The State Public Health Laboratory’s Role in Antibiotic Resistance Testing

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Florida Bureau of Public Health Laboratories (BPHL)
APHL Annual Meeting, June 3, 2018
Objectives

• Describe the role of the State Public Health Laboratory in antibiotic testing as part of the Antibiotic Resistance Laboratory Network (ARLN)

• Discuss challenges with capability and capacity for antibiotic resistance testing in the public health laboratory

• Summarize lessons learned and solutions for improved testing, referral of samples and data exchange within the ARLN to meet Healthcare Associated Infections (HAI) program needs
ARLN: The New Kid on the Block

• Communication and outreach
  o How the network “works”
  o Services that are provided by the entities in the network and the roles of each entity in the network
  o How the network benefits health care institutions and ultimately patients (value-added and not duplicative)

• Partnership building
  o Establish new relationships
  o Create a collaborative approach to testing and surveillance

• Development of testing system
  o Referral of sample
  o Result reporting
ARLN: The New Kid on the Block
Many state public health laboratories (PHLs) have limited experience and capacity for antimicrobial resistance (AR) testing

As part of ARLN PHLs are:
- Enhancing the already expanding relationship with their healthcare associated infection programs
- Building capability and capacity by adding on new tests and new staff
- Developing new collaborations at the state and local level with local health departments and health care providers to detect and prevent AR threats
PHLs – Antibiotic Resistance Testing
c.2015
PHLs – Antibiotic Resistance Testing
c.2018
CRE/CRPA Testing within the ARLN

- Carbapenem-R *Enterobacteriaceae* (CRE)
  - CRE isolate testing for carbapenemase production and resistance mechanisms are performed at state PHL
  - CRE colonization testing for outbreak response is performed at regional ARLN PHL, with approval from HAI epidemiologist

- Carbapenem-R *Pseudomonas aeruginosa* (CRPA) and *Acinetobacter* species
  - Isolate testing for carbapenemase production (like CRE)

- Extended-spectrum beta-lactamase (ESBL)-producing *Enterobacteriaceae*
  - Isolate testing for colistin resistance (*mcr-1*-mediated resistance)
Florida ARLN Testing Algorithm

Receive Isolate

Confirm Species ID
- MALDI-ToF
- Vitek

Confirm as Target Isolate

Phenotypic AST
- BMD - Disk Diffusion
- E-test

Phenotypic CRE
- mCIM
- Carba NP

Molecular CRE
- Cepheid Carba-R
- PCR

No Further Testing Needed

Non-Target Isolate

Send Isolate to Regional Lab
Outbreak of VIM-producing *Pseudomonas aeruginosa*

- March 2017: BPHL detected an Oxacillinase (OXA)-48 CRE submitted by an acute care hospital (ACH). Enhanced surveillance at the facility was initiated by recommendation from the Florida Department of Health HAI program for submission of CRE and CRPA to BPHL.

- June 2017: BPHL received isolates from a patient recently admitted to the ACH from a long-term acute care hospital (LTACH) facility. The patient had been placed on contact precautions but it was unknown when precautions were implemented and whether transmission to other patients had occurred. *Pseudomonas aeruginosa* Verona Integron-Mediated Metallo β-lactamase (VIM) CRE positive isolates were identified for the patient.
Outbreak of VIM-producing *Pseudomonas aeruginosa*

- July to December 2017: BPHL received several *Klebsiella pneumoniae* and *P. aeruginosa* isolates that were *Klebsiella pneumoniae* carbapenemase (KPC) and VIM positive respectively from several patients at the facility (and another related facility). During this time period, BPHL:
  - Received and tested 132 isolates for CRE/CRPA
  - Sent 2 isolates to the Regional ARLN Laboratory, Tennessee State Public Health Laboratory (TN) for CRPA confirmation
  - Sent 8 isolates to CDC for CRPA confirmation and whole genome sequencing (WGS)
  - Coordinated sending 476 swab specimens to TN for colonization screening, resulting in 13 CRPA confirmations
Outbreak of VIM-producing *Pseudomonas aeruginosa*

- BPHL implemented a reporting system to track isolates

<table>
<thead>
<tr>
<th>Submitting Public Health Laboratory</th>
<th>Florida</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporting Month (MM/YYYY)</td>
<td>Oct-17</td>
</tr>
<tr>
<td>AST Method(s) (Disk Diffusion, E-test, Broth Microdilution)</td>
<td>E-test</td>
</tr>
<tr>
<td>Phenotypic Screen Method (CIM or Carba NP)</td>
<td>mCIM</td>
</tr>
<tr>
<td>PCR Method (Cepheid, CDC, or Other)</td>
<td>Cepheid</td>
</tr>
<tr>
<td>Identification Method</td>
<td>MALDI-TOF</td>
</tr>
</tbody>
</table>
Florida PHL: Example Report

Weekly report provided (average 20 isolates/week) – example of a positive and a negative CRPA

<table>
<thead>
<tr>
<th>State Lab Isolate ID</th>
<th>Date Received at State Lab (MM/DD/YYYY)</th>
<th>Isolate Collection Date (MM/DD/YYYY)</th>
<th>Submitting Clinical Laboratory ID (CCN)</th>
<th>Isolate ID from Submitting Laboratory</th>
<th>Organism Tested (Genus/Species)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JBI17001702</td>
<td>10/26/2017</td>
<td>10/21/2017</td>
<td>1729405102</td>
<td></td>
<td>Pseudomonas aeruginosa</td>
</tr>
<tr>
<td>JBI17001729</td>
<td>10/31/2017</td>
<td>10/24/2017</td>
<td>4762456</td>
<td></td>
<td>Pseudomonas aeruginosa</td>
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</table>
# Florida PHL: Example Report

<table>
<thead>
<tr>
<th>mCIM</th>
<th>KPC</th>
<th>NDM</th>
<th>OXA-48-like</th>
<th>VIM</th>
<th>IMP</th>
<th>mcr-1</th>
<th>Forward to Regional Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>mCIM neg</td>
<td>Not detected</td>
<td>Not detected</td>
<td>Not detected</td>
<td>Not detected</td>
<td>Not detected</td>
<td>Not tested</td>
<td>NO</td>
</tr>
<tr>
<td>mCIM pos</td>
<td>Not detected</td>
<td>Not detected</td>
<td>Not detected</td>
<td>VIM detected</td>
<td>Not detected</td>
<td>Not tested</td>
<td>YES</td>
</tr>
<tr>
<td>mCIM and Carba-R positive</td>
<td>Imipenem</td>
<td>Ertapenem</td>
<td>Ceftazidime</td>
<td>Cefepime</td>
<td>Ceftriaxone</td>
<td>Aztreonam</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MIC</td>
<td>MIC</td>
<td>MIC</td>
<td>MIC</td>
<td>MIC</td>
<td>MIC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;32</td>
<td>&gt;32</td>
<td>&gt;256</td>
<td>128</td>
<td>&gt;256</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>
How’s the New Kid Doing?
Florida’s Experience

Total Number of CRE Tests Performed at BPHL
How’s the New Kid Doing?
Florida’s Experience

CRE Positive Isolates Confirmed at BPHL

- **KPC+**
- **VIM+**
- **NDM+**
How’s the New Kid Doing?

ARLN Challenges

• Complex testing algorithm. PHLs are in the process of building capacity and capability to respond to AR threats

• Complex testing system with several entities involved (CDC, Regional ARLN Laboratory, state PHL, health departments, health care providers)
  o Example: Where to send samples and in which situations and whether to send samples directly or through state lab

• Partnering and collaborating to meet the ARLN goals
  o Example: Submission of samples - from passive to active
How’s the New Kid Doing?

ARLN Challenges

• Communication to make the network “work”
  o Coordination of testing to be performed and reporting of results to appropriate parties
  o Timely exchange of data – manual vs. electronic

• Communication to public health partners that ARLN testing results in public health action

• Educating clinical laboratories about their role and the importance of submitting isolates, despite increased use of Culture-Independent Diagnostic Tests (CIDT) - isolates are still needed for characterization or AR testing and to detect unusual AR
Steps Toward Improving AR Detection and Prevention Through the ARLN

• Standardizing the process
  o Surveillance versus diagnostic testing

• Improved communication of information and laboratory results with health care providers
  o Electronic ordering and reporting - Florida PHL working on a web portal
  o Education and outreach

• Improved communication and coordination between programs
  o Florida PHL provide a biweekly report to HAI program regarding ARLN testing
Steps Towards Improving AR Detection and Prevention Through the ARLN

Example of Biweekly Report from BPHL to the HAI Program

<table>
<thead>
<tr>
<th>Date Received at BPHL</th>
<th>Isolate Collection Date</th>
<th>ID</th>
<th>BPHL Carba-R</th>
<th>BPHL mCIM</th>
<th>BPHL E-test</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/5/2018</td>
<td>1/22/2018</td>
<td><em>Candida duobushaemulonii</em></td>
<td></td>
<td></td>
<td></td>
<td>Partial report from TN on 2/14 with ID. Susceptibilities to follow. Faxed to Provider 2/14</td>
</tr>
<tr>
<td>2/2/2018</td>
<td>1/28/2018</td>
<td><em>Pseudomonas aeruginosa</em></td>
<td></td>
<td></td>
<td></td>
<td>Sent to TN on 2/14 for CRE confirmation</td>
</tr>
<tr>
<td>1/31/2018</td>
<td>1/23/2018</td>
<td><em>Klebsiella pneumoniae</em></td>
<td>KPC detected</td>
<td>Positive</td>
<td>Completed</td>
<td>Reports are being finalized by BPHL Microbiology Dept.</td>
</tr>
</tbody>
</table>
Thank You! Questions?

Acknowledgements
Susanne Crowe, BPHL-Jacksonville Laboratory Director
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Kendra Edwards, BPHL ARLN Laboratorian