care providers (PCPs) have shown promise in reducing inappropriate antibiotic prescribing for RTIs. While one perceived barrier to such interventions is the concern that these adversely impact patient satisfaction, few data exist in this area. Here, we examine whether a recent PCP-targeted intervention that significantly reduced antibiotic prescribing for RTIs was associated with a change in patient satisfaction.

Methods. The PCP-targeted intervention involved monthly education sessions and peer benchmarking reports delivered to 31 clinics within an academic health system, and was previously shown to reduce antibiotic prescribing. Here, we performed a retrospective, secondary analysis of Press Ganey (PG) surveys associated with the outpatient encounters in the pre- and post-intervention periods. We evaluated the impact on patient perceptions of PCPs based on provider exposure to the intervention using a mixed effects logistic regression model.

Results. There were 17,416 out of 197,744 encounters (8.8%) with associated PG surveys for the study time period (July 2016 to September 2018). In the multivariable model, patient satisfaction with PCPs was most strongly associated with patient-level characteristics (age, race, health status, education status) and survey-level characteristics (survey response time, patient's usual provider) (Figure 1). Satisfaction with PCPs did not change following delivery of the provider-based intervention even after adjusting for patient- and survey-level characteristics (adjusted odds ratio (95% CI): 1.146 (1.06, 1.244)). However, a small increase in satisfaction associated with receiving antibiotics during the entire study period was seen (adjusted odds ratio (95% CI): 1.146 (1.06, 1.244)).

Figure 1: Association of a provider-targeted intervention as well as patient, provider, and practice characteristics with patient satisfaction in a multivariable mixed effects logistic regression model.

Conclusion. Regional variability in outpatient antibiotic prescribing for Tier 2 and 3 ARTIs remained even after controlling for patient age, comorbidities, and setting of care. It is likely that this variability is in part due to non-clinical factors such as regional differences in clinicians’ prescribing habits and patient expectations. Targeted and enhanced public health stewardship interventions are needed to address cultural factors that affect antibiotic prescribing in outpatient settings.

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24. Antibiotic Use in Hospital Emergency Departments and Observation Settings from 2012–2018 in a Large Cohort of U.S. Hospitals
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Session: O-5. Antimicrobial Stewardship: Population Trends in Antibiotic Use

Background. While discharge antibiotic prescriptions from emergency department (ED) visits have been reported, systemic antibiotic use during ED and hospital observation (OBS) visits have not been well assessed. We conducted a descriptive analysis of antibiotic use in these settings.

Methods. We identified ED and OBS visits not resulting in hospitalization, and systematic antibiotic administration charges during these visits from January 2012-December 2018 using the Premier Healthcare Database, representing at least 600 hospitals annually. Antibiotics prescribed after discharge were excluded. We reported the proportion of visits with antibiotic use, and described antibiotic use by class, agent and route stratified by location. We also examined trends in antibiotic use over time using a multivariable logistic model.

Results. We assessed 161,291,011 ED visits and 15,660,062 OBS visits from 2012–2018. Systemic antibiotics and diagnostics were identified in 9.0% of ED visits and 25.2% of OBS visits respectively. In the ED, 36.4% of ARTIs were treated with third-generation cephalosporins, followed by beta-lactams (25.9%) and the combination of oxacillin and clindamycin (24.5%). In OBS, the most common ARTIs treated were oral infections (33.6%), followed by genitourinary infections (23.7%) and respiratory infections (21.6%). Antibiotics prescribed for ARTIs included beta-lactams (32.5%), third-generation cephalosporins (25.1%), and macrolides (16.7%). A total of 100,104,860 visits were analyzed. In multivariable modeling, ARTI visits in the South were more likely to be associated with receiving an antibiotic for Tier 2 conditions vs. patients in other regions (Figure 1).

Figure 1. Multivariable model comparing risk of receiving an antibiotic for an ARTI by region and diagnostic tier in urgent care, retail health, emergency department, and office visits, MarketScan® 2017, United States

Conclusion. Regional variability in outpatient antibiotic prescribing for Tier 2 and 3 ARTIs remained even after controlling for patient age, comorbidities, and setting of care. It is likely that this variability is in part due to non-clinical factors such as regional differences in clinicians’ prescribing habits and patient expectations. Targeted and enhanced public health stewardship interventions are needed to address cultural factors that affect antibiotic prescribing in outpatient settings.

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23. Regional Variation in Outpatient Antibiotic Prescribing in a Commercially-insured Population, United States, 2017
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Session: O-5. Antimicrobial Stewardship: Population Trends in Antibiotic Use

Background. Studies have shown that the Southern United States has higher rates of outpatient antibiotic prescribing compared to other regions in the country, but reasons for this variation are unclear. We aimed to determine whether the regional variability in outpatient antibiotic prescribing for respiratory diagnoses can be explained by differences in patient age, care setting, comorbidities, and diagnosis in a commercially-insured population.

Methods. We analyzed the 2017 IBM® MarketScan® Commercial Database of commercially-insured individuals aged < 65 years. We included visits with acute respiratory tract infection (ARTI) diagnoses from retail clinics, urgent care centers, emergency departments, and physician offices. ARTI diagnoses were categorized as: Tier 1, antibiotics are almost always indicated (pneumonia); Tier 2, antibiotics are sometimes indicated (sinusitis, acute otitis media, pharyngitis); and Tier 3, antibiotics are not indicated (asthma, allergy, bronchitis, bronchiolitis, influenza, nonsuppurative otitis media, viral upper respiratory infections, viral pneumonia). We calculated risk ratios and 95% confidence intervals (CI) stratified by US Census region and ARTI tier using log binomial models controlling for patient age, comorbidities (Elixhauser and Complex Chronic Conditions for Children), and setting of care, with Tier 3 visits in the West, the strata with the lowest antibiotic prescription rate, as the reference for all strata.

Results. A total of 100,104,860 visits were analyzed. In multivariable modeling, ARTI visits in the South and Midwest were highly associated with receiving an antibiotic for Tier 2 conditions vs. patients in other regions (Figure 1).

Figure 1. Antibiotic use in emergency departments and observation settings by region and diagnostic tier in urgent care, retail health, emergency department, and office visits, MarketScan® 2017, United States

Conclusion. Regional variability in outpatient antibiotic prescribing for Tier 2 and 3 ARTIs remained even after controlling for patient age, comorbidities, and setting of care. It is likely that this variability is in part due to non-clinical factors such as regional differences in clinicians’ prescribing habits and patient expectations. Targeted and enhanced public health stewardship interventions are needed to address cultural factors that affect antibiotic prescribing in outpatient settings.

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Figure 1: Antibiotic use in emergency departments and observation settings by antibiotic class, Premier Healthcare Database Hospitals, 2012-2018

Figure 2: Overall antibiotic use in emergency departments and observation settings by year, Premier Healthcare Database Hospitals, 2012-2018

Conclusion. Hospital ED and OBS settings are uniquely positioned to improve appropriate antibiotic use across the spectrum of healthcare. Frequent use of IV antibiotics and recent increases in antibiotic use in observation settings call for evaluation of appropriateness of their use and presence of transition-of-care process. Further evaluation of diagnoses to evaluate the appropriateness of IV administration may highlight additional opportunities for optimizing prescribing practices.

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26. in Vitro selection Of enterobacter Cloacae with Cefepime, Meropenem, and Ceftazidime-avibactam Generate Diverse Resistance Mechanism

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Session: O-6. Antimicrobial insights

Background. Acquired β-lactamases are not a common β-lactam resistance mechanism in E. cloacae. In this species, porin mutations decreasing β-lactams permeability are associated with overexpression of the constitutive AmpC with or without increased efflux contributing to β-lactam resistance. We subjected 6 E. cloacae isolates to 10-day serial passage with cefepime (FEP), meropenem (MER), and ceftazidime-avibactam (CAZ-AVI) to evaluate resistance level and mechanism in the mutant strains.

Methods. Serial passage was performed in broth microdilution (BMD). Isolated colonies growing in the highest antimicrobial concentrations were submitted to short-read whole genome sequencing (WGS) and analyzed for β-lactam resistance mechanisms. Final mutants displaying > 2-fold changes from the baseline and baseline isolates were sequenced using long-read WGS for single nucleotide polymorphism (SNP) analysis.

Results. After 10-day passaging, 3 (50.0%) isolates displayed FEP resistance, but only 1 isolate had decreased resistance to MER or CAZ-AVI (Table). MIC changes were 4→64 for FEP, 16→64 for MER and 2→32-fold for CAZ-AVI. SNP analysis demonstrated that final resistant mutants had diverse mechanisms. MER and CAZ-AVI selected for AmpC mutants B617, G213D, and V363E. OmpC and AcrA regulator alterations were noted in MER and CAZ-AVI mutants for 1 isolate. Mutations in the ABC transporter UrtB and the cell division inhibitor MioC were observed when 1 isolate was exposed to any of the 3 agents. Mutants for 1 isolate had deletion of OmpC (PCR confirmed). Mutations in the upstream region of various genes and gene

Table 1

| mcr allele | No. | Species | Organism | Conditions | COL MIC range (mg/L) |
|------------|-----|---------|----------|------------|---------------------|
| mcr-1.1    | 23  | E. coli | K. pneumoniae | Argentina (7), Spain (5), Panama (2), France (1), Brazil (1), Vietnam (1) | 2-8 |
| mcr-1.2    | 1   | E. coli | India     |             | 4                   |
| mcr-1.4    | 1   | E. coli | USA       |             | 1.2                 |
| mcr-1.6    | 1   | K. pneumoniae | USA |             | 8                    |
| mcr-3      | 1   | K. pneumoniae | Mexico |             | 4                   |
| mcr-4.2    | 1   | K. pneumoniae | USA |             | 8                    |
| mcr-5      | 1   | K. pneumoniae | Russia |             | 8                    |
| mcr-6      | 1   | K. pneumoniae | USA |             | 2                    |
| mcr-9.1    | 1    | O. rhiniae; E. coli, O. rhiniae, K. pneumoniae | Australia (1), Argentina (1), Brazil (1), China (1), Germany (1), Iceland (1), Poland (1), Portugal (1), Russia (1), Spain (1) | 8 (1-8) |
| mcr-9.1    | 1    | E. cloacae, O. rhiniae, K. pneumoniae | USA |             | 8 (1-8) |
| mcr-9.1    | 1    | E. cloacae, K. pneumoniae | USA (1), Japan (1), USA (10) |             | 8 (1-8) |

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