Microbes, Emerging Resistance, & Superbugs: Healthcare Worker Safety, the New Frontier

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Background & Case Studies

- Bloodborne Pathogens
  - HBV, HCV, HIV
- Multi-Drug Resistant Microbes
  - MRSA, VRE
- Tuberculosis
- SARS
- Avian Flu
Global Emerging & Re-emerging Microbes

Hepatitis B Virus

• Prevalence
  – 2,000,000,000 cases
  – 350,000,000 chronically infected
  – 0.5% of adults in North America
  – 0.1 – 20% globally

• HBV cause of up to 80% of all cases of hepatocellular carcinoma worldwide
  – HBV vaccine is the first CANCER vaccine

• Vaccine
  – Required in Occupational Settings
  – Childhood
Hepatitis B Virus
Three Outbreaks in Long Term Care

• Nursing Home, MS, 2003
  – 2 fatal cases of HBV
  – Lancets not routinely cleaned between patients
  – Shared vials of insulin
  – Poor hand hygiene

• Assisted Living, CA, 2004
  – 4 acute cases of HBV
  – Pens and glucometers used for multiple patients
  – Discouraged from wearing gloves, poor hand hygiene

• Nursing Home, NC, 2003
  – 11 acute cases of HBV
  – Lancets reused, glucometers not cleaned b/w patients
  – Poor hand hygiene

Source: MMWR March 11, 2005
Hepatitis C Virus

- RNA Virus
- Progression to cirrhosis or hepatocellular carcinoma
- 130-170,000,000 persons chronically infected (2-3% of world population)
  - 12,600,000 in the Americas
- Treatment and prevention
  - Treated with combination therapy
    - Ribavirin & interferons
  - Post-exposure prophylaxis with IG is NOT effective
    - Unlike HBV
  - Behavioral – IDUs, HCW safety
Surgical Safety

• Reciprocal Exposures
  – 25% of injuries to surgeons occurred in the operative site
  – NYC Case: HCV transmission Dr to Pt, HCV+ cardiac surgeon
    • 14/937 cases tested HCV+

• Device Reuse
  – TX Case: HCV transmission Pt to Pt Nurse anesthetist
HIV/AIDS
Co-Infections & Emerging Resistance

- 40,000,000 worldwide
  - ~28,000,000 sub-Saharan Africa
  - ~1,000,000 in North America, ~10,000 deaths
- 20,000,000 deaths
- Tuberculosis – leading cause of morbidity and mortality among HIV-infected people
  - 8,700,000 new cases each year
  - 2,000,000 die each year
  - 27,000 new cases were drug resistant
    - Incompletion of drug regimens
    - Prisons higher percent – Russia ~40% incidence population

- Hepatitis B Virus
- Hepatitis C Virus
Occupational Deaths, HCW

- **2000-2002 DOL/BLS and CDC/NaSH (NHSN)**
  - 6 million (9 million) HCWs (per BLS)
  - 157-353 deaths (per NaSH, BLS) (~1995 to pres)
    - 400 HBV cases
    - 3-8 die from liver disease
    - 57 HIV confirmed, 121 possible
    - HCW as a group have same HCV seroprevalence as the general population (increases with NSI risk)
    - 6-9 died from TB and complications, latent MDRTB, reactivation

- **Tracking Problems/Concerns**
  - High employment turnover
    - Exposure to death continuum
  - Does not account for microbes and emerging resistance

Sepkowitz (Mem Sloane Kett), Emerging Infectious Diseases, July 2005
Antimicrobial Resistance

• Methycillin Resistant Staphylococcus *aureus* (MRSA)
  – Emerged in 1960s (shortly after intro of methicillin)
  – 6 million infections in US, Europe, Japan
  – ~90,000 deaths (CDC NNIS)
  – Typical exposure in acute and long-term care
    • Recent deaths in healthy children in communities

• Vancomycin Resistant enterococcus (VRE)
  – Emerged in 2002
    • Consequence of intensive use of antimicrobials
    • Patient to Patient, HCW to Patient, HCW/Patient to Community
MRSA & VRE: Alarming Growth (US)

Reference: National Nosocomial Infections Surveillance (NNIS) System [This CDC system is “Passive”, reporting results after clinical diagnosis]

MRSA - Methicillin Resistant *Staphylococcus aureus*  VRE - Vancomycin Resistant Enterococci
The Inanimate Environment Can Facilitate Transmission

Contaminated surfaces increase cross-transmission

~


X represents VRE culture positive sites
Measuring MRSA Impact

MRSA Colonization Conversion to Infection

Hospital

Infection 19%

Transmission

Infection 25%
Controls for Transmission

- Contact Precautions, “Contact Isolation”
- Hand Hygiene (~40% compliance)
- Active Surveillance Testing
  - Testing of high risk patients upon admission to identify patients that are potential reservoirs of MRSA or VRE infection, 7% of admits colonized
  - The CDC guideline for isolation precautions recommends contact isolation for “patients known or suspected to be colonized or infected with epidemiologically important” antibiotic-resistant microorganisms.\(^2\)

\(^1\)Haley RW, et a, Am J Epidemiol 1985; 121
\(^2\)Garner, et al. ICHE 1996;17:53
MRSA Case Study

I. Animal to Human via natural care

2000 - 2002 – Ontario Canada
- 27 humans and 79 horses were isolated with MRSA
  - 16 were in from the veterinary hospital
  - 8 were from a horse farm
- Main mode of transmission is hand contact
- Bacterial skin lesions usually associated with the nasal areas

II. Human to Human via disaster

FIGURE. Methicillin-resistant *Staphylococcus aureus* in the leg of an evacuee from Hurricane Katrina – Dallas, Texas, September 2005

Source: Emerging Infectious Diseases March 2005
We are in need of hand washing detectors!
Tuberculosis Case Study

• Number of overall TB cases has declined in the US, However the number of MDR cases has increased. Biggest increase in foreign born individuals.

• Infectious pulmonary tuberculosis was diagnosed in a nurse working in the newborn nursery and maternity ward of a NYC hospital

• 1545 patients and coworkers are being tested.

Source: MMWR December 23, 2005
Tuberculosis

- Seattle - Spring 2004
- 3 Lab workers were infected with TB while working on a vaccine
- None of the workers have active TB and were treated with preventative drugs

Source: Seattle Times Apr. 29, 2005
SARS

- Major Outbreak
  - Nov ‘02 to July ‘03
- Coronavirus
- Incubation
  - 3-10 days
- Communicability
  - 21 days
- Malaise, fever, cough, shortness of breath, diarrhea
- HCW high risk – pulmonary procedures
* Health-care workers; † All guests except G and K stayed on the 9th floor of the hotel. Guest G stayed on the 14th floor, and Guest K stayed on the 11th floor; § Guests L and M (spouses) were not at Hotel M during the same time as index Guest A but were at the hotel during the same times as Guests G, H, and I, who were ill during this period.
SARS Transmission/Prevention

**Transmission**
- Expelled respiratory droplets
- Membrane contact w/contaminated surfaces
- NOT likely spread via ventilation systems or on public transportation

**Prevention**
- Handwashing
- HCW PPE
  - Respiratory Protection
    - NRP 95, 99, 100
  - Gloves
  - Eye Protection
  - Disposable Gown
  - Apron
  - Footwear that can be decontaminated
SARS Canadian MD

- Family Physician
- Examined 3 people exposed to SARS
  - No infection control or precautions used
- 2 days later developed symptoms
- 6 days later developed had pneumonia
- Admitted to SARS ward and then to ICU
- In ICU lab results returned positive for SARS
- 11 people who cared for the patient became ill
- All wore recommended PPE
- Engineering controls in place but sub-optimal
- No respiratory protection program existed

Source: Dr. Patricia Bray OSHA
Avian Flu: H5N1

**Transmission**
- Inhalation of dust or water droplets of chicken farming or processing
- Contact with mucus membrane
- Chickens/Birds to Humans
- Ingestion – no evidence

**Global**
- Inevitable?
- Preparedness and Stockpiling
- Vaccine (clinical trails underway)
# Current Human Case Totals

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<tr>
<th>Country</th>
<th>Cases</th>
<th>Deaths</th>
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<tr>
<td>Azerbaijan</td>
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<td>5</td>
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<td>4</td>
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<tr>
<td>Viet Nam</td>
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<td>42</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>206</strong></td>
<td><strong>114</strong></td>
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2003 to Present: Source: WHO: 5 May 2006
Avian Flu Prevention

- Avoid contact with poultry and other birds
- Avoid inhalation of dust from bird farming material
- Avoid touching contaminated material
- Practice hand hygiene

- Personal Protective Equipment
  - Gloves
  - Respirators
  - Gowns/coveralls/apron foot coverings
  - Safety glasses or goggles
  - Removal and disposal of contaminated clothing
  - Isolation rooms (HCW)
THANK YOU!

- Stay safe, healthy and don’t forget to WASH