The Local Hospital Milieu and Healthcare-Associated VRE Acquisition

Margaret J. Zhou MD, Jianhua Li PhD, Hujet Salmasian MD, MPH, PhD, Phillip Zachariah MD, MS, Yu-Xiao Yang MD, Daniel E. Freedberg MD, MS

Departments of Medicine, Biomedical Informatics, Columbia University Medical Center and Columbia University; Department of Pediatrics, Columbia University Medical Center; Division of Gastroenterology, Penetam School of Medicine, University of New York; Division of Digestive and Liver Diseases, Columbia University Medical Center New York, New York, USA.

References:

Background
• Vancomycin-resistant Enterococcus (VRE) causes 4% of all healthcare-associated infections (HAIs) in the United States.
• Rates of gastrointestinal colonization on admission to intensive care units (ICUs) range from 4% to 30%.
• In the ICU, VRE colonized patients have longer ICU stays, increased hospital costs, and increased mortality compared to non-colonized patients.
• The relationship between the local hospital environment and VRE acquisition is not fully understood, and the relative effectiveness of standard infection control approaches in controlling VRE acquisition in reducing transmission is unclear.

Objectives
To determine the specific factors within the local hospital environment in healthcare-associated VRE acquisition.

Study Methods
Study Design and Subjects
• Retrospective cohort study including adults ≥18 years old admitted to any of 6 ICUs affiliated with a large academic medical center from January 1, 2002 to December 31, 2011.
• Inclusion criteria: having a negative VRE surveillance rectal swab within 24 hours of ICU admission.

Variables
Factors related to the local presence of VRE immediately preceding and during each patient’s hospitalization and factors related to the local use of vancomycin, as well as co-variables such as laboratory values and treatment received.
• VRE colonization pressure was defined as the circulating VRE burden during the patient’s ICU stay.
• Daily Exposure to VRE – positive patients (VRE pressure).

Time of length at risk
VRE importation pressure was defined to encapsulate the VRE burden at the time of ICU admission.

Number of patients – days of VRE – positivity in prior 28 days (Number of all patients – days)

Endpoints and Statistics
• Primary outcome: healthcare-associated VRE acquisition (positive subsequent VRE surveillance swab performed at any time after the initial negative surveillance swab during the same hospitalization).
• Multivariable analysis was constructed using a Cox proportional hazards model with patients followed from the time of ICU admission until death, VRE acquisition, or for a maximum of 30 days.

Results
Patient Characteristics
• Among 8,485 patients included in the study, 161 patients (2%) acquired VRE.
• Patients with VRE acquisition were more likely to be admitted to the two transplant medical ICUs, have had recent surgery, required dialysis, required mechanical ventilation, received immunosuppressants, had elevated creatinine, or had hypoproteinemia.

Factors Associated with VRE Acquisition
• On univariate analysis, patients with VRE acquisition were more likely to have received vancomycin, have had a neighboring patient who received vancomycin, have high vancomycin importation pressure, or have high VRE colonization pressure.
• High VRE colonization pressure was the most important covariate, with a VRE acquisition rate of 42% for those with high VRE colonization pressure versus 21% for those with low VRE colonization pressure (log rank p < 0.05).
• On multivariable analysis, only high VRE colonization pressure was an independent predictor of VRE acquisition (AHR 0.97, 95% CI 0.95 – 0.99). Similar results were obtained in the sensitivity analyses, specifically when the analysis was restricted to 1,131 patients who were rechecked for VRE at the index hospital (AHR 0.96, 95% CI 0.93 – 0.99), or when the analysis was restricted to 3,305 patients admitted to the tertiary referral medical ICUs (AHR 0.96, 95% CI 0.91 – 0.92).

Table 1: Clinical characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>VRE acquisition</th>
<th>No VRE acquisition</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>59 (36%)</td>
<td>60 (37%)</td>
<td>0.52</td>
</tr>
<tr>
<td>Sex</td>
<td>30 (19%)</td>
<td>31 (19%)</td>
<td>0.81</td>
</tr>
<tr>
<td>VRE colonization pressure</td>
<td>46 (29%)</td>
<td>42 (27%)</td>
<td>0.05</td>
</tr>
<tr>
<td>Charlson comorbidity index</td>
<td>1 1 2</td>
<td>3 4 5</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Race</td>
<td>White</td>
<td>62 (39%)</td>
<td>0.29</td>
</tr>
<tr>
<td>Characteristics</td>
<td>African</td>
<td>26 (16%)</td>
<td>0.06</td>
</tr>
<tr>
<td>Race</td>
<td>Hispanic</td>
<td>28 (17%)</td>
<td>0.06</td>
</tr>
<tr>
<td>Characteristics</td>
<td>Other</td>
<td>3 (2%)</td>
<td>0.18</td>
</tr>
<tr>
<td>Race</td>
<td>Asian</td>
<td>13 (8%)</td>
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<tr>
<td>Characteristics</td>
<td>American</td>
<td>2 (1%)</td>
<td>0.18</td>
</tr>
<tr>
<td>Characteristics</td>
<td>Unknown</td>
<td>4 (3%)</td>
<td>0.18</td>
</tr>
</tbody>
</table>

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