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Brief report

Regional differences in vancomycin-resistant *Enterococcus* colonization rates in critically ill veterans

Linda McKinley RN, MPH, CIC [a,*], Helene Moriarty RN, PhD [b,c], Thomas H. Short PhD [d], Mary Hagle RN, PhD [e], Abigail Ranum MS, MLS (ASCP) [e], Susan Valentine RN, MSN [a,e], Nasia Safdar MD, PhD [a,f]

[a] *William S. Middleton Memorial VA Hospital, Madison, WI*
[b] *Philadelphia VA Medical Center, Philadelphia, PA*
[c] *College of Nursing, Villanova University, Villanova, PA*
[d] *John Carroll University, University Heights, OH*
[e] *Milwaukee VA Medical Center, Milwaukee, WI*
[f] *University of Wisconsin, Madison, WI*

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Screening for vancomycin-resistant *Enterococcus* (VRE) has not been universally implemented within the Department of Veterans Affairs (VA). A prospective study was conducted to identify the admission prevalence rate of VRE in patients admitted to the intensive care unit in 2 VA facilities. Significant regional differences were found between the 2 facilities. Further studies are needed to account for regional differences in VRE admission prevalence, to optimize infection control interventions.

The success of the Department of Veterans Affairs (VA) methicillin-resistant *Staphylococcus aureus* (MRSA) reduction initiative, involving active detection of MRSA colonization in all hospitalized patients regardless of population or facility-specific risk, has spurred interest in examining whether this approach might prove effective for other emerging pathogens, such as vancomycin-resistant *Enterococcus* (VRE).[1,2] To date, screening for other antibiotic-resistant organisms has not been implemented within the VA.

The burden of VRE colonization has been found to be a strong predictor of transmission and acquisition, and when the proportion of patients colonized is high, other risk factors for colonization may become less important.[3] Quantifying the burden of colonization of antibiotic-resistant bacteria can estimate the probability of cross-contamination and guide facility-specific interventions; however, the prevalence of VRE colonization may be highly variable across geographic locations.[4] Infection prevention activities need to be tailored to meet individual facilities' needs and be based on their respective colonization pressures. We examined the VRE colonization rate on admission in patients in intensive care units (ICUs) in 2 VA facilities in Wisconsin.

METHODS

This prospective study was conducted to identify the admission prevalence rate of VRE colonization in ICU patients admitted in 2 VA facilities in Milwaukee and Madison, Wisconsin. The Milwaukee ICU is a 16-bed closed unit, and the Madison ICU comprises 2 open units, each with 8 beds (comanaged with intensivists), with similar weighted case severity index scores (0.83 and 1.06, respectively). VA national aggregate index scores are 0.67 (5th percentile), 0.97 (mean), and 1.42 (95th percentile). The University of Wisconsin Madison's Institutional Review Board (IRB) approved the study protocol, and all participants provided written or verbal informed consent. Initially, the IRBs at both sites required written consent, and subject recruitment was

* Address correspondence to Linda McKinley, RN, MPH, CIC, 2500 Overlook Terrace, Madison, WI 53705.
E-mail address: Linda.mckinley2@va.gov (L. McKinley).

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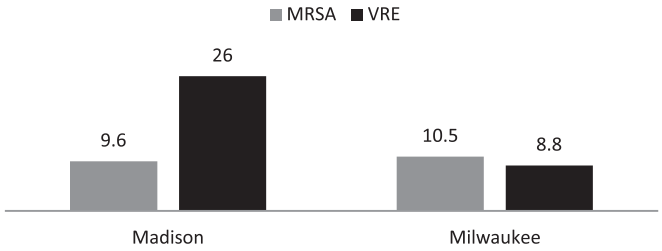

Fig 1. MRSA and VRE ICU admission prevalence rates during study period.

limited to times when the research coordinators were available, specifically during the day shift from Monday through Friday. Later, verbal assent was approved by the Madison IRB, and trained clinical staff were then available around the clock for subject recruitment.

VRE colonization was identified from perirectal swabs using a rapid polymerase chain reaction assay (Cepheid, Sunnyvale, CA). Subjects were recruited between February and April 2011 (3 months) at Madison and between January and December 2011 at Milwaukee (12 months). Multiple binary logistic regression models were fitted using SPSS Version 20 (IBM, Armonk, NY) to independent variables, including VA facility and risk factors for the dependent variable, VRE colonization. In addition to assessments of statistical significance for predictors of VRE colonization, logistic regression models produced predicted probabilities of VRE colonization given specific profiles of observed and hypothetical risk factors. Predicted probabilities for patients in the dataset were compared with observed outcomes for those patients using sensitivity and specificity analyses.

RESULTS

A total of 141 patients (Madison, n = 52; Milwaukee, n = 89) were recruited, of whom 110 (78%) were VRE-negative and 20 (14%) were VRE-positive. Eleven patients had missing samples and were not included in our analysis. The patients at the 2 facilities were comparable in terms of average severity of illness and demographics. Among the 130 patients analyzed, 13 of 50 (26%) at the Madison VA and 7 of 80 (8.8%) at the Milwaukee VA were VRE-colonized (Fig 1). During the same time period, the MRSA prevalence rate of all patients admitted to the ICU was similar at the Madison VA and Milwaukee VA (9.6% and 10.5%, respectively) (Fig 1).

To evaluate the regional differences in VRE prevalence, we undertook an analysis of risk factors for VRE colonization. Despite the relatively small sample sizes, multiple binary logistic regression analysis identified 3 statistically significant risk factors for VRE on admission: regional site (Madison or Milwaukee), history of *Clostridium difficile* infection (CDI), and severe renal disease (Table 1). The odds of VRE on admission were 4.4-fold greater for patients at Madison compared with those at Milwaukee, 5.6-fold greater for patients receiving hemodialysis compared with those not receiving hemodialysis, and 11.2-fold greater for patients with a history of CDI compared with those without a history of CDI. We created a prediction model using these 3 risk factors—regional site, hemodialysis, and history of CDI—that had an observed sensitivity of 80% for predicting VRE on admission.

DISCUSSION

Our study has produced several important findings. First, ICU patients at the Madison VA had a greater prevalence of VRE on admission compared with a ICU patients at a similar facility in Milwaukee. The reasons for these regional differences are unknown; however, similarities in severity of illness scores at the 2 sites and low rates (2.6%) of direct transfers, which could account for regional infection control practices and unrecognized interfacility transmissions of VRE as reported in other studies,[5] support our findings, suggesting regional differences.

Second, hemodialysis and history of CDI were identified as risk factors for VRE colonization. This supports previous findings and is likely related to frequent exposure to health care, invasive devices, and anti-infective agents, as well as immunosuppression caused by treatment and/or disease pathology.[6] A history of CDI as a risk factor for VRE colonization is also biologically plausible and corroborated by previous studies identifying oral vancomycin exposure during CDI treatment as the likely mechanism for VRE colonization.[7]

Third, we found that a prediction model successfully identified the majority of patients colonized with VRE on admission. Recognizing the benefits of pathogen screening without the costs, other investigators have identified prediction rules (ie, previous hospitalization or antibiotic use)[8] as useful in identifying patients at high-risk for VRE colonization requiring contact precautions.

Our study has some limitations. Less than one-half of ICU patients (48%) were approached for study participation: 65% were transferred or discharged quickly, and 35% were critically ill and unable to consent. Of those 48% of ICU patients approached for study participation, only 53% at Madison and 20% at Milwaukee were recruited for the study intervention. This low recruitment rates prompted the study team to systematically consider possible reasons for subject refusal. The most common patient-reported reason for nonparticipation was the use of the perirectal swab. Ostrowsky et al. also reported low recruitment rates for VRE screening among hospitalized patients (55%) compared with long-term care residents (93%) and only noted that surgical and obstetric patients frequently refused participation, without describing the reasons for refusal.[9] That study required oral assent.

It is possible that the greater proportion of patients screened at the Madison VA explains the higher proportion of VRE-positive patients found at Madison. In addition, seasonal differences were not controlled for in these preliminary analyses, because VRE screening was conducted for 12 months at the Milwaukee VA, but for only 3 months at the Madison VA.

VRE colonization pressure may vary by region. Active surveillance of VRE should be considered at the facility-level if VRE prevalence is high to quantify the burden and to optimize the allocation of infection control resources. Facilities may consider barrier precautions when caring for ICU patients presenting with kidney disease requiring hemodialysis and a history of CDI. Future studies should validate this prediction rule to examine its utility across other sites.