Multi-drug Resistant Organisms – Prevention and Response
November 16, 2017
NC SHARPPS
Objectives

• Describe the SHARPPS program

• Discuss multi-drug resistant organisms and the public health significance of these organisms across the continuum of care

• Describe the role of public health in investigating cases and outbreaks in healthcare facilities
Mission

To work in partnerships to prevent, detect, and respond to events and outbreaks of healthcare-associated and antimicrobial resistant infections in North Carolina.
SHARPPS Surveillance for Healthcare Associated & Resistant Pathogens Patient Safety Program

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**Surveillance for Healthcare Associated & Resistant Pathogens Patient Safety Program**

### Surveillance, Investigation & Response
- HAI reporting to NHSN
- CRE surveillance
- DHSR Infection Prevention Breach reporting
- Outbreak & Exposure management

### Prevention, Education & Training
- Campaigns: One & Only, Get Smart
- Drug Diversion
- Antimicrobial resistance & stewardship
- Infection Control, Assessment & Response (ICAR)
- Partnerships

### Monitoring & Evaluation
- Data validation
- TAP reports
- Identification, evaluation of aberrant data (CLABSI, CDI)

### Communication
- HAI data reports
- Newsletters
- Monthly webinar updates
- Drug Diversion tabletop
Defining MDROs
Multidrug-Resistant Organisms (MDROs)
Multidrug resistant organisms (MDROs) - Organisms that have become resistant to multiple types of antimicrobials. Many organisms can become drug resistant, some common examples are in the figure below:

- **CRE** - Carbapenem-Resistant Enterobacteriaceae
- **VRE** - Vancomycin-Resistant Enterococci
- **C Diff** - *Clostridium difficile*
- **ESBLs** - Extended Spectrum Beta-Lactamase Producers
- **MRSA** - Methicillin-resistant *Staphylococcus aureus*
- **MDR Acinetobacter** - Multi-drug resistant *Acinetobacter*
- **MDR Pseudomonas** - Multi-drug resistant *Pseudomonas*

... and more!
Extended-Spectrum Beta-Lactamases (ESBLs)

- Enzyme → Produced by Gram-negative bacteria
- Difficult to treat
- Endemic in United States
  - Can be community acquired
- Spread via direct and indirect contact with colonized/infected patients and contaminated environmental surfaces.
- Improper treatment → organisms may produce another enzyme called carbapenemase
Carbapenem-Resistant Enterobacteriaceae (CRE)

• First recognized in US in 2001

• Enterobacteriaceae = gut bacteria
  • Klebsiella spp.
  • E. Coli
  • Enterobacter spp.

• Resistant to nearly all antibiotics

• Many ways to be resistant
  • Carbapenemase producing CRE (CP CRE)
    • Klebsiella pneumoniae carbapenemase (KPC),
    • New Delhi metallo-β-lactamase (NDM),
    • Verona integron encoded metallo-β-lactamase (VIM),
    • Imipenemase metallo-β-lactamase (IMP)
    • Oxacillinase-48 (OXA-48)
Public Health Significance of Carbapenemase Producing CRE

• “Urgent public health threat” - CDC
• Highly resistant
• Mobile resistance elements
• >9,000 healthcare-associated infections each year
• Up to 50% mortality
Multidrug resistant organisms (MDROs)- Organisms that have become resistant to multiple types of antimicrobials. Many organisms can become drug resistant, some common examples are in the figure below:

CRE - Carbapenem-Resistant Enterobacteriaceae; CP-CRE- Carbapenemase producing CRE; VRE - Vancomycin-Resistant Enterococci; C Diff - Clostridium difficile; ESBLs- Extended Spectrum Beta-Lactamase Producers; MRSA - Methicillin-resistant Staphylococcus aureus; MDR Acinetobacter- Multi-drug resistant Acinetobacter; MDR Pseudomonas- Multi-drug resistant Pseudomonas
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**MDROS:**
- MRSA
- VRE
- C diff
- MDR Pseudomonas
- MDR Acinetobacter
- Candida auris
  ... and more!

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**Enzymes**

**MDROS:**
- MRSA
- VRE
- C diff
- MDR Pseudomonas
- MDR Acinetobacter
- Candida auris
- ... and more!

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Responding to MDROs
What is a healthcare facility?

- Long-term care
- Skilled-nursing
- Hospital
- Dental office
- Dialysis
- Outpatient
Why are investigations in healthcare facilities different?

- Vulnerable population
  - Increased Incidence
  - Higher mortality

- Common source

- Communal living

- Can be initiated or propagated by activities, staff, or other characteristics of the facility

We investigate to prevent, or stop, an outbreak
CRE Case Investigation: Goals

- Identify if transmission/dissemination is occurring
- Identify affected patients
- Ensure appropriate control measures are promptly implemented
- Characterize the organism
CRE Case Investigation: Components

• Initial investigation
  – Healthcare/community exposures

• Infection control considerations

• Contact Investigation
  – Healthcare
  – Healthcare personnel
  – Household

• Prospective laboratory surveillance (clinical cultures)
10 Steps of an Outbreak Investigation

1. Identify investigation team and resources
2. Establish existence of an outbreak
3. Verify the diagnosis
4. Construct case definition
5. Case finding: Find cases systematically / develop line list
6. Perform descriptive epidemiology / develop hypotheses
7. Evaluate hypotheses / perform additional studies (as necessary)
8. Implement control measures
9. Communicate findings
10. Maintain surveillance
Verify the diagnosis

Confirm that a case meets the case definition by reviewing the isolate's susceptibility information
What am I looking for?

• Organism identification
  • May use a culture or “NAAT” (“nucleic acid amplification test”)

• Antimicrobial susceptibility results
  • Also called “MICs” (“minimum inhibitory concentration”) with “interps” (“interpretation”)
CRE

CDC case definition: Enterobacteriaceae resistant to imipenem, meropenem, doripenem, or ertapenem OR documentation that the isolate possesses a carbapenemase

https://www.cdc.gov/hai/organisms/cre/definition.html
CDC case definition: **Enterobacteriaceae resistant to imipenem, meropenem, doripenem, or ertapenem** OR documentation that the isolate possesses a **carbapenemase**
What do you think?
What do you think?

- Organism
- Susceptibility
What do you think?

- Organism
- Susceptibility
What do you think?

- CRE
- Organism = *Enterobacter cloacae*
- Resistant to ertapenem
What do you think?

- Organism(s)
- Susceptibility
What do you think?

- **Organism(s)**
- **Susceptibility**
Next:

- Notify patient and healthcare facilities as appropriate
- Ensure implementation of control measures
Initial control measures

Gown and gloves

Hand hygiene

Prevent opportunities for transmission
Site Visit

• Investigate to stop transmission & prevent future outbreaks
Major Findings from recent investigations

• **Hand hygiene**: inconsistent ✗
• **Wound care**: reusing scissors, interruptions in flow from clean to dirty ✗
• **OT/PT**: contact precautions not adequately maintained, lack of dedicated equipment ✗
• **Contact precautions**: implemented to varying degrees ✗
• **Lack of inter-facility notification**: ✗
• **Outdated policies**: ✗
Additional Control Measures

1. Staff Education
2. Laboratory notification
3. Cohort infected residents
4. Contact precautions
5. Hand Hygiene
6. Environmental cleaning
7. Communicate CRE status to transferring and receiving facilities
8. Review infection prevention policies and procedures
9. Antimicrobial Stewardship
Review the patient’s risk factor information

- Demographics & clinical presentation of infection
- Travel
- Healthcare
  - Complex medical devices (e.g., duodenoscopes)
  - Long term care facility stay
  - Other healthcare exposures
  - Medical devices (catheters, foley, trach, etc) in place within 2 calendar days prior to culture
- Antibiotics
Contact investigation

• Screening may be recommended for high risk contacts
• Coordinated through the antimicrobial resistant laboratory network (ARLN)
• In consultation with DPH and CDC
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9. Communicate findings
10. Maintain surveillance
Surveillance - CP-CRE Nationally Notifiable

• Improved detection

• Track trends and spread over time

• Rapid response and containment

• Prevention and control
CRE Reporting in NC - Next Steps

- Assess clinical laboratory capacity to detect CRE
- Update CRE laboratory guidance
- Rule change
- Build NCEDSS module

- In the mean time.....
CRE activities in NC

• Outbreak response
• Sentinel event investigations
• Education
• Mechanism testing
• Colonization screening
• Special projects
  – Targeted surveillance
  – Non-big three surveillance
More patients get infections when facilities do not work together.

(Example: 5 years after CRE enters 10 facilities in an area sharing patients)

**Common Approach (status quo)**
- 2,000 patients will get CRE.
- CRE will impact **12%** of patients.

**Independent Efforts**
- 1,500 patients will get CRE.
- CRE will impact **8%** of patients.

**Coordinated Approach**
- 400 patients will get CRE.
- CRE will impact **2%** of patients.

SOURCE: CDC Vital Signs, August 2015.
Responding to MDROs

- Detect MDROs
  - Increased awareness and testing
  - ARLN

- Ensure rapid response & containment
  - Prevent transmission
  - Inter-facility communication

- Stewardship efforts
  - Antimicrobial resistance subcommittee
  - Get Smart Campaign

- Education
  - Collaborative effort (SPICE, DPH, LHD)
Resources

• MDROs
  • Management of Multidrug Resistant Organisms in Healthcare Settings, 2006
    https://www.cdc.gov/hicpac/mdro/mdro_toc.html
  
  • Interim Guidance for a Public Health Response to Contain Novel or Targeted Multidrug-resistant Organisms (MDROs)
    https://www.cdc.gov/hai/outbreaks/docs/Health-Response-Contain-MDRO.pdf
  
  • NC DPH CRE information for Long-Term Care Facilities
    http://epi.publichealth.nc.gov/cd/hai/docs/CREinfoLTCfacilities.pdf
  
  • Antimicrobial Stewardship
    • http://epi.publichealth.nc.gov/cd/antibiotics/campaign.html
  
  • NCHAI@DHHS.NC.GOV
Questions?