

(mean  $\pm$  SD, 2.4 $\pm$ 2.3 vs 3.0 $\pm$ 2.6;  $P < .01$ ), and were less commonly at a long-term care facility (24% vs 31%) or hospital (15% vs 21%;  $P < .01$ ) in the 4 days prior to the CRE culture. CRE-EO were more susceptible to all antibiotics tested at the clinical laboratory ( $P < .01$ ) except for tigecycline ( $P = 1.0$ ) (Table 1). Of the 300 (32%) isolates tested for carbapenemase genes, 98 (33%) were positive (7% CRE-EO vs 62% CRE-O;  $P < .01$ ). Of the CP isolates, we identified *blaKPC* in 93 cases (95%), *blaNDM* in 3 cases (3%), *blaOXA-48*-like in 2 cases (2%). CRE-EO cases had lower 90-day mortality (13% vs 21%;  $P < .01$ ). **Conclusions:** CRE-EO are epidemiologically distinct from CRE-O and are less likely to harbor carbapenemase genes. CRE-EO may require less intensive infection prevention interventions and have more therapeutic options.

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### Presentation Type:

Poster Presentation

### Central-line–Associated Bloodstream Infections Among Adult Intensive Care Unit Patients in Canadian Hospitals, 2011–2018

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**Background:** Nosocomial central-line–associated bloodstream infections (CLABSI) are an important cause of morbidity and mortality in hospitalized patients. CLABSI surveillance establishes rates for internal and external comparison, identifies risk factors, and allows assessment of interventions. **Objectives:** To determine the frequency of CLABSI among adult patients admitted to intensive care units (ICUs) in CNISP hospitals and evaluate trends over time. **Methods:** CNISP is a collaborative effort of the Canadian Hospital Epidemiology Committee, the Association of Medical Microbiologists and Infectious Disease Canada and the Public Health Agency of Canada. Since 1995, CNISP has conducted hospital-based sentinel surveillance of healthcare-associated infections. Overall, 55 CNISP hospitals participated in  $\geq 1$  year of CLABSI surveillance. Adult ICUs are categorized as mixed ICUs or cardiovascular (CV) surgery ICUs. Data were collected using standardized definitions and collection forms. Line-day denominators for each participating ICU were collected. Negative-binomial regression was used to test for linear trends, with robust standard errors to account for clustering by hospital. We used the Fisher exact test to compare binary variables. **Results:** Each year, 28–42 adult ICUs participated in surveillance (27–37 mixed, 6–8 CV surgery). In both mixed ICUs and CV-ICUs, rates remained relatively stable between 2011 and 2018 (Fig. 1). In mixed ICUs, CLABSI rates were 1.0 per 1,000 line days in 2011, and 1.0 per 1,000 line days in 2018 (test for linear trend,  $P = .66$ ). In CV-ICUs, CLABSI rates were 1.1 per 1,000 line days in 2011 and 0.8 per 1,000 line days in 2018 ( $P = .19$ ). Case age and gender distributions were consistent across the surveillance period. The 30-day all-cause mortality rate was 29% in 2011 and in 2018 (annual range, 29%–35%). Between 2011 and 2018, the percentage of isolated microorganisms that were coagulase-negative staphylococci (CONS) decreased from 31% to 18% ( $P = .004$ ). The percentage of other gram-positive organisms increased from 32% to 37% ( $P = .34$ ); *Bacillus* increased from 0% to 4% of isolates and methicillin-susceptible *Staphylococcus aureus* from 2% to 6%. The gram-negative organisms increased from 21% to 27% ( $P = .19$ ). Yeast represented 16% in 2011 and 18% in 2018; however, the percentage of yeast that were *Candida albicans* decreased over time (58% of yeast in 2011 and 30% in 2018;  $P = .04$ ). Between 2011 and 2018, the most commonly identified species of microorganism in each year were CONS (18% in 2018) and *Enterococcus* spp

**Figure:** Central line-associated bloodstream infection (CLABSI) rate per 1000 line-days in mixed- and cardiovascular (CV) surgery intensive care units (ICUs) among adult patients at CNISP hospitals, 2011–2018, with 95% confidence intervals

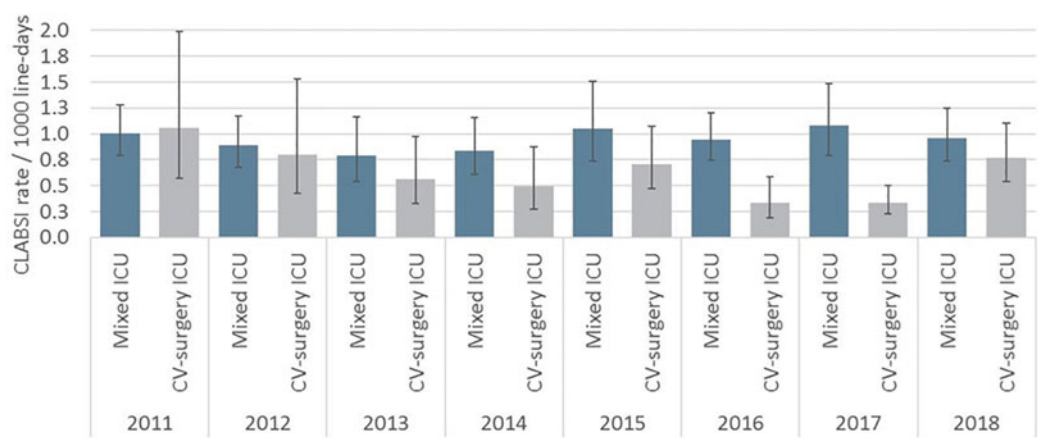


Fig. 1

(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%.

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#### Changes in Nursing Team Composition and Risk of Device Associated Infection in Intensive Care Units

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**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

**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.

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.

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#### Characterization of Ceftazidime-Avibactam-Resistant Carbapenem-Resistant Enterobacteriaceae, United States, 2015–2017

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**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- $\beta$ -lactamases (MBLs). Emerging resistance to CZA is a cause for concern. Our objective