Bridging Biosafety and Infection Prevention: Professional Development for a New Era

Robert Emery DrPH, Scott Patlovich, DrPH, and Janelle Rios, PhD
The University of Texas Health Science Center at Houston

Association for Professionals in Infection Control and Epidemiology
Houston Chapter | May 17, 2016
Learning Objectives

- List the 4 major professions charged with the control and prevention of infectious disease
- Describe the Global Health Security Initiative
- List 5 threats to global health security
- Describe recent research into the stated competencies for the biosafety and infection prevention professions
- Describe current educational efforts underway to meet training needs
## Summary of the First 10 Confirmed Cases of Ebola Virus on US Soil
*(as of November 30, 2014)*

<table>
<thead>
<tr>
<th>NO.</th>
<th>NAME</th>
<th>REMARKS</th>
<th>CONTRACTED EBOLA IN THE USA?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kent Brantley</td>
<td>Purposely transported to US for treatment in specialized facility, survived</td>
<td>NO</td>
</tr>
<tr>
<td>2</td>
<td>Nancy Writebol</td>
<td>Purposely transported to US for treatment in specialized facility, survived</td>
<td>NO</td>
</tr>
<tr>
<td>3</td>
<td>Rick Scara</td>
<td>Purposely transported to US for treatment in specialized facility, survived</td>
<td>NO</td>
</tr>
<tr>
<td>4</td>
<td>Unnamed person</td>
<td>Purposely transported to US for treatment in specialized facility, survived</td>
<td>NO</td>
</tr>
<tr>
<td>5</td>
<td>Askoka Mukpo</td>
<td>Purposely transported to US for treatment in specialized facility, survived</td>
<td>NO</td>
</tr>
<tr>
<td>6</td>
<td>Thomas Duncan</td>
<td>Flew to US while asymptomatic, treated, but died</td>
<td>NO</td>
</tr>
<tr>
<td>7</td>
<td>Nina Pham</td>
<td>Healthcare worker directly involved in Mr. Duncan’s care, survived</td>
<td>YES</td>
</tr>
<tr>
<td>8</td>
<td>Amber Vinson</td>
<td>Healthcare worker directly involved in Mr. Duncan’s care, survived</td>
<td>YES</td>
</tr>
<tr>
<td>9</td>
<td>Craig Spencer</td>
<td>Patient contact in West Africa, flew asymptomatic, survived</td>
<td>NO</td>
</tr>
<tr>
<td>10</td>
<td>Martin Salia</td>
<td>Purposely transported to US for treatment in specialized facility, died</td>
<td>NO</td>
</tr>
</tbody>
</table>

Note: 43 community contacts with Mr. Duncan passed the 21 day incubation period and came off “fever watch” and “enforceable control orders”. 75 health care workers who supported Mr. Duncan’s care also were cleared.
The Significance of Public Health in America:
64% Increase in Average Life Expectancy Over 100 Year Period

Source: Ten Great Public Health Achievements -- United States, 1900-1999 MMWR, April 02, 1999 / 48(12);241-243
http://www.cdc.gov/mmwr/preview/mmwrhtml/00056796.htm
Ten Great Public Health Achievements in the United States, 1900 to 1999

1. Vaccinations
2. Motor-vehicle safety
3. Safer workplaces
4. Control of infectious disease
5. Decline in deaths from coronary heart diseases and stroke
6. Safer and healthier foods
7. Healthier mothers and babies
8. Family planning
9. Fluoridation of drinking water
10. Recognition of tobacco use as a health hazard

Source: Ten Great Public Health Achievements -- United States, 1900-1999  MMWR, April 02, 1999 / 48(12);241-243
http://www.cdc.gov/mmwr/preview/mmwrhtml/00056796.htm
150 Years of Change

Number of Days to Go Around the World

World Population in Billions
“...In the silent war against disease, no truce is ever seen...”

Line from the United States Public Health Service Commission Corps march song
Despite all of this progress, the infectious disease burden in the United States is significant, resulting in over 100,000 deaths each year.  

(Note – this is 22 times the number of workplace fatalities each year: 4,400)

While the health care community is focused on the treatment of individuals with disease (a subset of which may be infectious), there are four professions that are focused primarily on the control and prevention of infectious disease:

1. Infection preventionists
2. Biosafety professionals
3. Environmental health specialists
4. Public health professionals

Although the targeted populations for each of these professions differ, a common set of core competencies exists that are absolutely essential in order to successfully control and prevent infection.
Public Health (MPH)
- Focus: Protection of the public
- Core courses: (1) Epidemiology, (2) Biostatistics, (3) Occupational and Environmental Health, (4) Behavioral Sciences and (5) Management & Policy Sciences
- Professional Organization: American Public Health Association (APHA)
- Certification: CPH

Infection Preventionist
- Focus: Protection of patients in clinical settings
- Professional organization: Association for Professionals in Infection Control and Epidemiology (APIC)
- Certification: CIC

Registered Environmental Health Specialist (Registered Sanitarian)
- Focus: Protection of the public
- Core areas: (1) Food, (2) Water, (3) Housing dangers, and (4) Waste management
- Professional organization: National Environmental Health Association (NEHA)
- Certification: REHS or RS

Common core competencies
**Disease Control:**
- Basic mechanisms of infection
- Germ theory
- Koch’s postulates
- Immunology
- Disease reservoirs & hosts
- Modes of transmission
- Pathogens
- Taxonomy
- Genetics DNA/RNA

Biosafety
- Focus: Protection of workers in labs
- Professional organization: American Biological Safety Association (ABSA)
- Certification: CBSP

Disease Control:
- Basic mechanisms of infection
- Germ theory
- Koch’s postulates
- Immunology
- Disease reservoirs & hosts
- Modes of transmission
- Pathogens
- Taxonomy
- Genetics DNA/RNA
• Primarily focused on protection of **patients** in clinical setting

• Examples diseases and organisms:
  • *Clostridium difficile*
  • Hepatitis
  • Human Immunodeficiency Virus (HIV)
  • Methicillin-resistant *Staphylococcus aureus*
  • Tuberculosis (TB)
  • Vancomycin-resistant *Enterococci* (VRE)

• Areas of concern:
  • Healthcare Associated Infections (HAIs) –
  • Central line-associated bloodstream infection (CLABSI)
  • Catheter-associated Urinary Tract Infection (CAUTI)
  • Surgical Site Infection (SSI)
  • Ventilator-associated Pneumonia (VAP)

• Key terms / concepts: patient safety, medication safety, injection / sharps safety, blood / transplant safety, vaccine safety, hand hygiene
Biosafety Profession

- Primarily focused on protection of **lab workers**

- Areas of concern:
  - Risk grouping of infectious agents (RG 1-4)
    - e.g. bacteria, viruses, parasites, prions
  - Biosafety level designations (BSL 1-4)
  - Animal biosafety level designations (ABSL 1-4)
  - Plant biosafety
  - Recombinant and synthetic nucleic acid molecules (NIH Guidelines)
  - Select agents and toxins (CDC/USDA)
  - Dual use research of concern
  - Biosecurity
  - Training
  - Biosafety cabinetry (and other containment)
  - Transportation of infectious agents
  - Decontamination, disinfection, sterilization

- Key terms / concepts: risk assessment, containment, laboratory acquired infections, good microbiological technique, safe work practices, laboratory facility design, gain of function
Registered Environmental Health Specialty Profession

- Primarily focused on protection of **public** from infection from food, water, housing, waste
- Example areas of concern:
  - Foodborne illness –
    - Norovirus
    - *Clostridium perfringens*
    - *Campylobacter* spp.
    - *Staphylococcus aureus*
    - *E. coli*
    - *Listeria monocytogenes*
  - Water borne illness –
    - *Giardia lamblia*
    - *Cryptosporidium parvum*
- Key terms / concepts: Swimming pools and recreational facilities, Vectors, pests, and poisonous plants, Solid and hazardous waste, air quality and noise, Occupational health and safety, General environmental health, Disaster sanitation and emergency planning
Public Health Profession

- Primarily focused on the education and protection of public from non-contagious and contagious diseases
- Example areas of concern:
  - Influenza
  - Tuberculosis
  - Sexually transmitted infections
  - Ebola
- Key terms / concepts: immunizations, records, contact investigations, “fever watch”, “enforceable control orders”
So, What is **Global Health Security**?

- The goal of the Global Health Security initiative is to: prevent, detect, and respond to infectious disease threats where they start.
- The initiative consists of the US and more than two dozen countries and international organizations.
- A consequence of a more interconnected world is the increasing opportunity for human, animal, and zoonotic diseases to emerge and spread globally.

> “Global health security is shared responsibility. No one country can achieve it alone. A threat anywhere is indeed a threat everywhere”
- Health and Human Services Secretary Kathleen Sebelius
Threats to Global Health Security

Five sources of threat to our global health security:

1. The emergence and spread of new microbes
2. The globalization of travel and food supply
3. The rise of drug-resistant pathogens
4. The acceleration of biological science capabilities and the risk that these capabilities may cause the inadvertent or intentional release of pathogens
5. Continued concerns about the acquisition, development, and use of biological agents by state or non-state actors

White House memo, July 18, 2014
National Strategy for Countering Biological Threats: Global Health Security Agenda

• **Prevent** avoidable outbreaks
  • Prevent the emergence and spread of antimicrobial drug resistant organisms and emerging zoonotic diseases, and strengthen international regulatory frameworks governing food safety
  • Promote national biosafety and biosecurity systems
  • Reduce the number and magnitude of infectious disease outbreaks

• **Detect** Threats Early
  • Launch, strengthen and link global networks for real-time bio-surveillance
  • Strengthen the global norm of rapid, transparent reporting and sample sharing in the event of health emergencies
  • Develop and deploy novel diagnostics and strengthen laboratory systems
  • Train and deploy an effective bio-surveillance workforce

• **Respond** Rapidly and Effectively
  • Develop an interconnected global network of Emergency Operations Centers and multi-sectoral response to biological incidents
  • Improve global access to medical and non-medical countermeasures during health emergencies
“At one time, protecting the public’s health was considered a local community responsibility. But in this new world that’s no longer so. With people and goods moving so freely across borders, we are all now citizens of a global community. We must now undertake a collaborative world-wide enterprise – nothing less will do.”

-From Dr. Robert Earl in a July 2015 editorial in Forbes on the issue of Global Health Security
Comparing Professional Competencies

• Biosafety and infection prevention professional competencies recently reviewed for commonalities and differences
  - As listed by APIC and ABSA

• Publication forthcoming in *Applied Biosafety* journal describing comparison
Comparing Professional Competencies

**Stated Competency Categories**

Primarily Applicable to **Biosafety**

- Prevention of laboratory associated infections
- Recombinant / synthetic nucleic acid molecules
- Animal work
- Compliance with profession-specific regulations
- Institutional Biosafety Committees (IBCs)
- Laboratory facility design issues
- Biosafety-specific equipment, e.g. biosafety cabinets

Primarily Applicable to **Infection Prevention**

- Environment of care
- Patient safety
- Surveillance and epidemiology
- Clinical facility design issues
- Community – patients, families, others

**Stated Competency Categories**

Applicable to Both Professions (with some differences)

- Disease history, transmission, prevention
- Risk assessment and risk management
- Exposure controls for infectious agents
  - Patients/Community
  - Workers
- Personal protective equipment
- Sterile techniques
- Hand hygiene
- Containment issues: e.g. directional airflow, aerosol mitigation
- Education & training
- Project management & communication
- Guidelines and regulations: e.g. OSHA Bloodborne Pathogen Standard
- Decontamination, disinfection, sterilization
- Biohazardous and sharps waste management & disposal
Relative Involvement of Infection Prevention and Biosafety Programs by Complexity of Clinical Encounter

- **Biosafety Program Domain**
  - Added issues:
    - Additional regulations (Select Agents, rDNA)
    - IBC review, Enhanced PPE selection and use, proper donning and doffing, specimen handling and transport, waste disposal, water releases, worker training, reporting

- **Infection Prevention Program Domain**
  - Typical infection prevention activities include hand hygiene, patient and medication safety, injection & sharps safety, blood / transplant safety, vaccine safety, monitoring for Healthcare Associated Infections (HAIs)

Clinical Encounter Type by Relative Level of Infection Control Complexity:
- Low
- High

Relative Healthcare Worker Infection Risk:
- Low
- High

Clinical Encounter Types by Complexity:
- Non-invasive clinical encounter
- Clinical encounter with invasive procedures
- Clinical encounter with contact exposure risk
- Clinical encounter with airborne exposure risk
- Clinical study involving human gene transfer (rDNA)
- Clinic encounter involving highly pathogenic infectious disease
New Academic Opportunities

• Biosafety and Infection Prevention course offerings at UT School of Public Health

• Various biosafety and infection prevention faculty and expertise; direct linkage with practicing professionals

• Graduate student talent matched with available internship opportunities
Continuing Education

Biosafety and Infection Diseases Training Institute (BIDTI)

- Funded by the National Institute of Environmental Health Sciences, National Institutes of Health
- Pilot project, summer 2015 – Fundamentals of Infectious Diseases of Public Health Significance
- Full 3-year project beginning soon
  - Expanded partnerships
  - Direct and train-the-trainer delivery models
  - Three course levels:
    - Community level
    - Awareness level
    - Operations level
Useful References

- Global Health government webpage http://www.globalhealth.gov
- CDC Global Health Security webpage http://www.cdc.gov/globalhealth/security/
- American Biological Safety Association www.absa.org
- American Public Health Association www.apha.org
- American Society for Microbiology www.asm.org
- CDC HAN Network http://emergency.cdc.gov/HAN/
- Association for Professionals in Infection Control and Epidemiology www.apic.org
- National Environmental Health Association www.neha.org
- Texas DSHS outbreak website: http://www.dshs.state.tx.us/news/updates.shtm
Thank you!