Prevention of Healthcare-Associated Legionella Disease, and other HAIs

What is this talk about?

- HAI program
- Antibiotic stewardship and resistance
- Outbreak detection and management
- Waterborne causes of non-GI illnesses
- Legionella
- Legionella water management programs

Who are we?

- DHHS Lincoln, DPH, Epidemiology
- HAI Office @ DHHS Lincoln, DPH, Epidemiology
- DHHS Environmental Health
- ICAP
- ASAP
- MDStewardship
- NPHL
- Safe Infection Program
- HAI Advisory Committee
HAI Program Lincoln

- Dr. Maureen Tierney - Director, Collaboration, Partnerships
- Dr. Caitlin Pedati - Outbreak Detection and Management
- Margaret Drake, IP - NHSN Data Validator and IP Mentor
- Peg Gilbert, RN, CIC, Safe Injection Program

ICAP
Infection Control Assessment and Promotion Program

- CDC funded via Ebola supplement to the ELC
- Voluntary and Confidential
- Evaluates Infection Control Practices and proposes mitigation
  - Acute Care Hospitals, esp. CAH
  - Long-term Care
  - Ambulatory Clinics
  - Dialysis

ASAP
Antimicrobial Stewardship Assessment and Promotion Program

- Evaluates antimicrobial prescribing practices in selected acute care hospitals and long-term care facilities
- Provides expert support in creation of antibiograms, ID pharmacy consultation, techniques for stewardship
- Utilizes data to create tools for all facilities to access on website (ASAP Nebraska)
- This year assessing sustainability of programs put into place
- Antibiotic Symposium, webinars and lectures
MDStewardship

- Telemedicine Model for antibiotic stewardship
- Assess stewardship program and capacity onsite
- Helps set up formulary changes, antibiograms
- Daily teleconference re-cases
- Grant funding for 5 rural critical access hospitals
- AS expert from Creighton

Goals of DHHS HAI Team

- Monitor and reduce HAIs
- Detect outbreaks and resistance
- Manage/contain resistance and outbreaks
- Prevent via stewardship and reduced transmission
- Educational resources for HCWs
- Education for public website

Monitoring HAIs

- National Healthcare Safety Network-CDC-now reportable in NE
- Tied to reimbursement-CMS
- Review SIRs, Validate Data, Brainstorm reduction strategies
  - All PPS Hospitals, LTACHs, and Rehab
    - CLABSI
    - CAUTI
    - SSI Colectomy and TAH
    - CDI
    - MRSA Bacteremia
    - Dialysis Centers-BSI, ABIC starts
Creation of a database containing susceptibility patterns for all reportable organisms
- Slowly rising in NE
- Efforts to reduce
  - Antibiotic stewardship
  - Reducing transmission inter-facility
  - Contact precautions
  - Environmental cleaning

**Clostridium difficile**
Antibiotic Susceptibility Data Registry

- Reportable since 2010
- Requires appropriate receipt of HL7 formatted messages from hospital to secure servers
- End result is a line list
- Screen for resistant organisms (CRE, VISA/VRSA, colistin resistance)
- Detect clusters of MDROs
- Follow development of resistance over time

Monitoring for Resistance

- All CREs
- CP-CRE
- CR-Pseudomonas
- Colistin R-Acinetobacter, mcr
- VISA, VRSA
- Candida auris

Outbreak Detection and Management

- Coordination with LHD
- Defining outbreaks
- Defining protocols
- Education to facilities
- Looking for colonization
Carbapenem Resistance

- Non-susceptible to any carbapenem
  - 4mcg imipenem, meropenem, doripenem
  - 2mcg ertapenem
  - OR + for carbapenemase
- Send to NPHL for:
  - Carbapenemases
  - Phenotypic testing
  - Molecular testing
  - If + phenotypic, -molecular ? novel

- Amp-C or ESBL + loss of porins
- Carbapenemases- mobile genetic components (CP-CRE)
  - Klebsiella pneumoniae Carbapenemase (KPC)
  - New Delhi Metallo-B-lactamase (NDM)
  - Verona Integron-encoded metallo-B-lactamase (VIM)
  - Oxacilinases-48-type carbapenemase (OXA-48)
  - Imipenem metallo-B-lactamase (IMP)

- All CREs contact precautions
  - While awaiting confirmation of presence of a carbapenemase
    - Private room and contact precautions
  - Contact DHHS Dr. Pedati or Dr. Tierney
  - Will work IP to determine colonization testing plan
  - Will send swabs to facility to culture contacts to detect colonization
  - Use transfer form
Microorganisms that like water

- Legionella
- Non-tuberculous mycobacteria (NTM)
- Non-enteric gram-negative rod bacteria (GNR)
  - Pseudomonas
  - Burkholderia
  - Aeromonas
- Enteric bacteria
  - Cryptosporidia
  - CRE
  - E.coli
  - Salmonella

Mechanisms of Illness

- Aerosolization
  - Inhalation—Legionella
  - Falls on top surfaces or wounds—NTM
- Direct contact from water—NTM, Aeromonas
- Contamination of environment—non-enteric GNR
  - Use of common equipment
  - Hands of HCWs

Legionella

- Moderate to severe "atypical" pneumonia (milder form: Pontiac fever)
- Acquired from inhalation of small droplets of water that contain Legionella bacteria.
  - ≥50 years, current or former smokers, and those with chronic diseases or a weakened immune system are at higher risk for Legionnaires' disease.
- Symptoms: Cough, Fever, SOB, HA, muscle aches, less commonly nausea, diarrhea
- Incubation: 2-14 days
- Diagnosis—urinary antigen, sputum or bronch PCR inc resp panel and/or culture
- Case Fatality Rate: 10%
- Treatment—macrolides, fluoroquinolones, tetracyclines, tigecycline
In the United States, reported cases of Legionnaires' disease have increased by nearly four and a half times since 2000. More illness occurs in the summer and early fall but can happen any time of year.

Number of Legionella Cases by Year, Nebraska

Healthcare-Associated Legionella

National Information
- 21 jurisdictions around the country
- Active Surveillance for Legionella
- 3,100 cases
- Overall mortality 10%
- 20% of cases healthcare associated
  - 3% definite (previous 10 d in HCF)
  - 17% probable (part of previous 10d in HCF)
- Mortality of definite HCA cases-25%
Legionellosis outbreaks most often occur in hotels, long-term care facilities, and hospitals. Legionella bacteria grows best in building water systems that are not well maintained, especially where levels of chlorine or other disinfectants are low and water temperatures are optimal for growth. The most common sources are potable water (e.g., drinkable water used for showering), cooling towers, hot tubs, and decorative fountains. The key to preventing outbreaks is good management of building water systems, in accordance with industry recommendations. Prevention is critical as Legionella was the cause of 66% of all potable water-associated outbreaks reported to CDC during 2011–2012 (Beer et al., 2015).


- In 70% of outbreak cases inadequate water disinfectant levels were reported and in 52% of cases water temperature was found to be inadequate to prevent growth. Both were an issue in several cases.
- Indications of inadequate maintenance of hot tubs and decorative fountains were almost always noted.
- Among the investigations where outbreaks were believed to be associated with unmanaged external changes, nearby construction (43%) and problems with water mains (43%) were most frequently noted.
Goal - Minimizing the Presence of Legionella Bacteria

- Legionella minimization activities involve the implementation of engineering controls to limit the growth of Legionella, monitoring water quality, and assessing any potential risks.
- Legionella growth in building potable water distribution systems is primarily suppressed by the implementation of engineering controls such as the maintenance of appropriate water temperatures and biocide levels.

Water Testing for Legionella Bacteria

- There is no evidence-based consensus or recommendation regarding routine water testing of Legionella bacteria for the prevention of disease.
- If a program team decides to test for Legionella bacteria in their water systems, the ASHRAE standard does not make recommendations regarding the sampling method, the number of sites to test, how often to test, or what laboratory method should be utilized for analysis.

Legionella Growth

100% prevention of exposure to Legionella is not possible, given host susceptibility, pathogen virulence, environmental prevalence, and water distribution system configurations and conditions, but prevention and control practices can be implemented to reduce the risk of exposure.
2015 ASHRAE Standard 188
American Society of Heating, Refrigerating, and Air Conditioning Engineers

- Provides a framework for proactively managing building water systems to reduce the potential for Legionella growth.
- Provides guidance that does not have regulatory authority unless it is incorporated into local building or plumbing codes.
- Applies to healthcare facilities where patients stay overnight, people with chronic or acute medical problems or weakened immune systems are housed or treated, and where people >65 years, with or without on-site skilled nursing staff are housed.

Note: It does not provide guidance on target water parameters, such as temperature and disinfectant levels. It also does not describe how to perform emergency remediation or give guidance about what to do if cases of disease are associated with the facility.
VHA Directive Regarding Water Temperature

- Addresses the risk of inhalation or aspiration of Legionella bacteria while minimizing the risk of scald injury from exposure to hot water.
- It is not possible to maintain water temperatures at the outlet that kill Legionella bacteria and simultaneously eliminate the possibility of scald injury without the installation/integration of anti-scald devices into plumbing fixtures or water tempering valves.

VHA Directive Regarding Biocides

- Minimum concentrations of biocides can inhibit the growth of Legionella in building potable water distribution systems.
- The use of one or more installed systemic water treatment system(s) may be necessary to supplement any residual disinfectant present in incoming water.
- The efficacy of biocides on suppressing or killing waterborne pathogens is dependent on the presence of organic and inorganic contaminants, pH levels, water hardness, disinfectant concentrations, and contact time.
- The minimum concentration of biocide necessary to suppress bacterial growth may vary from building to building and even within buildings.

Components of a Healthcare-associated Legionella Disease (HCA-LD) Prevention Plan

1. Maintain a current schematic of the water distribution system (i.e., distribution, circulation, storage, heating, cooling, treatment, and monitoring points). Identify any areas in which water is processed differently (e.g., hemodialysis and sterile processing).
2. Complete an annual risk assessment of the building for temperature, biocide, and receptor risk factors. Examples: Changes to the distribution system? A new dialysis center?
3. Establish engineering control strategies to inhibit Legionella growth and to identify control mechanisms for preventing scald injury.
4. Identify water system management points where monitoring and controls can be implemented to prevent the growth of Legionella and prevent scald injury.
5. Establish a schedule of routine monitoring of the engineering control strategies and document when each water quality and control measure was monitored and what and when corrective action was taken.
6. Validate control measures to ensure they are effectively inhibiting Legionella growth.
#3 Engineering Control Strategies for Prevention of Legionella Growth - Temperature

- Potable water entering each building should be continuously monitored for incoming water pressure, temperature, pH, dissolved solids, and oxidant residual.
- If a building uses domestic hot water storage tanks, water temperature of all such storage tanks must be maintained at a **minimum of 140 degrees F** (60 degrees Celsius) to kill Legionella bacteria.
- The minimum discharge temperature for instantaneous and semi-instantaneous heat exchangers must be **130°F (54.4°C)**.
- Water in the potable hot water distribution system piping must be no lower than **124°F (51.1°C)** (prior to any temperature-reducing mixing valve or anti-scaid device at the water outlet).
- Cold water temperature throughout the system should be maintained at or below **67°F (19.4°C)** to the greatest extent practicable to inhibit growth.

### Continuous temperature monitoring must be conducted, at a minimum, in the following areas:

- Incoming water supply to the building
- Water storage tanks
- Hot water discharge at the hot water source equipment
- Hot water return proximal to the hot water source equipment
- Water at the return of circulation loops
- Water supplied to representative outlets (e.g., loop or branch, hydraulic remoteness, flow)

### The use of mixing valves and anti-scaid devices on all outlets where people access water from the potable hot water distribution system is required in order to prevent scald injury. The water temperature delivered from the outlet must not exceed **110°F (43.3°C)**.
#3 Engineering Control Strategies for Prevention of Legionella Growth - Disinfection

- Disinfectant and other chemical levels in cooling towers and hot tubs should be continuously maintained and regularly monitored. Surfaces with any visible biofilm (i.e., slime) should be cleaned.
- Monitor biocide residual levels at distal water outlets in the hot and cold potable water distribution systems to determine if levels are within the established control limits and in compliance with regulatory requirements.
- Flush hot and cold water at outlets (e.g., sink taps, showers) at least twice per week, particularly those not in routine use or which experience low water flow, to prevent water stagnation for extended periods of time.
- Decorative fountains should be kept free of debris and visible biofilm.

- Continually monitor the oxidant residual levels in the building incoming water supply and at representative outlets (e.g., loop or branch, hydraulic remoteness, flow) to determine if any disinfectant water treatment from the municipality or other source is present when the water reaches the building and after distribution in the building.

- Minimum concentrations of oxidant residual necessary for inhibition of Legionella growth may vary from building to building. The following minimum detected oxidant residual levels at hot and cold water outlets are suggested as guidance.
  - 0.5 milligrams (mg) per liter (L) for chlorine (as free chlorine)
  - 0.5 mg/L for monochloramine
  - 0.3 mg/L for chlorine dioxide

- Facilities may choose to implement a systemic supplementary water treatment system(s) in buildings to supplement municipal or source treatment of water. Factors to consider include but are not limited to:
  - The levels of oxidant residual in the incoming water supply and/or at outlets
  - Past history of HCA-LD
  - Results from environmental and clinical validation testing
If the facility decides to install a supplemental water treatment system in a building, then the following actions are required:

- With the installation of treatment for the purpose of eliminating Legionella or any other contaminant, DHHS would require plans and specifications submitted for approval by a Nebraska registered engineer.
- The facility would then need to apply for a permit to operate a Public Water System (PWS). Such a PWS would be considered to be a consecutive system (even though the facility would be receiving water from a PWS, they are adding treatment to the water.)
- U.S. EPA approved oxidants for disinfection include: chlorine, monochloramine, and chlorine dioxide. The manufacturer of the system must provide the minimum and maximum outlet biocide levels in writing for both hot and cold water.

Control Measures

- Anticipate hazardous conditions that could be associated with scheduled or unanticipated changes in water quality, such as:
  - System start up
  - System shut down
  - Regularly scheduled maintenance
  - Renovations, construction, and installation of new equipment on your property
  - Equipment failure
  - Water main break or other service interruptions

Special Use Water Systems

Hemodialysis, Laboratory, Pharmacy Compounding

- It is important to consider the implications of Legionella mitigation strategies on special use water systems within the building. For example, chemical disinfectants may result in the introduction of products into, or the formation of disinfection.
- The impact of mitigation strategies must account for potential toxicity, methods for removal of the chemical agent and byproducts from the special use water system, and availability of assay methods to measure the chemical agent and byproducts for assuring patient safety.
- Employees responsible for the oversight of special use water systems are to be consulted during the development and implementation of water treatment strategies for Legionella and promptly notified of any changes in treatment procedure.
#5 Documentation of Routine Monitoring + Annual Review = Risk Assessment (#2)

- Water temperature and biocide residual testing, as well as corrective actions, must be documented to determine if the engineering controls are effectively controlling Legionella growth in the building’s potable water distribution systems.

- (#6) Validation includes both a clinical component to assess incidence of HCA-LD and an environmental component to assess the need for corrective actions.

#6 Corrective Action Measures

- If routine monitoring determines that the water temperatures or biocide residual levels from an installed system are not within the established limits, then the following actions, at a minimum, must occur:
  - Assess the reason(s) why the control(s) were not within the established limit.
  - Take action promptly to satisfy implementation of the control measures to within established limits.

- Point-of-use filters may be installed at specific outlets to prevent Legionella exposure to patients. This method may be of particular use in areas that treat high-risk patients.

CORRECTIVE ACTION EXAMPLE

1. During routine inspection of the hospital, the following control(s) were observed to not meet established limits. The generator failed to turn on, and the biocide residual levels were below the established limits.

2. As directed by the institutional policy, the biocide residual levels were corrected to within the established limits by increasing the biocide dosage and ensuring proper mixing and circulation throughout the distribution system.
The Centers for Disease Control (CDC) has developed a toolkit that provides practical guidance on how to implement ASHRAE 188.
The CDC encourages all healthcare facilities to include clinical disease surveillance in addition to environmental surveillance in their Legionellosis risk management plan.


CDC Toolkit

CDC Environmental Assessment Form


Note: Sampling should only be performed after a thorough environmental assessment has been done and a sampling plan has been made.

CDC Sampling Procedure


Note: This protocol is for collecting environmental samples for Legionella culture during a cluster or outbreak investigation or when cases of disease may be associated with a facility.

Sampling should only be done by a trained environmental professional.
Helping People Live better Lives.

- Environmental Legionella Isolation Techniques Evaluation Program (ELITE)
  - [https://wwwn.cdc.gov/elite/Public/MemberList.aspx](https://wwwn.cdc.gov/elite/Public/MemberList.aspx)
  - Provides a list of laboratories that can provide analysis for Legionella
  - There are no laboratories on the list from Nebraska

- Triggered by...
  - A definite HCA-1D case, a cluster or outbreak, or when cases of disease are suspected to be associated with a facility.
  - Note: Prior to the implementation of emergency mitigation, stakeholders at the facility must be informed in order to facilitate safe implementation of the emergency procedures.

- Emergency Remediation Potable Water Distribution Systems
  - Includes one or both of the following procedures:
    - Shock chlorination. Increasing the chlorine level of the hot and cold water distribution systems to at least 2 mg/L and maintaining that level throughout the systems for at least 2 hours (but not exceeding 24 hours) and flushing all outlets. Chlorination of the hot water tank(s) or the water heater(s) to a concentration of 20 to 50 mg/L may be required to achieve this level of free chlorine residual.
    - After shock chlorination the system must be thoroughly flushed before reuse. If post-shock chlorination water testing indicates that Legionella bacteria are still present in the distribution system, it may be necessary to repeat with a higher concentration of chlorine (e.g., at least 10 mg/ml free chlorine residual throughout the system and at outlets for 24 hours or 200 mg/L for three hours).
Emergency Remediation Potable Water Distribution Systems

Include one or both of the following procedures:

- Thermal Eradication. Temporary resetting of the temperature in the hot water distribution system(s) to 160°F – 170°F (71°C – 77°C) while continuously flushing each outlet in the system for at least 30 minutes. Consideration needs to be given as to the feasibility of implementing thermal eradication depending on the design of the mixing valves in place.
- Legionella will likely reappear if proper routine water temperatures or residual biocide levels (or other supplementary systems or processes) are not maintained. Communication must occur to inform stakeholders once complete.

Estimates of the annual prevalence and total cost of hospitalizations for Legionnaires’ Disease in the USA (2006-2007)

<table>
<thead>
<tr>
<th>Medicaid</th>
<th>Medicare</th>
<th>Commercial</th>
<th>Uninsured</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of hospitalizations</td>
<td>1404</td>
<td>8598</td>
<td>8972</td>
<td>15,982</td>
</tr>
<tr>
<td>Total hospitalization cost</td>
<td>$184,827,308</td>
<td>$174,881,413</td>
<td>$407,708,721</td>
<td></td>
</tr>
</tbody>
</table>

Questions?
Governor Pete Ricketts

Vision:
Grow Nebraska

Mission:
Create opportunity through more effective, more efficient, and customer focused state government

We Value:
• The Taxpayer
• Our Team
• Simplicity
• Transparency
• Accountability
• Integrity
• Respect

DHHS Accomplishments

• Completed 39 of 41 initiatives in one year Business Plan and made substantial progress on the others. Over 90% of the 213 deliverables were completed.
• Implemented Nebraska’s Medicaid managed care programs integrating long-term services and supports, prescription drug monitoring, and managed care to improve outcomes for children with special health care needs.
• Launched the Behavioral Health System of Care for children and youth, integrating services and support with education, primary care, and family centered care.
• Conducted an in-depth review of the Nebraska Medicaid Health Plan contracts with focused RFPs for behavioral health and long term services and supports.
• Developed, gained federal approval for, and implemented Medicaid Developmental Disabilities Home and Community-Based Services waivers focused on person-centered, customer-focused planning.
• Developed, launched, and implemented twoWaiver Services Management System and Common Client Information System.
• Created an integrated System of Care and Multi-Tier System of Support for children with serious emotional disturbances.
• Increased access to the Prescription Drug Monitoring Program, and developed and implemented naloxone education resources.

DHHS 2017-2018 Priorities

• Reduce single case child welfare and incarceration rates.
• Support more personalized intervention plans by the family and plan for a return to healthy living services and supports.
• Improve the integration of community based behavioral health treatment and services through the Medicaid Plan and Behavioral Health System.
• Complete the SDM program roll out as part of the Nebraska Medicaid Long Term Services and Supports Redesign initiative.
• Improve the integration of community based behavioral health treatment and fiscal opportunities for improved outcomes.
• Decrease the number of pages from 14 to 3, and slashed the wait time to determine eligibility from 69 days to 14.
• Decrease the number of days waiting for admission to the Lincoln Regional Center for Developmental Disabilities from 39 to nine days.
• Decrease the average days waiting for admission to the Children’s Home for Mental Retardation from 21 to five.
• Safely prevent and reduce the percent of state wards in out of home placements by 2018.
• Decrease the number of days waiting for investigation from 57 Nebraska counties.
• Decrease the number of days waiting for investigation from 57 Nebraska counties.
• Decrease the number of days waiting for investigation from 57 Nebraska counties.