Public Health Epidemiology for Infection Prevention Practitioners in Idaho

I-APIC 14th Annual Educational Conference

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Idaho Division of Public Health
Idaho Public Health structure

**National**
Centers for Disease Control and Prevention

**State**
Division of Public Health and Bureaus/Programs

**Local**
Seven Independent Public Health Districts
Local Public Health Districts
Public Health case definitions

- Each disease has a formal case definition to standardize surveillance
- A “case” is close, but not exactly equal to, a “diagnosed patient”
- Idaho generally follows the CDC/CSTE case definitions with few exceptions

**Pertussis (Whooping Cough) (Bordetella pertussis)**

**2010 Case Definition**

**CSTE Position Statement(s)**
09-ID-51

**Case Classification**

**Probable**
In the absence of a more likely diagnosis, a cough illness lasting ≥2 weeks, with at least one of the following symptoms:
- Paroxysms of coughing; OR
- Inspiratory "whoop"; OR
- Post-tussive vomiting; AND
- Absence of laboratory confirmation; AND
- No epidemiologic linkage to a laboratory-confirmed case of pertussis.

**Confirmed**
- Acute cough illness of any duration, with isolation of *B. pertussis* from a clinical specimen; OR
- Cough illness lasting ≥2 weeks, with at least one of the following symptoms:
  - Paroxysms of coughing; OR
  - Inspiratory "whoop"; OR
  - Post-tussive vomiting; AND
  - Polymerase chain reaction (PCR) positive for pertussis;
- OR
- Illness lasting ≥2 weeks, with at least one of the following symptoms:
  - Paroxysms of coughing; OR
  - Inspiratory "whoop"; OR
  - Post-tussive vomiting; AND
  - Contact with a laboratory-confirmed case of pertussis.

**Comment(s)**
The clinical case definition above is appropriate for endemic or sporadic cases. In outbreak settings, a case may be defined as a cough illness lasting at least 2 weeks (as reported by a health professional).
Monitoring diseases in Idaho

- Diseases established as reportable by law
- Specific diseases healthcare providers and facilities are required to report to a public health agency
- Sentinel surveillance
- Influenza, RSV
- Diseases that cause outbreaks or clusters
- Outbreaks of non-reportable diseases (e.g., human metapneumovirus, scabies)
Example: Human Metapneumovirus

- SWDH contacted by a Canyon County LTCF
  - Cluster of 7 residents with pneumonia in last week; several hospitalized; expect 2-3 cases during the time period
- Site Visit
  - IC processes; chart review; completed line-list/questionnaire
- Case Definition
  - Cough onset in a resident or employee during the timeframe
    - Confirmed: meets clinical criteria (URTI/LRTI and physician diagnosed pneumonia)
    - Probable: insufficient information to determine if clinical criteria for respiratory illness were met

Investigation results

- 40 cases met case definition
  - 28 confirmed; 12 probable
- Attack rate
  - Residents 34% (29/86); Employees 9% (11/119)

Case report
Laboratory report
“Suspects”

Fax
Phone
Electronic

Public Health case investigation and intervention

Public Health surveillance systems

Reporting and discussion about individual patients is allowed under HIPAA
Interventions based on reports

Utah DOH contacted us regarding an Idaho resident in University Hospital with CRE

Although not reportable, the disease falls under “emerging” or “extraordinary” occurrence of illness
Interventions based on reports

- Called epidemiologist in public health district in which the patient resided
  - Any reports received?
- State Epis coordinated with the Utah DOH RE: medical records from the Utah facility
- Medical records forwarded to local epidemiologist
  - Hx of ESBL, ertapenem IV x 1 mo recently
    - ESLD secondary to sclerosing cholangitis
    - Liver transplant candidate
  - Admitted to Idaho hospital prior to transport to Utah facility
Interventions based on reports

- Local epidemiologist contacted the Idaho hospital the patient was transferred from
  - Was the patient tested for any bacterial infection or colonization prior to transport (did they already know about the infection)?
  - Shared results of Utah lab report with the Idaho facility
- Worked with infection prevention staff to ensure that contact precautions had been taken while the patient was admitted in the Idaho facility
Annual surveillance data summaries

- Disease data and statistics
- Annual Reportable Disease Summary
  - All reportable conditions reported to public health in the previous calendar year
  - Statewide and by Public Health District and county of residence (not shown)
Disease trend data

Slide deck of disease trend slides available on the website with Idaho and U.S. data for each year
Outbreak data – etiologies, 2006-12

- **Norovirus** 32.9%
- **Gastroenteritis** 21.5%
- **Pertussis** 9.7%
- **Campy** 5.7%
- **STEC** 5.3%
- **Salmonella** 4.8%
- **Crypto** 3.5%
- **Other** 16.7%

Most outbreaks investigated in the last 7 years are due to enteric illnesses.

Outbreak data – venues, 2006-12

- Over ¼ of all outbreaks reported occur in assisted living facilities (includes LTCF, assisted living, skilled nursing)
- Half of all outbreaks were assisted living facilities or households (where people live)

<table>
<thead>
<tr>
<th>Venue</th>
<th>#</th>
<th>%</th>
<th>Cum %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assisted Living</td>
<td>57</td>
<td>25.6</td>
<td>25.6</td>
</tr>
<tr>
<td>Household</td>
<td>53</td>
<td>23.8</td>
<td>49.3</td>
</tr>
<tr>
<td>Restaurant</td>
<td>29</td>
<td>13.0</td>
<td>62.3</td>
</tr>
<tr>
<td>School</td>
<td>12</td>
<td>5.4</td>
<td>67.7</td>
</tr>
<tr>
<td>Daycare</td>
<td>11</td>
<td>4.9</td>
<td>72.6</td>
</tr>
<tr>
<td>Community</td>
<td>9</td>
<td>4.0</td>
<td>76.7</td>
</tr>
<tr>
<td>Gathering/event</td>
<td>8</td>
<td>3.6</td>
<td>80.3</td>
</tr>
<tr>
<td>Recreational water</td>
<td>8</td>
<td>3.6</td>
<td>83.9</td>
</tr>
<tr>
<td>Hospital</td>
<td>6</td>
<td>2.7</td>
<td>86.5</td>
</tr>
<tr>
<td>Campground/camping</td>
<td>5</td>
<td>2.2</td>
<td>88.8</td>
</tr>
<tr>
<td>LTCF</td>
<td>4</td>
<td>1.8</td>
<td>90.6</td>
</tr>
<tr>
<td>Residential facility</td>
<td>4</td>
<td>1.8</td>
<td>92.4</td>
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<tr>
<td>Jail</td>
<td>3</td>
<td>1.3</td>
<td>93.7</td>
</tr>
<tr>
<td>Rehab facility</td>
<td>2</td>
<td>0.9</td>
<td>94.6</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>4.5</td>
<td>99.1</td>
</tr>
<tr>
<td>Unknown</td>
<td>2</td>
<td>0.9</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Meaningful Use impact on reporting
“Using electronic health records (EHRs) to achieve significant improvements in care.”
Percent of reportable disease laboratory reports received electronically

Turner K, Hamilton J, Hall J, et al. Progress in Increasing Electronic Reporting of Laboratory Results to Public Health Agencies — United States, 2013. MMWR. September 27, 2013 / 62(38);797-799
Antibiotic Resistance
Urgent Threats
- *C. diff*
- CRE
- *N. gonorrhoeae*

Serious Threats
- *Acinetobacter*
- *Campylobacter*
- Fluconazole-resistant *Candida*
- VRE
- ESBLs
- *Pseudomonas aeruginosa*
- *Salmonella*
- *Shigella*
- MRSA
- *Streptococcus pneumoniae*
- Tuberculosis

Concerning Threats
- VRSA
- Erythromycin-resistant GAS
- Clindamycin-resistant GBS
CDC emphasizing the “Call to Action”

- Preventing infections and preventing the spread of resistance
  - We are already educating the population regarding the prevention activities: immunization, safe food preparation, handwashing, using antibiotics as directed/only when necessary

- Tracking resistant bacteria
  - We are doing this; additional data on risk factors would inform interventions and detect emergent additional resistance

- Improving the use of today’s antibiotics
  - Antibiotic stewardship programs
  - Reduced use of antibiotics in agriculture / food production

- Promoting the development of new antibiotics and developing new diagnostic tests for resistant bacteria
History of Hospital Epidemiology

How we got where we are
Public Health, Infection Control, and Hospital Epidemiology History

**Public Health?**
Plague victim bodies collected/disposed of; visitors from infected areas hanged; isolation of infected/exposed

**Medieval Era: Dirty and deadly**
Outbreaks of disease in communities killed millions

**5TH Century**

**Hospitals**
12th Century: 1st European hospitals (est. by religious orders) for the sick, insane, and destitute

**Hospitals**
13th Century: Leprosy hospitals; later “pest houses”

**5TH Century**

**Plague, smallpox, influenza, dysentery, and typhus**

**Medicine**
Wound prophylaxis (cautery, oil/treacle)
Surgery performed by barber/surgeons

**15TH Century**

When a sick person entered a hospital, property was disposed of. In some regions, a requiem mass was held as if he or she had already died

Epidemics of infectious disease persisted up to 1650
Public Health, Infection Control, and Hospital Epidemiology History

**Infectious disease leading cause of death**

1500 - 1800

**Early Modern Era: Rise of public health and hospitals**

- **Life expectancy**: 19-33 years
- **1796**: Edward Jenner - smallpox

**Vectors**
Lice, vermin, other zoonotic vectors problematic

**In 1793, yellow fever killed 10% of the residents of Philadelphia (including 10 of the 80 physicians). In response, Philadelphia created one of the 1st health departments in the country**

**Cleaning servants**
People who slept on your woolen/cotton goods to rule out contagious illness

**Treatments**
purges, emetics, calomel (tincture of mercury), opium, quinine, and bloodletting

**PEOPLE WITH MONEY WOULDN’T BE CAUGHT DEAD IN A HOSPITAL**

At Bellevue Hospital in NYC and Blockley Hospital In Philly, care was provided by prisoners!
AMPUTATIONS: 40% MORTALITY RATE
Public Health, Infection Control, and Hospital Epidemiology History

1800

Progressive Era: Germ theory

Public Health: pasteurization, water and sewer systems

- Use of soap became widespread. A bar of Ivory soap cost 7 cents in 1897

- Big Names
  - Semmelweis (hand hygiene)
  - Koch (anthrax – bacteriology)
  - Pasteur (smallpox, rabies)
  - Lister (antisepsis)
  - Nightingale (antisepsis, nursing)

- Leading cause of death
  In 1900 was influenza and pneumonia, followed by TB

- Health Departments
  By 1900, 40 of the 45 states had health departments

- 25% of children 1-14 years of age died from diphtheria, measles, scarlet fever, or whooping cough

- At turn of the century, TB, pneumonia, wound infections, and typhoid fever were common hospital infections

1940

Death rates for many common infections started falling in the 1800s
By 1900, most hospitals gave patients a bath on admittance, often after lengthy debate, because many patients felt that water was weakening.

(Picture: 1900 Clarkson Hospital Operating Room in Omaha, Nebraska)
Public Health, Infection Control, and Hospital Epidemiology History

1940s
- **Antibiotic use begins; Hospital building boom**
- Federal Food, Drug and Cosmetic Act of 1938
  - Required proof of safety before using new drugs
- 1942 Penicillin administered at Yale University Hospital
- CDC founded in 1946
  - From the Office of Malarial Control
  - Earliest formal infection control programs appeared in the 1950s – originally focused on environmental cleanliness

1950s
- Post WWII: Rise of public health and hospitals
- Hill-Burton Act
  - Hospital Survey and Construction Act of 1946
- HCPs at significant risk for TB infection
  - 30-100% of nurses/nursing students with (-) skin tests converted to (+) during training; 10-23% developed clinical TB. High TB conversion rates in medical students were associated with attending autopsies of TB patients
- S. aureus emerged as a predominant pathogen by the 1950s, in part due to antibiotic resistance
Public Health, Infection Control, and Hospital Epidemiology History

Surveillance
The National Nosocomial Infection Surveillance System (NNIS) established in 1970 now the National Healthcare Safety Network (NHSN) since 2005


1991 OSHA released the Bloodborne Pathogens Standard

2000 IOM in To Err is Human: Building a Safer Health System

2009 ARRA Funding Brings Public Health together with Healthcare for HAI prevention

1976: Joint Commission created as Joint Commission on Accreditation of Healthcare Organizations

Reduce HAIs by 32%: Findings from SENIC
- Surveillance/feedback of IC rates to staff
- Enforcement of preventative practices
- Supervising IP to collect/analyze data
- Involvement of physician / microbiologist with specialized training in IC

Modern era: Systems thinking

Antibiotic resistance; prevention through collaboration

In 2008 CMS implemented withholding reimbursement for certain HAIs
Healthcare Associated Infections
And Hospital Epidemiology
Why MDRO HAIs matter to public health

- **Hospital Acquired**
  (Most severely ill hospitalized patients)

- **Healthcare Associated**
  (Spreads to other patients in the healthcare environment)

- **Community**
  (Moves from healthcare environments to the community)
HAI Program Activities

- State program funded through CDC
  - 2009-2011: $$ for surveillance infrastructure / support for acute care facilities
  - 2012-2014: $$ supports technical assistance and surveillance data validation

- Idaho Hospital Association (IHA)
  - Ginger Floerschinger-Franks, DrPH
  - Recruitment
  - Technical Assistance
  - Data Validation
  - Data Summarization
Idaho HAI Program - Surveillance

- Required Reporting (IDAPA 16.02.10)
  - Invasive MRSA (MRSA 1) reported to Public Health as a reportable disease
  - Invasive MRSA risk factor chart review: 2014

- Voluntary Reporting
  - MRSA 2 – Incidence rate of MRSA BSIs based on clinical cultures
    - Hospital-wide; based on lab identification
  - SSI 1 – Surgical site infections from specific procedures
    - Gallbladder surgery, colon surgery, and hip prostheses
Invasive MRSA in Idaho

- Idaho annual incidence rate: 7.2 / 100,000 pop.
  - National rate: 31.8 / 100,000 pop.*

<table>
<thead>
<tr>
<th>Population</th>
<th>Incidence</th>
<th>Incidence rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>111</td>
<td>7.2 / 100,000</td>
</tr>
<tr>
<td>Rural residents</td>
<td>32</td>
<td>3.5 / 100,000</td>
</tr>
<tr>
<td>Urban residents</td>
<td>79</td>
<td>12.4 / 100,000</td>
</tr>
</tbody>
</table>

- Annual incidence rates and CFRs significantly lower in rural vs. urban populations

<table>
<thead>
<tr>
<th>Population</th>
<th>Total deaths</th>
<th>CFR</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural residents</td>
<td>3</td>
<td>61.2</td>
<td>0.2952</td>
</tr>
<tr>
<td>Urban residents</td>
<td>21</td>
<td>179.5</td>
<td></td>
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</table>

Invasive MRSA in Idaho

Severity of disease is significantly higher if healthcare-associated vs. community-associated infection

<table>
<thead>
<tr>
<th>Environment</th>
<th>Cases</th>
<th>Mean LOS(^1)</th>
<th>Min</th>
<th>Max</th>
<th>SD</th>
</tr>
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<tbody>
<tr>
<td>HA-MRSA</td>
<td>119</td>
<td>10.5</td>
<td>0</td>
<td>127</td>
<td>13.546</td>
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<tr>
<td>CA-MRSA</td>
<td>2</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Community-associated (CA): Infection in an individual without any known HA risk factors

Healthcare-associated (HA): Infection in an individual with history of invasive devices placed; MRSA infection/colonization; or surgery, hospitalization, dialysis, or residence in a long-term care facility in the previous 12 months

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1. Disease severity proxy = mean length of stay (LOS)

Due to lack of hospital stays among patients with CA-MRSA, all cases (including LOS=0) were included in analyses to ensure comparability
Invasive MRSA RFs in Idaho

- Most common risk factor: hospitalization within 12 months prior to culture
  - Second most common: surgery within 12 months prior to culture
- MRSA history (n=138 w/documentation)
  - 16% had previous MRSA colonization or infection
  - 6% had (+) culture from same site 7-30 days after initial culture
  - 7% had (+) culture from site other than the initial culture site
Future of Idaho HAI Program

- Continuing activities in HAI Surveillance in Idaho
  - Invasive MRSA chart review in 2014
- HAIs are a CDC “Winnable Battle” and will continue to get funded during current administration
- Monitoring emerging threats like CREs (e.g., *Klebsiella pneumoniae*)
  - 3/29 facilities surveyed (10.3%) identified CRE in last year; 50% believed it was an epidemiologically important MDRO
- Future prevention activities will expand focus to transitions of care between acute and long term care facilities (SNF, ALF, NH, RF)
Changes in Nursing Home Care

- From 1999-2008
  - 16% SNF beds / 1,000 US Population
  - 10% LTC Residents
  - 22% in percentage of LTC recipients <65

- Shorter length of stay
- Post-acute care population growing
- Custodial care shifting to assisted living facilities or home-care and away from skilled nursing facilities

Nosocomial Infections and Outbreaks

*Nosos* (illness) and *Komeion* (care)

*Nosokomein* (Hospital)
Nosocomial Infections and Outbreaks

Hospitals/surgery centers are full of sick people coming to get well, but hospitals and invasive outpatient interventions introduce risks that could harm a patient’s health.

Infections are common, outbreaks are uncommon.
Environmental and HCP cultures

- Confirming source of HAI outbreak
  - Molecular typing is often necessary for confirmation
  - What does a negative result mean?
    - Not the source?
    - Organism cleared or no longer present?
    - Intermittent shedding or colonization?
    - Wrong area sampled?
  - Many organisms are ubiquitous (e.g., staph) and without molecular typing, it is difficult to be certain
Contacting Public Health: Other roles in patient management and disease control

- Obtaining botulism antitoxin
- Immunization questions
- TB and Rabies questions
- Poison Control
- Cancer Registry
- Isolate testing: facility outbreaks (IBL)

Most calls from clinicians are either regarding possible rabies exposure, questions around TB testing and/or treatment, or concerns about a perceived increase in cases of a certain disease.

Business hours: 334-5939; after hours contact State Communications: 1-800-632-8000)
Questions?