What this talk is about

- HAI Program
- NHSN Reporting and Validation
- HAI Rates in Nebraska
- Antibiotic Data Registry
- Antibiotic Resistance In NE, esp CRE
- Outbreak Detection and Management
Infrastructure

- DHHS
- Department of Public Health
- Epidemiology and Informatics
- Epidemiology
- Healthcare Associated Infections
Who Are We

- HAI Office @ DHHS Lincoln
- 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
Goals of DHHS HAI Team

- Assess Monitor and Reduce HAIs
- Detect Outbreaks and Resistance
- Manage/Contain Resistance and Outbreaks
- Prevent via Stewardship and Reduced Transmission
- Educational Resources for HCWs, Website, Support and training for IP
- Education for Public-website
- [http://dhhs.ne.gov/publichealth/HAI](http://dhhs.ne.gov/publichealth/HAI)
Butchering and disease biographies of Joseph Lister, the ancestor of modern domestic health teaching.

Factories were built with hope, but for many, it was the start of modern disease. Lister knew.

CLEAN ROOM Operating on a patient ca. 1880. The man at right is using the carbolic-acid sprayer popularized by Lister.
Infection Control Assessment and Promotion Program

- CDC funded via Ebola supplement to the ELC
- Voluntary and Confidential
- Aggregate Data to DHHS and CDC-
- Gaps: HH in LTC, disinfection and sterilization CAH, equipment spacing in dialysis
- Evaluates Infection Control Practices and proposes mitigation
  - Acute Care Hospitals, esp. CAH
  - Long term Care
  - Ambulatory Clinics
  - Dialysis
Governor’s Proclamation

“Whereas, the CDC has declared the week of Nov 13 through the 19 U.S. Antibiotic Awareness Week as a way to improve antibiotic stewardship in communities, in healthcare facilities, and on the farm in collaboration with state-based programs;

Whereas, the Nebraska Department of Public Health’s Healthcare Associated Infections program is dedicated to the reduction of antibiotic resistance, a major threat to the public health;

Whereas, the inappropriate use of antibiotics may lead to further antibiotic resistance and an increase in untoward complications such as C.difficile;

Whereas the observance of Antibiotic Awareness Week will help patients “Be Antibiotics Aware” and Support “Smart Use” of antibiotics by prescribers;

Now, Therefore, I, Pete Ricketts, Governor of the State of Nebraska,

DO HEREBY PROCLAIM, the week of Nov 13 ANTIBIOTIC AWARENESS WEEK

In Nebraska and I do hereby urge all citizens to take due note of the observance.
Evaluates antimicrobial prescribing practices in 5 acute care hospitals and 5 long term care facilities.

Supported creation of leadership teams.

Provided expert support in creation of antibiograms, ID pharmacy consultation, techniques for stewardship.

Utilizing data to create tools for all on website (NebraskaASAP.com).

This year assessing sustainability.

Antibiotic Symposium, webinars and lectures.
MD Stewardship

- Telemedicine Model for antibiotic stewardship
- Assesses stewardship program and capacity onsite
- Meets with pharmacy and micro
- Daily teleconference re cases
- Grant funding for 5 rural critical access hospitals
- AMS experts from Creighton
Monitoring Reportable HAIs

- National Healthcare Safety Network-CDC
- ¾ million HAIs per year, 5% hospitalizations
- Tied to reimbursement-CMS
- Now Reportable in NE
- All PPS Hospitals, LTACHs, and Rehab
  - CLABSI
  - CAUTI
  - SSI Colectomy and TAH
  - CDI
  - MRSA Bacteremia
  - Dialysis Centers-BSI, ABIC starts
Monitoring HAIs

▶ Review NHSN Reports

▶ SIRs (standardized incidence ratio = O/E)

▶ Targeted Assessments (TAP) Reports

▶ CAD - Cumulative Attributable Differences (# of cases to be prevented to achieve desired rate)

▶ Validation onsite - highest, lowest, random

▶ Work with IPs to design strategies to improve rates (NHSN Users group Quarterly)
## National Action Plan to Prevent Healthcare-Associated Infections: Progress and Targets

<table>
<thead>
<tr>
<th>Measure</th>
<th>Data Source</th>
<th>Baseline Years</th>
<th>2013 Target</th>
<th>Progress By 2014</th>
<th>Targets for 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce central-line associated bloodstream infections (CLABSIs) in ICU and ward-located patients</td>
<td>CDC/NHSN</td>
<td>2006-2008</td>
<td>50% reduction or .50 SIR</td>
<td>50% reduction or .50 SIR</td>
<td>50% reduction from 2015 baseline</td>
</tr>
<tr>
<td>Reduce catheter-associated urinary tract infections (CAUTI) in ICU and ward-located patients</td>
<td>CDC/NHSN</td>
<td>2009</td>
<td>25% reduction or .75 SIR</td>
<td>no change</td>
<td>25% reduction from 2015 baseline</td>
</tr>
<tr>
<td>Reduce the incidence of invasive healthcare-associated methicillin-resistant Staphylococcus aureus (MRSA) infections</td>
<td>CDC/EIP/ABC</td>
<td>2007-2008</td>
<td>50% reduction</td>
<td>36% reduction</td>
<td>50% reduction from 2015 baseline</td>
</tr>
<tr>
<td>Reduce facility-onset methicillin-resistant Staphylococcus aureus (MRSA) in facility-wide healthcare</td>
<td>CDC/NHSN</td>
<td>2010-2011</td>
<td>25% reduction or .75 SIR</td>
<td>13% reduction or .87 SIR</td>
<td>50% reduction from 2015 baseline</td>
</tr>
<tr>
<td>Reduce facility-onset Clostridium difficile infections in facility-wide healthcare</td>
<td>CDC/NHSN</td>
<td>2010-2011</td>
<td>30% reduction or .70 SIR</td>
<td>8% reduction or .92 SIR</td>
<td>30% reduction from 2015 baseline</td>
</tr>
<tr>
<td>Reduce the rate of Clostridium difficile hospitalizations</td>
<td>AHRQ/HCUP</td>
<td>2006</td>
<td>30% reduction</td>
<td>18% increase</td>
<td>30% reduction from 2015 baseline</td>
</tr>
<tr>
<td>Reduce Surgical Site Infection (SSI) admission and readmission</td>
<td>CDC/NHSN</td>
<td>2006-2008</td>
<td>25% reduction or .75 SIR</td>
<td>18% reduction or .82 SIR (2012)</td>
<td>30% reduction from 2015 baseline</td>
</tr>
</tbody>
</table>
## Nebraska HAI SIRs

<table>
<thead>
<tr>
<th>HAI Type</th>
<th>2015</th>
<th>2016</th>
<th>2017 1st half</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLABSI</td>
<td>1.2</td>
<td>.7</td>
<td>.87</td>
</tr>
<tr>
<td>CAUTI</td>
<td>.97</td>
<td>.84</td>
<td>.87</td>
</tr>
<tr>
<td>SSI Colon</td>
<td>.96</td>
<td>1.35</td>
<td>1.39</td>
</tr>
<tr>
<td>SSI TAH</td>
<td>1.2</td>
<td>.97</td>
<td>1.42</td>
</tr>
<tr>
<td>MRSA bacteremia Lab ID</td>
<td>.95</td>
<td>.72</td>
<td>.65</td>
</tr>
<tr>
<td>CDI Lab ID</td>
<td>.84</td>
<td>.89</td>
<td>.70</td>
</tr>
<tr>
<td>Dialysis BSI</td>
<td>---</td>
<td>--</td>
<td>.7</td>
</tr>
</tbody>
</table>
### NEBRASKA

**HEALTHCARE-ASSOCIATED INFECTIONS PROGRESS**

Healthcare-associated infection (HAI) data give healthcare facilities and public health agencies knowledge to design, implement, and evaluate prevention and control measures.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>CLABSI</td>
<td>27</td>
<td>1%</td>
<td>1%</td>
<td>1.5%</td>
<td>1.72</td>
<td>1%</td>
<td>28%</td>
</tr>
<tr>
<td>CAUTI</td>
<td>27</td>
<td>1.5%</td>
<td>1.5%</td>
<td>7%</td>
<td>2.17</td>
<td>1.5%</td>
<td>28%</td>
</tr>
<tr>
<td>SSI, Abdominal Surgery</td>
<td>21</td>
<td>5%</td>
<td>5%</td>
<td>7%</td>
<td>1.07</td>
<td>5%</td>
<td>25%</td>
</tr>
<tr>
<td>SSI, Colon Surgery</td>
<td>22</td>
<td>7%</td>
<td>7%</td>
<td>25%</td>
<td>0.61</td>
<td>7%</td>
<td>25%</td>
</tr>
<tr>
<td>MRSA Bacteremia</td>
<td>28</td>
<td>14%</td>
<td>14%</td>
<td>20%</td>
<td>0.61</td>
<td>14%</td>
<td>20%</td>
</tr>
<tr>
<td>C. difficile Infections</td>
<td>50</td>
<td>11%</td>
<td>11%</td>
<td>24%</td>
<td>0.12</td>
<td>11%</td>
<td>24%</td>
</tr>
</tbody>
</table>

This number is calculated as the number of HAIs divided by the number of hospital admissions. For additional information, visit the technical data tables online, which can be found on the CDC website.

**WHAT IS THE STANDARDIZED INFECTION RATIO (SIR)?**

The SIR is a summary statistic that can be used to track HAIs prevention progress over time. Lower SIRs are better. The SIR for a facility or state is adjusted to account for factors that might cause infection rates to be higher or lower, such as hospital size, teaching status, the type of patients at a hospital, services, and surgery and patient characteristics.

**WHAT IS NEBRASKA DOING TO PREVENT HEALTHCARE-ASSOCIATED INFECTIONS?**

- Prevention efforts to reduce specific HAI types
  - Antimicrobial stewardship
  - Healthcare personnel influenza vaccination
  - Prevention and control of HAIs
  - Infection prevention and control

This report is based on data from 2014.
Post Validation Visit

- Mentoring and Brainstorming

- Information Sharing, how can we help

- Follow-up Visits planned 6-12 months later, to assess progress

- Examples:
  - Hand Hygiene for CDI
  - Importance of normothermia in reducing HAIs
  - Timing of pre-op antibiotics
  - Best practices-env services, CL team
  - Prep prior to TAH
Clostridium difficile

- Reportable since 2010
- Slowly rising in NE (Testing vs real?)
- Reportable via lab
  - 65 labs do CDI testing
    - NAAT alone 55% (inc GI panel)
    - EIA alone or GDH-15%
    - 2 step EIA, GDH-20%
    - Cytotoxicity assay or culture 10%
- Efforts to Reduce:
  - Antibiotic Stewardship
  - Reducing transmission inter-facility
  - Contact precautions
  - Environmental cleaning
Monitoring for Resistance

- Expanding the Reportable Disease List
  - HAIs
  - MERS-CoV
  - GI and Respiratory Panel Results
  - All potential carriers of CREs
    - Enterobacter
    - Klebsiella
    - E.coli
    - Citrobacter
    - Acinetobacter
    - Pseudomonas
Antibiotic Susceptibility Data Registry

- Creation of a database containing susceptibility patterns for all reportable organisms

- 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
Most Worrisome MDROs

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

- Chromosomal resistance well-documented
  - Colistin binds lipopolysaccharide
  - Resistance through Lipid A modification
  - ~11% of ESBLs tested at CDC have colistin MIC ≥4 μg/ml
- Plasmid-mediated resistance first reported in November 2015 in China*
  - mcr-1: mobile colistin resistance
  - *E. coli* (primarily) and *K. pneumoniae*
  - Meat, animal isolates, clinical isolates

Mcr-1 Isolates in US

- Mcr-1-mobile genetic element
  - Nov 2015 in China
  - 27 Human isolates
    - Northeast
    - West coast
    - Texas
    - Northern midwest
  - 2 Animal isolates (pigs) IL, SC
Colistin Susceptibility Testing

- Multiple methodological issues and technical challenges
  - No FDA-cleared automated testing methods
  - E-test underestimates MIC by 1-2 doubling dilutions
  - Disk diffusion does not work due to poor diffusion

- ASM 2016: Laboratories that choose to test for colistin susceptibilities for clinical decisions should use broth microdilution
  - Vast majority of clinical labs in U.S. do not have this capacity
  - Might need to have reference labs perform this testing
Identifying Isolates for *mcr-1* Screening

- MicroScan ID/AST panel has colistin well (4 μg/ml) for identification
  - 2 *mcr-1* *E. coli* isolates in CDC/FDA AR Bank (MIC = 4 μg/ml)
  - Panel accurately identified colistin R in both isolates across 3 replicates per isolate and 2 inoculation methods*
  - Could be useful for surveillance purposes for identifying *mcr-1*
  - Cannot be used for clinical purposes

- Gradient diffusion method (e.g. E-test)
  - Issue with false susceptible results (very major errors)
  - Can be only be used for surveillance purposes and has limited sensitivity

*Barbara Zimmer, Beckman Coulter, unpublished data*
Candida auris

- New resistant yeast
- First identified in Japan in 2009 from an ear abscess
- 66 cases last year, 120 as of late September. In 10 states mostly NE
- More resistant
  - 90% resistant to Azoles
  - 1/3 to Amphotericin
  - 7% also to echinocandins
  - 40% R to 2 classes; 4% to all 3
Candida auris

- Occurs mostly in patients with prolonged healthcare stays, central venous or other invasive lines, long term antibiotic or antifungal therapy
- Long term colonization
- Hardier on surfaces
- Use cleaning protocol similar to C. difficile
- Use infection control protocols and colonization testing similar to CRE
- Treatment of choice an echinocandins to start
- Any resistant Candida invasive send to NPHL

Harder to identify
- C. haemulonii on BD Phoenix, Vitek 2, MALDI-TOF
Not Like the Others
Carbapenem Resistance

- Non-susceptible to any carbapenem
  - 4mcg imipenem, meropenem, doripenem
  - 2mcg ertapenem
  - OR + for carabapenemase

- Send to NPHL for:
  - Carbapenemases
    - phenotypic testing
    - Molecular testing
    - If + phenotypic, -molecular ??? novel
Carbapenem Resistance CRE

- Amp-C or ESBL + loss of porins (more common) CRE
- Carbapenemases - movable genetic components (CP-CRE 5 since March in NE)
  - 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)
Carbapenem Resistance

All CREs-contact precautions; CP-CRE=outbreak

- 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
Carbapenemase-producing (CP) *Enterobacteriaceae* Investigated and Confirmed by Month, January 1, 2017 to October 18, 2017

- **Potential CP Enterobacteriaceae Investigated**
  - January: 0
  - February: 0
  - March: 3
  - April: 2
  - May: 5
  - June: 1
  - July: 6
  - August: 10
  - September: 3
  - October: 2

- **CP Enterobacteriaceae Confirmed**
  - January: 0
  - February: 0
  - March: 0
  - April: 1
  - May: 0
  - June: 0
  - July: 2
  - August: 0
  - September: 0
  - October: 1
Outbreak Detection and Management

- Coordination with LHD
- Defining Outbreaks
- Defining Protocols
- Education to facilities
- ARLN
- Looking for Colonization
Outbreaks

• Hepatitis B mutant in Dialysis

• SSI Outbreak due to increased traffic in the OR

• Cluster of CLABSIs-too much accessing of port

• Cluster of Proteus ESBLs in Nursing home, unclear source, ? Hot tubs

• *M. chimaera* associated with heater cooler devices
  • conference call with all facilities with use of affected devices
  • developed survey of facilities
  • shared patient notification materials
  • helped create follow up programs
Maureen R. Tierney, MD, MSc.

Director HAI Program

Maureen.Tierney@Nebraska.Gov

402-471-6549
Follow the Money

- 2010 CDC Funding for state HAI programs
- 2011-2015 50% FTE Contract with QIO
- 2015-$$ for
  - Ebola readiness,
  - infection control quality
- 2016-
  - FTE HAI Director
  - Stewardship
  - Safe Injection
- 2017 Resistance
- Sending Antibiotic Utilization Data to NHSN
- SUR Standardized Utilization Ratio created
- Sending Antibiotic Resistance Data to NHSN
- Requires interface with pharmacy database
- Requires interface with LIS system
- Upgrade EHR module-expensive and requires IT support
- Incentification to CUMC, UNMC
Molecular features of *mcr-1*

- Highly transmissible
  - By conjugation among *E. coli*
  - By transformation into *K. pneumoniae* and *P. aeruginosa*
  - Stably maintained in absence of polymyxin drug pressure
  - Potential for movement and rapid spread through epidemic clones
- Increased colistin MICs 8 to 16-fold
  - Typical MICs 4 to 8 μg/ml
- Other variant, *mcr-2*, identified in Belgium
  - 77% homology with *mcr-1*
  - In Belgium, more common than *mcr-1*
  - Similar colistin MIC increase as *mcr-1*