CRE and XDRO: What Hospital IC/Ps Need to Know

April 29, 2014
Featured Presenters

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Cook County Health & Hospitals System

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The opinions, viewpoints, and content presented in this webinar may not represent the position of the Illinois Department of Public Health
Carbapenemase-Producing CRE in the United States

CDC’s Guidance for Control of Carbapenem-resistant Enterobacteriaceae (CRE) 2012 Toolkit

- Infection Prevention and Control Departments should:
  - Be cognizant of the epidemiological significance of CRE
  - Be aware of the prevalence of the organism in the community or region
  - Attempt to identify patients in the facility who are colonized or infected with CRE
  - Implement facility practices to prevent transmission of CRE
  - Participate in regional initiatives designed to address CRE
Case Presentation

- Elderly female presented from home with failed outpatient antibiotic pneumonia therapy at the end of December and admitted to ICU
- Intubated after admission
- Negative initial blood, urine, and sputum cultures
- Subsequent cardiac arrest, tracheostomy, PEG, and hemodialysis
- 10 days following admission, sputum culture positive for Klebsiella pneumoniae Carbapenemase-producing bacteria (KPC)
Initial Interventions

- Patient placed in Contact Precautions (all private rooms in ICU)
- Contacted Lab to determine if any other CRE organisms recently identified
- Notified ICU Manager of positive CRE (KPC) and requested active surveillance screening cultures from all current ICU patients
- Informed Lab of CRE screening measures
- Initiated daily bleach cleaning of high touch surface areas by EVS and ICU staff
- Dedicated all supplies and patient equipment, including hemodialysis equipment
- Observed compliance to hand hygiene, disinfection, and contact precautions
Education of Unit and Ancillary Staff (Also Patients and Caregivers)

- In-Person
- Communication
- And Use of the CDC Tool:

Facility and Public Health Notification and the XDRO Registry

- Department Education
  - Respiratory Therapy
  - Dialysis
  - OR
  - Radiology

- Internal Notification
  - Critical Care Intensivists and Residents
  - Quality Department
  - Hospital Administration

- External Notification
  - Chicago Department of Public Health
  - IDPH XDRO registry – case entered into database
Inter-facility Transfer and Communication

Second Case Presentation

• Female patient in her 50’s admitted to ICU from home with seizures
• Intubated on admission
• Initial blood, urine, body fluid, and sputum cultures negative
• Patient had exploratory laparoscopy, bronchoscopy, tracheostomy, and PEG
• 10 days after admission, urine culture positive for KPC
• 19 days after admission, sputum culture positive for KPC
2\textsuperscript{nd} Case Interventions

- All interventions initiated for previous KPC positive patient instituted AND...
- Checked proximity and timeline in relation to 1\textsuperscript{st} case
- Reviewed patient link in terms of staff caring for them
- Investigated any possible invasive procedures or tests shared by both patients
- Instituted CHG bathing for patients in ICU
- Notified CDPH and hospital administration
- No further cases identified to date
Collaboration with Labs and Local Public Health Departments

- Establish dependable Lab contacts
- Perform Micro review or line list every 6 months or at least annually
- Notify local public health departments for assistance if guidance is needed
Infection Prevention and Control Checklist for One Identified Hospital Acquired CRE Case in a Facility with no or few cases

- Microbiology Review
- Active rectal surveillance cultures on the unit
- Ensure screening lab is aware of CRE testing measures
- Observe compliance to contact precautions and hand hygiene
- Monitor environmental cleaning with EPA approved disinfectant in high-contact surface areas
- Education of unit and ancillary staff, patient, family, and caregivers
- Inter-facility communication and case entry into XDRO registry
Infection Prevention and Control Checklist for a Cluster of Hospital-Acquired CRE Cases

All previous interventions, AND:

- Investigate potential epidemiological links (staff, procedures, location in facility)
- Consider cohorting patients and staff
- Possible CHG bathing of patients
CDC 2012 CRE Toolkit

CDC 2012 CRE Toolkit Guidance

- Notify appropriate facility personnel and public health (if indicated)
- Place patient on Contact Precautions in single room (if available)
- Monitor adherence to hand hygiene and use of Contact Precautions on affected ward/unit
- Educate healthcare personnel about preventing CRE transmission
- Screen epidemiologically-linked patient contacts for CRE and/or consider point prevalence survey of affected unit
- Consider preemptive Contact Precautions of these patients pending results of screening cultures
- Consider cohorting patients and staff
- Ensure appropriate intra- and inter-facility communication
Questions?
References


XDRO Registry: 6 month update

April 2014

Michael Lin, MD MPH
William Trick, MD
Chicago CDC Prevention Epicenter
Objectives

1. CRE overview and recent trends
2. CRE definition / laboratory considerations
3. XDRO registry website updates
4. Querying and automated alerts
5. Question and answer
### CRE: 2 dominant types

<table>
<thead>
<tr>
<th></th>
<th><strong>KPC</strong></th>
<th><strong>NDM</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stands for:</td>
<td>Klebsiella pneumoniae carbapenemase</td>
<td>New Delhi metallo-β-lactamase</td>
</tr>
<tr>
<td>Bacterial species</td>
<td>Usually Klebsiella, sometimes <em>E. coli</em></td>
<td>Usually <em>E. coli</em> (in U.S.) but variable</td>
</tr>
<tr>
<td>Prevalence</td>
<td>Most common CRE</td>
<td>Rare but emerging</td>
</tr>
<tr>
<td>Treatment</td>
<td>Nearly impossible</td>
<td>Nearly impossible</td>
</tr>
<tr>
<td>Concerning?</td>
<td>Yes</td>
<td>Yes!! Because it is still rare in U.S. and spreads aggressively. If your lab suspects it, report right away to IDPH</td>
</tr>
</tbody>
</table>
New-Delhi Metallo-β-Lacatamase (NDM) in U.S.

<table>
<thead>
<tr>
<th>Year</th>
<th>US patients with NDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-2012</td>
<td>27</td>
</tr>
<tr>
<td>2013</td>
<td>67 (44 pts in Illinois)</td>
</tr>
</tbody>
</table>
2013 NDM outbreak in Illinois

32 pts epidemiologically linked to NDM-colonized endoscope used for ERCP

All were NDM were found in *E. coli*
Facility Data [a]

Resistance Mechanism
- Unrep...
- KPC
- NDM-1
- OXA
- Unknown

Specimen Source
- Unrep...
- Blood
- Cerebrospinal fluid
- Rectal (screenee)
- Skin (screenee)
- Sputum
- Tissue
- Wound

 Entire Dataset

Trend, Last 12 Months

(Number of patients)

State Data [b]

Resistance Mechanism
- Unrep...
- KPC
- NDM-1
- Other
- Unknown

Specimen Source
- Blood
- Body fluid
- Other
- Rectal (screenee)
- Sputum
- Urine
- Wound...

 Entire Dataset

Trend, Last 12 Months

(Number of patients)
Resistance mechanisms reported to XDRO registry

Data through March 20, 2014; from pts with reported mechanism data, 68% of total
Organism distribution

KPC (N=281)

- 93% Klebsiella
- 2% E. coli
- 5% Other

NDM (N=32)

- 94% E. coli
- 6% Other

Data through March 20, 2014; from pts with reported mechanism data, 68% of total
CRE definition and laboratory considerations
CRE definition: Enterobacteriaceae with one of the following test results:

1. Molecular test (e.g., PCR) specific for carbapenemase
   OR
2. Phenotypic test (e.g., Modified Hodge) specific for carbapenemase production
   OR
3. For *E. coli* and *Klebsiella* species only: non-susceptible to ONE of the carbapenems (doripenem, meropenem, or imipenem) AND resistant to ALL third generation cephalosporins tested (ceftriaxone, cefotaxime, and ceftazidime).

Report 1st CRE event per patient per encounter
CRE reporting: points of confusion

• What are Enterobacteriaceae?

<table>
<thead>
<tr>
<th>Common</th>
<th><em>E. coli</em>, Klebsiella spp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less common</td>
<td>Enterobacter, Proteus, Citrobacter, Serratia, Morganella, or Providentia species</td>
</tr>
<tr>
<td>Never</td>
<td>Pseudomonas, Acinetobacter</td>
</tr>
</tbody>
</table>

• Ignore ertapenem susceptibility

• ESBL (extended spectrum β-lactamase) does not qualify as CRE
Laboratory considerations

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Lab test</th>
<th>Common?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Molecular</td>
<td>PCR</td>
<td>Some</td>
</tr>
<tr>
<td>2: Phenotypic</td>
<td>Modified Hodge</td>
<td>Some</td>
</tr>
<tr>
<td>3: Susceptibility</td>
<td>Automated system</td>
<td>All labs</td>
</tr>
</tbody>
</table>

• Ask your lab about testing capability
  – Currently, many facilities will only use criterion 3
• Molecular testing (PCR) tests for the presence of CRE genes, and is currently the only way to confirm the carbapenemase type (KPC vs NDM)
Laboratory example

This laboratory performed confirmation testing and thus was able to determine carbapenemase presence. (but I had to ask the lab that the test was PCR and that it confirmed KPC)

<table>
<thead>
<tr>
<th>MIC mcg/ml</th>
<th>MIC INTERP</th>
<th>MIC mcg/ml</th>
<th>ET INTERP</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRIMETH/SULFA</td>
<td>&gt;2/38 RESISTNT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEFAZOLIN</td>
<td>&gt;16 RESISTNT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIGECYCLINE</td>
<td></td>
<td>1.00 SUSCEPT</td>
<td></td>
</tr>
<tr>
<td>LEVOFLOXACIN</td>
<td>&gt;4 RESISTNT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEFOTAXIN</td>
<td>16 INTERMED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIP/TAZOBACTAM</td>
<td>&gt;64 RESISTNT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TICARCI/K CLAV</td>
<td>&gt;64 RESISTNT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEPFRIAXONE</td>
<td>&gt;32 RESISTNT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GENTAMICIN</td>
<td>&lt;=4 SUSCEPT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOBRAMYCIN</td>
<td>&gt;8 RESISTNT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AMIKACIN</td>
<td>16 SUSCEPT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IMIPENEM</td>
<td>8 RESISTNT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEROPENEM</td>
<td>&gt;8 RESISTNT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CEPFEPIME</td>
<td>16 RESISTNT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COLISTIN</td>
<td></td>
<td>0.38 SUSCEPT</td>
<td></td>
</tr>
<tr>
<td>A ERTAPENEM</td>
<td>&gt;4 RESISTNT</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ceftriaxone was only 3<sup>rd</sup> gen cephalosporin reported

Non-susceptible to at least 1 carbapenem

Ignore ertapenem results
List of questions to ask your lab

1) Do you perform Modified Hodge testing for CRE?

2) Do you perform PCR testing for CRE?
   – If yes, can you confirm KPC or NDM?

3) Do you perform any special testing to screen for NDM (such as metallo-β-lactamase E-test [MBL E-test]?)
XDRO registry website updates
### XDRO Report

**XDRO culture information**

- **Organism name (genus/species)**
  - Please Select Organism:

- **Specimen source**
  - Please Select Specimen:

- **XDRO criteria** (select all that apply)
  - Reporting rule
  - Molecular test (e.g. PCR) specific for carbapenemase
  - Phenotypic test (e.g. Modified Hodge) specific for carbapenemase production
  - For E. coli and Klebsiella spp. only:
    - Resistant to ALL 3rd gen cephalosporins tested and non-susceptible (intermediate or resistant) to one carbapenem. Ignore ertapenem.

- **Date (culture acquisition)**
  - mm / dd / yyyy

- **Mechanism of resistance**
  - Please Select Mechanism:

### Facility information

- **Facility name**
  - Sample Hospital

- **Patient MRN**

- **Date of admission/Encounter Date**
  - mm / dd / yyyy

- Culture obtained as outpatient

### Patient demographics

- **First name**

- **Last name**

- Maiden name (if applicable)
XDRO Report

XDRO culture information

* XDRO criteria (select all that apply)
  Reporting rule
  - Molecular test (e.g. PCR) specific for carbapenemase
  - Phenotypic test (e.g. Modified Hodge) specific for carbapenemase production
  - For E. coli and Klebsiella spp. only: Resistant to ALL 3rd gen cephalosporins tested and non-susceptible (intermediate or resistant) to one carbapenem. Ignore ertapenem.

* Date (culture acquisition)
  mm / dd / yyyy

* Mechanism of resistance
  Please Select Mechanism:

Patient information

* First name

* Last name

Maiden name (if applicable)

* Date of admission/Encounter Date
  mm / dd / yyyy
XDRO culture information

* Organism name (genus/species)
Klebsiella pneumoniae

* XDRO criteria (select all that apply)
   Reporting rule
   □ Molecular test (e.g. PCR) specific for carbapenemase
   □ Phenotypic test (e.g. Modified Hodge) specific for carbapenemase production
   □ For E. coli and Klebsiella spp. only:
   Resistant to ALL 3rd gen cephalosporins tested and non-susceptible (intermediate or resistant) to one carbapenem. Ignore ertapenem.

* Date (culture acquisition)
mm / dd / yyyy

* Mechanism of resistance
Please Select Mechanism:

Facility information

Facility name
Sample Hospital

* Patient MRN

* Date of admission/Encounter Date
mm / dd / yyyy

Culture obtained as outpatient

Patient demographics

* First name

* Last name

Maiden name (if applicable)
XDRO culture information

* Organism name (genus/species)
  Klebsiella pneumoniae

* XDRO criteria
  - Molecular test (e.g. PCR) specific for carbapenemase
  - Phenotypic test (e.g. Modified Hodge) specific for carbapenemase production
  - For E. coli and Klebsiella spp. only: Resistant to ALL 3rd gen cephalosporins tested and non-susceptible (intermediate or resistant) to one carbapenem. Ignore ertapenem.

* Date (culture acquisition)
  mm / dd / yyyy

* Mechanism of resistance
  Please Select Mechanism:

Facility information

* Facility name
  Sample Hospital

* Patient MRN

* Date of admission/Encounter Date
  mm / dd / yyyy

  □ Culture obtained as outpatient

Patient demographics

* First name

* Last name

Maiden name (if applicable)
XDRO culture information

* Organism name (genus/species)
  - Klebsiella pneumoniae

* XDRO criteria
  - Molecular test (e.g. PCR) specific for carbapenemase
  - Phenotypic test (e.g. Modified Hodge) specific for carbapenemase production
  - For E. coli and Klebsiella spp. only:
    - Resistant to ALL 3rd gen cephalosporins tested and non-susceptible (intermediate or resistant) to one carbapenem. Ignore ertapenem.

* Specimen source
  - Please Select Specimen:

* Date (culture acquisition)
  - mm / dd / yyyy

* Mechanism of resistance
  - KPC (Klebsiella pneumoniae carbapenemase)
  - NDM-1 (New Delhi Metallo-β-lactamase)
  - OXA
  - Other
  - Unknown

Facility information

Facility name
- Sample Hospital

* Patient MRN

* D
  - Culture obtained as outpatient

Patient demographics

* First name

* Last name

Maiden name (if applicable)
**XDRO culture information**

* Organism name (genus/species)
  - Klebsiella pneumoniae

* Specimen source
  - Urine

**XDRO criteria**
- **Molecular test** (e.g. PCR) specific for carbapenemase
- **Phenotypic test** (e.g. Modified Hodge) specific for carbapenemase production
  - For E. coli and Klebsiella spp. only: Resistant to ALL 3rd gen cephalosporins tested and non-susceptible (intermediate or resistant) to one carbapenem. Ignore ertapenem.

**Reporting rule**

**Date (culture acquisition)**
- 04 / 29 / 2014

**Mechanism of resistance**
- KPC (Klebsiella pneumoniae)

**Facility information**

- Facility name: Sample Hospital
- Culture obtained as outpatient

**Patient demographics**

- * First name
- * Last name
- Maiden name (if applicable)
Patient demographics

* First name

* Last name

* Date of birth (mm/dd/yyyy)

* Maiden name (if applicable)

* Social Security Number (last 4)

Race

- Male
- Female

Please Select One:

Ethnicity

- Hispanic or Latino
- Not Hispanic or Latino

* Street address

* City

* County

* State

* Zip code

Comments

CANCEL  SAVE DRAFT  SUBMIT
Search Instruction

a. Available fields
   Last name (required), first name (optional), DOB (required).

b. Search algorithm
   i. If you enter all 3 fields, then attempt to match (exact; case insensitive) on all 3 fields.
   ii. If no match returns on 3 fields, then attempt to match (exact; case insensitive) on last name and DOB (ignore first name completely).

c. Results display
   i. In general, You will see the search results for exactly how you entered the information.
   If there are no exact matches for last name and dob, you will see a NULL result.
<table>
<thead>
<tr>
<th>RID</th>
<th>Name</th>
<th>Date of Birth</th>
<th>MRN</th>
<th>Organism</th>
<th>Culture Date</th>
<th>Status</th>
<th>Username</th>
</tr>
</thead>
<tbody>
<tr>
<td>585</td>
<td>Q, Q</td>
<td>12/12/2010</td>
<td>1212</td>
<td>Citrobacter spp.</td>
<td>03/01/2014</td>
<td>Pending</td>
<td>devxtest</td>
</tr>
<tr>
<td>835</td>
<td>Duck, Daffy</td>
<td>11/13/1973</td>
<td>1234</td>
<td>Klebsiella pneumoniae</td>
<td>02/14/2014</td>
<td>Submitted</td>
<td>rleidig</td>
</tr>
<tr>
<td>1017</td>
<td>T, Test</td>
<td>01/01/1955</td>
<td>1234536</td>
<td>Escherichia coli</td>
<td>12/31/2013</td>
<td>Submitted</td>
<td>devxtest</td>
</tr>
<tr>
<td>846</td>
<td>S, B</td>
<td>11/11/1950</td>
<td>32152</td>
<td>Citrobacter spp.</td>
<td>12/12/2013</td>
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</tr>
<tr>
<td>777</td>
<td>E, Ds</td>
<td>11/11/1982</td>
<td>1110</td>
<td>Enterobacter aerogenes</td>
<td>11/22/2013</td>
<td>Submitted</td>
<td>devxtest</td>
</tr>
<tr>
<td>861</td>
<td>Test Criteria</td>
<td></td>
<td></td>
<td>Escherichia coli</td>
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<td>872</td>
<td>D, Testzip</td>
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<td>Enterobacter aerogenes</td>
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<td>01/23/1980</td>
<td>3232132</td>
<td>Citrobacter spp.</td>
<td>11/11/2013</td>
<td>Submitted</td>
<td>devxtest</td>
</tr>
</tbody>
</table>


Patient information

Patient name: Duck, Daffy  
MRN: 1234  
Date of birth: 11/13/1973  
SSN (last 4):  
Address: 122 S. Michigan, Chicago, IL 60603

Admission date: 03/13/2014  
Race:  

XDRO culture information

Organism: Klebsiella pneumoniae  
Culture date: 02/14/2014  
XDRO criterion: Molecular test  
Specimen source:  
Mechanism of resistance: KPC  

Comments:

Submitted by ROBYNN LEIDIG, 03/14/2014, Sample Hospital
**XDRO Report - Sample Hospital**

**Patient information**

**Patient name:** Duck, Daffy  
**MRN:** 1234  
**Admission date:** 03/13/2014

**Date of birth:** 11/13/1973  
**SSN (last 4):**  
**Race:**  
**Address:** 122 S. Michigan, Chicago, IL 60603

**XDRO culture information**

**Organism:** Klebsiella pneumoniae  
**Culture date:** 02/14/2014

**XDRO criterion:** Molecular test  
**Specimen source:**  
**Mechanism of resistance:** KPC

**Comments:**

Submitted by ROBYNN LEIDIG, 03/14/2014, Sample Hospital

---

**Reason for deleting the above record:** Please Select Reason:  
**Comment:** De-colonization or infection resolution is not a valid reason to delete the record.
XDRO Report - Sample Hospital

Patient information

Patient name: Duck, Daffy  
MRN: 1234  
Admission date: 03/13/2014

Date of birth: 11/13/1973  
SSN (last 4):  
Race:

Address: 122 S. Michigan, Chicago, IL 60603

XDRO culture information

Organism: Klebsiella pneumoniae  
Culture date: 02/14/2014

XDRO criterion: Molecular test  
Specimen source:

Mechanism of resistance: KPC

Comments:

Submitted by ROBYNN LEIDIG, 03/14/2014, Sample Hospital

Reason for deleting the above record:

Please Select Reason:

- De-colonization or infection resolution
- Data entry error
- Laboratory testing error
- Patient deceased
- Not a CRE
- Other

Comment: 
Querying and automated alerts
Querying the registry

• Currently, querying requires typing patient information into the webpage
  – Reasonable for facilities with few admissions per day (e.g., long term care facilities)
  – Large facilities may want to query only high-risk patients (e.g., transfers)

• Planned: automated CRE alerts
Automated CRE alerts

1. Send patient info (encrypted)
2. Receive CRE alert if match

All Illinois facilities

Automated alerts will be piloted at limited hospitals in 2014; anticipate wider availability in 2015
Question and answer forum
## Upcoming Webinars

<table>
<thead>
<tr>
<th>Target Audience</th>
<th>Topics</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital leadership</td>
<td>Patient safety and quality improvement initiatives,</td>
<td>May 13</td>
</tr>
<tr>
<td></td>
<td>Role of infection prevention</td>
<td></td>
</tr>
<tr>
<td>Laboratorians</td>
<td>CRE testing guidelines,</td>
<td>June 6</td>
</tr>
<tr>
<td></td>
<td>Reporting to XDRO</td>
<td></td>
</tr>
</tbody>
</table>

Webinar recordings and slides will be available at [https://www.xdro.org/cre-campaign/index.html](https://www.xdro.org/cre-campaign/index.html)
Survey and Continuing Education Units

• Fill out webinar evaluation on SurveyMonkey at: https://www.surveymonkey.com/s/CRE-hospital-ip

• Instructions on applying for CEUs will appear at the end of the SurveyMonkey

• Surveys and CEU applications must be completed by Friday, May 9!

Contact: Robynn.Leidig@illinois.gov or Angela.Tang@illinois.gov