	-
Pseudomonas aeruginosa	-	-	-	93 (433)	91 (433)	96 (433)	95 (371)	83 (433)	96 (433)	96 (355)	-	98 (84)	93 (110)	-	-

S. aureus is *Staphylococcus aureus*. Amox/clav is amoxicillin/clavulanate. Pip/tazo is piperacillin/tazobactam. TMP/SMX is trimethoprim/sulfamethoxazole.
For a given bacterium, the differences in the total number of isolates is the result of differences in antibiotics included in susceptibility testing for the different hospitals

decreased from 49% to 34%. Over the 8 years, susceptibility to ceftriaxone for *E. coli* ranged from 93% to 95% and from 90% to 95% for *K. pneumoniae*. Susceptibility to meropenem for *E. coli* and *K. pneumoniae* ranged from 99% to 100%. **Conclusions:** Antibiotic susceptibility for pediatric bacterial isolates in Georgia remained stable over time and supported the narrow-spectrum empiric antibiotic treatment recommended in national evidence-based guidelines for skin and soft-tissue infections, community-acquired pneumonia, and uncomplicated urinary tract infections. MRSA rates decreased over time and multidrug-resistant gram-negative bacilli were uncommon and remained stable.

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Initial blood culture collection practices and the associated factors upon continued empiric piperacillin-tazobactam usage

Satoshi Kitaura; Koh Okamoto; Ryo Yamaguchi; Takehito Yamamoto; Toshiyuki Kishida; Daisuke Inoue; Hirotaka Miyashita; Masayuki Ueda; Hideki Hashimoto; Sohei Harada; Shu Okugawa; Takeya Tsutsumi and Kyoji Moriya

Background: Approaches to the prescription behavior of broad-spectrum antibiotics, including preauthorization and prospective audit and feedback (PAF), are a focus of antimicrobial stewardship (ASP). However, preprescription behavior, such as blood-culture collection before empiric prescription, is understudied and merits more attention given its influence on the usage of broad-spectrum antibiotics. At the University of Tokyo Hospital, carbapenems are subject to PAF, which has resulted in a compensatory increase in piperacillin-tazobactam use. To evaluate the inherent preprescription behavior associated with a broad-spectrum antibiotic, we investigated the initial blood-culture collection practices upon hospitalization in patients who were continued on empiric piperacillin-tazobactam. **Methods:** A retrospective observational study was conducted at the University of Tokyo Hospital, a tertiary-care hospital in Tokyo, Japan. Patients who were administered piperacillin-tazobactam on the day of hospitalization between April 2016 and December 2017 were included. Patients aged <=18 years and/or patients who discontinued piperacillin-tazobactam within two days were excluded. Only 1 admission per patient was kept for analysis. The medical records of 250 randomly selected patients were reviewed to obtain data on demographics, blood-culture collection, severity, specialties, and risk factors for multidrug-resistant organisms. A multivariable logistic regression analysis was used to identify factors associated with blood-culture collection. **Results:** In total, 960 discrete patients fulfilled the study criteria. Of the randomly selected 250 patients, blood cultures were collected from 162 patients (64.8%), and microbial growth was observed in 30 cases (18.5%). Enterobacterales

and anaerobes accounted for 73.3% of the microbial population. Gastroenterologists (94, 37.6%) and general surgeons (52, 20.8%) were the most common prescribers. Hepatobiliary (83, 33.2%), respiratory (58, 23.2%), and intra-abdominal infections (IAI; 34, 13.6%) were the major suspected diagnoses. Blood-culture collection was associated with the use of immunosuppressive agents (OR, 3.48; 95% CI, 1.49–8.99), intra-bdominal infection (OR, 0.28; 95% CI, 0.12–0.67), systemic inflammatory response syndrome criteria ≥ 2 (OR, 4.50; 95% CI, 2.25–9.42), and surgical specialty (OR, 0.33; 95% CI, 0.18–0.60). **Conclusions:** More than one-third of patients requiring hospitalization and empiric piperacillin-tazobactam did not undergo blood-culture collection. The finding that blood cultures were less likely to be obtained in patients with suspected IAI requiring hospitalization and by surgical specialties raises a concern regarding suboptimal evaluation. Further assessment of the appropriateness of blood-culture collection in the setting of broad-spectrum antibiotic prescription and tailored promotion of blood-culture collection to surgical specialties may be warranted.

Disclosures: S.K.: The author (during graduate school (PhD) was involved in antiviral research relevant to a neglected tropical disease and favipiravir. During this graduate school research, favipiravir was provided by FUJIFILM Toyama Chemical Co. Ltd

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Risk Factors and outcomes associated with inappropriate empiric broad-spectrum antibiotic use in hospitalized patients with community-acquired pneumonia

Tejal Gandhi; Lindsay Petty; Valerie Vaughn; Anurag Malani; David Ratz; Tawny Czilok; Jennifer Horowitz; Elizabeth McLaughlin; Lisa Dumkow; Stephanie Burdick; Danielle Osterholzer; Mariam Younas; Steven Bernstein and Scott Flanders

Background: Inappropriate broad-spectrum antibiotic use targeting methicillin-resistant *Staphylococcus aureus* (MRSA) and *Pseudomonas aeruginosa* can result in increased adverse events, antibiotic resistance, and *Clostridioides difficile* infection. In 2019, revised ATS/IDSA community-acquired pneumonia (CAP) guidelines removed healthcare-associated pneumonia (HCAP) as a clinical entity and modified patient factors warranting empiric broad-spectrum antibiotic (BSA) use. As a result, most patients hospitalized with CAP should receive empiric antibiotics targeting standard CAP pathogens. Based on revised guidelines, we evaluated predictors and outcomes associated with inappropriate BSA use among hospitalized patients with CAP. **Methods:** Between November 2019 and July 2022, trained abstractors collected data on non-ICU adult medical patients admitted with CAP at 67 Michigan hospitals who received either an inappropriate empiric BSA on hospital day 1 or 2 or a standard CAP regimen. Inappropriate empiric BSA use was defined as use of an anti-MRSA or anti-pseudomonal antibiotic in a patient eligible for standard CAP coverage per IDSA guidelines. Patients with immune compromise, moderate or severe chronic obstructive pulmonary disease (COPD), pulmonary complication, or guideline-concordant treatment with BSA were excluded. Data collected included comorbidities, antibiotic use and hospitalizations in the preceding 90 days, cultures in the preceding year, signs or symptoms of pneumonia, hospital characteristics, and 30-day postdischarge patient outcomes. Data were collected through chart review and patient phone calls. Predictors of inappropriate empiric BSA were evaluated using logistic general estimating equation (GEE) models, accounting for hospital-level clustering. We assessed the effect of inappropriate empiric BSA (vs standard CAP therapy) on 30-day patient outcomes using logistic GEE models controlling for predictors associated with the outcome and probability of treatment. **Results:** Of 8,286 included patients with CAP, 2,215 (26.7%) were empirically treated with inappropriate BSA. The median BSA treatment was 3 days (IQR, 2.5). After adjustments, factors associated with inappropriate empiric BSA treatment included hospitalization or treatment with high-risk antibiotics in preceding 90 days, transfer from a postacute care facility, hemodialysis, support with ≥3 L supplemental oxygen, severe sepsis, leukocytosis, and higher pneumonia severity index (Fig. 1). After adjustments, patients with

Figure 1. Multivariable model of Patient and Hospital-Level Factors Associated with Inappropriate Empiric Broad-Spectrum Antibiotic Treatment of Community-Acquired Pneumonia in Hospitalized Patients

Variable	CAP Coverage (N= 6071)	Inappropriate Empiric Broad-Spectrum Coverage (N=2215)	Adjusted Odds Ratio (95% CI)	P-Value
Hemodialysis in preceding 30 days	144 (2.4%)	168 (7.6%)	2.19 (1.68-2.85)	<.001
Hospitalization in preceding 90 days[a]	643 (10.6%)	801 (36.2%)	3.71 (3.22-4.27)	<.001
Received high-risk antibiotic in preceding 90 days[a,b]	597 (9.8%)	524 (23.7%)	1.82 (1.55-2.13)	<.001
Transfer from post-acute care facility[c]	286 (4.7%)	419 (18.9%)	3.37 (2.81-4.04)	<.001
Supplemental oxygen[d]				
Room air	2237 (37.0%)	685 (31.1%)	REF	REF
1-2L	1329 (22.0%)	467 (21.2%)	1.12 (0.96-1.30)	0.16
3-4L	1717 (28.4%)	658 (29.8%)	1.17 (1.02-1.35)	0.03
5+ L	768 (12.7%)	396 (17.9%)	1.50 (1.26-1.77)	<.001
Pneumonia Severity Index[e] (per 20-point increase)	96.6 (73.3-121.4)	109.2 (85.0-133.9)	1.10 (1.06-1.14)	<.001
Severe sepsis[f]	1578 (26.0%)	844 (38.1%)	1.50 (1.32-1.70)	<.001
Leukocytosis (>10,000 cells/uL)[f]	3959 (65.2%)	1537 (69.4%)	1.26 (1.12-1.42)	<.001
Academic hospital[g]	4842 (79.8%)	1665 (75.2%)	0.76 (0.56-1.02)	0.065

[a] Does not include patients receiving empiric antibiotics targeting MRSA or *Pseudomonas aeruginosa* on hospital day 1 or day 2 with severe community-acquired pneumonia as defined by IDSA/ATS 2019 guidelines and were hospitalized in past 90 days and additionally received high-risk antibiotics in previous 90 days. These patients were considered to have received guideline concordant empiric broad-spectrum antibiotics and not included in the inappropriate empiric broad-spectrum treatment cohort.
[b] Includes any intravenous antibiotic, any fluoroquinolone, or linezolid as these are associated with increased risk for multidrug-resistant organisms or are active against methicillin-resistant *Staphylococcus aureus* or *Pseudomonas* species.
[c] Includes patients transferred from subacute rehabilitation center, skilled nursing home, acute rehabilitation center, assisted living facility or resided in these facilities in the preceding 30 days.
[d] Highest level of oxygen support on either hospital day 1 or 2.
[e] Highest pneumonia severity index (PSI) on hospital day 1 or 2. PSI includes age, sex, comorbidities, vital sign and laboratory abnormalities, and pleural effusion on imaging. Higher scores indicate more severe disease.
[f] Present on hospital day 1 or 2.
[g] Academic hospital status was obtained from the American Hospital Association's data hub.
Odds ratios > 1 indicates factors associated with receiving inappropriate empiric broad-spectrum antibiotic treatment on hospital day 1 or day 2; P-value <0.05 is considered significant
CI, confidence interval; OR, Odds ratio

Figure 2. Outcomes for Patients Hospitalized with CAP Receiving Standard Empiric CAP Treatment vs Inappropriate Empiric Broad-Spectrum Antibiotic Treatment N=8286

Outcome[a]	CAP Coverage (n=6071)	Inappropriate Empiric Broad-Spectrum Coverage (n=2215)	Unadjusted Odds Ratio (95% CI)	Unadjusted P-value	Adjusted Odds Ratio (95%CI)	Adjusted P - Value
In-Hospital and 30-d Postdischarge mortality[b]	183 (3.0%)	117 (5.3%)	1.80 (1.42-2.29)	<.001	1.02 (0.81-1.30)	0.85
30-d Postdischarge Re-admission[b]	626[g] (10.4%)	344[i] (15.8%)	1.63 (1.41-1.88)	<.001	1.18 (1.03-1.35)	0.02
30-d Postdischarge ED-Visit[b]	548[g] (9.1%)	236[i] (10.9%)	1.24 (1.05-1.46)	0.01	1.11 (0.95-1.29)	0.18
In-Hospital and 30-d Postdischarge *Clostridioides difficile* Infection[c]	15 (0.3%)	12 (0.5%)	2.20 (1.03-4.71)	0.04	1.88 (0.85-4.16)	0.12
In-Hospital and 30-d Postdischarge Antibiotic – Associated ADE[d]	139 (2.3%)	71 (3.2%)	1.46 (1.09-1.96)	0.01	1.73 (1.24-2.43)	0.001
Duration of Hospitalization, median (IQR)[e]	4 (3-6)	5 (4-7)	1.19 (1.16-1.21)	<.001	1.11 (1.09-1.13)	<.001
Transfer to ICU[f]	86 (1.4%)	60 (2.7%)	1.95 (1.39-2.75)	<.001	1.55 (1.10-2.19)	0.01

[a] Outcomes were adjusted for patient variables found to be significant (P<.05) and associated with treatment in the multivariate analysis as well as baseline characteristics known to be associated with each individual outcome (see other footnotes).
[b] Mortality, readmission, and return to ED are adjusted for age, length of stay (LOS), Charlson comorbidity index, prior hospitalization, transfer from post-acute care facility, discharge to a long-term acute care facility, subacute nursing facility, or rehabilitation facility, Medicaid insurance, Pneumonia Severity Index, chronic obstructive pulmonary disease (COPD) exacerbation, congestive heart failure (CHF) exacerbation.
[c] *Clostridioides difficile* infection is adjusted for age, antibiotics in prior 90 days, hospitalization in prior 90 days, transfer from post-acute care facility, LOS, Charlson comorbidity index, and proton-pump inhibitor.
[d] Antibiotic-associated ADE is adjusted for age, gender, and Charlson comorbidity index
[e] Duration of hospitalization is adjusted for age, gender, Charlson comorbidity index, transfer from post-acute care facility, hospitalization in prior 90 days, and expected duration category.
[f] Transfer to ICU is adjusted for age, Charlson comorbidity index, hospitalization in prior 90 days, transfer from post-acute care facility, Pneumonia severity index, and Medicaid insurance.
[g] Cohort includes 6027 patients because patients who died in the hospital were excluded from this outcome
[i] Cohort includes 2173 patients because patients who died in the hospital were excluded from this outcome
CAP: Community-acquired pneumonia; ED: Emergency Department; ADE: adverse drug event; ICU: Intensive Care Unit.