Carbapenem-Resistant *Enterobacteriaceae (CRE)* & Multi-drug Resistant *Acinetobacter (MDR-A)*

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Objectives

- What is CRE/ MDR-A
- Transmission
- Who is at risk
- Control measures/ infection prevention
- The Environment
- Additional recommendations
- Supplemental measures
What is Enterobacteriaceae?

- Large family of gram-negative bacilli
  - *E. coli, Klebsiella, Enterobacter*
- Normal part of the GI tract
- Common cause of infections
  - Community
  - Health care-associated

What is Acinetobacter?

- Common in soil & water
- *A. baumannii* – 80% of reported infections
- Can cause variety of illnesses
  - Little risk to the healthy
Transmission

- Person-to-person
  - Contact with positive patients
  - Contact with wounds or stool
- Medical devices or equipment
- Inanimate objects

Who is at Risk?

- CRE & MDR-A infections are more common in patients who have:
  - Frequent or prolonged hospital stays
  - Prolonged antibiotic use
  - Indwelling medical devices
    - Foley’s
    - Central lines
  - Chronic medical conditions
    - COPD, asthma
    - History of surgery
    - Decubitus
Why are these Important?

- Complex resistance
- Rapid transmission in health-care settings
- Limited treatment options available
- High mortality rates

The Development of Resistance

- Production of β-lactamases
  - Resistance to penicillin's
- Production of Extended Spectrum β-lactamases
  - Resistance to β-lactams, monobactams & 3rd gen ceph.
- Production of Carbapenemase
  - Resistance to Carbapenems: Imipenem, meropenem, doripenem, ertapenem
- Identified pan-resistant strains
Resistance Mechanisms

- Mechanisms for Enterobacteriaceae to be CRE
  - Active efflux of antibiotic
  - Structural mutations + overproduction of β-lactamases
  - Production of carbapenemases

Carbapenemases in the U.S.

- *Klebsiella pneumoniae* carbapenemase (KPC)
- Metallo-beta-lactamases (MBL)
  - New Delhi (NDM)
  - Verona integron-encoded (VIM)
  - Imipenemase (IMP)

**All of these are enzymes that make a bacteria be labeled as “CRE”**
What does the Texas Administrative Code (TAC) say?


➢ Multi-drug resistant (MDR) Acinetobacter--MDR-Acinetobacter as defined by ...
Defining CRE

**CDC – CRE Toolkit**
An Enterobacteriaceae that is
- Nonsusceptible to imipenem, meropenem or doripenem
  AND
- Resistant to all the following third-generation cephalosporins that were tested: ceftriaxone, cefotaxime and ceftazidime

**CDC – NHSN MDRO Protocol**
E.coli or any Klebsiella spp. testing non-susceptible to imipenem, meropenem or doripenem by standard susceptibility testing methods or by a positive result for any method FDA-approved for carbapenemase detection from specific specimen sources.

If you have an E.coli or Klebsiella that meets this criteria – report it.

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Defining MDR-Acinetobacter

Nonsusceptible to at least 1 antibiotic in at least 3 antimicrobial classes of the following 6 antimicrobial classes:

<table>
<thead>
<tr>
<th>Beta-Lactam</th>
<th>Aminoglycosides</th>
<th>Carbapenems</th>
<th>Fluoroquinolones</th>
<th>Cephalosporins</th>
<th>Sulbactam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piperacillin</td>
<td>Amikacin</td>
<td>Imipenem</td>
<td>Ciprofloxacin</td>
<td>Cefepime</td>
<td>Ampicillin</td>
</tr>
<tr>
<td>Piperacillin/tazobactam</td>
<td>Gentamicin</td>
<td>Meropenem</td>
<td>Levofloxacin</td>
<td>Ceftazidime</td>
<td>/ sulbactam</td>
</tr>
</tbody>
</table>
State CRE Reporting Requirements

APIC Updated 1/6/14

Lab Detection for CRE

- Clinical and Laboratory Standards Institute (CLSI) breakpoints for determining carbapenem susceptibility
  - Breakpoints were lowered to improve detection
- Modified Hodge Test
  - Tests for carbapenemase
- Other methods
Case Examples

Reportable or not?
Case 1

<table>
<thead>
<tr>
<th>SUSCEPTIBILITY RESULTS:</th>
<th>MIC</th>
<th>INTERP</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMIKacin</td>
<td>3</td>
<td>S</td>
</tr>
<tr>
<td>APNOX/CLAV ACID</td>
<td>&gt;32</td>
<td>R</td>
</tr>
<tr>
<td>AMPICILLIN/ACIDUC</td>
<td>&gt;32</td>
<td>R</td>
</tr>
<tr>
<td>AMPICILLIN</td>
<td>&gt;32</td>
<td>R</td>
</tr>
<tr>
<td>CEPAZOLIN</td>
<td>&gt;64</td>
<td>R</td>
</tr>
<tr>
<td>CEFOTAXIME</td>
<td>&gt;64</td>
<td>R</td>
</tr>
<tr>
<td>CEFUROXIME</td>
<td>&gt;64</td>
<td>R</td>
</tr>
<tr>
<td>ERTAPENEM</td>
<td>&gt;8</td>
<td>R</td>
</tr>
<tr>
<td>GENTAMICIN</td>
<td>&gt;16</td>
<td>R</td>
</tr>
<tr>
<td>TETRACYCLINE</td>
<td>&gt;4</td>
<td>R</td>
</tr>
<tr>
<td>NETROCIN</td>
<td>&gt;1</td>
<td>R</td>
</tr>
<tr>
<td>NITROFURANTOIN</td>
<td>128</td>
<td>R</td>
</tr>
<tr>
<td>PEBER·TAZOBACT</td>
<td>&gt;128</td>
<td>R</td>
</tr>
<tr>
<td>TMP/SMX</td>
<td>&gt;320</td>
<td>R</td>
</tr>
<tr>
<td>TOBRAMYCIN</td>
<td>0</td>
<td>I</td>
</tr>
</tbody>
</table>

THIS ISOLATE DOES NOT PRODUCE A CARBAPENAMASE
Reportable or not?

Case 2

Reportable or Not?

Case 3
Facility Level Recommendations

- Lab detection and notification of CRE
  - Facility antibiogram
- Retrospective surveillance
  - Perform surveillance (6-12mos) to find unreported CRE
- Intra and inter-facility communication of patients
- Hand hygiene survey
  - Accessibility of product
- EVS and healthcare worker training
  - High touch areas and practice adherence

Facility Level Recommendations continued...

Core prevention measures:

1. Hand hygiene
2. Contact precautions
3. Patient and staff cohorting
4. Limit use of devices
5. Antimicrobial stewardship
6. CRE screening
Facility Level Recommendations continued...

Supplemental measures
1. Active surveillance testing
   • Reactive vs. Proactive
2. Chlorhexidine bathing

LTAC Specific Recommendations

➢ Resident placement
   • Low vs. high risk
➢ Modified contact precautions
➢ Occupational and physical therapy
   • Controlled vs. uncontrolled secretions/excretions
➢ Social activities
   • Infection risk vs. psychological risk
➢ Admission of CRE+ patients is ok
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References