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An evaluation of the prevalence of vancomycin-resistant enterococci (VRE) and methicillin-resistant *Staphylococcus aureus* (MRSA) in hospital food

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An Evaluation of the Prevalence of Vancomycin-Resistant *Enterococci* (VRE) and Methicillin-Resistant *Staphylococcus aureus* (MRSA) in Hospital Food

Methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant *Enterococci* (VRE) are associated with significant patient morbidity and mortality.¹ MRSA and VRE have been found in retail foods, primarily animal products,^{2–6} but the role of hospital food in MRSA and VRE transmission in health-care facilities is unknown. The purpose of this study was to determine the prevalence of MRSA and VRE in hospital food, with an emphasis on foods consumed by hospital patients.

METHODS

This prospective cohort study was conducted at Barnes-Jewish Hospital, a 1,250 bed tertiary care center in St Louis, Missouri, from May 2011 through July 2012 in conjunction with a study of *Clostridium difficile* in hospital food.⁷ Our methods were described previously.^{7,8} Briefly, patients on medical and surgical wards collected food samples from their meals in sterile specimen cups (1 cup per meal; ≥1 food item per cup) to ensure that the foods sampled were those consumed by patients. Food specimens were frozen at –30°C. Prior to culture, specimens were thawed, combined with 10 mL sterile water, and homogenized for 1 minute. A 1 mL volume of food homogenate was added to TSB broth with 6.5% NaCl; then the mixture was incubated overnight at 35°C. The broth was subcultured on sheep blood agar (Hardy Diagnostics, Santa Maria, CA), Spectra MRSA (Remel Diagnostics, Lenexa, KS), and chromID VRE (bioMérieux, Marcy-l'Étoile, France). The Vitek matrix-assisted laser desorption/ionization time-of-flight mass spectroscopy (MALDI-TOF MS, bioMérieux, Marcy-l'Étoile, France) method was utilized to identify *S. aureus* or *Enterococcus* spp. Susceptibility testing was performed using Kirby Bauer disk diffusion in accordance with CLSI standards,⁹ and SCCmec typing was performed.¹⁰

Data were collected from patient interviews, chart review, and medical informatics queries, including MRSA and VRE clinical laboratory results from 1 year before enrollment to 1 year after enrollment. Descriptive data analyses were performed using SPSS version 21 software (IBM, Armonk, NY). The Washington University Institutional Review Board approved the study.

RESULTS

In total, 149 patients were enrolled in the study and 910 food specimens were collected (median, 5 specimens per patient; range, 1–24 specimens). The median patient age was 55 years (range, 23–90 years); 80 patients (54%) were female. 8 patients (5%) had clinical cultures (infection and/or surveillance) positive for MRSA, and 7 patients (5%) had clinical cultures positive for VRE, in the year before enrollment.

Overall, 1 or more food specimens from 17 patients (11%) were positive for MRSA, and 1 or more food specimens from 17 patients (11%) were positive for VRE. MRSA was cultured from 29 specimens (3.2%), and VRE was cultured from 22 specimens (2.4%); more than 1 positive specimen was collected from some patients. Of the 29 MRSA-positive isolates, 9 (31%) were SCCmec II, 2 (7%) were SCCmec III, and 18 (62%) were SCCmec IV. Notably, 7 SCCmec IV isolates came from a single patient (ie, 39% of SCCmec IV isolates). MRSA and VRE were cultured from every food category except nuts (Table 1). VRE was recovered from 5% of dairy or egg specimens and MRSA was recovered from 5% of bread or grain specimens and “other” specimens; for all other foods, the culture positivity rate was <5%.

Only 4 patients (3%) had a clinical culture positive for MRSA or VRE after having positive food without a previous

TABLE 1. Food Specimens Positive for Methicillin-Resistant *Staphylococcus aureus* (MRSA) and Vancomycin-Resistant *Enterococci* (VRE), by Food Type^a

Food Item	No. of Samples (N = 910) ^b	MRSA Positive (N [%]) ^c	VRE Positive (N [%]) ^c
Meat	308	7 (2)	9 (3)
Poultry	142	2 (1)	2 (1)
Fruit	179	2 (1)	2 (1)
Vegetable	455	14 (3)	5 (1)
Nuts	1	0	0
Dairy/eggs	210	7 (3)	11 (5)
Bread/grains	376	19 (5)	12 (3)
Other	200	9 (5)	3 (2)
Other (list)		Veggie burger, sauce, pudding, jelly, gravy (2), fish, cake (2)	Gravy (2), fish

^aN = 149 patients; 910 food specimens.^bMore than 1 food item could be included in a sample.^cPercentages are number of positive specimens per total food items of that type.

clinical history of MRSA or VRE. MRSA was isolated from the urine of patient A 28 days after the positive food specimen (SCCmec IV) was collected. Patient B had 2 positive MRSA surveillance screens, 48 and 50 days after the positive food specimens were collected. MRSA was cultured from food specimens collected by this patient on 5 separate days, and 7 of the SCCmec IV isolates were obtained from specimens collected by this patient. *Enterococcus faecalis* was cultured from food collected by patient C 23 days before this patient had a positive VRE surveillance screen. Between the food and screen dates, patient C had 2 urine specimens positive for *Enterococcus* (1 vancomycin susceptible, the other unknown) and 1 blood culture positive for *E. faecalis* (vancomycin susceptible). Finally, 2 food specimens, positive for MRSA and *E. faecalis*, were collected by patient D on 2 separate days, and this patient had a positive VRE surveillance screen more than 3 months after the positive food specimens were collected.

DISCUSSION

To the best of our knowledge, ours is the first study to evaluate the presence of MRSA and VRE in the food of hospitalized patients. We previously found that food is unlikely to be a significant source of *C. difficile* acquisition for hospitalized patients.⁷ The prevalence of MRSA and VRE found in food in the current study (3.2% and 2.4%, respectively) was higher than the prevalence of *C. difficile* (0.2%), but the overall contamination rate was still low.

While this study was not designed to determine conclusively whether patients acquired MRSA or VRE from their hospital food, our results suggest that acquisition via food may be rare. Additionally, patients enrolled in this study collected their own food specimens; thus, the patients themselves may have been the source of the contamination. Of the 4 patients with positive MRSA or VRE clinical cultures after a positive food culture and no prior clinical history of MRSA or VRE, 2 patients had MRSA or VRE cultured from food specimens on more than 1 day.

Because the overall food contamination rate was low, this pattern suggests patient contamination. Thus, prior clinical history or possible self-contamination may eliminate the possibility of food acquisition in all but 2 patients (1%).

While MRSA and VRE have been documented in retail food previously, the comparability of results prior to our study cannot be determined.^{2,3,5,6} The effect of food preparation on the bacterial burden in hospital food is unknown. Despite these limitations, our study indicates that MRSA and VRE can be present in the food of hospitalized patients, and the implications of this finding warrant additional study.

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Placing Venous Catheters in the Home: Pilot Data from the Mobile VAD Program

Patients requiring vascular access devices (VADs) for home infusion therapy typically receive them as inpatients prior to

discharge home. However, for years many otherwise-stable outpatients requiring VADs have avoided hospitalizations altogether by having the VADs placed in ambulatory health-care settings.¹ In the novel Johns Hopkins Home Care Group Mobile VAD Program, VAD placement is even removed from ambulatory health-care facilities such as clinics: trained nurses place VADs in patient homes. The program allows the entire home infusion therapy process (VAD placement, patient and caregiver training, delivery of supplies, infusion therapy, and assessment by home care nurses) to take place in the home, outside health-care settings. We present preliminary outcomes from a prospective cohort of patients in the program.

METHODS

Starting in December 2015, outpatients¹ requiring VADs but not needing hospitalization were referred to the Mobile VAD program. Telephone screenings ensured patients had a location in the home appropriate for VAD placement (ie, with a clean bed and a clean accessible sink, and where traffic from other household residents and pets can be avoided). A trained nurse placed the VAD (peripherally inserted central catheter [PICC] or midline catheter), using electrocardiogram (EKG)-based technology to confirm placement (Bard Site Rite 8 Ultrasound System, Bard Access Systems, Salt Lake City, UT). Patients could then be followed by any home infusion agency for medications, infusions, and supplies, and by any home nursing agency for training and support in VAD care.

We expanded a previously described prospective cohort of home infusion therapy patients² to include Mobile VAD patients. Eligible patients (>18 years of age, with a PICC or midline catheter placed in the home through the Mobile VAD program December 2015 through April 2017 for home infusion therapy) consented to a telephone survey and chart abstraction 2 weeks after VAD placement. Patients were ineligible if they were in hospice care, did not speak English, or could not verbally consent. Consenting patients completed a 10-minute telephone survey focusing on VAD complications.² The electronic health record (EHR) was abstracted for demographic and clinical information through 1 month after VAD removal. VAD days were calculated as the number of days between VAD placement and removal. The Charlson Comorbidity Index was calculated.³

The primary outcome was any VAD complication per 1,000 home VAD days and included any of the following: central-line-associated bloodstream infection (CLABSI), catheter-associated venous thromboembolism (CA-VTE), bloodstream infection (BSI), or VAD occlusion, dislodgement, accidental removal, kinking, coiling, breaking, phlebitis, or linking. CA-VTE was defined as a venous thromboembolism (VTE) on imaging in any location, as PICCs may be risk factors for upper and lower VTEs.⁴ CLABSI were defined based on Association for Professionals in Infection Control (APIC) criteria for CLABSI in home infusion⁵ (adapted from National Healthcare Surveillance Network [NHSN] CLABSI definitions).⁶ Bloodstream infections were defined as at least 2 positive samples