Healthcare Antibiotic Resistance Prevalence—DC (HARP-DC)

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CRE: A Growing Concern

- Common
- Resistant
- Deadly
- Spreading
Working Together is Vital!

Source: http://www.cdc.gov/vitalsigns/stop-spread/
Washington D.C. – A Unique Landscape

• Metropolitan city that is not part of any state
• 6th largest metropolitan statistical area in the U.S. with population over 6 million
• All healthcare facilities clustered within 61 square miles
• Patient population comprised of residents from D.C., MD, and VA, as well as national and international visitors
• Facilities that share patients are also competing for market share
You Can’t Manage What You Don’t Measure

- Colonization among asymptomatic patients common
- Identified and unidentified colonized patients serve as reservoir for transmission
- Burden can only be determined through active surveillance
- D.C. does not mandate CRE reporting
- Healthcare facilities do not routinely conduct active CRE surveillance
Study Design and Methods
Study Design

• Study team:
  – D.C. Department of Health
  – D.C. Department of Forensic Science – Public Health Lab
  – District of Columbia Hospital Association
  – OpGen Laboratories

• 16 participating healthcare facilities:
  – All 8 short-term acute care (STAC)
  – Both long-term acute care (LTAC)
  – 5 skilled nursing facilities (SNF)
  – Sole inpatient rehabilitation facility (IRF)
Study Design

• Surveillance conducted over a 1 to 3 day interval for each facility between January 11, 2016 and April 14, 2016

• Used CDC 2015 CRE surveillance definition
  – Identified by culture and susceptibility OR possessing a carbapenemase

• Approved by independent external review board

• Verbal consent obtained

• Peri-anal swab samples collected by facility-based volunteers
Study Design

• Exclusion criteria:
  – Psych or OB/GYN patients, inability to consent, or clinically inappropriate

• Patient based variables collected:
  – Age, sex, and zip code

• Unit location variables grouped as:
  – Critical care, step-down units, wards, inpatient rehabilitation, and long-term care (with SNF and LTAC combined)
CRE Detection

Analyzed at OpGen laboratories
HARP-DC Results
HARP-DC Results Overview

Target Population
2217 patients

Short-term Acute Care
1581
Eligible
1042 (65.9%)
Agree
732* (70.2%)
Refuse
310 (29.8%)
n CRE
36 (5.0%)

Inpatient Rehabilitation
93
Eligible
85 (91.4%)
Agree
52 (61.2%)
Refuse
33 (38.8%)
n CRE
0 (0.0%)

Long-term Care
543
Eligible
377 (69.4%)
Agree
252† (66.8%)
Refuse
125 (33.2%)
n CRE
17 (7%)

n = 2,217
n = 1,504
n = 1,036

* = 6 tests not performed
† = 8 tests not performed
## Results by Facility and Facility Type

<table>
<thead>
<tr>
<th>Patient Care Type</th>
<th>CRE (%)</th>
<th>Range (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inpatient Rehabilitation</td>
<td>0.0</td>
<td>--</td>
</tr>
<tr>
<td>Long Term Care</td>
<td>7.0</td>
<td>0.0-29.4</td>
</tr>
<tr>
<td>Short Term Acute Care</td>
<td>5.0</td>
<td>0.0-7.7</td>
</tr>
<tr>
<td>-- Critical Care</td>
<td>6.7</td>
<td>0.0-11.6</td>
</tr>
<tr>
<td>-- Step down</td>
<td>1.6</td>
<td>0.0-3.7</td>
</tr>
<tr>
<td>-- Ward</td>
<td>5.0</td>
<td>0.0-9.5</td>
</tr>
<tr>
<td>Total</td>
<td>5.2</td>
<td>0.0-29.4</td>
</tr>
</tbody>
</table>
CRE Prevalence by Age Group

<table>
<thead>
<tr>
<th>Age</th>
<th>Prevalence (% with CRE)</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>1.8</td>
<td>55</td>
</tr>
<tr>
<td>20-39</td>
<td>8.0</td>
<td>88</td>
</tr>
<tr>
<td>40-59</td>
<td>5.6</td>
<td>285</td>
</tr>
<tr>
<td>60-79</td>
<td>5.9</td>
<td>442</td>
</tr>
<tr>
<td>over 79</td>
<td>2.2</td>
<td>137</td>
</tr>
</tbody>
</table>
CRE Prevalence by Sex

<table>
<thead>
<tr>
<th>Prevalence (% Resistance)</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.6</td>
<td>7.1</td>
</tr>
</tbody>
</table>

p = 0.01
## CRE Identification by Detection Method

<table>
<thead>
<tr>
<th>Organisms Identified by ID-AST</th>
<th>Carbapenemase Genes</th>
<th>Total (% of total CRE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>KPC</td>
<td>NDM</td>
</tr>
<tr>
<td><em>Klebsiella pneumoniae</em></td>
<td>16</td>
<td></td>
</tr>
<tr>
<td><em>Enterobacter cloacae</em></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><em>Serratia marcescens</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Citrobacter sp.</em></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Indeterminant</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>No growth (gene only)</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total (% of total CRE)</strong></td>
<td>44 (83.0)</td>
<td>1 (1.9)</td>
</tr>
</tbody>
</table>

* One sample without growth was positive for both KPC and OXA-48. The total column corrects for the double count.
Distribution of Organisms

- **K. pneumoniae** (n=19, 56%)
- **E. cloacae** (n=7, 20%)
- **E. coli** (n=4, 12%)
- **Indeterminate** (n=1, 3%)
- **S. marcescens** (n=1, 3%)
- **C. amalonaticus** (n=1, 3%)
- **C. koseri** (n=1, 3%)
DNA Profiles by Facility

Institution A
Institution B
Institution C
Institution D
Institution E
Institution F

Acutas Lighthouse Profile

Detected on One Ward
HARP-DC Conclusions
Limitations

- Limited risk factor analysis
- Results de-identified
- Verbal consent challenges
- Selection of peri-anal site
  - Patient acceptability
  - Difficulty for patients who were obese, bed-bound, or in chair
- Variability in acceptance rate across facilities
• One of few studies to assess regional prevalence aligning with CDC’s recommended collaborative approach
  – 4 facility types sampled

• Used surveillance cultures rather than clinical cultures
  – All participating ward types sampled, rather than selected areas

• Samples obtained from a single peri-anal source rather than multiple source-types

• All testing performed with a single molecular/culture method to allow for standardization across sites
Conclusions

• CRE is endemic in D.C. healthcare facilities
  – Average prevalence of 5.2%
  – Wide variation across facilities

• Importance of surveillance highlighted
  – Genotypic profiling identified possible CRE transmission within and between facilities

• D.C. successfully initiated a collaborative approach for further assessment and control efforts

• HARP-DC provides a model for other regions to collaborate on MDRO prevalence measurement
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• Providence Hospital
• Sibley Memorial Hospital
• Sibley Renaissance
• Transitions Healthcare
• United Medical Center
Supplemental Slides
Projected Impact of Coordinated Approach