to CZA. Our findings are unique compared with other published reports where CT has consistently demonstrated greater activity than CZA against resistant *P. aeruginosa* and suggest routine testing of both CT and CZA should occur.

Table 1: Comparison of CZA and CT susceptibility, MIC_{50}, MIC_{90}, and ranges among PSA isolates

		CZA				CT			
	# of Isolates	% S	MIC_{50} (mg/L)	MIC_{90} (mg/L)	MIC Range (mg/L)	% S	MIC_{50} (mg/L)	MIC_{90} (mg/L)	MIC Range (mg/L)
All isolates	2972	96.2	≤2	4	≤2 - >16	94.2	≤1	2	≤1 - >32
FEP-/CAZ-/PTZ-/MEM-S	2083	100	≤2	≤2	≤2 - 8	99.6	≤1	≤1	≤1 - >32
FEP-R	51	100	≤2	4	≤2 - 8	96.1	2	4	≤1 - >32
CAZ-R	7	85.7	≤2	16	≤2 - 16	85.7	≤1	16	≤1 - 16
PTZ-R	87	100	≤2	8	≤2 - 8	100	≤1	2	≤1 - 2
MEM-R	144	100	≤2	4	≤2 - 8	99.3	≤1	≤1	≤1 - 8
FEP-/CAZ-R	6	83.3	≤2	>16	≤2 - >16	66.7	≤1	>32	≤1 - >32
FEP-/PTZ-R	20	100	4	8	≤2 - 8	100	2	2	≤1 - 4
FEP-/MEM-R	15	100	4	8	≤2 – 8	100	2	2	≤1 - 4
CAZ-/PTZ-R	57	100	≤2	4	≤2 – 8	100	≤1	2	≤1 - 4
CAZ-/MEM-R	3	100	≤2	8	≤2 – 8	100	≤1	32	≤1 - 32
PTZ-/MEM-R	114	100	≤2	8	≤2 – 8	99.1	≤1	2	≤1 - 32
FEP-/CAZ-/PTZ-R	75	78.7	4	16	≤2 - >16	76	4	8	≤1 - 32
FEP-/CAZ-/MEM-R	8	62.5	4	>16	≤2 - >16	12.5	16	>32	4 - >32
CAZ-/PTZ-/MEM-R	25	88	4	16	≤2 - >16	96	2	2	≤1 - >32
FEP-/PTZ-/MEM-R	60	96.7	4	8	≤2 - >16	95	2	4	≤1 - 8
FEP-/CAZ-/PTZ-/MEM-R	217	59.4	8	>16	≤2 - >16	41.5	8	>32	≤1 - >32

Table 2: CZA susceptibility stratified by CT susceptibility

	CT-S (n=2799)	CT-R (n=173)
CZA-S (n=2859)	2775	84
CZA-R (n=113)	24	89

Disclosures. **All authors:** No reported disclosures.

523. Dual vs. Triple Antibiotic Therapy for Carbapenem-Resistant *Acinetobacter baumannii* Infections

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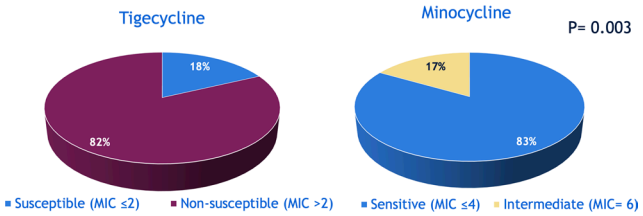
Background. Infections caused by carbapenem-resistant *Acinetobacter baumannii* (CRAB) remain some of the most difficult to treat due to extremely high rates of resistance. The purpose of this study was to compare the efficacy of dual vs. triple targeted antibiotic regimens for CRAB infections.

Methods. This was an IRB approved retrospective cohort study performed at a 607-bed community health system between January 2016 and December 2018. Patients were included in the analysis if they were ≥18 years old and received antibiotics for *CRAB* for ≥72 hours. Patients were excluded if they were pregnant and had *CRAB* isolated solely from the urine. The primary endpoints of the study were differences in all-cause in-hospital mortality (ACIM) and clinical cure (CC) rates for patients treated with dual vs. triple antibiotic therapy. The secondary endpoint result focused on the difference in length of stay (LOS) between treatment groups. A sub-group analysis was performed for patients treated with tigecycline vs. minocycline combination therapy to determine differences ACIM and CC, and LOS. A multi-logistic regression analysis (MLRA) was performed to determine patient factors that were associated with ACIM and CC.

Results. A total of 32 patients were included in the primary analysis. No difference was seen in ACIM between dual vs. triple antibiotic groups (9.5% vs. 18.2%, $P = 0.59$). CC (63.6% vs. 57.1%, $P = 1.0$) and LOS (12 vs. 11 days, $P = 1.0$) was similar amongst patients treated with dual vs. triple antibiotic group. No differences were seen in ACIM (15.4% vs. 16.7% $P = 1.0$), CC (83.3% vs. 69.2%, $P = 1.0$) and LOS (15 vs. 14 days, $P = 1.0$) between tigecycline and minocycline combination therapy groups. The MLRA revealed a positive association with increased serum creatinine and ACIM (OR 3.29, 95% CI 1.35–8.04; $P = 0.009$) as well as shorter time to appropriate antibiotic therapy and clinical cure (OR 1.49, 95% CI 1.02–2.20; $P = 0.04$). CRAB isolates were more likely to be susceptible to minocycline vs. tigecycline (83% vs. 18%, $P = 0.003$).

Conclusion. No differences were seen in ACIM, CC and LOS between dual vs. triple antibiotic groups. Minocycline tends to sustain better susceptibility toward CRAB vs. tigecycline. Elevated serum creatinine was found to be a predictor for ACIM while shorter time to appropriate antibiotic therapy was associated with CC.



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524. Understanding the Treatment of Carbapenem-Resistant Enterobacteriaceae (CRE) Infections in the United States (US): Insights from a Survey of Hospital-Based Pharmacists

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Background. New anti-CRE antibiotics (ceftazidime–avibactam, C-A; meropenem-vaborbactam, M-V; plazomicin, PLZ) are associated with improved outcomes and lower toxicity than polymixins (PMs; colistin; polymyxin B) in treating CRE infections. We previously demonstrated that ~40% (range: 28–71%) and ~23% (16–41%) of CRE infections in the United States were treated with PMs or new agents, respectively, as of 1/19.

Methods. To understand formulary status, availability and positioning of new anti-CRE agents and PMs, we surveyed hospital-based Society of ID Pharmacists (SIDP) members (11–12/18; Qualtrics).

Results. There were 218 respondents from 41 states. Mean CRE infections encountered were 2.7/mo (0–36). C-A, M-V, PLZ were formulary restricted or non-formulary but available at 84%, 68% and 31% of hospitals, respectively; agents were stocked at 80%, 37% and 4%. In 33% of instances, C-A was presented to P&T a second time prior to approval. In rank order, reasons for adding a new agent to formulary were improved outcomes/efficacy, safety/toxicity, and local stewardship (ASP) opinion. Ranked reasons for not adding a new agent were infrequency of CRE, cost, concern for misuse, and limited data. A new agent was positioned as first-line against CRE pneumonia (PNA), bacteremia (BSI), abdominal (IAI) and urinary infections by 87%, 90%, 83% and 56% of respondents [Table]. Smaller hospitals (stratified as ≤200, 201–400, >400 beds) were more likely to have not made a formulary decision or have new agents as no buy ($P = 0.0005$), and less likely to have a new agent stocked ($P = 7e^{-8}$) or to position a new agent as first line against CRE PNA, BSI and IAI ($P = 0.009$). Similar associations were not evident by hospital type (academic, community teaching, or non-teaching).

Conclusion. New agents are positioned as the first line against CRE PNA, BSI and IAI at most US hospitals with an SIDP member pharmacist, but they are still prescribed less against CRE infections than PMs nationally. Smaller hospitals are less likely to have mechanisms for using new agents or to position them as the first line. Discrepancies between positioning and use of new agents may reflect a bias in SIDP membership toward larger hospitals with ASP, lags between endorsing a first-line agent and incorporating it into care, and/or conservative ASP approval of agents in individual cases.

Positioning of agents against CRE infections, as reported by ID pharmacists

Agent positioned as first-line	Type of CRE infection, percentage of respondents (number)			
	Pneumonia	Bacteremia	Intra-abdominal	Urinary tract
Ceftazidime-avibactam	54%	58%	51%	36%
Meropenem-vaborbactam	32%	31%	31%	14%
Plazomicin	2%	1%	1%	5%
Other	13%	10%	17%	44%

Disclosures. **All authors:** No reported disclosures.

525. Evaluation of Implementation of Guidelines for Carbapenem-resistant Enterobacteriaceae (CRE) Prevention Using the Consolidated Framework for Implementation Research (CFIR)

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Background. Infections caused by carbapenem-resistant Enterobacteriaceae (CRE) and carbapenemase-producing (CP) CRE are difficult to treat, resulting in a high mortality annually. In 2017, VA released guidelines for CRE/CP-CRE laboratory testing, prevention, and management. We used the Consolidated Framework for Implementation Research (CFIR) to understand factors influencing implementation of the CRE guideline at VA Medical Centers (VAMCs).

Methods. Between 9/17–8/18, 43 semi-structured interviews were conducted with Multi-Drug Resistant Organism Program Coordinators, laboratorians, physicians and infection preventionists from 29 geographically representative VAMCs of varying size and CP-CRE burden. Interviews addressed perceptions of guideline dissemination, laboratory testing, training, patient education, and IT support (e.g., CRE/CP-CRE flag, lab report and template). We analyzed transcripts using a consensus-based mixed deductive-inductive coding approach to identify CFIR constructs, best practices, recommendations/feedback and implementation challenges.

Results. 95% of interviewees reported using VA CRE/CP-CRE guidelines, most (79%) with high confidence. Respondent comments (n = 798) were coded using CFIR constructs [Inner Setting (e.g., resources), (48%); Process (e.g., planning), (23%); Intervention Characteristics (e.g., VA guidelines) (17%); Outer Setting (e.g., patient needs) (6%); Characteristics of Individuals (e.g., self-efficacy) (6%)]. Interviewees also described Best Practices (15%) and Feedback/Recommendations (12%) including the need for improved lab testing/reporting, communication, contact isolation, staff training, patient education and cost.

Conclusion. Our results suggest sustained improvement in multiple areas to facilitate guideline implementation to identify, prevent, and manage CRE/CP-CRE are needed. This is critical because CRE/CP-CRE incidence and mortality rates are projected to increase.

Figure 1.
Representative quotes: CFIR Inner Setting and Feedback/Recommendations

Challenges	Description	Representative quotes
1. CFIR Inner Setting		
Need for Improved Lab Testing and Reporting	Labs lack equipment and personnel to implement timely Polymerase Chain Reaction (PCR) testing	"[We] didn't have the gene[tic testing]. [Samples were…] sent out to the state lab … and that took time to get back." "We don't have confirmatory testing. We can only send 1-2x a week, so it takes time to come back. But we still do isolation precautions in the meantime. I wish we had confirmation in our facility." "There has been leadership turnover in lab and there have been some issues in management and labor management."
Contact Isolation Space	Inadequate contact isolation space	"We're an old hospital, with multi-patient rooms. So, on a day-to-day basis, we have to cohort a certain percentage of [MRSA+] patients [already]… That's a big barrier.
2. Feedback/Recommendations		
Staff Training	Guideline dissemination gaps and lack of standardized staff educational materials	"Sometimes when [guidelines are sent] to the facilities, it takes a while for the content to get down to the right people." "[Staff] should have a [CRE] training at least once a year because we are more able to get our questions answered."
Patient Education	Standardized patient educational materials are lacking	"We could use some education materials for a low literacy population." "[Patients and families need to understand] why the physician is ordering [CRE testing], its benefit and what to expect for being positive." It would be great [for patients and families] to have a simple overview handout [and] why isolation is important.

Figure 2.
Representative quotes: Barriers and Intervention Characteristics

1. Barriers		
Challenges	Description	Representative quotes
Communication	Information sharing about CP-CRE+ patients	"We don't always get information from other facilities. One patient came in from a different facility and no one knew [the patient's CRE status]. There is a lack of communication from facility to facility." "There should be an interfacility transfer form but there isn't one right now. We developed an interfacility form for when we send our patients out. " "[After the need for contact precautions is confirmed], infection control and [the] ordering provider [are] notified … via a view alert in CPRS … [and the] Theradoc© system…as well. [Infection Control] communicate[s] with staff nurses."
2. Intervention characteristics		
Cost	Costly or unavailable lab testing equipment	"We looked at bringing [PCR] on site and did a cost analysis. Based on the volume and the number of tests…. we decided it wasn't cost effective. Our reference lab…didn't have the equipment. "For our own confirmatory testing, the barrier is the low volume and the cost of the testing to bring it in [house]. I've looked into the Carb-R testing, the cost and what I'd have to do in volume and it's not cost-effective for us to do it here…. unsure how many cases we'd have to have but the 3 [CRE+ cases] in the last year wasn't anywhere close." "We have the [lab] equipment, [but to justify] the cartridge [costs], we'd have to do 15-20 validations, [which] would take about 1.5 to 2 months [even] if I were to get positive [cases] from other facilities."

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526. Significant Reduction of Hospital Onset Carbapenem-Resistant *Enterobacteriaceae* Utilizing Infection Prevention Strategies: *It takes a Village!*

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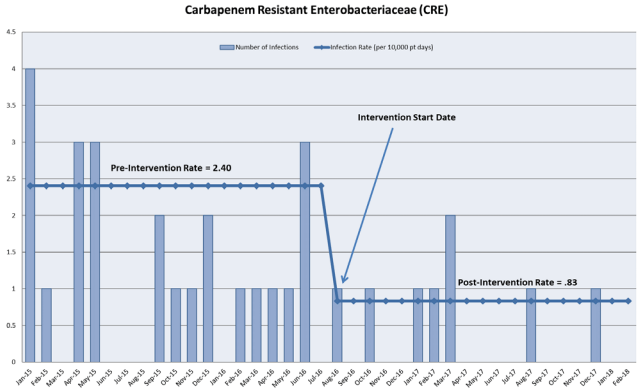
Background. Carbapenem-resistant Enterobacteriaceae (CRE) is a Gram-negative bacteria and is considered one of the major challenges in healthcare worldwide. CRE has a high mortality rate, and the majority produce carbapenemase enzymes, which can be easily spread to other bacteria and patients. An inner-city hospital had a substantial decrease in CRE associated infections/colonization after the implementation of a multi-disciplinary process championed by hospital leadership and Infection Prevention (IP).

Methods. A quasi-experimental study of patients with hospital-onset CRE-positive cultures over Thirty-eight months was conducted. The pre-intervention period was from January 2015 to July 2016 and the post intervention period was from August 2016 to February 2018. The intervention comprised of a CRE prevention and control (CPC) bundle. The bundle comprised of hand hygiene, strict contact precautions, appropriate surveillance cultures and the cleaning of a patient's environment and equipment with bleach. Hospital leadership implemented the CPC bundle during daily huddles with IP and department leaders with real-time identification and resolution of any barriers. The diligence of cleaning and disinfection was monitored using a transparent, easily cleanable and environmentally stable solution that fluoresces when exposed to UV light. The solution was used to mark standardized high touch surfaces and shared equipment in CRE patient rooms prior to terminal cleaning. These surfaces were evaluated with a UV light and used as an opportunity to educate staff on common cleaning oversight.

Results. Prior to implementation of the CPC bundle, there were 24 cases of CRE with a baseline rate of 2.40. After introducing the CPC bundle, there were 8 cases of CRE with a rate of 0.83 (P = 0.006). The CPC bundle was associated with a reduction in CRE cases by 67%.

Conclusion. A hospital-wide approach between multiple departments is critical for the success of CRE prevention and control. This study provides further evidence that a multi-faceted approach to monitoring compliance with the CPC bundle can help reduce the transmission of CRE. This approach can decrease the burden on the healthcare system and improve patient outcomes.



CRE Infection Prevention & Control Bundle	
Enhanced hand hygiene	✓
Strict contact precautions	✓
Routine terminal cleaning	✓
Dedicated staff and equipment	✓
Confirmation and evaluation of cleaning/disinfection	✓
Real time hospital wide communication	✓
Reinforced education	✓
Post discharge UV lighting	✓
Active hospital leadership engagement	✓
Surveillance cultures	✓

Disclosures. **All authors:** No reported disclosures.

527. Project "Isolation Zero": Discontinuing Contact Precautions for Patients Colonized/Infected with Multidrug-Resistant Organisms through Community-Level Follow-Up in Spain

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