Background. Bacterial resistance in China had been increasing in prevalence. Vancomycin-resistant enterococcus (VRE) different from other bacteria had lower isolated rate and apparent regional variations. In this study, we identified the characteristics of VRE infections in Chinese patients based on the China Antimicrobial Surveillance Network (CHINET) in 2016.

Methods. This case–control study was conducted in 97 VRE patients and 95 Vancomycin-susceptible Enterococcus (VSE) patients from 20 medical centers. Demographics, disease characteristics, therapeutic measure, as well as laboratory data were obtained from medical records for analysis. Descriptive statistics, simple and multivariate logistic regression were performed to explore the risk factors of VRE infection.

Results. The mean age of patients in the case and control groups was 75.0 years and 65.0 years, respectively. In the case group, 52 patients developed urinary tract infections, accounting for 53.6%, followed by bloodstream infections (19.6%) and abdominal infections (5.2%). And the cases of Enterococcus faecium, Enterococcus faecalis and other enterococci infections were 70 (72.2%), 7 (7.2%), and 20 (20.6%), respectively. Moreover, the proportion of vancomycin usage before infection was 20.6%. The result of resistance analysis showed VRE patients' other dug resistance rate was higher than VSE ones. Compared with VSE patients, VRE patients had received more urinary intubation, indwelling venous catheter, and dialysis. Additionally, the proportions of combination with stroke (8.3% vs. 2.1%), multiple organ failure (8.3% vs. 3.2%), and other infection (59.8% vs. 40.0%) were higher in the case group. What's more, 44 (45.4%) VRE patients had been treated in intensive care unit, while 21 (22.1%) cases in the control group. Multivariate logistic regression showed that receiving indwelling venous catheter was independent risk factor for VRE infection (OR=3.342, 95% CI: 1.379~8.099). For prognosis, VRE patients had a lower effective rate (67.4% vs. 83.7%), higher hospital expense (￥94991 vs. ￥38248), and longer hospital stay (26.0 days vs. 21.0 days).

Conclusion. Indwelling venous catheter may increase the VRE infection risk and Linezolid or Fosfomycin could still be used for infection treatment in VRE patients.

Table 1. Comparison of demographic and other characteristics between VRE and VSE patients

Characteristics	VSE patients (N=95)	VRE patients (N=97)	*P* value
Female	43 (46.2%)	38 (39.6%)	0.3555
Age, years	65.0 (49.0, 86.0)	75.0 (62.0, 83.0)	0.0042
Place before infection			0.3768
Hospital	42 (47.2%)	51 (57.3%)	
Community	46 (51.7%)	36 (40.4%)	
Transfer of external hospital	1 (1.1%)	2 (2.2%)	
Diabetes	13 (13.7%)	22 (22.7%)	0.1065
Tumor	24 (25.3%)	17 (17.5%)	0.1909
Cerebrovascular diseases	12 (12.6%)	22 (22.7%)	0.0682
Cardiovascular diseases	9 (9.5%)	23 (23.7%)	0.0081
Cardiac insufficiency	5 (5.3%)	10 (10.3%)	0.2824
Hepatic insufficiency	0	2 (2.1%)	0.4974
Liver cirrhosis	2 (2.1%)	0	>.9999
Renal insufficiency	8 (8.4%)	13 (13.4%)	0.2689
COPD	2 (2.1%)	5 (5.2%)	0.4446
Viscera perforation	0	2 (2.1%)	0.4974
Immune disease	1 (1.1%)	2 (2.1%)	>.9999
Gastrointestinal bleeding	6 (6.3%)	2 (2.1%)	0.1672
Severe acute pancreatitis	1 (1.1%)	1 (1.0%)	>.9999
After the pacemaker implantation	1 (1.1%)	0	0.4948
Intestinal fistula	2 (2.1%)	0	0.2435
Urinary intubation	32 (33.7%)	38 (39.2%)	0.4293
Indwelling venous catheter	9 (9.5%)	31 (32.0%)	0.0001
Mechanical ventilation	17 (17. 9%)	37 (38.1%)	0.0018
Dialysis	0	8 (8.3%)	0.0067
Drainage	12 (12.6%)	10 (10.3%)	0.6135
Surgical drainage	12 (12.6%)	5 (5.2%)	0.0682
Ventricular drainage	0	5 (5.2%)	0.0594
Organ transplantation	2 (2.1%)	1 (1.0%)	0.6191

VRE: vancomycin-resistant *Enterococcus*; VSE: vancomycin-susceptible *Enterococcus*; COPD, chronic obstructive pulmonary disease.

Table 2. Related factors of VRE infection by multivariable logistic regression

Factors	OR (95%CI)	*P* value
Age, years	1.014 (0.997~1.031)	0.0983
Diabetes	1.321 (0.578~3.022)	0.5091
Cerebrovascular diseases	1.775 (0.764~4.124)	0.1823
Cardiovascular diseases	1.965 (0.795~4.855)	0.1434
Indwelling venous catheter	3.342 (1.379~8.099)	0.0076
Mechanical ventilation	1.829 (0.856~3.908)	0.1189
Surgical drainage	0.363 (0.106~1.246)	0.1074

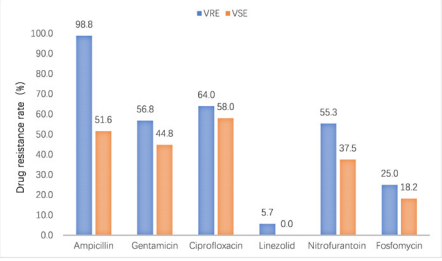

Figure 1. Antimicrobial resistance in VRE and VSE patients

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

577. The Role of Healthcare Worker-Mediated Contact Networks in the Transmission of Vancomycin-Resistant Enterococci

Eili Klein, PHD[1]; Jeremiah Hinson, MD, PhD[1]; Katie K. Tseng, MPH[2]; Aria Smith, MA[1]; Matthew Toerper, MA[1]; Joe Amoah, MD[1]; Scott Levin, PhD[1] and Aaron Milstone, MD, MHS[3]; [1]Johns Hopkins School of Medicine, Baltimore, Maryland; [2]Center for Disease Dynamics, Economics and Policy, Washington, DC; [3]Johns Hopkins University School of Medicine, Baltimore, Maryland

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Background. Healthcare workers (HCWs) commonly contact multiple patients daily and serve as an important vector for transmission of pathogens such as vancomycin-resistant enterococci (VRE). Characterizing the HCW-patient network is difficult, which limits understanding of the role of HCWs in the horizontal transmission of pathogens. Electronic health records (EHR) present an opportunity to generate HCW-mediated contact networks and evaluate their impact on transmission.

Methods. Retrospective analysis of patients (PT) admitted to a medical intensive care unit and solid-organ transplant unit between July 2016 and June 2017. Clinical and demographic information, including VRE surveillance swab outcomes, were extracted from the hospital EHR system. PT-HCW-PT connections were defined as HCW contacts with a patient within an hour of another patient. Multi-variable logistic regression was used to analyze factors associated with unit-acquired VRE colonization incidence.

Results. A total of 2,336 patients had a recorded interaction with 4,956 unique HCWs. 146 patients were colonized with VRE on unit-admission, and 29 patients had unit-acquired VRE colonization. HCWs had contact with ~2 (range: 1–23) patients a day and ~6 (range: 1–58) contacts with patients per day (Figure 1), though rates varied by HCW-type. Patients were contacted by ~7 different HCWs resulting in ~28 contacts per day, with nurses being the most common (Figure 2). This resulted in approximately 10 PT-HCW-PT connections per day (range: 1–33) to an average of 3 other patients. After adjusting for known VRE acquisition risk factors, HCW connections to other patients with VRE significantly increased the risk of VRE acquisition (odds ratio = 1.32; 95% CI: 1.20–1.44; Table 1).

Conclusion. Understanding how HCWs connect patients can elucidate how pathogens, such as VRE, spread in the hospital. We demonstrated how EHR data can inform how HCWs connect patients to spread HAIs and the impact of those connections on the spread of VRE. Though EHR data have limitations, as certain activities and contacts are not logged into the system, they provide a scalable and generalizable source for understanding how patients are connected and can be utilized to reduce the spread of nosocomial infections.

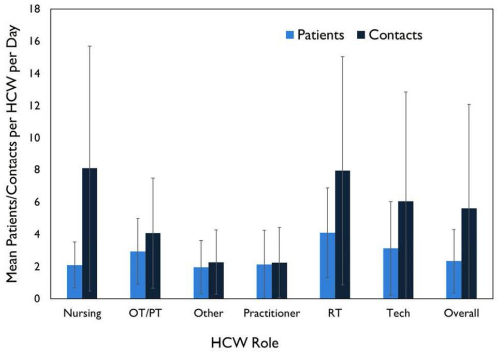

Figure 1: Number of Patients Contacted by Type of Healthcare Worker and Number of Daily Contacts
Displays the mean number of patients seen by healthcare workers (HCWs) each day (light blue) and the mean number of contacts that they have with those patients daily (dark blue). The error bars show the standard deviation of those numbers. HCW categories include nursing (all nursing roles except nurse practitioners), OT/PT (occupational and physical therapists), RT (respiratory therapists), Tech (technicians), practitioners (doctors and nurse/dental practitioners), and other (all other types of HCWs that contact patients daily).

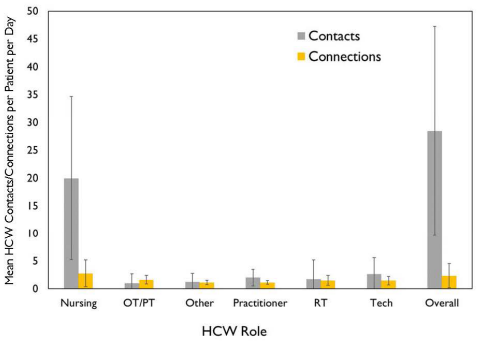

Figure 2: Mean Number of Healthcare Worker Contacts and Connections to Other Patients for Patients Daily
Patients have a large number of contacts by a large number of HCWs daily (grey bars) though they are most consistently contacted by nurses. Many of these contacts occur within a short time period in which the HCW contacted another patient (yellow bars) – which shows how connected patients are to other patients through HCW-mediated contact networks. HCW categories include nursing (all nursing roles except nurse practitioners), OT/PT (occupational and physical therapists), RT (respiratory therapists), Tech (technicians), practitioners (doctors and nurse/dental practitioners), and other (all other types of HCWs that contact patients daily).

Table 1: Multivariable Logistic Results (Risk factors for acquiring VRE colonization in the medical ICU and solid organ transplant unit

	OR (95% CI)
HCW Connections to VRE Patients	1.32 (1.20-1.44)
Patient on contact precautions (Y/N)	1.04 (0.96-1.13)
Rectal tube use (Y/N)	3.61 (2.85-4.58)
GI Tube use (Y/N)	1.13 (0.71-1.79)
Patient was in a long-term care or skilled nursing facility in the last six months	5.59 (3.45-9.06)
Amount of administered proton pump inhibitors (DDDs)	1.01 (0.99-1.02)
Amount of administered antibiotics (DDDs)	1.00 (1.00-1.00)
Received dialysis (Y/N)	3.15 (1.23-8.09)
Mechanical ventilation (days)	1.04 (0.98-1.10)
Comorbidity score	0.99 (0.91-1.07)
Age	0.99 (0.97-1.00)
Female	0.75 (0.64-0.89)
N	2,190

Note: CI = confidence interval, DDD = defined daily dose, GI = gastrointestinal, HCW = healthcare worker, OR = odds ratio, VRE = vancomycin-resistant enterococci, Y/N = yes/no

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

578. Microbiology Laboratory-Driven Standardized Urine Culture Reporting Increases Aminopenicillin Prescribing in Vancomycin-Resistant Enterococci Urinary Infections

Genevieve Cheung, PharmD[1]; Diane Javier[2]; Farrnam Kachouei[2]; Roxanne Pasiliao[3]; Michelle Ta[3]; Dennys Estevez, MPH[4]; Michael Bolaris, MD[4] and David Ha, PharmD, BCIDP[5]; [1]Pomona Valley Hospital Medical Center, Pomona, California; [2]Western University College of Pharmacy, Pomona, California; [3]Keck Graduate Institute School of Pharmacy, Claremont, California; [4]Los Angeles Biomedical Institute, Torrance, California; [5]KGI School of Pharmacy/Pomona Valley Hospital Medical Center, Los Angeles, California

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Background. Vancomycin-resistant Enterococcus (VRE) urinary tract infections (UTI) are traditionally treated with therapies like linezolid or daptomycin. Multiple recent studies have demonstrated that aminopencillins (APs) have equivalent clinical efficacy outcomes as these therapies are able to achieve high urinary drug concentrations and may also have favorable comparative safety profiles and lower costs. Our institution implemented a standardized microbiology report for urine cultures positive for VRE which encouraged prescribing of APs and blinded sensitivity results.

Methods. This was a single-center, retrospective, observational study evaluating the impact of this microbiology report on prescribing outcomes in patients being treated for VRE UTI at a community regional medical center. The study was conducted over 7.5 years with January 2011 to September 2014 representing the pre-intervention cohort and October 2014 to July 2018 representing the post-intervention cohort. Patients were included if they were 18 years or older and received antibiotic therapy for a diagnosed VRE UTI. The primary outcome measure was terminal antibiotic therapy.

Results. Out of 388 patients with VRE positive urine cultures, 102 were included for analysis, 38 in the pre-intervention cohort and 64 in the post-intervention cohort. Cohorts were similar in terms of age, Charlson Comorbidity Index (CCI), β-lactam allergy, ID consultation, and urologic abnormalities. AP prescribing significantly increased from 3% (1/38) in the pre-intervention cohort to 44% (28/64) in the post-intervention cohort both in univariate (OR 29.8, 95% CI 3.7–222.8) and multivariate (OR 38.7, 95% CI 4.8–312.3) analyses. In the post-intervention cohort, age, gender, CCI, β-lactam allergy, and urologic abnormalities were not significantly associated with differences in aminopenicillin prescribing. There was no difference in in-hospital mortality between cohorts.

Conclusion. The results from this study demonstrate that a simple microbiology report for VRE positive urine cultures encouraging AP prescribing is significantly associated with an increase in AP prescribing for diagnosed VRE UTI and should be considered as a supplementary antimicrobial stewardship intervention.

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

579. Machine-Learning Based Models for Prediction of Recurrence-free Catheter Retention After ALT Treatment of CLABSI in a Pediatric Population

Lorne W. Walker, MD, PhD[1]; Andrew J. Nowalk, MD, PhD[2] and Shyam Visweswaran, MD, PhD[3]; [1]UPMC Children's Hospital of Pittsburgh, Pittsburgh, Pennsylvania; [2]Division of Pediatric Infectious Diseases, Department of Pediatrics, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania; UPMC Children's Hospital of Pittsburgh, Pittsburgh, Pennsylvania, ; [3]University of Pittsburgh, Pittsburgh, Pennsylvania

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Background. Deciding whether to attempt salvage of an infected central venous catheter (CVC) can be challenging. While line removal is the definitive treatment for central-line associated bloodstream infection (CLABSI), salvage may be attempted with systemic antibiotics and antibiotic lock therapy (ALT). Weighing risk and benefit of CVC salvage is limited by uncertainty in the future viability of salvaged CVCs. If a CVC is likely to require subsequent removal (e.g., due to recurrent infection) salvage may not be beneficial, whereas discarding a viable CVC is also not desirable. Here we describe a machine learning approach to predicting outcomes in CVC salvage.

Methods. Episodes of pediatric CLABSI cleared with ALT were identified by retrospective record review between January 1, 2008 and December 31, 2018 and were defined by a single positive central blood culture of a known pathogen or two matching cultures of a possible contaminant. Clearance was defined as 48-hours of negative cultures and relapse was defined as a matching positive blood culture after clearance. Predictive models [logistic regression (LR), random forest (RF), support vector machine (SVM) and an ensemble combining the three] were used to predict recurrence-free CVC retention (RFCR) at various time points using a training and test set approach.

Results. Overall, 712 instances CLABSI cleared with ALT were identified. Demographic and microbiological data are summarized in Tables 1 and 2. Few (8%) instances recurred in the first 28 days. 58% recurred at any time within the study period. Rates of RFCR were 75%, 43%, 22% and 10% at 28, 91, 182 and 365 days. Machine learning (ML) models varied in their ability to predict RFCR (Table 3). RF models performed best overall, although no model performed well at 91 days.

Conclusion. ML models provide an opportunity to augment clinical decision making by learning patterns from data. In this case, estimating the likelihood of useful line retention in the future could help guide informed decisions on salvage vs. removal of infected CVCs. Limitations include the heterogeneity of clinical data and the use of an outcome capturing both clinical decision making (line removal) and infection recurrence. With further model development and prospective validation, practical machine learning models may prove useful to clinicians.

	CLABSI Events (N=712)
Distinct Individuals	322
Sex = Male (%)	387 (54)
Race = White (%)	493 (69)
Race = Black (%)	167 (23)
Race = Other (%)	52 (7)
Age (y) (mean [IQR])	8 [2-13]
Diagnosis = ONC (%)	172 (24)
Diagnosis = SGS (%)	155 (22)
Diagnosis = SOT (%)	216 (30)
Diagnosis = BMT (%)	27 (4)
RFCR at 28 days	531 (75)
RFCR at 91 days	303 (43)
RFCR at 182 days	155 (22)
RFCR at 365 days	71 (10)

Table 1: Data set demographics and outcomes. IQR: Interquartile range. ONC: oncology, SGS: short gut syndrome, SOT: solid organ transplant, BMT: bone marrow transplant. RFCR: recurrence-free catheter retention. y: years. An instance may belong to more than one diagnosis group.

	CLABSI Events (N=712)
CVC = Tunneled Line (%)	570 (80)
CVC = Implanted Port (%)	99 (14)
CVC = Other (%)	43 (6)
CVC age (d) (mean [IQR])	243 [43-290]
Polymicrobial infection (%)	154 (22)
Organism = GPC (%)	412 (58)
Organism = GNR (%)	380 (53)
Organism = YST (%)	71 (10)
Organism = OTH (%)	11 (2)
Lock = vancomycin (%)	287 (40)
Lock = gentamicin (%)	263 (37)
Lock =ethanol (%)	103 (14)
Lock = AMB (%)	56 (8)
Lock = other (%)	59 (8)

Table 2: Microbiological and central venous catheter (CVC) data. d: days. GPC: Gram-positive cocci, GNR: Gram-negative rods, YST: Yeast, OTH: Other. AMB: liposomal amphotericin B.