Carbapenem-Resistant Enterobacteriaceae in Virginia

Results from a Survey of Hospital Infection Preventionists
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Objectives

- Describe laboratory testing capacity for CRE in Virginia

- Describe current CRE surveillance and prevention practices and discuss how they align with recommended Centers for Disease Control and Prevention (CDC) strategies

- Share recommendations on how to improve communication between laboratorians and infection preventionists and between healthcare facilities to enhance timely implementation of CRE control measures
Overview

• Brief CRE background
• Laboratory testing capacity in Virginia
• IP survey methodology
• CRE incidence in Virginia
• Prevention strategies
• Inter-facility communication
• Recommendations
Antibiotic Resistance Threats in the United States, 2013: “These bacteria are immediate public health threats that require urgent and aggressive action.”

Incidence and prevalence of CRE in Virginia is unknown
CRE: Just Another MDRO?

- What makes CRE special...
  - No decolonization strategy
  - Few treatment options available
  - High mortality rate (50% or greater in some studies)
  - Multiple organisms and resistance mechanisms
    - Resistance can hop between many Enterobacteriaceae (over 70 bacteria in the Enterobacteriaceae family)
    - High speed/rate of resistance transfer
Resistance Mechanisms

- Most prevalent carbapenemase in US is *Klebsiella pneumoniae* carbapenemase (KPC)
- “Unusual” resistance mechanisms (NDM-1, VIM, OXA-48)
  - Risk factor: recent (within last 6 months) exposure to hospitalization in a country outside the US
- VDH has specified that any CRE with an unusual resistance mechanism must be reported to the health department as an “unusual occurrence of disease of public health concern”
CDC CRE Toolkit (2012)

• Recommendations for healthcare facilities:
  • Implement recommended CRE infection prevention measures
  • Routinely complete inter-facility transfer forms with documentation of a patient’s CRE status

• Recommendations for health departments:
  • Conduct regional surveillance
  • Educate and assist facilities in implementing recommended prevention measures and inter-facility communication

http://www.cdc.gov/hai/organisms/cre/cre-toolkit
Virginia CRE Laboratorian Survey

- Distributed by VDH and DCLS to 58 sentinel laboratories in Virginia
  - 100% response rate!
  - 84% hospital labs, 7% independent private labs, 9% other
- Goal was to learn more about laboratory testing for CRE in Virginia as well as communication practices when a CRE isolate is identified
Lab Survey - Susceptibility Breakpoints

Carbapenem susceptibility breakpoints used by laboratory/reference laboratory when testing Enterobacteriaceae

<table>
<thead>
<tr>
<th>Carbapenem</th>
<th>Minimum Inhibitory Concentration Breakpoint</th>
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<tbody>
<tr>
<td></td>
<td>≤0.25 mcg/ml</td>
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<tr>
<td>Imipenem</td>
<td>4</td>
</tr>
<tr>
<td>Meropenem</td>
<td>6</td>
</tr>
<tr>
<td>Ertapenem</td>
<td>4**</td>
</tr>
<tr>
<td>Doripenem</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
</tr>
</tbody>
</table>

* Current CLSI breakpoints at the time of survey administration (CLSI M100-S23)
** The CLSI M100-S23 breakpoint for ertapenem is ≤0.5 mcg/ml, which was not specifically asked in this survey. Instead, ≤0.25 mcg/ml was analyzed as a proxy for ≤0.5 mcg/ml.
Confirmatory tests for carbapenemase performed on non-susceptible isolates of Enterobacteriaceae

- **E-test**: 4
- **Kirby-Bauer disk diffusion**: 0
- **Modified Hodge Test (MHT)**: 21
- **Molecular testing, such as PCR**: 3
- **Send isolate to reference laboratory**: 11
- **Other**: 6
- **No confirmatory tests are performed for carbapenemase**: 17

**Confirmatory Test**
IP Survey Methodology

• Developed by VDH and APIC-VA
• Distributed electronically
  • All acute care, children’s, critical access, long-term acute care, military hospitals (n=95)
  • Only one response per hospital, unless facility had both an acute care and long-term acute care hospital, in which case separate responses were requested for each hospital setting
• Open for several weeks Oct - Nov 2013
  • Follow-up e-mails to non-responders
  • Phone calls/e-mails to resolve data quality issues
Demographics of Survey Respondents

• 46/95 responded (48%)
• Largest proportion (46%) had 100-199 beds
• Average IP FTE = 1.53 (range 0.5-8.5)
• Overall, representation of respondents very similar to all hospitals sent survey

<table>
<thead>
<tr>
<th>Hospital Type</th>
<th>Respondents</th>
<th></th>
<th>Surveyed Facilities</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
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<tr>
<td>Acute Care</td>
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<td>76</td>
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<tr>
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<td>2.2</td>
<td>3</td>
<td>3.1</td>
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<tr>
<td>Critical Access</td>
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<td>4.4</td>
<td>7</td>
<td>7.4</td>
</tr>
<tr>
<td>Long-Term Acute Care</td>
<td>2</td>
<td>4.4</td>
<td>5</td>
<td>5.3</td>
</tr>
<tr>
<td>Military</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4.2</td>
</tr>
<tr>
<td>Total</td>
<td>46</td>
<td>100</td>
<td>95</td>
<td>100</td>
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Demographics of Survey Respondents

<table>
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<tr>
<th>Health Planning Region</th>
<th>Respondents</th>
<th>Surveyed Facilities</th>
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<tbody>
<tr>
<td></td>
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<td>Number</td>
</tr>
<tr>
<td></td>
<td>Percent</td>
<td>Percent</td>
</tr>
<tr>
<td>1 - Northwest</td>
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<tr>
<td></td>
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<td>15.8</td>
</tr>
<tr>
<td>2 - Northern</td>
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<td>9</td>
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<tr>
<td></td>
<td>8.7</td>
<td>9.5</td>
</tr>
<tr>
<td>3 - Southwest</td>
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<tr>
<td></td>
<td>37.0</td>
<td>29.5</td>
</tr>
<tr>
<td>4 - Central</td>
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<td>19</td>
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<tr>
<td></td>
<td>21.7</td>
<td>20.0</td>
</tr>
<tr>
<td>5 - Eastern</td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>17.4</td>
<td>25.3</td>
</tr>
<tr>
<td>Total</td>
<td>46</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100</td>
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</tbody>
</table>
CRE Incidence in Virginia Hospitals

- 27/46 hospitals (59%) have previously identified CRE in their facilities

Facilities that have ever identified CRE infections or colonizations from clinical cultures

<table>
<thead>
<tr>
<th>Region</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Eastern</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Northern Region</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Northwest</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Southwest</td>
<td>7</td>
<td>10</td>
</tr>
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</table>
CRE Incidence

- The 27 hospitals that have previously identified CRE most frequently reported identifying CRE 2-10 times per year (44%)

![Bar chart showing frequency of CRE infections/colonizations among facilities that previously identified CRE (n=27)]
Community vs Hospital-Associated

Frequency of CRE infections/colonizations identified **before or within** two calendar days of patient’s admission

- Daily: 0
- Weekly: 2
- Monthly: 4
- 2-10 times/year: 11
- Yearly: 4
- Less frequently than yearly: 5
- Not sure: 1

Frequency of CRE infections/colonizations identified **more than** two calendar days after patient’s admission

- Daily: 0
- Weekly: 1
- Monthly: 1
- 2-10 times/year: 1
- Yearly: 1
- Less frequently than yearly: 6
- Not sure: 4

VDH VIRGINIA DEPARTMENT OF HEALTH
Protecting You and Your Environment
CRE Prevention Strategies

• CDC CRE Toolkit advises all facilities implement 8 core measures to prevent CRE transmission:
  • Hand Hygiene
  • Contact Precautions
  • Healthcare Personnel Education
  • Minimize Device Use
  • Patient and Staff Cohorting
  • Laboratory Notification
  • Antimicrobial Stewardship
  • CRE Screening

• Two additional supplemental measures for facilities with CRE transmission:
  • Active Surveillance Testing
  • Chlorhexidine Bathing
Contact Precautions

• All facilities would place CRE infected patient on contact precautions
  • Time on contact precautions varied:
    • 52% indefinitely, 32% duration of current stay, 9% screen/culture negative
• 42/46 (91%) would place CRE colonized patient on contact precautions
  • Time on contact precautions varied:
    • 44% indefinitely, 34% duration of current stay, 10% until screen/culture negative
Contact Precautions

Frequency with which a facility would place patients on contact precautions, given history or suspicion of CRE infection or colonization

- **History of CRE Infection**
  - Always: 3 (7%)
  - Sometimes: 2 (4%)
  - Never: 9 (20%)
  - Missing: 40 (87%)

- **Suspected CRE Infection**
  - Always: 2 (4%)
  - Sometimes: 2 (4%)
  - Never: 33 (72%)
  - Missing: 4 (9%)

- **History of CRE Colonization**
  - Always: 1 (2%)
  - Sometimes: 1 (2%)
  - Never: 40 (87%)
  - Missing: 1 (2%)

Legend:
- Always
- Sometimes
- Never
- Missing
If Patient Reports Foreign Hospitalization

- 59% of facilities indicate they always collect whether patient has history of recent hospitalization in a country outside of the US

Frequency certain infection prevention measures are implemented if patient reports recent foreign hospitalization:

- Place patient under presumptive contact precautions
- Screen patient for CRE
- Test for resistance mechanisms if patient positive for CRE
Patient and Staff Cohorting

• Place patient in single room:
  • CRE infected - 97%
  • CRE colonized - 89%

• Implement patient/staff cohorting:
  • CRE infected - 24%
  • CRE colonized - 20%
Majority of facilities (87%, n=40) reported having an established system in place for lab to alert IPs in timely manner when CRE identified.

Preferred communication methods for laboratory to report CRE results to infection prevention*

- Phone: 28 facilities
- Automatic alert through IT system: 25 facilities
- Routine lab report: 20 facilities
- Email: 9 facilities
- Fax: 6 facilities
- Page: 3 facilities
- Other**: 1 facility

* Respondents could select more than one answer
**Other specified: “Lab prints all positive cultures to my printer”
Lab Survey: IP Notification

Communication methods used to notify Infection Prevention when CRE isolate is confirmed (n=40)

- **Phone**: 26
- **Email**: 8
- **Page**: 2
- **Fax**: 7
- **Routine lab report**: 19
- **Automatic alert through IT system**: 7
- **Other**: 4

Communication Method
CRE Results on Laboratory Report

IPs were asked if the way the laboratory communicates CRE results on a laboratory report allows Infection Prevention to know it is CRE in a timely manner so appropriate action can be taken:

• N/A, never had a CRE case - 43% (n=20)
• Yes - 41% (n=19)
• No - 13% (n=6)

• Two facilities provided suggestions on how the CRE results on a lab report could be communicated more quickly or effectively:
  • “Make CRE a critical [value] that needs to be called to the nurse.”
  • “Call [directly] to IP.”
Lab Survey: Language on Lab Reports

- Many laboratories added language to lab report to help IPs identify the isolate as a CRE:
  - “CRE”
  - “carbapenem-resistant”
  - “carbapenemase-producing”
- Some added language was not conducive to timely identification of CRE
  - “MDRO”
  - “extended spectrum beta-lactamase (ESBL)-producing”
CRE Screening

- Microbiology record review: review microbiology records for a given time period to detect previously unrecognized or unreported cases
  - 15 facilities (33%) have done this for CRE
  - 6 facilities (40%) identified previously unrecognized/unreported cases
- Point prevalence survey: single round of active surveillance cultures in high-risk units
  - 5 facilities (11%) have done this for CRE
  - 2 facilities did not identify any unrecognized cases, 3 facilities didn’t specify
Screening Epidemiologic Links

- Epidemiologic Link = a patient who was in same unit or was provided care by same healthcare personnel as a person who tested positive for CRE

Facility conducts testing of patients with epidemiologic links to an identified CRE case

Test Patients with Epi Link to CRE Case

<table>
<thead>
<tr>
<th>Yes, always</th>
<th>Yes, sometimes</th>
<th>No</th>
<th>N/A - have not encountered this situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0</td>
<td>15</td>
<td>29</td>
</tr>
</tbody>
</table>
Active Surveillance Testing

• Supplemental measure for facilities that have identified CRE transmission within their facility

• Screen patients at admission for CRE, or screen at admission and periodically during hospital stay
  • Focus on high-risk patients or patients transferred from high-risk settings (e.g., LTACHs)

• 13 facilities reported previously identifying hospital-associated CRE cases
  • Only 4 facilities (31%) have conducted active surveillance testing
Inter-Facility Communication

- In addition to prevention strategies, CDC CRE Toolkit encourages all facilities to routinely communicate a patient’s MDRO status when transferring.

Frequency with which a facility communicates a patient’s CRE status when **transferring** to another facility.

<table>
<thead>
<tr>
<th>Number of Facilities</th>
<th>Communicate Patient’s CRE Status to Receiving Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, always</td>
<td>41</td>
</tr>
<tr>
<td>Yes, sometimes</td>
<td>4</td>
</tr>
<tr>
<td>No</td>
<td>1</td>
</tr>
</tbody>
</table>

Frequency with which a facility receives communication on a transfer patient’s CRE status when **receiving** from another facility.

<table>
<thead>
<tr>
<th>Number of Facilities</th>
<th>Receive Communication on Patient’s CRE Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, always</td>
<td>5</td>
</tr>
<tr>
<td>Yes, sometimes</td>
<td>31</td>
</tr>
<tr>
<td>No</td>
<td>5</td>
</tr>
</tbody>
</table>
Inter-Facility Communication

• To make sure MDRO status gets communicated, the CDC CRE Toolkit recommends using a transfer form for every transfer
  • 69% of facilities reported using a transfer form when transferring a patient to another facility
  • 67% of facilities reported receiving a transfer form when a patient is transferred to their hospital

http://www.vdh.virginia.gov/OLC/Forms/Documents/HOSPITAL/pdfs/Final%20TransferFormJune09editable.pdf
Discussion

- Based on the reported incidence, all regions in Virginia are “regions with few CRE identified” - per CDC CRE Toolkit
  - Toolkit recommends aggressive action to control and prevent further CRE spread
- Limitations:
  - Low response rate - only 48%
  - Survey conducted at single point in time, incidence and prevalence could have changed already
  - Many hospitals not actively screening for CRE - likely the actual CRE incidence in Virginia is higher than what was measured
Recommendations

• Conduct more epidemiologic screenings for CRE, such as point prevalence surveys, retrospective microbiology record reviews, or active surveillance testing of high-risk patients.
  • Will allow facilities to better understand their incidence of CRE and to identify any potentially missed CRE cases
  • VDH can assist by offering educational resources on how to conduct CRE screenings.

• Ensure CRE risk factor information, such as recent foreign hospitalization, is collected at admission and documented in a way that is easy for Infection Prevention and clinical staff to locate in patient’s medical record.
Recommendations

• If a previously unrecognized CRE infection or colonization is identified, assess for and screen any other patients with epidemiologic links to the CRE case to prevent the organism’s spread within the facility.

• The CDC 2012 CRE Toolkit emphasizes that infection prevention measures are the same for patients with CRE infection or colonization. Ensure that the recommended infection prevention measures are carried out for both types of patients in your facility.
Recommendations

• Assess current inter-facility transfer communication methods to determine if they are adequate for CRE, MDROs, and epidemiologically important organisms. Consider adopting an inter-facility transfer form if one is currently not in use.
  • Refer to the Virginia Model Universal Transfer Form or the CDC Inter-Facility Infection Control Transfer Form as a guide.

• Have discussions with laboratory about IP and clinical preferences for laboratory notification of CRE
  • Assure that there is a process to deliver CRE results on weekends and holidays that ensures appropriate infection prevention precautions can be implemented.
Recommendations

• Explore opportunities to participate in antimicrobial stewardship initiatives with other healthcare partners.
  • Stewardship Interest Group of Virginia (SIGoVA): http://www.vshp.org/sigova.html

• Report any CRE suspected or confirmed to have an unusual resistance mechanism (e.g. NDM-1, VIM, OXA-48) to the health department as an “unusual occurrence of disease of public health concern.”
  • Any suspected or confirmed outbreak of CRE (regardless of resistance mechanisms) is reportable too
Resources - VDH

• VDH Multidrug-Resistant Organisms website (includes links to CRE survey report, CRE PPT for education, summary CRE surveillance and prevention recommendations, CRE fact sheet):
  http://www.vdh.virginia.gov/epidemiology/surveillance/hai/MRSAandMDRO.htm

• To find your local health department:
  www.vdh.virginia.gov/lhd

• VDH Healthcare-Associated Infections Program
  • 804-864-8141
Resources - CDC

- CDC CRE laboratory protocol: [http://www.cdc.gov/HAI/pdfs/labSettings/Klebsiella_or_Ecoli.pdf](http://www.cdc.gov/HAI/pdfs/labSettings/Klebsiella_or_Ecoli.pdf)
- CDC Health Advisory on CRE (Feb 2013): [http://emergency.cdc.gov/HAN/han00341.asp](http://emergency.cdc.gov/HAN/han00341.asp)
- CDC Inter-facility Infection Control Transfer Form: [http://www.cdc.gov/HAI/toolkits/InterfacilityTransferCommunicationForm11-2010.pdf](http://www.cdc.gov/HAI/toolkits/InterfacilityTransferCommunicationForm11-2010.pdf)
Thank you!

Questions?

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