Background. Daptomycin (dap) has been approved and successfully used for the treatment of methicillin-resistant *Staphylococcus aureus* (MRSA) infections. However, reports of daptomycin nonsusceptible (DNS) MRSA strains have emerged over the recent years. This study describes the clinical characteristics of patients with DNS MRSA bloodstream infections (BSIs) with the objective of identifying risk factors and outcomes.

Methods. This is a retrospective case–control study in a tertiary healthcare system in southeast Michigan. Cases included 34 patients with DNS MRSA BSI between September 24, 2005 and March 31, 2018. Cases were matched with controls with MRSA BSI based on age, source of BSI, and time-period of BSI in a 1:1 ratio. Charts were reviewed for clinical and laboratory data. Vancomycin (van) and dap minimum inhibitory concentrations (MICs) were determined by E-test. DNS was defined as an MIC >1.0 µg/mL. Chi-square test, Fisher's exact test, and t-test were used to determine statistical significance.

Results. In the case cohort, the source of BSI was endovascular in 11(32%) patients, central-line associated in 3(9%), secondary BSI in 13(38%), and unknown in 7(21%). Table 1 is a summary of the results.

Table 1. Clinical Characteristics and Outcomes of Cases and Controls

	Cases	Controls	
	N = 34(%)	*N* = 34(%)	*P*-value
Mean age (SD)	63.5 (12.0)	61.9 (11.2)	0.572
Male	18 (52.9)	21 (61.8)	0.462
Mean bacteremia duration in days (SD)	4.4 (3.2)	5.9 (4.9)	0.195
Mean LOS in days (SD)	19.5 (13.6)	18.4 (14.6)	0.751
Mean van MIC (SD)	2.04 (1.19)	1.39 (0.36)	0.003
Mean dap MIC (SD)	2.69 (1.32)	0.57 (0.24)	<0.0001
Epidemiologic acquisition			
Community-acquired	0 (0)	9 (26.5)	0.002
Healthcare-associated	21 (63.6)	22 (64.7)	0.927
Hospital-acquired	12 (36.4)	3 (8.8)	0.007
90-day prior dap exposure	23 (82.1)	3 (9.7)	<0.0001
Mean dap exposure in days	23.6 (21.0)	2.68 (10.6)	<0.0001
90-day prior van exposure	25 (89.3)	9 (29)	<0.0001
Mean van exposure in days	13.0 (14.7)	4.19 (12.7)	0.020
30-day mortality[a]	10 (32.3)	6 (18.8)	0.218
Mean Charlson Comorbidity Index (SD)	5.7 (3.07)	4.4 (2.9)	0.077
90-day MRSA BSI recurrence[a]	8 (44.4)	2 (9.5)	0.025

[a]From date of index BSI.

Conclusion. Prior exposure to dap and van, and higher van MIC in MRSA isolates are risk factors for DNS MRSA BSI. DNS is associated with significantly higher risk of 90-day MRSA BSI recurrence.

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1223. Increasing Incidence of Methicillin-Resistant *Staphylococcus aureus* in Greenland

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Background. The first case of methicillin-resistant *Staphylococcus aureus* (MRSA) in Greenland was diagnosed in 2000 and led to the first guideline on screening and treatment for MRSA. Up to 2015 there were only 13 patients with MRSA but since then a nearly 4-fold increase in incidence has been seen. The objectives of this study were to analyze the reasons for this increase.

Methods. MRSA data were collected from the laboratory surveillance database at Dronning Ingrids Hospital, typing results from the Reference Laboratory for Antimicrobial Resistance and Staphylococci at SSI, and the patient records.

Results. From 2000 to 2017, 48 patients (15 children and 33 adults) have been diagnosed with MRSA. Thirty patients were colonized with MRSA, predominantly in the nose and throat. Eighteen patients had infections: conjunctivitis, middle ear infections, wounds, skin abscesses, mastitis, surgical site infections, for example.

The increase since 2015 was mainly due to three large outbreaks in three different cities: Aasiaat in 2014/2015 (seven persons with MRSA; three children and four adults), the capital Nuuk in 2016 (six persons with MRSA; two children and four adults) and Tasiilaq in 2017 (13 persons with MRSA; three children and ten adults). The first two outbreaks were community-acquired with transmission in families and the last one was community-acquired or community-onset hospital acquired. Each outbreak was caused by a specific MRSA-type: t902 CC22 in Aasiaat (unknown epidemiology), t3979 CC5 in Nuuk (probably from Australia), and t304 CC6 in Tasiilaq (probably from Denmark).

MRSA was mainly imported from Denmark or abroad due to admission to hospital or due to traveling to high-endemic countries like Australia, but in some cases the epidemiology was unknown. Transmission occurred mainly in families with close contact.

Conclusion. The increasing number of patients with MRSA in Greenland can be explained by factors such as import from Denmark or abroad due to admission to hospital or traveling, and transmission in Greenland. An ongoing surveillance, compliance to screening procedures (especially patients admitted to hospitals abroad) and guidelines for infection prevention and control are necessary in order to combat MRSA in Greenland in the future.

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1224. Drug-Resistance Dynamics of *Staphylococcus aureus* at a Tertiary Hospital, Beijing, China: 2013–2017

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Background. To understand the drug-resistance dynamics of *Staphylococcus aureus* and provide references for effective control of methicillin-resistant *Staphylococcus aureus* (MRSA) infection.

Methods. All data were obtained from the healthcare-associated infection surveillance system. Different strains of *S. aureus* were identified using the VITEK-2 automated system, the drug susceptibility results of resistance and intermediate were classified into resistance. Chi-square test and variation analyses of *S. aureus* drug-resistant rate were performed.

Results. From 2013 to 2017, 2,289 strains of *S. aureus* were isolated, and the specimen were mostly collected from sputum (721, 31.50%), wound secretion (211, 9.22%), and blood (210, 9.17%). The resistance rate of *S. aureus* was highest for tigecycline (94.43% in 2013, 100% in 2017) and penicillin (96.49% in 2013, 95.60% in 2017) (P = 0.028). The resistance rates among other drugs such as clindamycin (65.28% in 2013, 71.39% in 2017) and erythromycin (69.62% in 2013, 62.59% in 2017) were more stable (P = 0.056). However, oxacillin (from 73.68% to 34.47%), gentamicin (from 51.51% to 24.13%), and tetracycline (from 46.78% to 30.81%) showed a declining trend (P = 0.017). Meanwhile, there were almost no *S. aureus* resistance to linezolid, vancomycin, and nitrofurantoin. During the previous 5-year period, MRSA rates decreased sharply and in 2017 rate was 34.47%. In 2017, MRSA was most frequently isolated in orthopedics, emergency ICU, and respiratory.

Conclusion. The reduction in drug-resistant MRSA may be evidence of effective antibiotic administration practice. Whereas more comprehensive infection control measures are needed to prevent the transmission of *S. aureus* and MRSA.

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1225. High Rate of Linezolid (LZD) Nonsusceptibility (LNS) Among Enteric Vancomycin-Resistant Enterococci (VRE) Recovered From Hospitalized Patients Actively Screened for VRE Rectal Colonization (VREC)

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Background. Select hospitalized patients are actively screened for VREC but VRE isolates may not undergo antibiotic susceptibility testing. We sought to identify predictors of daptomycin (DAP) nonsusceptibility (DNS, MIC > 4) and LNS (MIC > 2) among enteric VRE isolates recovered from patients actively screened for VREC for which antibiotic susceptibility testing was not preformed.

Methods. This was a retrospective study of consecutive adults admitted to a surgical intensive care unit (ICU) or associated medical unit between June 1, 2017 and March 1, 2018 who had a VRE isolate from active screening. Only index isolates were included. DAP and LZD MICs were determined by Etest. Patient- and antimicrobial-level data, including ambulatory prescriptions, dating back to January 1, 2016 were collected. Multivariable logistic regression models were used to determine predictors of DNS and LNS VRE.

Results. In total, 64 patients' VRE rectal isolates were included. Fifty-nine (92.2%) were *E. faecium* and 50 (78.1%) were from ICU patients. Thirty-seven patients (57.8%) were female and the mean age ± SD was 60 ± 13 years. Five (7.8%) and 20 (31.3%) patients had previous abdominal transplant and VRE infection, respectively. DAP and LZD MIC distributions are shown in the table below. Forty-one (64.1%) VRE isolates were LNS, including five LZD-resistant isolates. Only one (1.6%) isolate was DNS precluding an analysis of DNS predictors; 12 (18.8%) isolates had a DAP MIC > 2 mg/L. Common antimicrobial exposures prior to index VRE isolate included: vancomycin (62.5%), ceftriaxone (64.1%), cefepime (53.1%), metronidazole (50%), and ciprofloxacin (50%). Previous LZD (17.2%) and DAP (15.6%) exposure were less common. In a multivariable model, number of previous cefazolin doses (adjusted odds ratio (aOR) 0.74 95% confidence interval (CI) 0.55–0.95), and previous tobramycin exposure (aOR 0.15, 95% CI 0.02–0.81) were inversely associated with LNS. Previous LZD exposure was not associated with LNS.

	MIC_{50}	MIC_{90}
DAP	1.5 mg/L	3 mg/L
LZD	4 mg/L	4 mg/L

Conclusion. LNS was common amongst VRE isolates in this cohort. Previous LZD exposure was infrequent and not associated with LNS. LZD susceptibility testing among VRE isolates recovered from patients actively screened for VREC warrants clinical consideration.

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1226. Can Universal Decolonization Obviate the Need for Screening and Contact Precautions for Carriers of Methicillin-Resistant *Staphylococcus aureus* in a Medical Intensive Care Unit With MRSA Endemicity? An Interrupted Time Series Study

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Background. Universal decolonization of patients in intensive care units (ICUs) has been identified to be an effective infection control strategy of methicillin-resistant *Staphylococcus aureus* (MRSA). However, it remains uncertain whether universal decolonization can obviate the need for active surveillance testing (AST) and contact precautions (CPs) for MRSA carriers.

Methods. We conducted an interrupted time series study to evaluate whether universal decolonization (daily chlorhexidine bathing plus twice-daily intranasal mupirocin ointment for 5 days) without AST and CPs did affect the incidence of MRSA acquisition on clinical specimen and MRSA bacteremia (the first positive blood culture obtained more than 48 hours after ICU admission) in a medical ICU. There was a 12-month control period of universal decolonization combined with AST and CPs, followed by a 12-month intervention period of universal decolonization without AST and CPs for MRSA carriers. Changes in incidence density (new cases of MRSA acquisition on clinical specimen per 1,000 eligible patient-days) of MRSA were evaluated by segmented Poisson regression, and the cox proportional-hazards regression model was used to compare the differences in incidence of MRSA bacteremia between the two periods.

Results. The median overall prevalence of MRSA did not differ between the two periods (25.3% vs. 23.4%, $P = 0.55$), and the segmented Poisson regression analysis revealed that there were no significant differences in both level and trend of MRSA prevalence ($P = 0.43$ and $P = 0.27$, respectively). The incidence density of MRSA acquisition on clinical specimen was lower during the intervention period (5.7 vs. 4.5, $P = 0.039$). However, both level and trend of MRSA incidence density did not differ significantly whether to perform active surveillance and contact precaution or not ($P = 0.94$ and $P = 0.81$, respectively). No patient developed MRSA bacteremia during the control period and there were only two patients of MRSA bacteremia during the intervention period, which showed no significant difference (Log rank test, $P = 0.21$).

Conclusion. Universal decolonization without AST and CPs for MRSA carriers do not increase the incidence of MRSA acquisition on clinical specimen and ICU-attributable MRSA bacteremia in ICU with high prevalence rate of MRSA.

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1227. Development of a Clinical Prediction Model for Mortality in Methicillin-Resistant *Staphylococcus aureus* Bacteremia

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Background. Methicillin-resistant *Staphylococcus aureus* bloodstream infection (MRSA BSI) is associated with high mortality despite advances in medical care. Mortality prediction may have a profound impact on clinical decision making and risk stratification. Widely used scoring systems such as the Acute Physiology and Chronic Health Evaluation (APACHE) II Score and the Pitt Bacteremia Score were derived in the general critical care and Gram-negative BSI populations, respectively and may be less precise in MRSA BSI. We sought to develop a predictive model (PM) for 30-day mortality in patients with MRSA BSI based on characteristics readily assessable at initial evaluation.

Methods. Retrospective, singe-center, cohort study in adults with MRSA BSI 2008 to 2018. Patients who did not receive active therapy within 72 hours of index culture were excluded. Independent baseline demographic, clinical and infection predictors of 30-day mortality were identified through multivariable logistic regression analysis with bootstrap resampling and coefficient shrinkage. The PM was derived using a regression coefficient-based scoring method. PM discriminatory ability was assessed using the c-statistic. The optimal threshold score was determined using the Youden Index (J).

Results. A total of 455 patients were included and 30-day mortality was 16.3%. The PM consisted of five variables and a potential total score of 33. Points were assigned as follows: age (9 points ≥90 years, 6 points 80–89 years, 5 points 70–79 years, 0 points <70 years); Glasgow Coma Scale (8 points ≤9, 5 points 10–13, 0 points ≥14); 7 points infective endocarditis or pneumonia; 5 points serum creatinine ≥ 3.5 dl/L; and four points respiratory rate <10 or >24. The PM c-statistic was 0.860 (95% CI 0.818, 0.902). The PM score with the maximum J value was 13. Thirty-day mortality was 5.2% vs. 44.5% for PM score <13 vs. ≥13 points, respectively ($P < 0.001$). The sensitivity, specificity, positive predictive value (PV), negative PV, and accuracy using a threshold of 13 points were 77.0%, 81.4%, 44.5%, 94.8%, and 80.7%, respectively.

Conclusion. Our findings demonstrate a weighted combination of five independent variables readily assessable at initial evaluation can be used to predict, with high discrimination, 30-d mortality in MRSA BSI. External validation is required before wide-spread clinical use.

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Theravance: Consultant, Grant Investigator and Speaker's Bureau, Consulting fee, Research grant and Research support. Sunovian: Consultant, Grant Investigator and Speaker's Bureau, Consulting fee, Research grant and Research support. Zavante: Consultant, Grant Investigator and Speaker's Bureau, Consulting fee, Research grant and Research support. NIAID: Consultant, Grant Investigator and Speaker's Bureau, Consulting fee, Research grant and Research support.

1228. Incidence of *Staphylococcus aureus* Infection after Elective Surgeries Among Adults in US Hospitals

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Background. *Staphylococcus aureus* is a leading cause of postsurgical infections. National estimates of these infections after elective surgeries based on microbiology data are limited. This study assessed 180-day postsurgical *S. aureus* incidence in real-world hospital settings.

Methods. Adults (≥18 years) who underwent elective surgery during a hospital-based outpatient or inpatient encounter from July 1, 2010–June 30, 2015 at one of 181 hospitals reporting microbiology results in the Premier Healthcare Database (PHD). Eighty-seven surgical categories were defined using ICD-9-CM and CPT procedure codes according to National Hospital Surveillance Network groupings plus additional categories. Microbiology results and ICD-9-CM diagnosis codes were used to identify invasive (e.g., deep incisional and organ-space SSI, bloodstream) and overall (i.e., invasive, superficial incisional, urinary tract, respiratory) *S. aureus* infections. Cumulative 180-day *S. aureus* infection rates were calculated as number of infections divided by number of discharges with elective surgeries. National infection volumes were calculated by multiplying infection rates by national inpatient elective surgery estimates using surgery counts in the entire PHD (665 hospitals) and weights based on hospital characteristics.

Results. Following 1,116,994 hospital-based outpatient elective surgeries, 180-day *S. aureus* incidence was 1.19% overall, with 0.38% complicated by invasive *S. aureus* infections. Among 884,803 inpatient elective surgeries, overall and invasive 180-day *S. aureus* infection incidence was 1.35% and 0.53%, respectively. This translated to an estimated 57,200 *S. aureus* infections (22,400 invasive) among an estimated 4.2 million elective inpatient surgeries annually in the US methicillin-resistance (MRSA) was observed in 45% and 46% of *S. aureus* infections after inpatient and outpatient surgeries, respectively. Figure 1 shows cumulative *S. aureus* incidence rates at each time point after outpatient and inpatient elective surgeries. Figure 2 delineates the incidence rates for each type of *S. aureus* infection.

Conclusion. Our study indicated similar *S. aureus* infection rates after inpatient and outpatient elective surgeries. The results highlight the much larger burden of disease of *S. aureus* infection in the United States beyond inpatient surgeries.