“Emerging Infectious Disease”

- **WHO** - one that has appeared in a population for the first time, or that may have existed previously but is rapidly increasing in incidence or geographic range.

- **CDC** - a disease whose incidence in humans has increased in the past 2 decades or threatens to increase in the near future.
  - New infections due to evolution of existing organisms
  - Known infections in new geographic areas or populations
  - Previously unrecognized infections
  - Old infections reemerging

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**Take Home Messages**

1. Are your policies and procedures current for any potential emerging pathogen?

2. Is your staff ready to handle these? (Don’t forget EVS, Lab, etc.)

3. What do you and your facility need to be ready?

4. Call WDH!!! 1-888-996-9104

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**Clostridium difficile NAP1/B1/027**

- North American PFGE type 1
- PCR Ribotype 027
- Restriction Endonuclease B1
- Anaerobic bacillus
- Produces 2 toxins (A, B)
- Spore former
- Causes mild to severe gastrointestinal illness
- produces 16x more A & 23x more B

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**http://www.bactaclean.co.uk/c-diff-disease/**

- North American PFGE type 1
- PCR Ribotype 027
- Restriction Endonuclease B1
- Anaerobic bacillus
- Produces 2 toxins (A, B)
- Spore former
- Causes mild to severe gastrointestinal illness
- produces 16x more A & 23x more B
1935 – *C. diff.* Discovered
1977 - Cause of antibiotic associated diarrhea
1980ish – NAP1/B1/027 identified
2000 - Increased outbreaks & severity
Increased resistance to fluoroquinolones
Increased illness outside acute care
Increased illness in low risk populations
CDI replaced MRSA as most common cause of HAI

Asymptomatic colonization
High concentrations of toxins
High transmissibility
High sporulation
High production of binary toxins
High level of fluoroquinolone resistance
Antibiotics help proliferation
Is *Clostridium difficile* NAP1/B1/027 in Wyoming?

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**C. diff. NAP1/B1/027 Precautions**


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VRSA Mechanisms & Emergence of Resistance

It was on a short-notice through the hospital kitchen that Albert was first approached by a member of the Antibiotic Resistance.
**VISA/VRSA Mechanisms & Emergence of Resistance**

**VRSA Cases in the U.S.**

<table>
<thead>
<tr>
<th>Case</th>
<th>State</th>
<th>Year</th>
<th>Age</th>
<th>Source</th>
<th>Diagnosis</th>
<th>Underlying Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MI</td>
<td>2002</td>
<td>40</td>
<td>Plantar ulcers and Cather tip</td>
<td>Plantar soft tissue infection</td>
<td>Diabetes, dialysis</td>
</tr>
<tr>
<td>2</td>
<td>PA</td>
<td>2002</td>
<td>70</td>
<td>Plantar ulcer</td>
<td>Osteomyelitis</td>
<td>Obesity</td>
</tr>
<tr>
<td>3</td>
<td>NY</td>
<td>2004</td>
<td>63</td>
<td>Urine from a nephrostomy tube</td>
<td>No infection</td>
<td>Multiple sclerosis, Diabetes, kidney stones</td>
</tr>
<tr>
<td>4</td>
<td>MI</td>
<td>2005</td>
<td>78</td>
<td>Toe wound</td>
<td>Gangrene</td>
<td>Diabetes, vascular disease</td>
</tr>
<tr>
<td>5</td>
<td>MI</td>
<td>2005</td>
<td>58</td>
<td>Surgical site wound after panniculectomy</td>
<td>Surgical site infection</td>
<td>Obesity</td>
</tr>
<tr>
<td>6</td>
<td>MI</td>
<td>2005</td>
<td>48</td>
<td>Plantar ulcer</td>
<td>Osteomyelitis MV A, chronic ulcers</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>MI</td>
<td>2006</td>
<td>43</td>
<td>Triceps wound</td>
<td>Necrotizing fasciitis</td>
<td>Diabetes, dialysis, chronic ulcers</td>
</tr>
<tr>
<td>8</td>
<td>MI</td>
<td>2007</td>
<td>48</td>
<td>Toe wound</td>
<td>Osteomyelitis</td>
<td>Diabetes, obesity, chronic ulcers</td>
</tr>
<tr>
<td>9</td>
<td>MI</td>
<td>2007</td>
<td>54</td>
<td>Surgical site wound after foot amputation</td>
<td>Surgical site infection</td>
<td>Diabetes, hepatic encephalopathy</td>
</tr>
<tr>
<td>10</td>
<td>MI</td>
<td>2008</td>
<td>55</td>
<td>Plantar foot wound</td>
<td>Plantar soft tissue infection</td>
<td>Diabetes, chronic kidney disease, chronic arthritis</td>
</tr>
<tr>
<td>11</td>
<td>DE</td>
<td>2010</td>
<td>64</td>
<td>Wound drainage</td>
<td>Prosthetic joint infection</td>
<td>Diabetes, end-stage renal disease, dialysis</td>
</tr>
<tr>
<td>12</td>
<td>DE</td>
<td>2010</td>
<td>83</td>
<td>Vaginal swab</td>
<td>Vaginal discharge</td>
<td>Chronic recurrent C. difficile infection, chronic UTI, vesicoenteric fistula</td>
</tr>
<tr>
<td>13</td>
<td>DE</td>
<td>2012</td>
<td>70</td>
<td>Foot wound</td>
<td>Chronic wound possible osteomyelitis</td>
<td>Chondroblastoma with chronic wound, sepsis, and diabetes mellitus</td>
</tr>
</tbody>
</table>

**VISA/VRSA Cases in WY**

- 1 case in 2014
- Adult
- Natrona County
- Multiple underlying conditions
- History of vancomycin treatment
- History of MRSA
- History of Enterococcus infection
VISA/VRSA Precautions

Management of Multidrug-Resistant Organisms in Healthcare Settings, 2006

Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings

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Carbapenem-Resistant Enterobacteriaceae
- Gram negative
- Typically rod shaped
- Examples: E. coli & K. pneumoniae
- Normal enteric flora
- Common cause of HAI and CAI
- Carbapenems used to treat severe HAI and CAIs
- “Nightmare Bacteria”
**CRE Mechanisms of Resistance**

Enzymes (carbapenemases):
- KPC
- NDM-1
- VIM
- IMP

**CRE vs. ESBL**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>CRE</th>
<th>ESBL Producing Organisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Produce carbapenemases</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Produce extended spectrum beta-lactamases</td>
<td>Yes, usually</td>
<td>Yes</td>
</tr>
<tr>
<td>Resistant to imipenem, meropenem, erapenem</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Resistant to cefotaxime, ceftriaxone</td>
<td>Yes, usually</td>
<td>No</td>
</tr>
<tr>
<td>Resistant to 3rd generation cephalosporins</td>
<td>Yes, usually</td>
<td>Yes</td>
</tr>
<tr>
<td>Resistant to monbactams</td>
<td>Yes, usually</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**CRE**

- 1996 – isolated in NC
- 2001 – KPC identified
- 2009 – NDM1 identified
- 2013 – Outbreak of NDM associated with ERCP
4/9/2015

UNDERSTANDING CRE, THE ‘Nightmare Superbug’ That Contributed to 2 DEA LA.

CRE in WY

Wyoming Hospital Laboratories Testing for CRE, 2013

- Unable to Test
- No CRE detected
- Detected CRE

<table>
<thead>
<tr>
<th>County</th>
<th>CRE Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fremont</td>
<td>Detected</td>
</tr>
<tr>
<td>Laramie</td>
<td>Detected</td>
</tr>
<tr>
<td>Goshen</td>
<td>No CRE</td>
</tr>
<tr>
<td>Platte</td>
<td>No CRE</td>
</tr>
<tr>
<td>Albany</td>
<td>No CRE</td>
</tr>
<tr>
<td>Carbon</td>
<td>No CRE</td>
</tr>
<tr>
<td>Sweetwater</td>
<td>No CRE</td>
</tr>
<tr>
<td>Uinta</td>
<td>No CRE</td>
</tr>
<tr>
<td>Niobrara</td>
<td>No CRE</td>
</tr>
<tr>
<td>Converse</td>
<td>No CRE</td>
</tr>
<tr>
<td>Natrona</td>
<td>No CRE</td>
</tr>
<tr>
<td>Weston</td>
<td>No CRE</td>
</tr>
<tr>
<td>Crook</td>
<td>No CRE</td>
</tr>
<tr>
<td>Campbell</td>
<td>No CRE</td>
</tr>
<tr>
<td>Johnson</td>
<td>No CRE</td>
</tr>
<tr>
<td>Sheridan</td>
<td>No CRE</td>
</tr>
<tr>
<td>Washakie</td>
<td>No CRE</td>
</tr>
<tr>
<td>Big Horn</td>
<td>No CRE</td>
</tr>
<tr>
<td>Hot Springs</td>
<td>No CRE</td>
</tr>
<tr>
<td>Park</td>
<td>No CRE</td>
</tr>
<tr>
<td>Sublette</td>
<td>No CRE</td>
</tr>
<tr>
<td>Lincoln</td>
<td>No CRE</td>
</tr>
<tr>
<td>Teton</td>
<td>No CRE</td>
</tr>
</tbody>
</table>

1. Hand hygiene*
2. Contact precautions*
3. Patient and staff cohorting*
4. Minimize use of invasive devices*
5. Promote antimicrobial stewardship*
6. Screening*
7. Healthcare personnel education
8. Laboratory notification
9. Conduct active surveillance testing
10. Chlorhexidine bathing
Take Home Messages

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Measles

- Highly contagious
- Koplik spots
- IgM serology for DX
- Born prior 1957 – full disease

Complications:
- Pneumonia 1 in 20
- Encephalitis 1 in 1000
- Death 1-2 in 1000

Measles History

- References as early as 7th Century
- 1846 - Incubation and immunity described
- 1963 - Vaccine licensed in U.S.
- Still common worldwide
- 2000 - Declared eliminated in U.S.
Measles

Measles – United States, 1950-2009

Measles – United States, 1980-2009

2015 Measles Cases in the U.S.
January 1 to March 27, 2015
Measles in WY

Measles Cases Reported to Wyoming Department of Health, 1911-2014

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- Family Filoviridae
  - Ebola viruses
    - Marburg virus
- Enveloped RNA viruses
- 5 species of Ebola virus
  - Zaire ebolavirus
  - Sudan ebolavirus
  - Tai Forest ebolavirus
  - Bundibugyo ebolavirus
  - Reston ebolavirus
- All but Reston ebolavirus known to cause disease in humans

- First discovered in 1976 near the Ebola River in the Democratic Republic of the Congo
- Outbreaks have occurred sporadically in Africa
- Largest previous outbreak was 425 cases, 224 deaths (Uganda, 2000)
# Ebola Virus

**Countries with Widespread Transmission**

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Cases (Suspected, Probable, and Confirmed)</th>
<th>Laboratory Confirmed Cases</th>
<th>Total Deaths (% of cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guinea</td>
<td>3515</td>
<td>3093</td>
<td>2335 (66%)</td>
</tr>
<tr>
<td>Liberia</td>
<td>9862</td>
<td>3151</td>
<td>4408 (45%)</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>12155</td>
<td>8558</td>
<td>3841 (32%)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>25532</td>
<td>14802</td>
<td>10584 (42%)</td>
</tr>
</tbody>
</table>


---

**Layered Lines of Defense against Ebola**

- **United States**
  - **ENTRY screening**: Transfers coming from countries with widespread Ebola transmission to one of five US airports (New York JFK, Atlanta, Dulles, Chicago O’Hare, and Miami).
  - Transfers are screened for symptoms and potential exposures and referred for post-arrival monitoring.

- **En Route**
  - All air-crafting in the United States are required to screen and transfer any suspect cases to US centers.
  - Suspected or exposed transfers are not permitted to leave.

- **West Africa**
  - **EXIT screening**: All travelers leaving countries with widespread Ebola transmission are screened before getting on their flights.
  - Suspected or exposed transfers are not permitted to leave.

---

**U.S. Entry Screening Data: 10/11/2013-3/24/2015**

<table>
<thead>
<tr>
<th>Travelers Screened</th>
<th>Referred to CDC for Public Health Assessment</th>
<th>Medical Evaluation (decontaminated from airport)</th>
<th>Ebola Cases Detected on Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>11,361</td>
<td>1,244 (11%)</td>
<td>20 (49.2%)</td>
<td>0*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Persons under investigation</th>
<th>PUI’s tested for Ebola</th>
<th>PUIs Confirmed as Ebola case</th>
</tr>
</thead>
<tbody>
<tr>
<td>272</td>
<td>117</td>
<td>0</td>
</tr>
</tbody>
</table>

* One traveler identified as a case after developing initial symptoms 4 days after arrival.
Ebola Virus Precautions

- Standard, contact AND droplet precautions
- Complete isolation
- Sharps safety
- Safe work practices
- Hand hygiene
- Barrier protection upon entry into room
- Appropriate waste handling

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Enterovirus-D68

- Family Picornaviridae
  - Polioviruses
    - Non-polioviruses
  - 1 of 100 non-polioviruses
  - Non-enveloped, ssRNA
  - Causes respiratory illness
  - WPHL Respiratory Panel to rule out other causes
**EV-D68**

- 1962 - Identified in CA
- 1987-2005 - Regular but sporadic cases
- 2005-2011 - Clusters in GA, PA, AZ
- 2014-2015 – Largest outbreak in US
- Associated with respiratory illness, acute flaccid myelitis and paralysis in children

---

**Laboratory Confirmed EV-D68 Cases, WY, 2014**

- Fremont Laramie Goshen Platte Albany Carbon Sweetwater Uinta Niobrara Converse
- 0 cases 1 case 2 cases

---

**EV-D68 Precautions**

- **Contact Precautions**
- **Droplet Precautions**

*In addition to standard precautions*
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Chikungunya

- Family Togaviridae
- Genus Alphavirus
- ssRNA arbovirus
- Symptoms
  - bilateral symmetric polyarthralgia
  - high fever
  - Rash
  - HA, myalgia, arthritis, N/V
- Death is rare, elderly

Chikungunya vs. Dengue

<table>
<thead>
<tr>
<th></th>
<th>Chikungunya</th>
<th>Dengue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever (≥39°C)</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>Arthralgia</td>
<td>+++</td>
<td>+/-</td>
</tr>
<tr>
<td>Arthritis</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Headache</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Rash</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Myalgia</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>+/-</td>
<td>++</td>
</tr>
<tr>
<td>Shock</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Lymphopenia</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Neutropenia</td>
<td>+</td>
<td>+++++</td>
</tr>
<tr>
<td>Thrombocytopenia</td>
<td>+</td>
<td>+++</td>
</tr>
<tr>
<td>Hemocoagulation</td>
<td>-</td>
<td>++</td>
</tr>
</tbody>
</table>

Both pictures above are from: Mohan et al. 2010 (Indian Journal of Dermatology, 2010, Jan-Mar: 55(1):54-63)
Chikungunya Life Cycle

Chikungunya Vectors

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