Antimicrobial Resistance in California: Updates on Clinical and Public Health Laboratory Testing

November 29th, 2018
Healthcare-Associated Infections (HAI) Program
Microbial Diseases Laboratory
California Department of Public Health
<table>
<thead>
<tr>
<th>Presenter</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sam Horwich-Scholefield, MPH</td>
<td>• Describe AR testing capabilities of clinical laboratories as reported via</td>
</tr>
<tr>
<td>CIC</td>
<td>the National Healthcare Safety Network (NSHN)</td>
</tr>
<tr>
<td>Stephanie Abromaitis, PhD</td>
<td>• Summarize results of the first year of phenotypic and molecular carbapenemase</td>
</tr>
<tr>
<td>Peng Zhang, PhD</td>
<td>testing at MDL</td>
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<tr>
<td></td>
<td>• Provide updates on upcoming testing capabilities at MDL</td>
</tr>
<tr>
<td>Matthew Sylvester, PhD</td>
<td>• Illustrate the use of Whole Genome Sequencing to assess relatedness of isolates to inform outbreak response</td>
</tr>
</tbody>
</table>
National Healthcare Safety Network (NHSN) Annual Survey

- All facilities reporting to NHSN complete an annual survey to describe and evaluate hospital and laboratory practices.
  - Hospital characteristics
  - Infection prevention measures
  - Antimicrobial stewardship programs
  - Microbiology testing methods and practices
- Unless otherwise indicated, all results reported are from the 2017 NHSN Annual Survey
Open Forum Infectious Diseases

BRIEF REPORT


Snigdha Vallabhaneni, Mathew Sapiano, Lindsey M. Weiner, Shawn R. Lockhart, and Shelley Magill

1Yctotic Diseases Branch and 2Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia

Concise Communication

Hospital microbiology laboratory practices for Enterobacteriaceae: Centers for Disease Control and Prevention National Healthcare Safety Network (NHSN) annual survey, 2015 and 2016

Alicia Shugart MA, Maroya Spalding Walters PhD, ScM, Lindsey M. Weiner MPH, David Lonsway MmedSc and Alexander J. Kallen MD, MPH

Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia
<table>
<thead>
<tr>
<th>Hospital Type</th>
<th>No.</th>
<th>Median Bed Size (IQR*)</th>
<th>Median ICU Bed Size (IQR*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community</td>
<td>269</td>
<td>156 (94-250)</td>
<td>18 (8-37)</td>
</tr>
<tr>
<td>Major Teaching</td>
<td>55</td>
<td>318 (226-450)</td>
<td>60 (32-90)</td>
</tr>
<tr>
<td>Critical Access</td>
<td>33</td>
<td>25 (16-25)</td>
<td>0 (0-4)</td>
</tr>
<tr>
<td>Long Term Acute Care</td>
<td>22</td>
<td>73 (54-95)</td>
<td>6 (4-6)</td>
</tr>
<tr>
<td>Pediatric</td>
<td>10</td>
<td>316 (80-356)</td>
<td>99 (30-146)</td>
</tr>
</tbody>
</table>

*Interquartile Range*
What is the primary or definitive method used to identify microbes from blood cultures? (n=367)

- Automated Instrument (e.g., Vitek, MicroScan, Phoenix, OmniLog, Sherlock, etc.) - 52%
- MALDI-TOF MS System (e.g., Bruker Biotyper, Vitek MS) - 33%
- Rapid Identification (e.g., Verigene, BioFire FilmArray, PNA-FISH, Gene Xpert, etc.) - 15%
- Non-automated Manual Kit (e.g., API, Crystal, RapID, etc.) - <1%
Does your facility have its own on-site laboratory that performs antimicrobial susceptibility testing (AST)? (n=389)

- Yes: 65%
- No: 35%

97% of hospitals reported using an Automated Testing Instrument.
Does your facility have its own laboratory that performs antifungal susceptibility testing for *Candida* species? (n=389)

- Yes: 31%
- No: 69%

Reference Lab: 48%
- Other: 10%
- Affiliated Medical Center: 8%
- Not Offered: 3%
Is antifungal susceptibility testing performed automatically/reflexively without needing a specific order or request for susceptibility testing from the clinician for any *Candida* species identified from a normally sterile site?
Antibiotic Resistance Laboratory Network (ARLN) Antifungal Susceptibility Testing

- West Regional ARLN, located in Washington State, offers routine testing for antimicrobial resistance pathogens
  - Confirms *Candida* species identification using MALDI-TOF
  - Performs antifungal susceptibility testing
Targeted Surveillance in California

- Enhanced testing for hard-to-detect pathogens
- ARLN supplies packaging materials, labels

Surveillance for: Testing Performed at Washington State PHL

<table>
<thead>
<tr>
<th>Surveillance for:</th>
<th>Testing Performed at Washington State PHL</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Carbapenemase-producing <em>Acinetobacter</em> spp.</td>
<td>• ID (MALDI-TOF/Commercial methods) and AST</td>
</tr>
<tr>
<td></td>
<td>• PCR for resistance mechanism</td>
</tr>
<tr>
<td>- <em>mcr</em> positive <em>E. coli</em> and <em>Klebsiella</em> spp.</td>
<td>• Colistin-susceptibility testing</td>
</tr>
<tr>
<td></td>
<td>• PCR to detect mc-1/2</td>
</tr>
<tr>
<td>- <em>Candida auris</em> and multi-drug resistant <em>Candida</em> spp.</td>
<td>• Antifungal susceptibility testing and organism ID</td>
</tr>
</tbody>
</table>
Enterobacteriaceae – Cephalosporin and Monobactam Breakpoints (MIC µg/ml) from 2009 to 2010

<table>
<thead>
<tr>
<th>Agent</th>
<th>Old Susc</th>
<th>Old Int</th>
<th>Old Res</th>
<th>Current Susc</th>
<th>Current Int</th>
<th>Current Res</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefazolin</td>
<td>≤8</td>
<td>16</td>
<td>≥32</td>
<td>≤1</td>
<td>2</td>
<td>≥4</td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>≤8</td>
<td>16-32</td>
<td>≥64</td>
<td>≤1</td>
<td>2</td>
<td>≥4</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>≤8</td>
<td>16-32</td>
<td>≥64</td>
<td>≤1</td>
<td>2</td>
<td>≥4</td>
</tr>
<tr>
<td>Ceftazidime</td>
<td>≤8</td>
<td>16</td>
<td>≥32</td>
<td>≤4</td>
<td>8</td>
<td>≥16</td>
</tr>
<tr>
<td>Cefepime*</td>
<td>≤8</td>
<td>16</td>
<td>≥32</td>
<td>≤2</td>
<td>4-8**</td>
<td>≥16</td>
</tr>
<tr>
<td>Aztreonam</td>
<td>≤8</td>
<td>16</td>
<td>≥32</td>
<td>≤4</td>
<td>8</td>
<td>≥16</td>
</tr>
</tbody>
</table>

*Cefepime breakpoints updated from CLSI M100-S23 (2013) to CLSI M100-S24 (2014)
**CLSI M100-S24 (2014) indicates cefepime breakpoints are Susceptible Dose Dependent (SDD)
Has the laboratory implemented the revised cephalosporin and monobactam breakpoints for Enterobacteriaceae recommended by CLSI as of 2010? (n=389)
## Enterobacteriaceae - Carbapenem Breakpoints (MIC µg/ml)¹

<table>
<thead>
<tr>
<th>Agent</th>
<th>Old</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Susc</td>
<td>Int</td>
</tr>
<tr>
<td>Ertapenem</td>
<td>≤2</td>
<td>4</td>
</tr>
<tr>
<td>Imipenem</td>
<td>≤4</td>
<td>8</td>
</tr>
<tr>
<td>Meropenem</td>
<td>≤4</td>
<td>8</td>
</tr>
<tr>
<td>Doripenem</td>
<td>none</td>
<td></td>
</tr>
</tbody>
</table>

¹CLSI M100 28th ed; corresponding disk diffusion breakpoints also provided.
Has the laboratory implemented the revised carbapenem breakpoints for Enterobacteriaceae recommended by CLSI as of 2010? (n=389)
Webinar - Implementing Current Breakpoints on Your AST System: Step by Step Instructions

Resources Provided to “Guide” You (Editable; Use is Optional!)

1. CBP Enterobacteriaceae BP Verif_D PPT slides
2. Checklist CBP Enterobacteriaceae BP Verif_D
3. Protocol CBP Enterobacteriaceae BP Verif_D
4. App D Worksheet CBP Enterobacteriaceae BP Verif_D
5. BIT ARBANK Updated MJM07302018_D – Spreadsheet w/ AR Bank Results (from CDC)

CBP, carbapenem; BP, breakpoint

Webinar recording, slides, and supportive materials are available at: https://www.cdph.ca.gov/Programs/CHCQ/HAI/Pages/CA_ARLN.aspx
Does the laboratory perform a special test for presence of carbapenemase?
Does the laboratory perform a special test for presence of carbapenemase? (Modified Hodge Test excluded)
Carbapenemase Test Type (n=184)

- Modified Hodge Test: 49%
- PCR-based Test: 34%
- E-Test: 17%
- Carba NP: 13%
- Other: 10%
- mCIM: 3%
- MBL Screen: 1%

Note some facilities indicated use of more than one test; sum is greater than 184.
Carbapenemase Testing at MDL

- Beginning August 2017, CDPH Microbial Disease Laboratory (MDL) offers testing for
  - *Klebsiella* spp., *E. coli*, *Enterobacter* spp., or *Pseudomonas aeruginosa* resistant to at least one carbapenem.
- Other species may be tested with prior consultation with HAI Program
  - Phenotypic (mCIM) and molecular (Carba-R) testing
Carbapenemase Testing among Hospitals not Using Updated Breakpoints

- Hospitals using old breakpoints may use carbapenemase testing to identify epidemiologically concerning gram negative bacteria.
  - In 2016, 464 (44%) US hospitals using old breakpoints reported not performing carbapenemase testing.
  - In 2016, 29 (49%) California hospitals using old breakpoints reported not performing carbapenemase testing.
How does the laboratory report results if a carbapenemase is detected? (n=184)

- Change susceptible carbapenem results to resistant: 65%
- Report carbapenem MIC results without an interpretation: 28%
- No changes are made in the interpretation of carbapenem; the test is used for epidemiological or infection control purposes: 8%
Does the facility routinely perform screening testing (culture or non-culture) for CRE? (n=389)

- No Screening Cultures for CRE: 88%
- Yes: 12%

Response options not mutually exclusive:
- Admission of All Patients?
- Epidemiologically-Linked Patients of Known CRE Cases
- Admission of High-risk Patients?
- Patients Admitted to High-risk Settings
- Other
CRE Colonization Testing at ARLN

- West Regional ARLN offers CRE colonization when a patient/resident with CRE is identified
  - Epidemiologically linked to previously identified CRE case (roommate, residing on same unit, etc.)
  - Point prevalence survey when transmission suspected

- Contact HAI Program at HAIprogram@cdph.ca.gov to access free testing service
CRE and Carbapenem-Resistant 
*Pseudomonas aeruginosa* (CRPA) Testing 
at 
CDPH Microbial Diseases Laboratory (MDL) 
August 2017 – October 2018

- **Stephanie Abromaitis, Ph.D.** - Foodborne & Waterborne Diseases Section
- **Peng Zhang, Ph.D.** - Bacterial Diseases Section
- **Matthew Sylvester, Ph.D.** - Core Laboratory
CRE & Carbapenem-Resistant Pseudomonas aeruginosa (CRPA) Testing at MDL

• In 2011 MDL began offering a lab-developed real time qPCR test to detect KPC

• In 2013 MDL began offering a lab-developed real time qPCR test to detect KPC and NDM

• In August 2017 MDL began offering:
  – Molecular CRE/CRPA testing: Cepheid Xpert® Carba-R
  – Phenotypic CRE/CRPA testing: Modified Carbapenem Inactivation Method (mCIM)
CRE & Carbapenem-Resistant *Pseudomonas aeruginosa* (CRPA) Testing at MDL

- In 2011 MDL began offering a lab-developed real time qPCR test to detect KPC

- In 2013 MDL began offering a lab-developed real time qPCR test to detect KPC and NDM

**In August 2017 MDL began offering:**

- Molecular CRE/CRPA testing: Cepheid Xpert® Carba-R
- Phenotypic CRE/CRPA testing: Modified Carbapenem Inactivation Method (mCIM)

August 26, 2017 to October 31, 2018
CRE & CRPA Testing at CDPH-MDL

New testing
August 2017

Isolates Tested


52 49 27 43 47 35 45 108 88 85 110
CRE & CRPA Testing at CDPH-MDL

New testing
August 2017

Aug 2017 - Oct 2018

- 325 CRE
- 105 CRPA
Submissions by Organism

- Pseudomonas aeruginosa: 24%
- Enterobacter spp.: 20%
- Escherichia coli: 13%
- Klebsiella pneumoniae: 40%
- Other: 3%

430 Isolates received
Isolates were received from **18** County Public Health Laboratories

- 89% of total submission were from:
  - Alameda
  - Orange
  - San Joaquin
  - Santa Clara
  - Riverside
  - San Bernardino
Isolates received from **128** different healthcare facilities

<table>
<thead>
<tr>
<th>Submitting County Public Health Lab (CPHL)</th>
<th>Origin Submitting Healthcare Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange</td>
<td>26</td>
</tr>
<tr>
<td>Alameda</td>
<td>33</td>
</tr>
<tr>
<td>San Joaquin</td>
<td>31</td>
</tr>
<tr>
<td>Santa Clara</td>
<td>8</td>
</tr>
<tr>
<td>Riverside</td>
<td>3</td>
</tr>
<tr>
<td>San Bernardino</td>
<td>4</td>
</tr>
<tr>
<td>Butte</td>
<td>4</td>
</tr>
<tr>
<td>Monterey</td>
<td>2</td>
</tr>
<tr>
<td>San Diego</td>
<td>1</td>
</tr>
<tr>
<td>Napa-Solano-Yolo-Marin</td>
<td>4</td>
</tr>
<tr>
<td>Santa Barbara</td>
<td>2</td>
</tr>
<tr>
<td>San Francisco</td>
<td>2</td>
</tr>
<tr>
<td>Stanislaus</td>
<td>2</td>
</tr>
<tr>
<td>Contra Costa</td>
<td>2</td>
</tr>
<tr>
<td>Kern</td>
<td>1</td>
</tr>
<tr>
<td>San Mateo</td>
<td>1</td>
</tr>
<tr>
<td>Santa Cruz</td>
<td>1</td>
</tr>
<tr>
<td>Tulare</td>
<td>33</td>
</tr>
<tr>
<td>Total</td>
<td>128</td>
</tr>
</tbody>
</table>
MDL CRE/CRPA Testing Workflow

Receive Isolate → Confirm Isolate ID → Rapid Molecular Testing

CRE/CRPA (+) Report

CRE/CRPA (-) Phenotypic Testing
• **Xpert® Carba-R** FDA cleared test, approved June 2016

• The Xpert® Carba-R detects and differentiates gene sequences for the carbapenemase resistance genes
  – *bla*KPC (**KPC**)
  – *bla*NDM (**NDM**)
  – *bla*VIM (**VIM**)
  – *bla*IMP (**IMP**)
  – *bla*OXA-48 like (**OXA-48**)
MDL CRE/CRPA Molecular Testing

• There are multiple variants of each carbapenemase gene

• Not all variants of each of the “Big Five” carbapenemases are detected by the Xpert® Carba-R
MDL CRE/CRPA Molecular Testing

- There are multiple variants of each carbapenemase gene
- Not all variants of each of the “Big Five” carbapenemases are detected by the Xpert® Carba-R

<table>
<thead>
<tr>
<th>Carbapenemase</th>
<th>Variants Detected by Xpert® Carba-R</th>
<th>Variants Not Detected by Xpert® Carba-R</th>
<th>Untested Variants (partial list)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMP</td>
<td>IMP-1, 2, 6, 10, 11</td>
<td>IMP-7, 13, 14</td>
<td>IMP-3, 8, 9, 19, 20, 21, 22, 24, 25, 27, 30, 31, 33, 37, 40, 42</td>
</tr>
</tbody>
</table>

Adapted from Cepheid Xpert® Carba-R 510(k) Substantially Equivalent documents
MDL CRE Molecular Testing Results

255 CRE isolates were tested by Xpert® Carba-R

![Bar Chart]

- **KPC +**: 124 (49%)
- **non-KPC +**: 39 (15%)
- **No Detect**: 92 (36%)
MDL CRE Molecular Testing Results

Carbapenemase Gene Detected

- **KPC +**: 124 (49%)
- **non-KPC +**: 39 (15%)
- **No Detect**: 92 (36%)

Number Isolates

- **IMP**: 1
- **NDM**: 24
- **OXA-48**: 9
- **VIM**: 1
- **NDM & OXA-48**: 4
MDL CRE Molecular Testing Results

**Carbapenemase Gene Detected**

- KPC +: 124 (49%)
- non-KPC +: 39 (15%)
- No Detect: 92 (36%)

**Phenotypic Testing (mCIM)**
MDL CRPA Molecular Testing Results

82 CRPA isolates were tested by Xpert® Carba-R.

- **1 (1%)** KPC+
- **7 (9%)** VIM+
- **74 (90%)** No Detect

Carbapenemase Gene Detected
MDL CRPA Molecular Testing Results

82 CRPA isolates were tested by Xpert® Carba-R

- Phenotypic Testing (mCIM)
  - 74 (90%)
  - 1 (1%)
  - 7 (9%)
  - No Detect
Phenotypic Testing for Carbapenemase Production

<table>
<thead>
<tr>
<th>Phenotypic Test Used for Epidemiological or Infection Control-Related Testing</th>
<th>Carba NP</th>
<th>Modified Carbapenem Inactivation Method (mCIM)</th>
<th>EDTA-modified Carbapenem Inactivation Method (eCIM)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organisms</strong></td>
<td>Enterobacteriaceae and <em>P. aeruginosa</em> that are not susceptible to one or more carbapenems</td>
<td>Enterobacteriaceae and <em>P. aeruginosa</em> that are not susceptible to one or more carbapenems</td>
<td>Enterobacteriaceae that are positive by mCIM</td>
</tr>
<tr>
<td><strong>Strengths</strong></td>
<td>Rapid</td>
<td>No special reagents or media necessary</td>
<td>No special reagents or media necessary</td>
</tr>
<tr>
<td><strong>Limitations</strong></td>
<td>Special reagents are needed and certain carbapenemase types (eg, OXA-type) are not consistently detected</td>
<td>Requires overnight incubation</td>
<td>Requires overnight incubation and only valid when mCIM is positive</td>
</tr>
</tbody>
</table>

CLSI M100 28th ed.
Phenotypic Testing for Carbapenemase Production
Modified Carbapenem Inactivation Method - mCIM

• **How does mCIM work?**
  
  – Meropenem in a disk is inactivated (hydrolyzed) by the carbapenemase produced by bacteria in a bacterial suspension.
  
  – The inactivation of meropenem is determined by transferring and incubating the disk on a plate with meropenem-susceptible indicator *E. coli*.

  ➢ **Carbapenemase producer**
  
  Meropenem in the disk is inactivated and allows indicator *E. coli* to grow. No zone or very small zone of inhibition around the disk.

  ➢ **Non-carbapenemase producer**
  
  Meropenem in the disk retains its activity and inhibits the growth of indicator *E. coli*. A zone of inhibition around the disk.
Phenotypic Testing for Carbapenemase Production
Modified Carbapenem Inactivation Method - mCIM

• **How is mCIM Result Interpreted?**
  
  – **Carbapenemase positive**: zone 6-15 mm or presence of colonies within a 16-18 mm zone.
  – **Carbapenemase negative**: zone ≥19 mm.
  – **Indeterminate**: zone 16-18 mm.

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CLSI M100 28th ed.
mCIM Testing on Carbapenemase Gene
Undetected CRE/CRPA Isolates

Total Isolates Tested: 255 (CRE = 158, CRPA = 97)

CRE Isolates

- Indeterminate: 9 (6%)
- Negative by mCIM & molecular tests: 125 (79%)
- Positive by mCIM, negative by molecular tests: 24 (15%)

Further Testing

Regional lab testing

CDC testing

California Department of Public Health
mCIM Testing on Carbapenemase Gene
Undetected CRE/CRPA Isolates

Total Isolates Tested: 255 (CRE = 158, CRPA = 97)
Summary of Carbapenem-Resistant Organisms Tested in MDL

- Total isolates tested: 430
  - 196 isolates (45.6%) are positive for carbapenemases
- Suspected CRE isolates tested: 325
  - 186 isolates (57.2%) are CP-CRE
- Suspected *P. aeruginosa* isolates tested: 105
  - 10 isolates (9.5%) are CP-CRPA
Suggestions and Reminders for Submission

• Send isolates that are resistant to *at least* one carbapenem
  – AST results must be included with the submission
• Avoid sending multiple isolates from same patient collected on same day
• For isolates that have already been tested using molecular testing:
  – Send those that have tested negative
  – Do not send positive isolates for confirmation without prior consultation with CDPH HAI Program and MDL
• Make sure field for original submitting facility is complete
• MUST get prior approval from CDPH HAI Program for submission of organisms other than *Klebsiella* spp., *E. coli*, *Enterobacter* spp., and *P. aeruginosa* ([HAIProgram@cdph.ca.gov](mailto:HAIProgram@cdph.ca.gov))
  – CDPH HAI Program may request additional epi information
Carbapenemase Testing at MDL/CDPH

- Bacterial Diseases Section (BDS)
- Foodborne & Waterborne Diseases Section (FWDS)
- High Risk Pathogens Section
- Immunodiagnostic Mycotic & Parasitic Diseases Section
- Mycobacterial Diseases Section
- Core Laboratory

<table>
<thead>
<tr>
<th>Testing available</th>
<th>mCIM</th>
<th>Xpert® Carb-R, lab-developed qPCR</th>
<th></th>
<th>Bacterial WGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing coming soon</td>
<td>Sensititre for CRE/CRPA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Future</td>
<td>Lab-developed qPCR for colistin resistant genes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Carbapenemase Gene Detection and Genetic Relatedness by Whole Genome Sequencing

Matthew Sylvester, Ph.D.
Research Scientist – Core Laboratory
Microbial Diseases Laboratory
Bacterial Whole Genome Sequencing and Carbapenemases

• MDL offers a CLIA-validated Whole Genome Sequencing (WGS) assay on the Illumina MiSeq sequencing platform

• This additional genetic testing may be useful for:
  – Species confirmation
  – Identification of antibiotic resistance genes
  – Establishing relatedness
  – **Multilocus sequence typing (MLST)**
  – **Virulence gene prediction**
Carbapenem-resistant *Acinetobacter baumannii* Outbreak in California

4 patients with highly drug-resistant *A. baumannii* (two available isolates)

Index patient transferred

5<sup>th</sup> patient with *A. baumannii*
Species Confirmation with WGS

### KmerFinder 3.0 results:

<table>
<thead>
<tr>
<th>Template</th>
<th>Num</th>
<th>Score</th>
<th>Expected</th>
<th>Template length</th>
<th>query_coverage</th>
<th>Coverage</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>NZ_CP015483.1 Acinetobacter baumannii strain ORAB01, complete genome</td>
<td>1211</td>
<td>142489</td>
<td>0</td>
<td>148957</td>
<td>96.41</td>
<td>97.68</td>
<td>0.96</td>
</tr>
</tbody>
</table>

Species is confirmed to be *Acinetobacter baumanii*
Antibiotic Resistance Gene Prediction from WGS

Gene encoding OXA-237 carbapenemase detected in a carbapenem-resistant *Acinetobacter baumanii*
Phylogenetic Analysis Supports Isolate Relatedness

- Sequencing helped to identify an outbreak of *A. baumanii* carrying a rare OXA-237 carbapenemase gene
- Closely-related isolates suggest a transmission route between facilities
Sequencing Informed Follow-up

- ACH
  - 4 patients with highly drug-resistant A. baumannii

- LTACH
  - Index patient transferred
  - 5th patient, WGS nearly identical
  - Interfacility communication

- SNF
  - Index patient transferred to Skilled Nursing Facility
  - LHD followed up with facility

- ACH
Isolate Submission

Due to limited testing capacity, before sending isolates to CDPH MDL for whole genome sequencing, facilities or public health departments must obtain prior approval from the CDPH HAI Program by emailing HAIprogram@cdph.ca.gov. The HAI Program will request additional epidemiological information to determine if whole genome sequencing is feasible at that time.
Questions?

• Please type all questions into the chat box and the presenters will answer them.

• A copy of the slides and a recording of the webinar will be posted on the CDPH HAI Program website, and all webinar participants will be notified when they are available.

• For any questions about this presentation or ARLN Targeted Surveillance, please email HAIProgram@cdph.ca.gov.

• Sign up for the California AR Lab Network mailing list (https://www.surveymonkey.com/r/ARLabNetworkContact) for information on future webinars.