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Session: O-16. Current Issues in Public Health

Background: In the United States, approximately 30,000 invasive group B Streptococcus (iGBS) infections occur annually; beta-lactam antibiotics (BL) are the first choice for prevention in young infants and treatment in all age groups. We obtained phenotypic and genotypic data for iGBS isolates from U.S. population-based surveillance sites to describe the emergence and characteristics of strains with reduced beta-lactam susceptibility (RS) over a 20-year period.

Methods: We analyzed RS iGBS isolates from eight Active Bacterial Core surveillance sites from 1998–2017. Through 2014, minimum inhibitory concentrations (MIC) for six BL were determined by broth microdilution, followed by whole genome sequencing (WGS) of RS isolates exceeding pre-defined breakpoints (Table 1). In 2015, WGS and MIC testing were performed for all isolates. After 2015, all isolates underwent WGS. MIC testing was continued on approximately 25% of isolates; otherwise, only those with modified penicillin binding protein (PBP) 2x transpeptidase amino acid sequence types or suboptimal WGS (< 1 % of isolates) underwent MIC testing. Clinical information on RS cases was abstracted from medical charts.

Results: Of 26,058 out of 27,269 iGBS isolates (95.6%) tested to date, 107 (0.4%) exhibited RS, increasing from 0% in 1998 to a peak of 1.1% in 2016 (P< 0.05 for trend) (Figure 1). Seven (6.5%) RS strains were from infants aged < 90 days; the rest were from adults aged ≥30 years (Table 2). RS strains consisted of 52 PBP2x types with diverse susceptibility patterns (Table 1). Seven RS strains (6.5%) had wild-type (non-modified) PBP2x; all met the RS criteria based on a single cephalosporin with a confirmed (repeated) MIC value at the break point (Table 1). Compared to non-RS strains, RS strains were more common in patients who presented with cellulitis and osteomyelitis and with underlying conditions such as diabetes or chronic skin breakdown (Table 2). Of 82 (85.4%) patients with RS strains and additional clinical information, 8.3% had known prior GBS infection; 26.8% had known BL exposure in the preceding year.

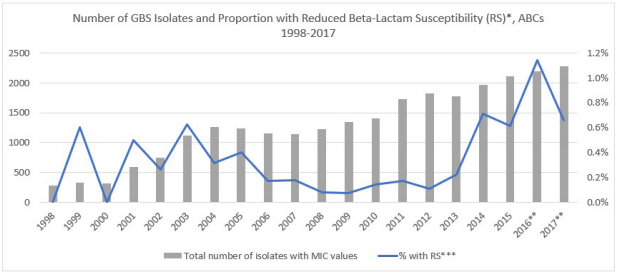
Table 1. Phenotypic Characterization and Diversity of Represented PBP2x Types of Invasive Group B *Streptococcus* (iGBS) Strains with Reduced Beta-lactam Susceptibility (RS), ABCs 1998–2017 (N=107)

Number of Antibiotics to which RS detected	Strain with RS to Individual Beta-lactam Antibiotics Determined by MIC Break Points (µg/mL)						Total Number of RS Isolates	Number of PBP2x types represented	Number of RS Isolates with *pbp2x* Mutation (%)
	Ampicillin MIC ≥0.5[1]	Penicillin MIC≥0.25[1]	Cefotaxime MIC ≥0.25	Ceftizoxime MIC ≥1[2]	Cefazolin MIC ≥1[2]	Cefoxitin MIC ≥16[2]			
1						Y	30	14	26 (86.7)[3]
				Y			15	11	14 (93.3)[4]
			Y				3	2	1 (33.3)[5]
	Y						1	1	1 (100)
2				Y		Y	21	17	21 (100)
			Y			Y	1	1	1 (100)
					Y	Y	1	1	1 (100)
3				Y	Y	Y	5	4	5 (100)
			Y	Y		Y	3	3	3 (100)
	Y			Y		Y	1	1	1 (100)
4			Y	Y	Y	Y	4	4	4 (100)
		Y		Y	Y	Y	2	2	2 (100)
	Y	Y		Y	Y		1	1	1 (100)
		Y	Y	Y		Y	1	1	1 (100)
5		Y	Y	Y	Y	Y	5	4	5 (100)
	Y	Y		Y	Y	Y	2	2	2 (100)
	Y	Y	Y	Y		Y	3	3	3 (100)
	Y	Y	Y	Y	Y		1	1	1 (100)
	Y		Y	Y	Y	Y	1	1	1 (100)
6	Y	Y	Y	Y	Y	Y	6	6	6 (100)

MIC=minimum inhibitory concentration; Y=presence of reduced susceptibility to the individual beta-lactam antibiotic
1. Same break points as defined by Clinical & Laboratory Standards Institute (CLSI)
2. No break points defined by CLSI
3. 4 isolates with wild-type PBP2X had cefoxitin MIC=16 µg/mL
4. 1 isolate with wild-type PBP2X had ceftizoxime MIC value=1 µg/mL
5. 2 isolates with wild-type PBP2X had cefotaxime MIC=0.25 µg/mL

Table 2. Characteristics of Invasive Group B *Streptococcus* (iGBS) Infections with Reduced Beta-Lactam Susceptibility (RS) Isolates, ABCs 1998–2017

	Infections with RS Strains (n=107), N (%)	Infections with non-RS Strains (n=25,951), N (%)	RS vs. Non-RS, P value (Chi-Squared Test)
Patient Age Group			0.34
<7 days	4 (3.7)	1,635 (6.3)	
7 to 89 days	3 (2.8)	1,550 (6.0)	
90 days to <1 year	0	211 (0.2)	
1–14 years	0	114 (0.4)	
15–64 years	50 (46.7)	12,176 (46.9)	
≥65 years	50 (46.7)	10,263 (40.0)	
Underlying Conditions			
Diabetes mellitus	56 (52.3)	10,476 (40.3)	**0.01**
Atherosclerotic Cardiovascular Disease	17 (15.9)	4,457 (17.2)	0.72
Current Smoker	19 (18.1)	2,610 (10.3)	**<0.01**
Emphysema/COPD	16 (15.0)	2,182 (8.4)	**0.02**
Chronic Skin Breakdown	20 (25.3)	2,061 (12.5)	**<0.01**
Solid Organ Malignancy	9 (11.4)	1,952 (11.8)	0.91
Chronic Kidney Disease	14 (13.1)	1,858 (7.2)	**0.02**
iGBS Presentation			
Bacteremia without focus	30 (28.0)	11,138 (42.9)	**<0.01**
Cellulitis	34 (31.8)	5,811 (22.4)	**0.02**
Pneumonia	11 (10.3)	2,689 (10.4)	0.98
Osteomyelitis	22 (20.6)	2,562 (9.9)	**<0.01**
Septic Arthritis	11 (10.3)	2,103 (8.1)	0.41



*Reduced beta-lactam susceptibility was defined as minimum inhibitory concentration (MIC) of ≥1 µg/mL for ceftizoxime or cefazolin, ≥0.25 µg/mL for cefotaxime or penicillin, ≥0.5 µg/mL for ampicillin, and ≥16 µg/mL for cefoxitin.

**Preliminary data

***Out of isolates with MIC values

Conclusion: Preliminary results show that RS increased in recent years; strains RS to penicillin and ampicillin remain low. Variable *pbp2x* mutations have emerged and predominant strains have not yet been identified.

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86. Health Resource Burden of Influenza Among the Elderly with Underlying Conditions in the United States

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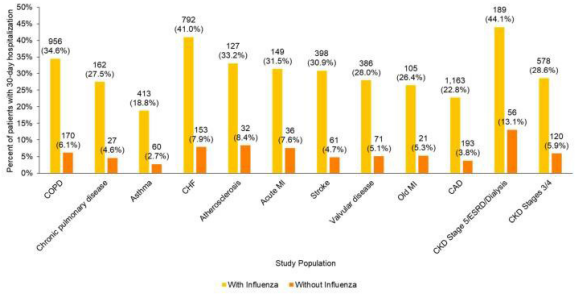
Session: O-16. Current Issues in Public Health

Background: Seasonal influenza poses a substantial clinical and economic burden, despite influenza vaccination efforts. This study evaluates healthcare resource utilization attributable to influenza in elderly populations at increased risk of influenza-related complications.

Methods: Elderly (≥ 65 years of age) patients (pts) with ≥ 1 influenza diagnosis (Dx) during influenza seasons from October 1, 2014 – March 1, 2019 were identified in the IQVIA PharMetrics® Plus claims database. The earliest influenza Dx was the index date and pts had evidence of pulmonary, cardiovascular, or renal disease before index. Pts had ≥ 12 months continuous enrollment (baseline before index) and ≥ 30 days follow-up after index. Medically-attended influenza cases were identified by primary influenza Dx codes or any influenza Dx with a record of an influenza test within ±14 days. Influenza pts were 1:1 propensity score matched to pts without influenza using baseline demographic and clinical characteristics and baseline healthcare costs. All-cause hospital and emergency department (ED) visits and total healthcare costs during follow-up (30-day and in the index influenza season) were compared in the matched cohorts.

Results: Baseline characteristics were balanced after matching. Elderly influenza pts had 3 to 7 times higher 30-day hospitalization rates compared to pts without influenza, including pts with congestive heart failure (41% vs. 8%), chronic obstructive pulmonary disease (35% vs. 6%), coronary artery disease (23% vs. 4%), and stage 5/end stage renal disease (ESRD)/dialysis (44% vs. 13%; all p< .05; Figure). Hospital and ED visit rates in the influenza season were 2 to 3 times higher in pts with vs. without influenza; ED visit rates were 49% vs. 23%, 44% vs. 18%, 37% vs. 14%, and 60% vs. 28% for the above cohorts, respectively (all p< .05). Mean total healthcare costs per patient per season were $3,299 to $12,398 higher in pts with vs. without influenza (all p< .05, except myocardial infarction and stage 5/ESRD/dialysis pts).

Figure. All-cause 30-day hospitalization rates in matched cohorts of elderly patients with baseline comorbidities with and without influenza



All p-values for comparisons of hospitalization rates <0.05.

Abbreviations: CAD, coronary artery disease; CHF, congestive heart failure; CKD, chronic kidney disease; COPD, chronic pulmonary disease; ESRD, end stage renal disease; MI, myocardial infarction

Conclusion: Hospitalizations, ED visits, and total healthcare costs are elevated in the elderly after evidence of medically-attended influenza, but to varying degrees depending on baseline comorbidities. Continued efforts to reduce influenza burden in high-risk populations are needed.

Disclosures: **Aimee Near, MPH, Employee of IQVIA; IQVIA paid by VIR Bio to complete research project** (Consultant) **Jenny Tse, MS, Vir Biotechnology, Inc.** (Other Financial or Material Support, I am employed by IQVIA which was paid by Vir Biotechnology, Inc. to complete this study.) **David K. Hong, MD, Vir Biotechnology** (Employee) **Carolina M. Reyes, PhD, Vir Biotechnology** (Employee, Shareholder)

87. Impact of State of Residence on Adult Vaccination Uptake: A Multilevel Modeling Approach

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Session: O-16. Current Issues in Public Health

Background: Previous studies on adult vaccination coverage found inter-state variability that persists after adjusting for individual demographic factors. Assessing the impact of state-level factors may help improve uptake strategies. This study aimed to:

- Update previous estimates of state-level, model-adjusted coverage rates for influenza; pneumococcal; tetanus, diphtheria, and acellular pertussis (Tdap); and herpes zoster (HZ) vaccines (individually and in compliance with all age-appropriate recommended vaccinations)
- Evaluate effects of individual and state-level factors on adult vaccination coverage using a multilevel modeling framework.

Methods: Behavioral Risk Factor Surveillance System (BRFSS) survey data (2015–2017) were retrospectively analyzed. Multivariable logistic regression models estimated state vaccination coverage and compliance using predicted marginal proportions. BRFSS data were then combined with external state-level data to estimate multilevel models evaluating effects of state-level factors on coverage. Weighted odds ratios and measures of cluster variation were estimated.

Results: Adult vaccination coverage and compliance varied by state, even after adjusting for individual characteristics, with coverage ranging as follows:

- Influenza (2017): 35.1–48.1%
- Pneumococcal (2017): 68.2–80.8%
- Tdap (2016): 21.9–46.5%
- HZ (2017): 30.5–50.9%

Few state-level variables were retained in final multilevel models, and measures of cluster variation suggested substantial residual variation unexplained by individual and state-level variables. Key state-level variables positively associated with vaccination included health insurance coverage rates (influenza/HZ), pharmacists' vaccination authority (HZ), presence of childhood vaccination exemptions (pneumococcal/Tdap), and adult immunization information system participation (Tdap/HZ).

Conclusion: Adult vaccination coverage and compliance continue to show substantial variation by state even after adjusting for individual and state-level characteristics associated with vaccination. Further research is needed to assess additional state or local factors impacting vaccination disparities.

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88. Impact of a Computerized Clinical Decision Support Tool on clostridioides Difficile Testing and Oral Vancomycin Utilization as a Balancing Metric

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Session: O-17. Diagnostic Stewardship

Background: Over diagnosis of hospital-onset *Clostridioides difficile* infection (HO-CDI) is directly tied to inappropriate *C. difficile* testing which does not distinguish between infected or colonized individuals. This can lead to inappropriate therapy. Multiple studies have utilized Computerized Clinical Decision Support (CCDS) tools to reduce inappropriate *C. difficile* testing. Our study looks at the impact of a Self-Assessment CCDS tools on *C. difficile* testing for HO-CDI and oral vancomycin utilization as a balancing metric.

Methods: Our institution utilizes a two-step test to diagnose HO-CDI that consists of toxin A/B enzyme immunoassay followed by a confirmatory PCR. We applied a self-assessment driven CCDS approach to reduce testing for HO-CDI. Our intervention was deployed in the 3rd quarter of 2018. It asked 3 questions about stool frequency, laxative use and previous *C. difficile* testing in the order itself. Inappropriate indications for testing included any of the following: < 3 bowel movements within 24 hours, receipt of a laxative within the past 48 hours, or a previous *C. difficile* test within the previous 7 days. Ordering providers would self-answer these questions. A 'yes' response to any of the three questions prevented further test ordering; though respondents had the freedom to change the answer and still proceed with the test order. We evaluated 3 metrics that were all calculated per 1000 inpatient census days: oral vancomycin usage, HO-CDI rates and *C. difficile* testing rates.

Results: Compared to baseline, our intervention resulted in a significant reduction of *C. difficile* testing and HO-CDI rates (Figure 1, Table 1). Oral vancomycin usage also decreased significantly (Figure 2, Table 1).

Figure 1. C. difficile testing and Hospital Onset C. difficile Infection Rates by Month, Before and After Intervention

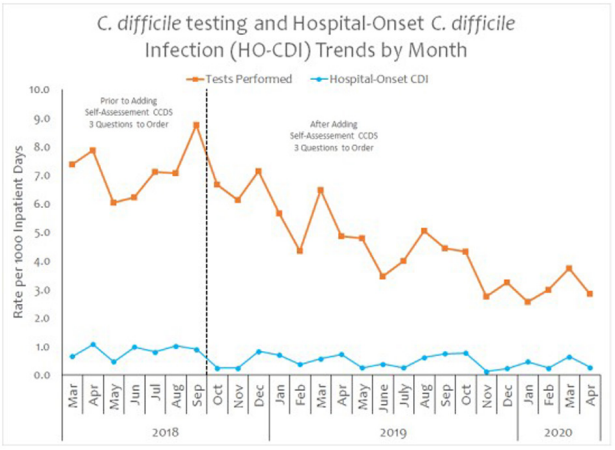

Figure 2. Oral Vancomycin Utilization by Month, Before and After Intervention

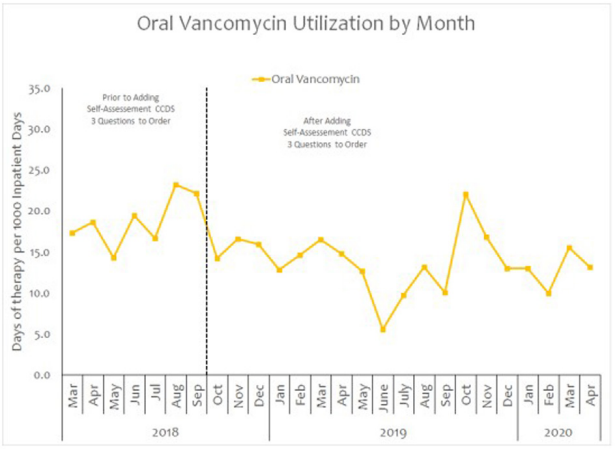

Table 1. Changes in Median Rates of C. difficile testing, Hospital Onset C. difficile Infections and Vancomycin Utilization, Before and After Intervention.

	Prior to Adding Self-Assessment CCDS 3 Question to the Order	After Adding Self-Assessment CCDS 3 Question to the Order	P-value
Median C. Difficile Testing Rate Per 1000 Inpatient days (IQR)	7.1 (6.2-7.9)	4.4 (3.6-6.5)	0.004
Median HO-CDI Rate Per 1000 Inpatient Days (IQR)	0.9 (0.7-1.0)	0.4 (0.2-0.7)	0.007
Median Oral Vancomycin Days of Therapy Per 1000 Inpatient Days (IQR)	18.6 (16.7-22.1)	13.2 (12.7-16.0)	0.005

Conclusion: Our self-assessment driven CCDS-based diagnostic stewardship resulted in a significant reduction in inappropriate *C. difficile* testing for HO-CDI and HO-CDI rates. Oral vancomycin utilization as a balancing metric also decreased significantly. This was despite the use of a self-assessment driven approach with the freedom to change the answers in order to proceed with the test order.

Disclosures: **All Authors**: No reported disclosures

89. Construction of an Electronic Algorithm to Efficiently Target Antimicrobial Stewardship Efforts for Adults Hospitalized with Community-acquired Pneumonia

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