
Patricia Marquez, MPH, CIC®, Nicole Green, PhD®, Dawn Terasita, MD, MPH¹, Sandeep Bhaurla, MPH, CIC®, Laurene Mascola, MD, MPH¹
1. Acute Communicable Disease Control, Los Angeles County Department of Public Health 2. Public Health Laboratory, Los Angeles County Department of Public Health

Introduction

Disease Burden
• Laboratory-based surveillance conducted from 2010-12 identified Los Angeles County (LAC) as a carbapenem-resistant Enterobacteriaceae (CRE) high incidence area

Current Surveillance
• Voluntary CRE surveillance projects initiated January 2015 by the LAC Department of Public Health (DPH) and Public Health Laboratory (PPL)
• Part one: reporting of CRE via LabID in NHSN
• Part two: clinical microbiology laboratory (CML) surveillance for identification of resistance mechanisms in K. pneumoniae, E. coli, and Enterobacter spp. isolates resistant to carbapenems

Situation awareness
• Information gained from enhanced surveillance projects will be used to define the extent of antibiotic resistance in Enterobacteriaceae in LAC and target prevention efforts

Aims
• Characterize the epidemiology of CRE resistance mechanisms circulating in the LAC healthcare community
• Detect emergence of non-KPC resistance in Enterobacteriaceae

Methods

Participation Requirements
• All 39 LAC hospital and regional reference labs invited to participate
• CMLs completed enrollment form indicating their method of susceptibility testing for CRE
• Susceptibility report submitted with isolates

PPL Testing Methodology
• Modified Nanosphere BC-GN assay used to identify KPC, NDM, OXA, IMP, VIM, and CTX-M resistance genes

Facility Characteristics
• For hospital-based CMLs, facility characteristics were analyzed in conjunction with PPL results

Results

Table 1. Submitting Laboratory and Facility Characteristics

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Acute Care Hospital</th>
<th>Teaching</th>
<th>Non-Teaching</th>
<th>Hospital Based</th>
<th>Long Term Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Count</td>
<td>31</td>
<td>10(32%)</td>
<td>17(55%)</td>
<td>3(9.7%)</td>
<td>1(3.2%)</td>
</tr>
</tbody>
</table>

Fig. 1 Method of Susceptibility Testing for CRE

Fig. 2 Age Range and Sex of CRE Positive Patients

Fig. 3 Non-KPC Resistance Mechanism by Organism Type (n=44)

Table 2. Resistance Mechanism Detected by Nanosphere

<table>
<thead>
<tr>
<th>Organism</th>
<th>KPC</th>
<th>VIM</th>
<th>IMP</th>
<th>OXA</th>
<th>NDM</th>
<th>CTX-M</th>
<th>CTX-M+kPC</th>
<th>CTX-M+kPC+NDM</th>
<th>No Marker</th>
<th>No Organism Detected</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>K. pneumoniae</td>
<td>188</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>1</td>
<td>9</td>
<td>0</td>
<td>201</td>
</tr>
<tr>
<td>E. coli</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Enterobacter spp</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Citrobacter spp</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Proteus spp</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Achromobacter spp</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Acinetobacter spp</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Morgan</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>208</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>18</td>
<td>12</td>
<td>2</td>
<td>27</td>
<td>5</td>
<td>283</td>
</tr>
</tbody>
</table>

Limitations & Conclusion

• Counts represent isolates not patients; future work includes de-duplication of isolates and generating countywide CRE antibiogram
• CRE continues to be predominately circulating carbapenemase, a decrease in previously identified 94% prevalence signal the emergence of other resistance mechanisms
• As compared to CDC Emerging Infections Program surveillance, which detected only KPC in their isolates, LAC has identified more variation in isolates tested

Future Activities

• Develop CRE response algorithm for when non-KPC resistance markers are identified
• Increase and diversify CMLs enrolled in surveillance – include more non-acute care setting laboratories
• Whole genome sequencing and confirmation of susceptibility at PHL to be done on subset of isolates without resistant mechanism identification
• Conduct analysis of colistin resistance from submitting CML susceptibility reports; PCR testing for mcr-1 on subset of isolates at PHL when primers completed

Acknowledgements

This study was funded by the Centers for Disease Control and Prevention (CDC) Cooperative Agreement Number 5U416-140102, PPHF II.

We thank the laboratorians and Infection Preventionists in Los Angeles County for their contributions to these surveillance projects

Table 3. Resistance Mechanism Detected by Nanosphere

Fig. 4 Resistance Mechanism by Non-Sterile Specimen Source (n=234)

Fig. 5 Resistance Mechanism by Sterile Specimen Source (n=46)