



**Background *Acinetobacter baumannii***

Gram-negative, glucose non-fermenter

Causes a variety of infections

- Respiratory
- Bloodstream
- Wound

Can also cause asymptomatic colonization

- Respiratory, skin, gastrointestinal, wounds

Slides courtesy Dr. Cal Ham, CDC

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***A. baumannii* in Healthcare Settings**

Environmental pathogen

- Resistant to effects of desiccation
- Contaminates:
  - Medical equipment
  - Environmental surfaces

Infections linked to healthcare outbreaks (rare outside healthcare settings)

- Acute care hospitals: ICUs and other settings with very ill patients
- Long-term care facilities

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**Carbapenem-Resistant *Acinetobacter***

Multidrug-resistant *Acinetobacter* considered a serious public health threat in the U.S.

- 7,000 infections
- 500 deaths

Carbapenems: "antibiotics of last resort", used to treat highly resistant infections

Carbapenem resistance in *Acinetobacter* dramatically increased from early 2000s to ~2010

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**Mechanisms of Antibiotic Resistance**

Antibiotic

Plasmid

Ribosomes

Impermeability (modified cell wall proteins)

Inactivation (add an phosphate group on the antibiotic, which will reduce its ability to bind to the bacterial ribosomes)

Pumping out (increasing active efflux of the drugs)

Modification (modified drug target)

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**Carbapenemases**

Carbapenemases are enzymes that degrade carbapenem antibiotics

- Public Health concern due to potential for rapid spread, outbreaks

Carbapenemase genes are often on mobile genetic elements that can be transferred among other gram-negative organisms.

Antibiotic-resistant cell

Antibiotic-sensitive cell

Plasmid

Common carbapenemases: KPC, NDM, VIM, OXA, and IMP

- Found in Enterobacteriaceae, *Pseudomonas aeruginosa*, and *Acinetobacter baumannii*

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## Carbapenemase Classifications

| Enzyme                                                     | Classification | Activity                                                                                |
|------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------|
| Klebsiella pneumoniae carbapenemase (KPC)                  | Class A        | Hydrolyzes all $\beta$ -lactam agents                                                   |
| New Delhi Metallo- $\beta$ -lactamase (NDM)                | Class B        | Hydrolyzes all $\beta$ -lactam agents except aztreonam                                  |
| Imipenemase (IMP)                                          |                |                                                                                         |
| Verona Integron Mediated Metallo- $\beta$ -lactamase (VIM) |                |                                                                                         |
| Oxacillinase (OXA)                                         | Class D        | Hydrolyzes carbapenems but not active against 3 <sup>rd</sup> generation cephalosporins |

\*in general

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## Carbapenem-resistant *A. baumannii* (CRAB)

### Acquired class A, B, and D carbapenemases reported

- Metallo- $\beta$ -lactamases and KPC rare
  - Multiple acquired class D oxacillinases
    - OXA-23
    - OXA-24/40
    - OXA-58
    - OXA-48
    - OXA-51
- Plasmid-associated (transferable)  
 Chromosomal-associated (intrinsic resistance)
- Phenotypic methods for carbapenemase production in CRAB are unreliable
    - Verigene is capable of detecting OXA-23, -24, -58, and -51
    - Cepheid is only able to detect OXA-48

Slide courtesy Dr. Jennifer Dalo, Minnesota Department of Health

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## Carbapenem-resistant *A. baumannii* (CRAB)

### CRAB isolates tested at Minnesota Dept. of Health

- PCR is recommended approach to identify carbapenemase genes
  - MDH tests for most common genes (KPC, NDM, OXA-48, VIM, IMP)
  - Missing most common CRAB carbapenemase genes and novel genes
- MDH is validating non-OXA-48 variants and will soon be reported out to facilities



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## OXA-producing CRAB

### CRAB specimen testing by MN ARLN (2018)

- Kansas: 34 CRAB isolates
  - All producing OXA-51 (intrinsic)
  - 27 (79%) OXA-23 or OXA-24
- CDC MDRO Database
  - 5 cases from 3 states (January 2017-July 2018)
    - NDM (2), OXA-24 (1)



\*data are preliminary and subject to change

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## Kansas OXA-Producing CRAB Isolates

### Three clusters of CRAB isolates from May – Dec. 2018

- 12 OXA-23 isolates (2 clusters)
  - MLST 208, 1806 and MLST 281, 1839
- 15 OXA-24 isolates (1 cluster)
  - MLST 208, 1806
  - Potentially related to MO cluster (WGS pending)



All OXA-24 isolates were clinical specimens; all taken from healthcare facilities in the greater KC metro area

- Long-term care facilities, skilled nursing facilities, acute care hospitals

\*data are preliminary and subject to change; \*MLST is based off of the Center for Genomic Epidemiology bioinformatics program.

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## Kansas OXA-24 CRAB Isolates (n=17)

### Patient location at time of isolate collection

- Acute care hospital: 7 (41%)
- Long-term acute care facility: 5 (29%)
- Nursing facility: 5 (29%)

### Specimen sources

- Respiratory: 6 (35%)
- Wound: 6 (35%)
- Urine: 3 (18%)
- Rectal (screening): 2 (12%)



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## Kansas OXA-24 CRAB Susceptibility

|                            |       |                |                               |                        |                           |
|----------------------------|-------|----------------|-------------------------------|------------------------|---------------------------|
| Susceptibility Information |       |                | Card: [REDACTED]              | Lot Number: [REDACTED] | Expires: [REDACTED]       |
|                            |       |                | Completed: [REDACTED]         | Status: Final          | Analysis Time: 6.38 hours |
| Antimicrobial              | MIC   | Interpretation | Antimicrobial                 | MIC                    | Interpretation            |
| EGGL                       |       |                | Meropenem                     | ≥ 16                   | R                         |
| Ampicillin                 |       |                | Ampicillin                    |                        |                           |
| Ampicillin/Sulbactam       | [4]*  | *R             | Gentamicin                    | ≥ 16                   | R                         |
| Piperacillin/tazobactam    | ≥ 128 | R              | Tobramycin                    | ≥ 16                   | R                         |
| Cefazolin                  | ≥ 64  | R              | Ciprofloxacin                 | ≥ 4                    | R                         |
| Cefoxitin                  |       |                | Levofloxacin                  | 4                      | I                         |
| Ceftazidime                | ≥ 64  | R              | Nitrofurantoin                |                        |                           |
| Ceftioxa                   | ≥ 64  | R              | Trimethoprim/Sulfamethoxazole | ≥ 320                  | R                         |
| Cefepime                   | 32    | R              |                               |                        |                           |

== Deduced drug    \* AES modified    \*\* User modified    [] = MIC Suppressed On Chart Report

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## Kansas Core Infection Control Practices for CRAB



### Standard Precautions

- Hand hygiene, PPE

### Contact Precautions

- Wound care
- Ventilator maintenance
- History of MDRO

### Patient Screening

- Screening options limited due to OXA variants other than 48 not being detected on Cepheid

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## Kansas Core Infection Control Practices for CRAB

### Environmental Infection Control

- Daily enhanced environmental cleaning
- Mobile medical equipment
- High-touch areas
- Keyboards



### Inter-facility patient transfer forms

- KDHE developing an inter-facility transfer form with transmission-based precautions based on the type of facility (e.g., skilled nursing, LTACH)

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## Kansas Core Infection Control Practices for CRAB

### Competency assessments and adherence monitoring

- How good are your staff members' practices

**Wound Care Observation Checklist for Infection Control**

The following represent best practices for infection control during wound dressing changes, assessment and care. To evaluate wound practices, observe wound care procedures from start to finish, marking whether practices were appropriate (yes) or not (no) or not observed (n/a). Make notes of all deviations from best practice (areas for improvement).

| Practice                                                                  | Yes | No | N/A | Notes |
|---------------------------------------------------------------------------|-----|----|-----|-------|
| 1. All supplies gathered before dressing change                           |     |    |     |       |
| • Supplies were handled in a way to prevent contamination                 |     |    |     |       |
| • Supplies are dedicated to and labeled for one individual                |     |    |     |       |
| • Multi-dose medications are used                                         |     |    |     |       |
| 2. Hand hygiene performed properly before dressing change                 |     |    |     |       |
| 3. Dressing held properly                                                 |     |    |     |       |
| • Surface cleaned with antiseptic wipes following manufacturer guidelines |     |    |     |       |
| • Surface barrier applied (e.g. Occlusive)                                |     |    |     |       |
| • Hand hygiene performed properly before                                  |     |    |     |       |

**CRAB Environmental Checklist for Monitoring Transient Colonies**

Enter:

Date: [REDACTED]

Unit: [REDACTED]

Room Number: [REDACTED]

Room of Use and Specialty: [REDACTED]

Evaluate the following practices daily for each patient room:

| High-touch items checked | Checked | Not Checked | Not Present in Room |
|--------------------------|---------|-------------|---------------------|
| 1. Bed rails             |         |             |                     |
| 2. Bed wheels            |         |             |                     |
| 3. Bed frame             |         |             |                     |
| 4. Bedside table         |         |             |                     |
| 5. Bed                   |         |             |                     |
| 6. Bedside table         |         |             |                     |
| 7. Bedside table         |         |             |                     |
| 8. Bedside table         |         |             |                     |
| 9. Bedside table         |         |             |                     |
| 10. Bedside table        |         |             |                     |
| 11. Bedside table        |         |             |                     |
| 12. Bedside table        |         |             |                     |
| 13. Bedside table        |         |             |                     |
| 14. Bedside table        |         |             |                     |
| 15. Bedside table        |         |             |                     |
| 16. Bedside table        |         |             |                     |
| 17. Bedside table        |         |             |                     |
| 18. Bedside table        |         |             |                     |
| 19. Bedside table        |         |             |                     |
| 20. Bedside table        |         |             |                     |

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## Kansas Reporting to Public Health (KS)

### Kansas Regulations (K.A.R. 28-1-2, 28-1-18)

- Any carbapenem-resistant bacterial infection or colonization report to KDHE within one business day
  - Carbapenem-resistant Enterobacteriaceae (CRE), *Acinetobacter baumannii* (CRAB), and *Pseudomonas aeruginosa* (CRPA)
  - Reporting form: [www.kdheks.gov/epi/disease\\_reporting.html](http://www.kdheks.gov/epi/disease_reporting.html)
- Laboratories must submit isolate to Kansas public health laboratory
- Outbreaks or clusters of any disease are reportable to KDHE within 4 hours by telephone (877-427-7317).



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## Kansas Reporting to Public Health (MO)

### Missouri Regulations (19 CSR 20.20-020)

- CRE shall be reported in aggregate on a quarterly basis
  - January, April, July, October
- Carbapenemase-producing CRE (CP-CRE) shall be reported within 24-hours to the Bureau of Communicable Disease Control and Prevention
  - Once CP-CRE is reported, an isolate may be sent to the Missouri State Public Health Lab for further testing
- Any outbreaks of Hospital Acquired Infections that pose a risk to public health must be reported regardless of the organism identified

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## Additional Resources

CDC *Acinetobacter* in Healthcare Settings

- [www.cdc.gov/hai/organisms/Acinetobacter.html](http://www.cdc.gov/hai/organisms/Acinetobacter.html)

APIC Guide to Elimination of MDR-*Acinetobacter baumannii* Transmission in Healthcare Settings:

- <https://apic.org/Professional-Practice/Implementation-guides/Acinetobacter>

Pennsylvania Department of Health Wound Care Observation Checklist for Infection Control:

- [www.health.pa.gov/topics/Documents/Programs/HAI-AS/Wound%20care%20observation%20checklist.FINAL.pdf](http://www.health.pa.gov/topics/Documents/Programs/HAI-AS/Wound%20care%20observation%20checklist.FINAL.pdf)

CDC Inter-facility Infection Control Transfer Form:

- [www.cdc.gov/hai/pdfs/toolkits/InfectionControlTransferFormExample1.pdf](http://www.cdc.gov/hai/pdfs/toolkits/InfectionControlTransferFormExample1.pdf)

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## Contact Information

Kansas Department of  
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Infectious Disease Epidemiology and  
Response Section

**Epidemiology Hotline (24/7)**

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**Epidemiology Fax**

877-427-7318

**Email**

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**Website**

[www.kdheks.gov/epi/index.html](http://www.kdheks.gov/epi/index.html)

Missouri Department of Health  
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