(18% in 2018). **Conclusions:** Ongoing CLABSI surveillance has shown stable rates of CLABSI in adult ICUs from 2011 to 2018. The causative microorganisms have changed, with CONS decreasing from 31% to 18%.

Presentation Type:
Poster Presentation
Changes in Nursing Team Composition and Risk of Device Associated Infection in Intensive Care Units

Hirsh Shah, Virginia Commonwealth University Meha Srivastava, 2000; Shelley A Knowlson, VCU Health; Audrey Roberson, Virginia Commonwealth University Medical Center Sherry Lockhart, Virginia Commonwealth University Medical Center Rachel Pryor, Virginia Commonwealth University Health System Shirley Beavers, Virginia Commonwealth University Medical Center Wesley McKinney, Virginia Commonwealth University Medical Center Kaila Cooper, Nursing VCU Health; Emily Godbout, Children's Hospital of Richmond at VCUHS; Michael Stevens, Virginia Commonwealth University School of Medicine; Gonzalo Bearman, Virginia Commonwealth University VCUHS Epidemiology and Infection Control; Michelle Elizabeth Doll, Virginia Commonwealth University

Background: The relationship between nursing staffing and healthcare-associated infections (HAIs) has been explored previously, with conflicting results. Intensive care units increasingly struggle to maintain trained staff. In May 2019, clinical coordinator (CC) roles changed to include 50% of time in direct patient care rather than supportive roles. In this study, we used shift records to explore the impact of staffing on HAI risk. **Methods:** Daily staffing records from December 2018 August 2019 for the medical-respiratory unit (MRICU) and the cardiac surgery unit (CSICU) were reviewed. Both units staff a fixed 2:1 patient:nurse ratio (1:1 for specific cardiac surgeries). Staff deficiency was defined as assignments filled by nurses pulled from other units/supplemental/or CC roles. Staff support comprised nursing assistants and unit secretaries. Census, admissions, and complexity score for number of devices were used to estimate care acuity. In CSICU, additional points were added for continuous renal replacement therapy, extracorporeal membrane oxygenation, ventricular assist devices, transplant, operative cases. NHSN definitions were used for central-line–associated bloodstream infections (CLABSIs) and catheter-associated urinary tract infections (CAUTIs). The Spearman correlation coefficient was used to determine relationship between staffing, acuity, and risk window for HAI (days 1–10 preinfection). Linear regression was used to determine whether staffing deficiencies and/or support associate with the risk window prior to HAI. The final model included census and complexity score as control variables. The statistical analysis was performed using SAS version 9.4 software (Cary, NC). **Results:** Overall, 8 HAIs occurred in the study period: medical-respiratory intensive care unit (MRICU: 3 CAUTIs and 1 CLABSI) and cardiac surgery intensive care unit (CSICU: 1 CAUTI and 3 CLABSIs). Staffing and census fluctuated daily (Table 1). Total number of nurses correlated with complexity scores (r = 0.35; P < .0001) and daily census (r = 0.31; P < .0001) in the CSICU, and the census (r = 0.12; P = .04) in the MRICU. Nursing deficiencies correlated with days 1–10 before infection (r = 0.20; P = .0013) in the CSICU. In the regression model for the CSICU, nursing deficiencies increased in the time prior to HAI (P = .004), and support staff decreased in the time prior to HAI (P = .034) while controlling for census and complexity. These relationships were not significant in the MRICU. **Conclusion:** The lack of core nurses to support the staffing structure in CSICU correlated with periods prior to CLABSI or CAUTI in this small, unit-based study. Failure to recruit and retain highly skilled core staff may produce HAI risks, particularly for CLABSI in specialized units.

Table 1. Variability in Daily Nursing Staffing and Acuity

Variable	MRICU		CSICU	
	Mean (SD)	Range	Mean (SD)	Range
Total nurses	29.1 (1.8)	[19–35]	15.8 (1.7)	[8–21]
Support	6.5 (1.4)	[4–11]	1.9 (0.8)	[0–4]
Deficiency	1.5 (0.9)	[0–4]	1.1 (0.12)	[0–6]
Census	29.5 (2.0)	[23–36]	12.9 (1.4)	[6–14]
Complexity	51.0 (8.9)	[28–72]	31.2 (7.1)	[11–51]

Note. MRICU, medical-respiratory intensive care unit; CSICU, cardiac surgery intensive care unit; SD, standard deviation.

Presentation Type:
Poster Presentation
Characterization of Ceftazidime-Avibactam-Resistant Carbapenem-Resistant Enterobacteriaceae, United States, 2015–2017

Uzma Ansari, Division of Healthcare Quality and Promotion, Centers for Disease Control and Prevention; Hannah E. Reses, Centers for Disease Control and Prevention; Julian Grass, Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention Sandra Bulens, Centers for Disease Control and Prevention; Joelle Nadle, California Emerging Infections Program; Sarah J. Janelle; Chris Bower, Georgia Emerging Infections Program/Foundation for Atlanta Veterans' Education and Research/Atlanta VA Medical Center; Jesse Jacob, Emory University; Elisabeth Vaeth, Maryland Department of Health; Lucy Wilson; Annastasia Gross; Ruth Lynfield; Medora Witwer, Minnesota Department of Health; Emily Hancock, University of New Mexico; Erin C. Phipps; Suzanne Dale, ACM Global Laboratories; Dwight Hardy; Ghinwa Dumyati, University of Rochester; Zintars Beldavs, Oregon Public Health Division; P. Maureen Cassidy; Daniel Muleta, Tennessee Department of Health; Maria Karlsson; Nadezhda Duffy, Centers for Disease Control and Prevention; Isaac See, Centers for Disease Control and Prevention; Joseph Lutgring, Centers for Disease Control and Prevention

Background: Carbapenem-resistant Enterobacteriaceae (CRE) are a major public health problem. Ceftazidime-avibactam (CZA) is a treatment option for CRE approved in 2015; however, it does not have activity against isolates with metallo-β-lactamases (MBLs). Emerging resistance to CZA is a cause for concern. Our objective

was to describe the microbiologic and epidemiologic characteristics of CZA-resistant (CZA-R) CRE. **Methods:** From 2015 to 2017, 9 states participated in laboratory- and population-based surveillance for carbapenem-resistant *Escherichia coli*, *Klebsiella pneumoniae*, *K. oxytoca*, *K. aerogenes*, and *Enterobacter cloacae* complex isolates from a normally sterile site or urine. A convenience sample of isolates from this surveillance were sent to the CDC for antimicrobial susceptibility testing (AST) using reference broth microdilution (BMD) including an MBL screen, species confirmation with MALDI-TOF, and real-time PCR to detect *bla*KPC, *bla*NDM, and *bla*OXA-48–like genes. Additional AST by BMD was performed on CZA-R isolates using meropenem-vaborbactam (MEV), imipenem-relebactam (IMR), plazomicin (PLZ), and eravacycline (ERV). Epidemiologic data were obtained from a medical record review. Community-associated cases were defined as having no healthcare exposures in the year prior to culture, no devices in place 2 days prior to culture, and culture collected before calendar day 3 after hospital admission. Data were analyzed in 3 groups: CRE that were CZA-susceptible (CZA-S), CZA-R that were due to *bla*NDM, and CZA-R without *bla*NDM. **Results:** Among 606 confirmed CRE tested with CZA, 33 (5.4%) were CZA-R. Of the CZA-R isolates, 16 (48.5%) harbored a *bla*NDM gene, of which 2 coharbored *bla*NDM and *bla*OXA-48-like genes; 9 (27.3%) harbored only a *bla*KPC gene. Of the 17 CZA-R isolates without *bla*NDM, all were MBL screen negative. CZA-R due to *bla*NDM were more frequently community-associated (43.8%) than CZA-S or CZA-R without *bla*NDM (11.0% and 5.9%, respectively); a higher percentage of CZA-R cases due to *bla*NDM also had recent international travel (25%) compared to the other groups (1.8% and 5.9%, respectively). CZA-R without *bla*NDM were more susceptible to MEV (76%), IMR (71%), PLZ (88%), and ERV (65%) compared to CZA-R due to *bla*NDM (19%, 6%, 56%, and 44%, respectively). **Conclusions:** The emergence of CZA-R isolates without *bla*NDM are concerning; however, these isolates are more susceptible to newer antimicrobials than those with *bla*NDM. In addition to high rates of resistance to newer antimicrobials, isolates with *bla*NDM are more frequently community-associated than other CRE. This underscores the need for more aggressive measures to stop the spread of CRE.

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Presentation Type:
Poster Presentation
Chemical, Mechanical, and Heat Cleaning to Decontaminate Hospital Drains Harboring Carbapenemase-Producing Enterobacteriales

Alainna Juliette Jamal, University of Toronto; Rajni Pantelidis, William Osler Health System; Rachael Sawicki, William Osler Health System; Angel Li, Sinai Health System; Wayne Chiu, William Osler Health System; Deborah Morrison, William Osler Health System; John Marshman, William Osler Health System; Mahin Baqi, William Osler Health System; David Richardson, William Osler Health System; Allison McGeer, Mount Sinai Hospital; Sergio Borgia, William Osler Health System

Background: Carbapenemase-producing Enterobacteriales (CPE) outbreaks have been linked to contaminated wastewater drainage systems in hospitals. The optimal strategy for CPE decontamination of drains is unknown. In this randomized controlled trial, we aimed to determine whether combining chemical, mechanical, and heat cleaning was superior to routine cleaning for drain decontamination. **Methods:** We enrolled CPE-contaminated hospital drains at 2 geographic locations. Eligible drains were those initially found to be culture positive in a 2017 study and that remained positive (by RT-PCR) when retested twice in August 2018. Drains were stratified by type (sink versus shower) and randomized with a 1:1 allocation ratio (as per computer-generated randomization) to standard-of-care cleaning (comparator) or combined chemical, mechanical, and heat cleaning (intervention) on day 0. Drain tail pieces were swabbed on days 0 (before administration of the intervention), 1, 2, 3, 7, and 14, and at months 1, 2, 3, 4, 5, and 6. Swabs were placed into brain heart infusion with 10% Dey-Engley neutralizing broth and incubated overnight. Direct RT-PCR was performed to detect KPC, VIM, NDM, OXA-48–like, IMP, GES, and SME genes. The primary outcome was drain decontamination, defined as no detectable carbapenemase gene in the drain from day 1 to 7 (inclusive). **Results:** Overall, 33 CPE-contaminated drains were enrolled (7 sink and 26 shower); 17 and 16 drains were randomized to the intervention and comparator, respectively. Moreover, 12 (36%) drains met the primary outcome of decontamination, 18 (55%) remained contaminated, and 3 (9%) could
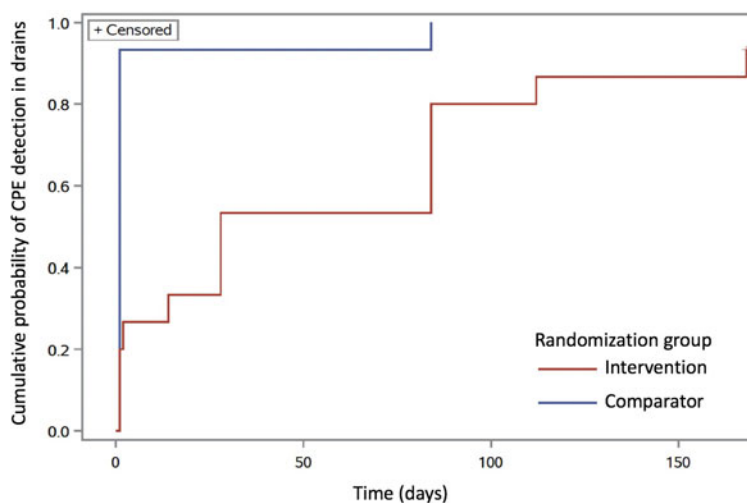

Fig. 1.