Every year about 2 million Americans get infections from antibiotic resistant germs, and more than 23,000 die from their infections. These germs can arise from one of four resistance mechanisms: 1) Destruction of the antibiotic (e.g., carbapenemases), 2) Efflux pumps, 3) Target site alteration, or 4) Decreased permeability of the antibiotic. Carbapenemases are concerning because the carbapenemase production gene is encoded on a bacterial plasmid that can easily transfer between organisms, allowing resistance to spread silently and quickly.

### Timeline of CP-CRE and CP-CRPA

2001: First CP-CRE identified in U.S.
2013: CDC releases antibiotic resistant threat report
August 2016: CDC funding for increased surveillance at the state level
March 2018: DCLS Virginia public health lab goes live with CRE/CRPA carbapenemase testing
April 2018: CDC releases CDC Vital Signs with Containment Strategy

### Acquiring and Spreading Carbapenemase Resistance

Organism can acquire resistance through:
1) Increased antibiotic use
2) Contaminated person/object

### Carbenemase Resistance Genes

1. *Klebsiella pneumoniae* carbapenemase (KPC)
2. Oxacillinase-48-type carbapenemase (OXA-like)
3. New Delhi metallo-beta-lactamase (NDM)
4. Verona Integron-encoded metallo-beta-lactamase (VIM)
5. Imipenemase metallo-beta-lactamase (IMP)

### Close to Home: CPOs in Virginia

From March 26, 2018 through August 31, 2018
- 288 isolates have been tested at DCLS
- 26% have been positive for carbapenemases
Facilities forwarding isolates to DCLS are participating in the containment strategy to help decrease AR threats. VDH and DCLS would like to thank all submitting labs, and strongly encourage those who are not submitting to do so.

The majority of carbapenemase producing isolates tested have been identified as KPC, however, Virginia is starting to see more non-KPC isolates. Collaboration is key to help prevent non-KPC isolates in Virginia.

To prevent MDROs the CDC Containment Strategy should be utilized.

So far, the Containment Strategy has been used in the following healthcare settings:
- Acute Care Hospitals
- Long Term Care
- Outpatient Practices
Evidence the Containment Strategy Works

According to the 2018 CDC Vital Signs report, NHSN data from the CDC show increased detection and aggressive early response decreases antibiotic resistance threats compared to a non-aggressive strategy.

% E. coli and K. pneumoniae isolates from selected HAIs with ESBL phenotype reported as non-susceptible to extended-spectrum cephalosporins

% E. coli and K. pneumoniae isolates from selected HAIs reported as resistant to a carbapenem

What is the Containment Strategy?

Goal
• Slow spread of novel or rare multidrug-resistant organisms or mechanisms

Response
• Systematic, aggressive response to a SINGLE case of high concern of antibiotic resistance

Approach
• Response activities are tiered (see below) based on organism/mechanism attributes

CDC Multidrug-Resistant Organism (MDRO) Tiers

<table>
<thead>
<tr>
<th>Tier 1</th>
<th>Tier 2</th>
<th>Tier 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Resistance mechanisms novel to the U.S.</td>
<td>• MDROs primarily found in healthcare settings but not found regularly in the region; organisms might be found more commonly in other areas in the U.S.</td>
<td>• MDROs that are already established in the U.S. and have been identified before in the region but are not thought to be endemic</td>
</tr>
<tr>
<td>• Organisms for which no current treatment options exist (pan-resistant)</td>
<td>In Virginia: • CP-CRE caused by KPC, NDM, VIM, IMP, OXA</td>
<td>In Virginia: • Not applicable until more is known</td>
</tr>
<tr>
<td></td>
<td>In Virginia: • Novel resistance mechanisms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pan-resistant isolates</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• VRSA</td>
<td></td>
</tr>
</tbody>
</table>

Taken from CDC MDRO toolkit
For CRE alone, the CDC estimates the Containment Strategy can reduce infections by 76%. It includes five elements:

1. Rapid Identification
2. Infection Control Assessments
3. Colonization Screenings
4. Coordinated Response
5. Continued Assessments

1. Rapid Identification

The CDC established the Antibiotic Resistance Lab Network, or ARLN, in 2016 to:
- Rapidly detect antibiotic resistance in healthcare and the community
- Provide comprehensive lab capacity and infrastructure for AR pathogens
- Prevent spread of future AR threats

The AR Lab Network includes labs in 50 states, five large cities, Puerto Rico, seven regional labs, and CDC.
2. Infection Control Assessments

Infection Prevention is an important strategy to stop the transmission of CP-CRE and CP-CRPA. Facility infection prevention policies should include the following:

<table>
<thead>
<tr>
<th>Infection Prevention Measure</th>
<th>Acute Care Facility</th>
<th>Long-Term Care Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Infected</td>
<td>Colonized</td>
</tr>
<tr>
<td>Standard Precautions</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Contact Precautions</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Private Room</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Door signage</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Designated or disposable equipment</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Visitor Recommendations

<table>
<thead>
<tr>
<th></th>
<th>Acute Care Facility</th>
<th>Long-Term Care Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform hand hygiene often, and always after leaving resident’s room</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Wear gown/gloves if contact with body fluids is anticipated</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Wear gown/gloves if no contact with body fluids is anticipated</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

*unable to perform hand hygiene, ventilator-dependent, incontinent of stool or urine, dependent on staff for activities of daily living (ADLs), draining wounds

When patients are identified at your facility with CP-CRE or CP-CRPA, the local health department may ask to conduct an infection control assessment to help guide their recommendations on healthcare contact screenings. Assessments should be completed on a regular basis to help identify and correct any deficits.

3. Colonization Screenings

The purpose of screening is to identify asymptomatic carriers so that additional control measures (e.g., contact precautions) can be put into place. The rationale for this testing is that clinical testing might only identify a small proportion of patients who are colonized. Screening typically involves collecting and testing rectal or perirectal culture swabs.

Screening can involve: screening contacts; conducting a point prevalence survey; or conducting active surveillance testing.

When CP-CRE or CP-CRPA is identified in a facility, the facility should work with the local health department to identify patients who should be screened. This is available through the ARLN at no charge to the patient or facility.
3. Colonization Screenings (continued)

Algorithm for approach to screening healthcare contacts:

Source patient with target MDRO

On CP for entire stay

Adequate IP and adherence to CP verified through IP assessment

Inadequate IP or adherence to CP

Not on CP for entire stay

1. Screen Roommates

2. Tier 1 Organism: Novel Pathogen
   - Broader contact screening is recommended
   - Screening contacts is generally not recommended, but could be considered in specific instances*

   Tier 1: Other Organism or Tier 2 Organism
   - Broader contact screening is not recommended

   Tier 3 Organism
   - Broader contact screening is recommended

   Tier 1 or 2 Organism
   - Broader contact screening is generally not recommended, but could be considered in specific instances*

   Tier 3 Organism

* see organism specific guidelines

4. Coordinated Response Between Facilities

CP-CRE and CP-CRPA can spread rapidly to other facilities. Infection prevention information should be transferred with the patient at the time of transfer to ensure the accepting facility is implementing the correct measures. The CDC Inter-facility Infection Control Transfer Form can be used if no other form is currently being used at the facility. You can find the form here: [https://www.cdc.gov/hai/pdfs/toolkits/InfectionControlTransferFormExample1.pdf](https://www.cdc.gov/hai/pdfs/toolkits/InfectionControlTransferFormExample1.pdf)
5. Continued Assessments and Screenings

Once an MDRO is detected in a facility, be on high alert for transmission. Encourage the laboratory to continue to send CRE and CRPA isolates to DCLS for mechanism testing. Continue to work with your local health district on enhanced surveillance and response.

Facilities should submit all their CRE and CRPA isolates to DCLS for further mechanism testing.

Facilities should communicate and collaborate with the health department when CP-CRE or CP-CRPA is identified.

A coordinated approach between healthcare providers/facilities and public health is necessary to help decrease antibiotic resistant threats.

Summary

Resources


CDC MDRO Toolkit: https://www.cdc.gov/hai/containment/guidelines.html


Healthcare-Associated Infections (HAI) and Antimicrobial Resistance (AR) Program

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