**BACKGROUND**

- CRE are a family of bacteria that cause infections which are difficult to treat due to their high levels of resistance to the carbapenem class of antibiotics.
- In the United States, the reported percentage of carbapenem-nonsusceptible Enterobacteriaceae causing common healthcare-associated infections (HAI) increased from 1.2% in 2001 to 4.2% in 2011.
- The Connecticut Department of Public Health (CT DPH) initiated laboratory reporting of CRE effective January 1, 2014.

**OBJECTIVES**

- Characterize CRE incident cases, pathogens and isolates reported to the HAI Program by the clinical laboratories.
- Assess risk factors of CRE cases during the data collection period and during their exposures in the previous year.
- Evaluate infection control practices.

**METHODS**

- In 2014, CRE was defined as clinical isolates of Enterobacteriaceae obtained from any sterile site, sputum, or urine which was non-susceptible to at least 2 carbapenems: doripenem, imipenem, meropenem, or ertapenem (resistant isolates only). In 2016, the CRE case definition was changed to include clinical isolates that were non-susceptible to any carbapenem.
- In 2014, in those cases where isolates had demonstrated non-susceptibility to only one carbapenem, the isolate was reportable if it was also resistant to all 3rd generation cephalosporins tested. In 2016, this criterion was removed.
- Multiple isolates of the same genus/species and antibiotic susceptibility pattern from a single patient were reportable as incident cases once every 30 days.
- Cases were classified as confirmed if they met the genus, clinical source, and antibiotogram components of the case definition, and as suspect if they had insufficient antibiotogram data.
- Chart review was performed for suspect and confirmed cases reported from January 1, 2014–December 31, 2015.
- Reports were assessed with the 2014 and the simplified 2016 case definitions to quantify any variance of case classification.

**RESULTS**

1. **Characteristics of CRE Cases**
   - For the demographic analysis, twelve duplicate forms were excluded to ensure unique individuals.
   - Females and males were nearly equally distributed (50.8% and 49.2%, respectively).
   - For females, most isolates were from urine (79.7%, 51/64).
   - The distribution of race and ethnicity was representative of the population in Connecticut.

2. **Specimen Source**

   ![Specimen source, hospitalized confirmed/suspect CRE cases](image)

<table>
<thead>
<tr>
<th>Specimen source</th>
<th>Hospitalized confirmed</th>
<th>Suspect CRE cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine</td>
<td>29.2</td>
<td>50.4</td>
</tr>
<tr>
<td>Respiratory</td>
<td>29.2</td>
<td>50.4</td>
</tr>
<tr>
<td>Blood</td>
<td>12.7</td>
<td>2.0</td>
</tr>
<tr>
<td>Perforated Tissue</td>
<td>3.2</td>
<td>2.0</td>
</tr>
<tr>
<td>Other</td>
<td>3.2</td>
<td>2.0</td>
</tr>
</tbody>
</table>

   Respiratory includes: sputum (20%), endotracheal aspirate (14), and bronchoalveolar lavage (BAL) (6).

3. **Type of Infection**

   ![Type of infection, hospitalized confirmed/suspect CRE cases](image)

<table>
<thead>
<tr>
<th>Type of infection</th>
<th>Hospitalized confirmed</th>
<th>Suspect CRE cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sepsis</td>
<td>29.2</td>
<td>50.4</td>
</tr>
<tr>
<td>Sepsis &amp; septic</td>
<td>29.2</td>
<td>50.4</td>
</tr>
<tr>
<td>Other</td>
<td>12.7</td>
<td>2.0</td>
</tr>
<tr>
<td>Open/drainage wound</td>
<td>3.2</td>
<td>2.0</td>
</tr>
</tbody>
</table>

4. **Type of Organism**

   ![Organism, hospitalized confirmed/suspect CRE cases](image)

<table>
<thead>
<tr>
<th>Organism</th>
<th>Hospitalized confirmed</th>
<th>Suspect CRE cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>7.2</td>
<td>2.0</td>
</tr>
<tr>
<td>Enterobacter aerogenes</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Acinetobacter</td>
<td>14.5</td>
<td>14.5</td>
</tr>
<tr>
<td>Enterobacter cloacae</td>
<td>14.5</td>
<td>14.5</td>
</tr>
<tr>
<td>Acinetobacter baumannii</td>
<td>14.5</td>
<td>14.5</td>
</tr>
</tbody>
</table>

**5. Exposures During Collection Period**

![Location of Culture collection](image)

**6. Exposures in the Past Year**

![Invasive Devices](image)

**7. Infection Prevention Considerations**

- More than half of cases were inconsistent of urine (58%), inconsistent of stool (52.9%), and had an open/drainage wound (10.3%).

**CONCLUSIONS**

- Most CRE cases were of older age (75.5%, ≥60 years old).
- *Klebsiella pneumoniae, Enterobacter cloacae, Enterobacter aerogenes, and Escherichia coli* represented 90% of the organisms reported.
- Urinary tract infection and pneumonia were the most common type of infection reported (64.3%).
- Most hospitalized cases had at least one known risk factor for CRE including ≥1 additional MDROs or ≥1 invasive devices.
- Most cultures were collected in the ED or ICU highlighting the significance of proper communication of CRE status within and between facilities upon patient transfer.

**LIMITATIONS**

- CRE case report is dependent on lab reports only.
- Limited outpatient information available.
- CRE cases reported with no antibiotic were classified as “suspect” pending antibiotic information collection.
- Medical record review strategies changed according to the facilities’ medical record storage systems.

**NEXT STEPS**

- Beginning 2017, the state Public Health Laboratory (SPHL) will perform genetic characterization of isolates.
- SPHL will collaborate with the Antibiotic Resistance Laboratory Network regional lab in New York and the CDC to look for molecular genetic markers.
- Develop a multidrug-resistant organism patient registry accessible to Infection Preventionists in acute care hospitals.
- Develop a data collection protocol for outpatients.

**ACKNOWLEDGEMENTS**

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**REFERENCES**