

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

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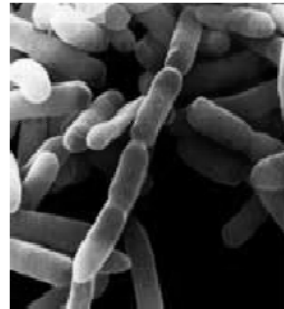
Objectives

- 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



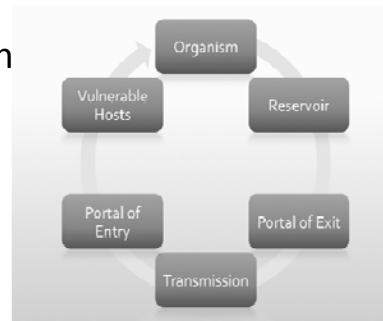
What is Acinetobacter?

- 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

New superbug found in two patients here

Both cases were initially contained as superbugs, but health officials say the bacteria is spreading.

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CRE IS CARBAPENEM-RESISTANT ENTEROBACTERIACEAE

The rise of the superbug

More cases of antibiotic-resistant bacteria are being reported. Health officials say the bacteria is spreading.

Help stop the superbug

A new strain of superbug has been found in Singapore. Health officials say the bacteria is spreading.

GOOD DAY

FOX 29



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



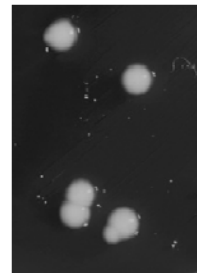
Resistance Mechanisms

- 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)



Klebsiella pneumoniae

**All of these are enzymes that make a bacteria be labeled as “CRE”



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.



Defining MDR-Acinetobacter

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

Beta-Lactam	Aminoglycosides	Carbapenems	Fluoroquinolones	Cephalosporins	Sulbactam
Piperacillin Piperacillin/ tazobactam	Amikacin Gentamicin Tobramycin	Imipenem Meropenem Doripenem	Ciprofloxacin Levofloxacin	Cefepime Ceftazidime	Ampicillin/ sulbactam

If you have an Acinetobacter that meets this criteria – report it.



APIC Updated 1/6/14

State CRE Reporting Requirements



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

>100,000 CFU/ML KLEBSIELLA PNEUMONIAE
 THIS ISOLATE DOES NOT PRODUCE A CARBAPENAMASE
 SUSCEPTIBILITY RESULTS:

AGENT	MIC	INTERP
AMIKACIN	<=2	S
AMOX/CLAV ACID	>=32	R
AMPICILL/SULBAC	>=32	R
AMPICILLIN	>=32	R
CEFAZOLIN	>=64	R
CEFOTAXIME	>=64	R
CEFUROXIME	>=64	R
ERTAPENEM	>=8	R
GENTAMICIN	>=16	R
IMIPENEM	>=8	R
LEVOFLOXACIN	>=8	R
NITROFURANTOIN	128	R
PIPER · TAZOBACT	>=128	R
TMP/SMX	>=320	R
TOBRAMYCIN	8	I



Reportable or not? Case 2


Isolate (Final)
Klebsiella pneumoniae
 ESBL-POSITIVE
 HODGE TEST POSITIVE
 TESTING PERFORMED AT LABCORP
 Carbapenem-intermediate or resistant organism

Iso. #1 (Final)
 Pseudomonas aeruginosa

	Isolate	Isolate
	Carbapenem-intermediate or resistant organism	Pseudomonas aeruginosa

M: C (mcg/ml)

Amikacin (AK)	+>=64 R	>=64 R
Ampicillin (AM)	>=32 R	
Ampicillin/Sulbactam (A/S)	+>=32 R	
Cefazolin (CFZ)	+>=64 R	
Cefepime (CEP)	+>=64 R	16 I
Ceftazidime (CAZ)	+>=64 R	4 S
Ceftriaxone (CRO)	+>=64 R	>=64 R
Ciprofloxacin (CP)	+>=4 R	>=4 R
Gentamicin (GM)	+>=16 R	>=16 R
Imipenem (IMP)	+<=0.255 R	>=16 R
Levofloxacin (LEV)	+>=8 R	>=8 R
Piperacillin/Tazo (TZP)	+>=128 R	>=128 R
Tetracycline (TO)	+>=16 R	>=16 R
Trimethoprim/Sulfa (SXT)	+>=320 R	>=320 R



Reportable or Not? Case 3

Node ID # 2035437
 Result # 1
 Enterobacteriaceae
 Carbapenem-resistant Enterobacteriaceae (CRE)
 Antimicrobial Susceptibility
 ***** S = Susceptible; I = Intermediate; R = R
 P = Positive, N = Negative
 MICs are expressed in micrograms per

Antibiotic	RSLT#1	RSLT#2
Amikacin	S	
Amoxicillin/Clavulanic Acid	R	
Cefazolin	R	
Cefepime	R	
Ceftazidime	R	
Ceftriaxone	R	
Cefuroxime	R	
Cephalothin	R	
Ciprofloxacin	R	
Gentamicin	R	
Imipenem	R	
Levofloxacin	R	
Meropenem	R	
Nitrofurantoin	I	
Piperacillin	R	
Tetracycline	I	
Tetracycline	R	
Trimethoprim/sulfa	R	



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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