Healthcare-Associated Infections: The Changing Epidemiology of HAIs

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Division of Healthcare Quality Promotion
Centers for Disease Control and Prevention

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Outline

- Background
- Major types of healthcare-associated infections (HAIs)
- Emergence of multidrug-resistant organisms (MDROs)
- Nonhospital settings
BACKGROUND
Healthcare-Associated Infections (HAIs)

- **Definition**
  - Infections acquired during course of receiving treatment for other conditions within a healthcare setting
  - Onset of infection can occur during stay in healthcare setting or after discharge

- **Healthcare settings**
  - Hospitals: acute care facilities, critical access facilities
  - Long term care facilities (LTCF)
  - Outpatient settings: dialysis centers, ambulatory surgical centers, specialty clinics, physician’s offices
Annual HAI Burden
What is Known: Acute Care Settings

- 1.7 million infections (5% of all admissions)
  - Most (1.3 million) were outside of ICUs
- 1 in 20 patients
- $28–33 billion in excess costs
- Estimated 100,000 associated deaths

## Social Costs of HAIs

<table>
<thead>
<tr>
<th>Categories of Cost*</th>
<th>Direct Hospital Costs</th>
<th>Indirect Costs</th>
<th>Intangible Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Costs</td>
<td>Buildings</td>
<td>Lost/Wages</td>
<td>Psychological Costs (i.e., anxiety, grief, disability, job loss)</td>
</tr>
<tr>
<td></td>
<td>Utilities</td>
<td>Diminished worker productivity on the job</td>
<td>Pain and suffering</td>
</tr>
<tr>
<td></td>
<td>Equipment/Technology</td>
<td>Short term and long term morbidity</td>
<td>Change in social functioning/daily activities</td>
</tr>
<tr>
<td></td>
<td>Labor (laundry, environmental control, administration)</td>
<td>Mortality</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Income lost by family members</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Forgone leisure time</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Time spent by family/friends for hospital visits, travel costs, home care</td>
<td></td>
</tr>
<tr>
<td>Variable Cost:</td>
<td>Medications</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Food</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Consultations</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Treatments</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Procedures</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Devices</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Testing (laboratory and radiographic)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supplies</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Causative Agents of HAI\$s

- Variety of pathogens (bacteria, virus, fungi)
- Common pathogens
  - *Staphylococcus aureus*
  - Enterococcus
  - *Clostridium difficile*
  - *Klebsiella pneumonia*
  - *Escherichia coli*
  - *Pseudomonas aeruginosa*
  - *Acinetobacter spp.*
  - Norovirus
  - Influenza
  - Bloodborne pathogens (hepatitis B, hepatitis C, HIV)
Key HAI Concepts

- **Mode of transmission**
  - Contact (direct, indirect)
  - Droplet
  - Airborne

- **Colonization vs infection**
Potential for Contact Transmission: Transfer of VRE from Contaminated Sites via HCP

Potential Droplet Transmission

- 5 cases of bacterial meningitis (NY – 3; OH – 2)
  - 4 confirmed *Streptococcus salivarius* infection, 1 death
  - OH patient isolates indistinguishable by PFGE; anesthesiologist’s oral swab positive for *S. salivarius*
- Each cluster linked to single anesthesiologist
  - OH anesthesiologist not wearing face mask
MAJOR TYPES OF HEALTHCARE-ASSOCIATED INFECTIONS
Site-Specific or Procedure-Associated HAIs

- **Bloodstream infections**
  - Central-line associated bloodstream infections (CLABSI)

- **Pneumonia**
  - Ventilator-associated pneumonia (VAP)

- **Urinary tract infections**
  - Catheter-associated urinary tract infections (CAUTI)

- **Surgical site infections**
## Estimated Annual Hospital Cost of HAI by Site of Infection

<table>
<thead>
<tr>
<th>Major Site of Infection</th>
<th>Total infections</th>
<th>Hospital Cost per Infection (2002 $)</th>
<th>Total annual hospital cost (in millions $)</th>
<th>Deaths Per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical Site Infection</td>
<td>290,485</td>
<td>$25,546</td>
<td>7,421</td>
<td>13,088</td>
</tr>
<tr>
<td>Central Line-associated Bloodstream Infection</td>
<td>248,678</td>
<td>$36,441</td>
<td>9,062</td>
<td>30,665</td>
</tr>
<tr>
<td>Ventilator-associated Pneumonia</td>
<td>250,205</td>
<td>$9,969</td>
<td>2,494</td>
<td>35,967</td>
</tr>
<tr>
<td>Catheter-associated Urinary Tract Infection</td>
<td>561,667</td>
<td>$1,006</td>
<td>565</td>
<td>8,205</td>
</tr>
</tbody>
</table>
Pathogenesis of CLABSI

More Common Mechanisms

▪ Pathogen migration from entry site along external surface of catheter - early (<7 days)
▪ Hub contamination with intraluminal colonization - more common >10 days

Less Common Mechanisms

▪ Hematogenous seeding from another source
▪ Contaminated infusates
CLABSIs Outside of ICUs

- Many central lines (CL) in patients outside ICUs
  - CL in 55% of ICU pts vs 24% of non-ICU pts
  - Overall 70% of pts with CL in the hospital were outside the ICU

- 2006–2008 NHSN pooled mean CLABSI rates:
  - Medical-Surgical ICUs = 1.5 to 2.1 per 1,000 catheter-days
  - Medical-Surgical wards = 1.2 per 1,000 catheter-days

CLABSIs in Outpatient Settings

- Patient groups with long-term central lines
  - Hemodialysis
  - Malignancy
  - Gastrointestinal tract disorders
  - Pulmonary hypertension

- CLABSI rates may be as high as that in ICUs
  - In hemodialysis facilities - 1 to 4 per 1,000 catheter-days
Pathogenesis of CAUTI

Source of Pathogens

- **Endogenous**
  - meatal, rectal, or vaginal colonization

- **Exogenous**
  - via HCP during catheter insertion or manipulation of collecting system

CAUTI

- Leading cause of secondary BSI, ~10% mortality
- Can lead to unnecessary antimicrobial use
- Urinary catheter use
  - 15-25% of hospitalized patients
  - 5-10% (75,000-150,000) NH residents
  - Inappropriate indications, physicians frequently unaware
  - Survey of U.S. hospitals:
    - > 50% did not monitor which patients catheterized
    - 75% did not monitor duration and/or discontinuation
Pathogenesis of VAP

Source of Pathogens

- **Endogenous**
  - Oropharynx, stomach

- **Exogenous**
  - Direct inoculation during manipulations of respiratory equipment or use of respiratory devices, or from contaminated aerosols
Biofilm Formation

- Pathogens on surfaces of devices secrete extracellular polymers
- Bacteria within biofilms bound tightly to surfaces and extremely resistant to antimicrobials and host defense

*Staphylococcus* biofilm on the inner surface of a needleless connector

Pathogenesis of Surgical Site Infections

- **Endogenous**
  - Patient flora (skin, mucous membranes, GI tract)
  - Seeding from a distant focus of infection

- **Exogenous**
  - Surgical personnel (surgeon and team)
    - Soiled attire
    - Breaks in aseptic technique
    - Inadequate hand hygiene
  - Operating room physical environment and ventilation
  - Tools, equipment, materials
EMERGENCE OF MULTIDRUG-RESISTANT ORGANISMS
MDROs: Epidemiologically Important Pathogens

- Infectious agents with $\geq 1$ of the following characteristics:
  - Newly discovered or reemerging pathogen
  - Propensity for transmission
  - Antimicrobial resistance implications, limited treatment options
  - Associated with serious clinical disease, increased morbidity and mortality

2006 HICPAC MDRO Guideline
Gram-Negative Bacilli: Significant Resistant Pathogens in Healthcare

- **Enterobacteriaceae**
  - *Klebsiella pneumoniae*
  - *Escherichia coli*
  - *Citrobacter freundii*
  - *Enterobacter* spp.
  - *Serratia* spp.
  - *Salmonella* spp.

- **Non-fermenters**
  - *Pseudomonas aeruginosa*
  - *Acinetobacter baumannii*
## HAI Pathogens
### NHSN Data, Jan 2006- Sept 2007 (n=33,848)

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Overall percentage (rank)</th>
<th>CLABSI</th>
<th>CAUTI</th>
<th>VAP</th>
<th>SSI</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. coli</em></td>
<td>10% (5)</td>
<td>3%</td>
<td>21%</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td><em>P. aeruginosa</em></td>
<td>8% (6)</td>
<td>3%</td>
<td>10%</td>
<td>16%</td>
<td>6%</td>
</tr>
<tr>
<td><em>K. pneumoniae</em></td>
<td>6% (7)</td>
<td>5%</td>
<td>8%</td>
<td>18%</td>
<td>3%</td>
</tr>
<tr>
<td><em>A. baumannii</em></td>
<td>3% (9)</td>
<td>2%</td>
<td>1%</td>
<td>8%</td>
<td>.6%</td>
</tr>
</tbody>
</table>

National Healthcare Safety Network (NHSN)
Multidrug-Resistant Gram-Negative Bacilli

- Associated with CLABSI, CAUTI, VAP in medical or surgical ICUs
- Resistant to ≥1 antimicrobial in ≥3 antimicrobial classes

### Table 1

<table>
<thead>
<tr>
<th>Organism(s)</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>A. baumannii</em></td>
<td>195/303 (64)</td>
<td>205/327 (63)</td>
<td>182/277 (66)</td>
<td>229/326 (70)</td>
<td>168/248 (68)</td>
<td>132/208 (63)</td>
<td>251/362 (69)</td>
<td>312/420 (74)</td>
</tr>
<tr>
<td><em>P. aeruginosa</em></td>
<td>217/1,174 (18)</td>
<td>210/1,096 (19)</td>
<td>204/1,029 (20)</td>
<td>204/966 (21)</td>
<td>146/700 (21)</td>
<td>102/574 (18)</td>
<td>156/707 (22)</td>
<td>182/1,080 (17)</td>
</tr>
</tbody>
</table>

Emerging Threat in Healthcare: CRE

Carbapenem-Resistant Enterobacteriaceae
A Potential Threat

- **Klebsiella pneumoniae carbapenemase (KPC)**
  - Predominant resistance mechanism in US
  - *K. pneumoniae, E. coli*

- **KPC-producing *K. pneumonia***
  - First identified in North Carolina in 1995
  - <1% of all *K. pneumoniae* reported in 2000
  - 11% of all *K. pneumoniae* associated with CLABSI in 2006-2007
Epidemiologic Data from NYC: *K. pneumoniae* Invasive Infections

**Overall Mortality Attributable to Invasive Infections**

- **48** Carbapenem-resistant
- **38** Carbapenem-susceptible

**Percent of subjects**

- **20** Carbapenem-resistant
- **12** Carbapenem-susceptible

*P* < 0.001

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Challenges of *Klebsiella Pneumoniae Carbapenemase* (KPC)

- KPCs are plasmid based and often flanked by transposon sequences:
  - Resistance can be transferred
  - Plasmids often contain other resistance genes
- Extremely drug resistant
- Becoming more widespread
Geographical Distribution of KPC-Producers, November 2006

- Widespread
- Sporadic Isolate(s)
Geographical Distribution of KPC-Producers, August 2010

KPCs received at CDC
Related KPC-Producing *K. pneumoniae* Isolates in Multiple States

~70% of database made up of ST258

<table>
<thead>
<tr>
<th># of isolates</th>
<th>States</th>
<th>MLST ST (N=22)</th>
</tr>
</thead>
<tbody>
<tr>
<td>172</td>
<td>AZ, CO, DE, FL, GA, IL, MA, NC, NJ, NM, NY, PA, and VA</td>
<td>ST 258 (N=12)</td>
</tr>
</tbody>
</table>

Brandon Kitchel, J. Kamile Rasheed, et al. ICAAC 2008
What Does This Mean?

- Could represent clonal dissemination of a *K. pneumoniae* clone that has acquired the KPC gene

- Finding similar to other MDROs
  - MRSA
  - NAP1 strain of *C. difficile*
Emergence of Metallo-beta-lactamase containing *Enterobacteriaceae* in the US

- **MBL-containing *Enterobacteriaceae***
  - Confers resistance to carbapenem and many other antimicrobials
  - 5 cases in 4 states from Apr 2009–Sep 2010
  - All linked to healthcare exposure in India or Pakistan (NDM-1)

- **Clinical and public health significance of NDM-1**
  - Extremely limited therapeutic options
  - Colonization allows for undetected transmission
  - Potentially very transmissible among *E. coli, K. pneumoniae*
  - Potential to join the ranks of MRSA, VRE, and KPC in rapid dissemination

CDC unpublished data.
Kallen et al. MMWR 2010;59(24):750.
MDR Gram-Negative Bacilli Infections in Nonhospital Settings

- **LTCF**
  - Single LTCF, >1600 clinical cultures:
    - 11% were MDR gram-negative bacilli
    - 6% were MRSA, 1% were VRE
  - Single LTCF (3 known KPC infections):
    - 49% of patients on same floor had CRE isolated from perirectal culture

- **Dialysis facilities**
  - Outpatient hemodialysis center, MDRO colonization of 67 patients:
    - 16% were MDR gram-negative bacilli
    - 13% were VRE, 5% were MRSA

Kallen A et al. *Infect Control Hosp Epidemiol* 2010;31(S1):S51.
Why is Antimicrobial Resistance Increasing?

- Susceptible hosts
- Inattention to basic infection control measures
- Selective pressure from antibiotic use
- Overuse/inappropriate use of antibiotics
- Unrecognized colonization
- Unrecognized reservoirs (e.g., environmental)
- Movement of patients and staff between institutions
Potential Spread of MDROs and other HAIs: Inter-Hospital Patient Sharing

Orange County, CA, 2005 – 32 hospitals

- **Overall data**
  - Patients with ≥2 admissions: 75% admitted to more than 1 hospital
  - Hospitals shared ≥1 patient with median of 28 other hospitals

- **C. difficile infections**
  - 41% of pts readmitted to different hospitals within 12 weeks

Huang S et al. *Infect Control Hosp Epidemiol* 2010;31:1161-69.
Potential Spread of MDROs and Other HAIs: Patient-Sharing Across Healthcare Settings

- **Healthcare System in Utah**
  - Hospitals (n=21), health centers (n=25), outpatient clinics (n=75), dialysis centers (n=5), a home health care service

- **System-wide surveillance of MRSA / VRE patient encounters during 5-year period:**
  - Hospitals (79%)
  - Outpatient health centers and clinics (19%)
  - Home health service (2%)

Evans RS et al. Medinfo 2004;212-216.
NONHOSPITAL SETTINGS
The Healthcare System — More than Just Hospitals

Acute Care Facility

Home Care

Outpatient/Ambulatory Facility

Long Term Care Facility
HAIs in Nonhospital Settings

- **Occurrence of HAIs**
  - Importation due to inter-facility patient sharing
  - Originating in facility due to infection control lapse

- **Burden of HAIs**
  - Minimal data available
HAIs in Long-Term Care Facilities

- >16,000 nursing homes (NH), 1.7 million beds annually
- Veterans Affairs NH survey (~11,000 residents)
  - 5.3% HAI prevalence
  - Invasive medical device: 25% of residents (HAI prevalence – 10.8%)

- Common HAIs among LTCF/NH residents
  - Pneumonia
  - Gastroenteritis
  - Urinary tract infections
  - Skin and soft tissue infections

NCHS, 2009.

Device-associated HBV Transmission Among Persons with Diabetes

- Blood contamination of finger stick device used for multiple persons
- Blood contamination of shared glucose testing meters

Challenge: increased point of care testing and use of over-the-counter personal care devices
Unique Challenges in LTCF

- **Suboptimal infection control**
  - High turn-over rate of staff
  - Florida, 48 LTCF surveyed (15 NH, 33 ALF): deficiencies in assisted blood glucose monitoring practices, worse in ALF

- **Grouped residence**

Thompson N et al. *J Am Geriatr Soc* 2010;58:914-8,
Growth in Outpatient Care

- **Dialysis Centers**
  - 2008: 5240 (82% increase since 1996)

- **Ambulatory Surgical Centers**
  - 2009: 5175 (240% increase since 1996)

- Approximately 1.2 billion outpatient visits / yr
Trends in Dialysis

- Dialysis population ~350,000
- $32 billion in end stage renal disease costs
- Infections – high morbidity and mortality
  - Incidence of sepsis – 100 times higher than general population
  - Death rate – 76 per 1,000 patient days

HAI Risks in Dialysis Population

- **Device use for vascular access**
  - Incidence of invasive MRSA BSIs: 100-fold higher than in non-dialysis population
  - Gram-negative pathogens: 30-40% of HAIs

- **Exposure to healthcare environment**
  - Contaminated surfaces, equipment / supplies, HCP hands

- **Potential exposure to infected patients**

- **Immunocompromised state**

- **Potential exposure to bloodborne pathogens (HBV, HCV, HIV)**
  - Multiple HCV outbreaks

National Kidney Month and World Kidney Day

March is National Kidney Month in the United States, and March 12 is World Kidney Day. Both commemorations are intended to raise awareness of kidney disease and the importance of prevention and early detection. Kidney disease is the ninth leading cause of death in the United States (1), but persons with chronic kidney disease (CKD) are more likely to die from cardiovascular disease than develop kidney failure (2).

In 2000, approximately 26 million U.S. adults had CKD (3). However, in 1999–2004, only 42% of adults with severe kidney disease (stage 4) and fewer than 10%...

Hepatitis C Virus Transmission at an Outpatient Hemodialysis Unit — New York, 2001–2008

In July 2008, the New York State Department of Health (NYSDOH) received reports of three hemodialysis patients seroconverting from anti-hepatitis C virus (HCV) negative to anti-HCV positive in a New York City hemodialysis unit during the preceding 6 months. NYSDOH conducted patient interviews and made multiple visits to the hemodialysis unit to observe hemodialysis treatments, assess infection control practices, evaluate HCV surveillance activities, review medical records, and conduct interviews with staff members. This report summarizes the results of that investigation, which found that...
*2005 values are estimates.
Ambulatory Care Facilities

- **Ambulatory Surgical Centers (ASCs)**
  - Variety of surgical procedures, less waiting time
  - Oversight of medicare-certified ASCs by State Survey Agencies or other accrediting organizations

- **Variety of outpatient facilities**
  - Single-physician offices, pain clinics, wellness center / infusion centers, etc.
  - No routine inspection
Concerns in Ambulatory Care

- Increasingly invasive, complex procedures
- Quick turnover between patients
- Expansion of services without proportionally expanded infection control oversight
- Regulatory requirements vary widely
  - ASC: median survey interval was >5 years
- Lack systematic surveillance to detect infections originating in ambulatory settings
Infection Control in ASCs (I)

- 2008: CDC-CMS piloted an infection control audit tool in a sample of ASCs in 3 states to assess compliance:
  - Hand Hygiene, use of PPE
  - Injection safety and medication handling
  - Equipment reprocessing
  - Environmental cleaning
  - Handling of blood glucose monitoring equipment

Schaefer M et al. JAMA 2010;303(22):2273-79.
Infection Control in ASCs (II)

- **68 ASCs sampled**
  - 68% of the pilot ASCs had lapses in infection control
  - 18% of ASCs had lapses extending across ≥3 areas of infection control

- **Efforts made to include infection control assessment and increase frequency of inspections**

Increasing number of outbreaks associated with outpatient care

- Wide range of settings (e.g., ASCs, cancer clinics, pain medicine clinics, physician offices, etc.)
- Unsafe injections, foundation of basic safe care practices lacking
TRANSMISSION OF BLOODBORNE PATHOGENS VIA CONTAMINATED EQUIPMENT OR MEDICATIONS

SOURCE
Infectious person, e.g. chronic, acute

CONTAMINATED EQUIPMENT OR MEDICATION OR HANDS

CASE
Susceptible, non-immune person
Standard Precautions

- Assume that *anyone* might be infected with a bloodborne pathogen
- Basic infection control principles that apply *every where* and *every time* healthcare is delivered
- **Safe Injection Practices**
  - Never administer medications from the same syringe to more than one patient
  - Do not enter a vial with a used syringe or needle
  - Minimize the use of shared medications
  - Maintain aseptic technique at all times
What Happens When Safe Injection Practices Are Not Followed?

Summary of U.S. experience in past decade

- >50 outbreaks of hepatitis B or C have occurred in healthcare settings
  - ~ 1/4 investigated in the last 24 months
  - Majority due to unsafe injection practices or related breakdowns in safe care in outpatient settings

- ~20 outbreaks involving bacterial pathogens (e.g., drug resistant gram negatives and invasive staph infections)
  - Typically resulting in bloodstream infections
  - Prolonged hospitalization and IV antibiotics
## Viral Hepatitis Outbreaks - Outpatient Settings due to Unsafe Injection Practices, 2001–2009

<table>
<thead>
<tr>
<th>State</th>
<th>Setting</th>
<th>Year</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>NY</td>
<td>Private MD office</td>
<td>2001</td>
<td>HCV</td>
</tr>
<tr>
<td>NY</td>
<td>Private MD office</td>
<td>2001</td>
<td>HBV</td>
</tr>
<tr>
<td>NE</td>
<td>Oncology clinic</td>
<td>2002</td>
<td>HCV</td>
</tr>
<tr>
<td>OK</td>
<td>Pain remediation clinic</td>
<td>2002</td>
<td>HBV+HCV</td>
</tr>
<tr>
<td>NY</td>
<td>Endoscopy clinic</td>
<td>2002</td>
<td>HCV</td>
</tr>
<tr>
<td>CA</td>
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<td>HCV</td>
</tr>
<tr>
<td>MD</td>
<td>Nuclear imaging</td>
<td>2004</td>
<td>HCV</td>
</tr>
<tr>
<td>FL</td>
<td>Chelation therapy</td>
<td>2005</td>
<td>HBV</td>
</tr>
<tr>
<td>CA</td>
<td>Alternative medicine infusion</td>
<td>2005</td>
<td>HCV</td>
</tr>
<tr>
<td>NY</td>
<td>Endoscopy/surgery clinics</td>
<td>2006</td>
<td>HBV+HCV</td>
</tr>
<tr>
<td>NY</td>
<td>Anesthesiologist office</td>
<td>2007</td>
<td>HCV</td>
</tr>
<tr>
<td>NV</td>
<td>Endoscopy clinic</td>
<td>2008</td>
<td>HCV</td>
</tr>
<tr>
<td>NC</td>
<td>Cardiology clinic</td>
<td>2008</td>
<td>HCV</td>
</tr>
<tr>
<td>NJ</td>
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</table>

Nearly half of these outbreaks were caused by unsafe injection practices related to anesthesia/sedation.

Patient Notifications due to Unsafe Injection Practices, 1999–2009

- At least 22 notification events in 13 states
- Estimated >123,000 patients notified to get tested for hepatitis B, hepatitis C, and HIV

Guh et al. SHEA 2010.
What Are Some Unsafe Injection Practices?

- **Direct syringe reuse**
  - Patient-to-patient transmission, Oklahoma pain clinic, 2002
    - 71 cases of HCV and 31 cases of HBV
  - Provider-to-patient transmission, Colorado hospital and ASC, 2009
    - Fentanyl diversion; 24 patients infected with HCV, nearly 6000 notified

- **Indirect syringe reuse**
  - Syringes reused to withdraw multiple doses for individual patients
  - Single-use vial then reused for subsequent patients
  - Endoscopy clinic, Nevada 2008
    - 8 cases of HCV, >50,000 patients notified
What Happens When Safe Injection Practices Are Not Followed?

Summary of U.S. experience in past decade

- >50 outbreaks of hepatitis B or C have occurred in healthcare settings
  - ~ 1/4 investigated in the last 24 months
  - Majority due to unsafe injection practices or related breakdowns in safe care in outpatient settings

- ~ 20 outbreaks involving bacterial pathogens (e.g., drug resistant gram negatives and invasive staph infections)
  - Typically resulting in bloodstream infections
  - Prolonged hospitalization and IV antibiotics
Examples of Bacterial Outbreaks due to Unsafe Injection Practices, 2008–2009

- **FL – pain clinic – 7 cases – Mycobacterium abscessus**
  - Epidural injections; all patients required laminectomy

- **FL – pain clinic – 24 cases – invasive S. aureus**
  - Epidural + other lumbar injections; 10 required laminectomy

- **NYC – pain clinic – 9 cases – Klebsiella pneumoniae**
  - Sacroiliac joint injections; 4 patients hospitalized

- **WV – pain clinic – 8 cases – invasive S. aureus**
  - Epidural injections; 7 patients hospitalized (range 5-23 days)

- **GA – primary care clinic – 5 cases – S. aureus (MSSA)**
  - Joint injections; all patients hospitalized ≥1 week
Other HAIs in Ambulatory Care Settings

- Other types of infection control lapses
- Post-procedure meningitis
- Surgical site infections
- Potential respiratory and gastrointestinal infections
Summary

- High HAI burden, morbidity and mortality, and financial impact
- Emergence of MDROs is an increasing concern
- Substantial HAI problem in nonhospital settings
  - Healthcare delivery increasingly occurring in outpatient settings
  - Improved understanding is needed
- Prevention efforts apply across all healthcare settings
  - Strengthen infection control infrastructure and standards
Resources on HAIs

http://www.cdc.gov/ncidod/dhqp/healthDis.html

Healthcare-Associated Infections (HAIs)

Healthcare-associated infections are infections that patients acquire during the course of receiving treatment for other conditions within a healthcare setting. Healthcare-associated infections are one of the top ten leading causes of death in the United States. As the nation’s health protection agency, CDC is committed to helping all Americans receive the best and safest care when they are treated at a hospital or other healthcare facility.

Infection Control Topics

- Infection Control Home
- Healthcare-Associated Infections

Topics

- Continuing Education on HAIs (Free): Roadmap for HAI Prevention Research: Bench to Bedside and Back
  A roundtable discussion with four infection prevention

- Estimates of Healthcare-Associated Infections
  Information relating to infections acquired within a healthcare setting.

- List of Infectious Diseases in Healthcare Settings
  Diseases that may be transmitted within healthcare facilities and how to prevent their transmission to patients and healthcare workers.

- Antimicrobial Resistance
  Bacteria that have developed resistance to certain antibiotics and how to prevent their transmission and conduct laboratory testing.

- Bloodborne Pathogens
  HIV, Hepatitis C and other pathogens that may be transmitted in healthcare settings via blood or bodily fluids and how to prevent transmission.

- SHEA/IDSA HAI Prevention Compendium
  As CDC continues to produce official guidelines in collaboration with professional societies and academic partners, implementation tools such as this compendium will serve as a means to ensure that the best practices for infection prevention are successfully brought to the bedside.
Thank you

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.