Table 1. Detection and quantitation of mucosal cytokines and viral loads in infants with RSV infection

	HC (n=20)		RSV-IP (n=48)		RSV-OP (n=36)		
	Detection n (%)	Concentration pg/mL	Detection n (%)	Concentration pg/mL	Detection n (%)	Concentration pg/mL	p-value*
Type-I IFN							
IFN-β	2 (10%)	6.4 (5.0-7.8)	7 (14%)	3.5 (2.5-9.8)	6 (17%)	34 (13.8-49.3)	0.004
Type-II IFN							
IP-10	14 (70%)	41.5 (11.3-99.9)	40 (83%)	65 (14.5-174.2)	36 (100%)	328.3 (137.5-2026)	<0.0001
IFN-γ	1 (5%)	-[a]	7 (15%)	2 (1.2-3.5)	20 (56%)	3.1 (1.0-25.8)	0.59
Type-III IFN (mucosal)							
IFN-λ1	2 (10%)	8.6 (5.2-12.1)	21 (44%)	4.4 (2.6-12.9)	24 (51%)	8.8 (3.7-45.9)	0.03
IFN-λ2/λ3	0 (0%)	-[a]	1 (2%)	-[a]	13 (36%)	20.4 (14.5-78.6)	-[b]
Other							
IL-6	8 (40%)	6.4 (3.5-23.8)	41 (85%)	14.8 (4.9-42.5)	31 (86%)	15.7 (4.6-52.8)	0.83
IL-8	20 (100%)	291 (161.6-1354)	48 (100%)	1105 (496-2142)	36 (100%)	1810 (672.2-9660)	0.09
RSV loads	NA	NA	---	7.5 (6.3-8.3)	---	8.2 (7.8-8.6)	0.002

HC: healthy controls; IP: inpatients; OP: outpatients. Values represent absolute numbers and percentages or medians (25%-75% interquartile range-IQR). Mann-Whitney test or Chi-square was used to determine differences between IP and OP (p-values*).
[a,b]Unable to perform statistical comparisons when <2 values in a group. IFN-α2, GM-CSF and IL-12p70 were below the limit of detection or detected at very low con. in all groups. RSV loads expressed as log10 copies/mL

Disclosures. Octavio Ramilo, MD, Bill & Melinda Gates Foundation: Research Grant; Janssen: Research Grant; Merck: Advisory Board; NIH: Research Grant; Ohio Children's Hospital Association (OCHA): Research Grant; Pfizer: Advisory Board, Consultant, Lectures; Sanofi/Medimmune: Advisory Board.

80. Opioid Analgesics Are Associated with Increased Clostridioides difficile Infection Risk in a National Cohort of Veterans

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Session: 31. Not Just Your Everyday Diarrhea
Thursday, October 3, 2019: 11:19 AM

Background. *Clostridioides difficile* infection (CDI) is the leading cause of healthcare-associated diarrhea. Several drugs are known to increase CDI risk, although the association between opioids and CDI risk has not been clearly established. Opioid analgesics have gastrointestinal antimotility and immunomodulatory effects, which may predispose patients to infection. The purpose of this study was to determine the association between opioid use and CDI risk.

Methods. This was a retrospective case–control study that utilized inpatient and outpatient data from the national United States Veterans Health Administration (VHA). CDI patients included those age 18 to 89 years with an ICD-9-CM code for CDI (008.45), a positive stool test, and active CDI therapy between October 1, 2002 and September 30, 2014. A control cohort of VHA patients was created by randomly sampling patients without a CDI ICD-9-CM code during the study period and matched to CDI patients by visit setting and fiscal year. Opioid use was defined as at least one prescription for morphine, hydromorphone, hydrocodone, and/or codeine in the 90 days prior to study inclusion. The χ^2 test was used to compare the proportion of patients who received an opioid in the CDI and control groups. Opioid risk factors for CDI were analyzed using a multivariable logistic regression model that included 33 covariates.

Results. A total of 85,451 patients were included in this study (26,149 CDI patients and 59,302 controls). Overall, 50.1% and 30.1% of patients were prescribed an opioid in the CDI and cohort group, respectively. Overall, opioids were associated with significantly increased CDI risk (OR 1.92, 95% CI 1.86–2.00) and was even greater for >1 opioid (OR 2.40; 95% CI 2.25–2.55). Opioids with the strongest association with CDI risk include morphine (OR 2.04, 95% CI 1.95–2.13), followed by hydromorphone (OR 1.74, 95% CI 1.63–1.87), codeine (OR 1.56, 95% CI 1.44–1.70), and hydrocodone (OR 1.14; 95% CI 1.09–1.19).

Conclusion. In a national cohort of veterans, patients with recent opioid analgesic use had an increased risk of developing CDI compared with a control group. Opioid analgesics with greater immunomodulatory and constipating effects were associated with increased risk compared with other opioids.

Disclosures. **All Authors:** No reported Disclosures.

81. Azithromycin-Nonsusceptible Salmonella Newport Infections Associated with Mexican-style Soft Cheese and Beef—the United States, 2018–2019

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Session: 31. Not Just Your Everyday Diarrhea
Thursday, October 3, 2019: 11:31 AM

Background. Azithromycin is a recommended oral agent for treating non-typhoidal *Salmonella* (NTS), when antibiotics are indicated. Azithromycin nonsusceptibility among NTS is <1% in the United States. CDC, FSIS, and state health departments investigated an outbreak of azithromycin-nonsusceptible *Salmonella* serotype Newport infections to determine sources.

Methods. We classified isolates as the outbreak strain if they were within 11 alleles by core genome multilocus sequence typing. We defined a case as infection with the outbreak strain during June 2018–February 2019. After stratifying by gender and ethnicity, we compared food exposures ≤7 days before illness onset with those reported by healthy persons in the Foodborne Diseases Active Surveillance Network population survey (2006–2007). We used broth microdilution to determine antimicrobial susceptibility.

Results. We identified 218 case patients from 31 states; 49 of 176 (28%) were hospitalized and 2 died. Overall, 65% (121/187) were Hispanic, and 41% (70/169) visited Mexico in the 7 days before illness onset. Among travelers to Mexico, 71% (23/32) reported eating Mexican-style soft cheese; 16/23 (70%) recalled obtaining the cheese in Mexico. Among nontravelers, the proportion who ate Mexican-style soft cheese (30%, 18/60) was similar to that reported by healthy persons, whereas the proportion who consumed beef (91%, 60/66) was higher than reported by healthy persons ($P = 0.04$). The outbreak strain was detected in a sample of soft cheese obtained in Mexico, and in a cecal sample from a steer and a beef sample that was collected at FSIS-regulated establishments in the United States. Isolates were resistant to ampicillin and trimethoprim–sulfamethoxazole, nonsusceptible to azithromycin, and showed decreased susceptibility to ciprofloxacin.

Conclusion. This is the first documented outbreak of azithromycin-nonsusceptible *Salmonella* infections in the United States. Two food vehicles—soft cheese obtained in Mexico, and beef obtained in the United States—were epidemiologically and genetically associated with this outbreak. Further investigation is warranted to determine the routes of entry, prevalence, and spread of azithromycin-nonsusceptible *Salmonella* in US and Mexican cattle.

Disclosures. **All Authors:** No reported Disclosures.

82. First 5 Years of Experience with the Illinois Extensively Drug-Resistant Organism (XDRO) Registry and Implementation of Automated Alerting

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Session: 32. Surveillance in Healthcare-associated Infections
Thursday, October 3, 2019: 10:30 AM

Background. The Illinois XDRO Registry was created in November 2013 as an information system for XDROs; currently, the registry includes carbapenem-resistant *Enterobacteriaceae* (CRE), carbapenemase-producing *Pseudomonas aeruginosa*, and *Candida auris*. All Illinois healthcare facilities can manually query the registry at the time of admission to assess patients' prior colonization status. A subset of facilities, mainly hospitals, participate in the registry's automated querying process; alerts are generated automatically and sent via email, page, or text to infection preventionists at the time of patient admission.

Methods. We assessed counts of XDRO report submissions and total queries (manual and automated) over time, by organism. Facilities achieved automated alerts by sending a near-real-time feed of inpatient admission data (patient name and date of birth) to Illinois Department of Public Health (IDPH) via one of the three connection types: direct (data sent directly to IDPH), vendor (data sent via vendor software), and syndromic surveillance (existing syndromic surveillance data adapted for registry).

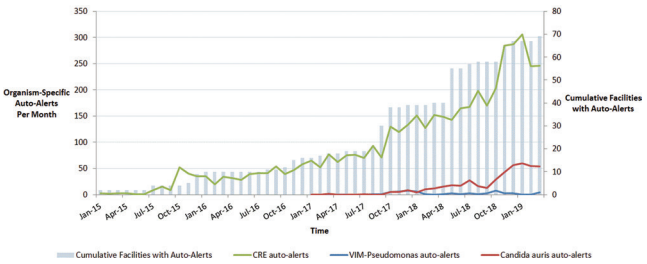
Results. In total, 6,445 unique patients (11,258 total reports) from 213 facilities have been reported to the XDRO registry (counts by organism type, Table). The registry has been manually queried 39,678 times by 232 facilities. Seventy-five facilities have achieved automation of alerting; the types of data connections used were direct ($N = 56$), vendor ($N = 18$), and syndromic surveillance ($N = 1$). In total, 5,344 automated alerts have been sent for 1,555 unique patients. Automated alerts per month have increased over time ($P < 0.001$, Figure). Infection preventionists reported feedback on 3,008 CRE alerts via a website questionnaire; among 1176 first alerts/patient/facility, 49% of patients' XDRO status were previously unknown to the facility, and 33% were not in contact precautions at the time of alert.

Conclusion. The XDRO registry, originally focused on CRE, successfully expanded to include emerging XDRO threats such as *Candida auris* and is poised for rapid response to emerging threats. The registry's adaptable reporting structure and expanding automation have enabled it to deliver an increasing number of actionable infection-control alerts over time.

Table. Extensively Drug Resistant Organism Types Reported to XDRO Registry

Organism	Date That Outbreak Was First Identified in Illinois	Date of First Report into XDRO Registry	Lag From Outbreak to Report in Months	Unique Patients (As of April 2019)
Carbapenem-resistant *Enterobacteriaceae*	December 2007	November 2013	72	6,140
Candida auris	May 2016	January 2017	9	593
VIM-producing *P. aeruginosa*	November 2016	April 2017	6	78

Figure. Illinois XDRO Registry Facility Auto-Alert On-Boarding and Alerts Per Month by XDRO type



Disclosures. **All Authors:** No reported Disclosures.

83. During A Million Patient-Days of Surveillance, Low Levels of Infection Prevention Staff Correlated with Higher Rates of Some Healthcare-Associated Infections

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Background. Reports regarding the correlations between infection preventionist (IP) staffing levels and healthcare-associated infections (HAI) are scarce, conflicting, and crucial for resource allocation and effort prioritization. We evaluated such correlations from January 1, 2012 to March 1, 2019 at a 528-bed teaching hospital in Rochester, NY; a period when IP staffing levels fluctuated between the recommended ratio of 1 IP: 80 patients and a critically low of 1 IP: >375.

Methods. Standardized National Health Safety Network (NHSN) definitions, along with laboratory events, re-admissions, interactions with surgical teams, and an independent data management company were used for case finding of catheter-associated urinary tract infection (CAUTI), *Clostridiodes difficile* (CDI), central line-associated bloodstream infection (CLABSI), carbapenem-resistant *Enterobacteria*ceae, and methicillin-resistant *Staphylococcus aureus* (MRSA). Colon, prosthetic knee and hip joint, hysterectomies, and coronary artery bypass graft surgical site infections (SSI) were also studied. Standardized infection ratios (SIR) were extracted from NHSN. Staffing levels were grouped into low (/ = 7 FTE). Correlations between HAI rates, SIR, and staffing levels were examined using Poisson and *T*-tests with the R statistical package.

Results. The average daily census of 451 resulted in 1.18 million total patient-days of surveillance. Periods of low and recommended IP levels occurred at similar seasons and for similar durations. There were fewer CDI, CAUTI, CLABSI, and MRSA infections when IP staff were at recommended levels than when IP staff were at the lowest level, but only CDI and CLABSI rates were significantly lower ($P = 0.003$ and 0.005, respectively). CLABSI SIR was 1.07 and 0.64 during periods of low and recommended staffing levels, respectively ($P = 0.004$). No significant differences occurred in SSI, either by type or by combined.

Conclusion. Hospitals often cannot achieve or maintain recommended IP staffing levels. Our findings suggest that, during critical personnel shortages, IP may have more impact by focusing on the types of HAI that correlated with preventionist staffing levels. This is among the largest such study to date, and uniquely includes the most types of HAI.

Disclosures. **All Authors:** No reported Disclosures.

84. Evaluation of the NHSN Standardized Infection Ratio (SIR) Risk Adjustment for HO-CDI in Oncology and ICU Patients in General Acute Care Hospitals

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Thursday, October 3, 2019: 11:00 AM

Background. The NHSN healthcare-facility onset *Clostridioides difficile* infection (CDI) standardized infection ratio (SIR) is used to compare hospital quality and set hospital reimbursement but inadequate risk adjustment could penalize hospitals unnecessarily. We hypothesized that general hospitals with large oncology and/or ICU populations were not fully adjusted in the 2015 NHSN acute care hospital CDI Laboratory-Identified (LabID) event prediction model and SIRs would be affected.

Methods. We validated a negative binomial regression HO-CDI event prediction model identical to the 2015 published model and used FY2016 data from eight general hospitals in California to test our hypothesis. We compared HO-CDI events and SIR values, with and without oncology/hematopoietic stem cell transplant or ICU unit events, patient-days, admissions, bed counts, and adjustment parameters included.

Results. Seven major teaching and one nonteaching general acute care hospitals were included (see Table). Eight had oncology/hematopoietic stem cell transplant units; seven had ≥43 ICU beds (median: 134; interquartile range [IQR]: 84–161). The median facility unmodified FacWideIn SIR was 1.23 [IQR: 1.15, 1.29]. Removal of oncology unit data resulted in a 15% median facility decrease in HO-CDI events (IQR: 14%, 21%) and −8% median facility decrease in SIR (IQR: −2%, −14%). Removal of ICU unit data resulted in a 22% median facility decrease in HO-CDI events (IQR: 16%, 26%) and 97% median facility increase in SIR at each facility (IQR: 78%, 105%).

Conclusion. The ICU bed adjustment in the 2015 NHSN SIR is a powerful correction that fully adjusted for ICU HO-CDI events at all hospitals in the study. However, the lack of risk adjustment for oncology/hematopoietic stem cell transplant unit HO-CDI events suggests that the current model unfairly penalizes general acute facilities, many of which also provide specialized oncologic care. Thus, the model needs to be re-adjusted to account for this important specialty care population in general acute care facilities.

Facility	CSMC	Sharp	UCD	UCI	UCLA RR	UCLA SM	UCSD	UCSF
Total HO-CDI events (observed)	298	68	112	138	141	70	213	232
ONC HO-CDI events (%)	29 (10%)	19 (23%)	15 (13%)	28 (20%)	20 (14%)	10 (14%)	35 (16%)	59 (25%)
ICU HO-CDI events (%)	63 (21%)	14 (17%)	29 (26%)	43 (31%)	50 (35%)	8 (11%)	60 (28%)	58 (25%)
Unmodified FacWideIn SIR	1.35	1.16	1.28	1.56	1.20	1.13	0.91	1.27
FWI SIR minus ONC (% change)	1.30 (-4%)	1.03 (-11%)	1.19 (-6%)	1.34 (-14%)	1.16 (-4%)	1.11 (-2%)	0.82 (-9%)	1.13 (-11%)
FWI SIR minus ICU (% change)	2.77 (+105%)	2.35 (+103%)	2.66 (+109%)	2.98 (+91%)	2.49 (+107%)	1.13 (0%)	1.71 (+88%)	1.87 (+47%)

Disclosures. **All Authors:** No reported Disclosures.

85. Use of Dual Statistical Process Control Charts for Early Detection of Surgical Site Infection Outbreaks at a Community Hospital Network

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Thursday, October 3, 2019: 11:15 AM

Background. We recently showed that the empirical use of a combination of 2 moving average (MA) statistical process control (SPC) charts was highly sensitive and specific for detecting potentially important increases in surgical site infection (SSI) rates. We performed this follow-up study to examine the performance of these same SPC charts when applied to known SSI outbreaks.

Methods. We retrospectively applied 2 MA SPC charts to all 30 SSI outbreaks investigated from 2007 to 2015 in a network of over 50 community hospitals. These outbreaks were detected via routine SSI surveillance activities that occurred in the network. We reviewed prior outbreak investigation documentation to determine the estimated time of outbreak onset and time of traditional surveillance outbreak detection. The first SPC chart utilized procedure-specific, composite SSI data from the hospital network for its baseline; the baseline for the second chart was calculated from SSI data from the outbreak hospital undergoing analysis. Both charts used rolling baseline windows but varied in baseline window size, rolling baseline lag, and MA window size. SPC chart outbreak detection occurred when either chart had a data point above the upper control limit of 1 standard deviation. Time of SPC detection was compared with both time of outbreak onset and time of traditional surveillance detection.

Results. With the dual chart approach, SPC detected all 30 outbreaks, including detection of 25 outbreaks (83%) prior to their estimated onset (Figure 1). SPC detection occurred a median of 16 months (interquartile range, 12–21 months) prior to the date of traditional outbreak detection, which never occurred prior to outbreak onset. Both individual SPC charts exhibited at least 90% sensitivity in outbreak detection, but the dual chart approach showed superior sensitivity and speed of detection (Figure 2).

Conclusion. A strategy that employed optimized, dual MA SPC charts retrospectively detected all SSI outbreaks that occurred over 9 years in a network of community hospitals. SPC outbreak detection occurred earlier than traditional surveillance detection. These optimized SPC charts merit prospective study to evaluate their ability to promote early detection of SSI clusters in real-world scenarios.