Carbapenem-Resistant Enterobacteriaceae (CRE) in Los Angeles County

Sandeep Bhaurla, MPH CIC
Antimicrobial Resistance Epidemiologist
Healthcare Outreach Unit
Acute Communicable Disease Control
Los Angeles County Department of Public Health
Objectives

• Describe characteristics of CRE in Los Angeles County (LAC)

• Discuss the clinical and public health implications of CRE
What are Carbapenemase-Producing (CP) CRE?

**CP- CRE**

Enzyme (plasmid mediated)

**Non-CP- CRE**

Other mechanisms (i.e., mutations)
Differences in Carbapenemase Characteristics

**KPC**
- Mostly found in *K. pneumoniae* and *E. coli*
- Endemic in US, Greece, Italy, Israel, China, Brazil, Colombia, Argentina
- Inhibited by clavulanic acid, tazobactam, boronic acid, avibactam
- Additional resistance to penicillins, cephapemycins, cephalosporins

**OXA**
- Mostly found in *Acinetobacter, Pseudomonas, Enterobacteriaceae*
- Endemic in Japan, Taiwan, India, Balkan states, Greece
- Inhibited by metal chelators
- Additional resistance to penicillins, cephapemycins, cephalosporins

**NDM, VIM, IMP**
- Metallo- β-lactamases
- Mostly found in Enterobacteriaceae
- Endemic in Turkey, North Africa, Europe
- Inhibited by NaCl
- Additional resistance to penicillins, temocillin, β-lactamase inhibitor combinations

Pitout 2015; Westblade & Brecher 2017
LAC CRE Surveillance Strategy

• Request to voluntarily submit:
  – CR- *K. pneumoniae*, *E. coli*, and *Enterobacter* spp. isolates
  – Antimicrobial susceptibility testing (AST) results

• 33 clinical microbiology labs in LAC, representing:
  – 35 (38%) acute care hospitals (ACHs)
  – 2 (25%) long-term acute care hospitals (LTACHs)
  – 412 (~60%) long-term care facilities (LTCF)
LAC Public Health Laboratory Methodology

• Matrix-assisted laser desorption ionization-time of flight (MALDI-TOF) mass spectrometry for organism identification

• Nanosphere® Verigene BC-GN to detect carbapenemase genes
  – KPC
  – NDM
  – OXA
  – VIM
  – IMP
LAC Results

• PHL tested 1,175 CRE isolates between Jan. 2015 to May 2018
  – 75% from acute care settings
  – 25% from long-term care settings

• AST data from submitting labs available for 661 isolates between Jan. 2015 to Apr. 2017
  – 83% used automated AST system
CRE Specimen Sources

- Urine, 50%
- Respiratory, 19%
- Blood, 11%
- Wound, 11%
- Other, 9%

N= 1,175
CRE Organisms Identified

N= 1,175
Genomic Epidemiology

• 973 (83%) were CP-CRE (compared to 34% in US (CDC))
  – 96.1% KPC - 0.3% VIM
  – 2.2% OXA - 0.1% IMP
  – 1.3% NDM

• 2.3% had two genes identified

• 15% were non-CP-CRE
## Susceptibilities for Select Adjunctive Agents

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>CP- CRE</th>
<th></th>
<th>Non-CP- CRE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%S</td>
<td>n</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>461</td>
<td>0.9</td>
<td>35</td>
</tr>
<tr>
<td>Amikacin</td>
<td>465</td>
<td>37.6</td>
<td>34</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>451</td>
<td>57.6</td>
<td>45</td>
</tr>
<tr>
<td>Tobramycin</td>
<td>407</td>
<td>16.1</td>
<td>34</td>
</tr>
<tr>
<td>Colistin</td>
<td>128</td>
<td>60.1</td>
<td>22</td>
</tr>
<tr>
<td>Tigecycline</td>
<td>107</td>
<td>77.5</td>
<td>12</td>
</tr>
</tbody>
</table>
Conclusions

• A large proportion of CRE in LAC produce a carbapenemase

• KPC is the predominant carbapenemase in LAC, but non-KPC mechanisms are present

• CP-CRE are highly resistant to adjunctive agents for CRE infections
Recommendations

- Obtain access to genetic resistance mechanism testing in order to rapidly identify CP-CRE
- Ensure inter-facility communication to prevent regional spread
Acknowledgements

Public Health Laboratory
• Dr. Nicole Green
• Audrey Manalo
• Julio Ramirez
• Sean Buono
• John Diaz-Decaro

Healthcare Outreach Unit
• Dr. James McKinnell
• Dr. Dawn Terashita
• Patricia Marquez
• Marcelo Moran
• Dr. Benjamin Schwartz
Questions?

sbhaurla@ph.lacounty.gov