

Highly Infectious Diseases: *What Preparedness Professionals Need to Know About “Global Health Security”*



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Learning Objectives

- ⌘ Define “Global Health Security” and describe its importance
- ⌘ List the 5 strategic objectives established for enhancing Global Health Security
- ⌘ Describe examples of current threats to our Global Health Security
- ⌘ Discuss the steps that should be taken by safety professionals to not only protect themselves and their families, but also the organizations they serve
- ⌘ Provide a useful list of references

Summary of the First 10 Confirmed Cases of Ebola Virus on US Soil

(as of November 30, 2014)

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

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.

Health



World Health
Organization

& WHO Definition:

“Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.”

- ❧ Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 States

Disease

⌘ “An interruption, cessation, or disorder of bodily function, system or organ”

⌘ Steadman’s Medical Dictionary, 27th Edition

⌘ Classified by the World Health Organization (WHO) as either “non-communicable” or “communicable”

⌘ **Non-communicable:** a disease manifested in an individual that is not transmissible to others

⌘ **Communicable:** a disease that is transmissible by infection or contagion directly or through the agency of a vector. Also commonly referred to as “infectious”

Outbreak

- ⌘ The occurrence of cases of disease in excess of what would normally be expected in a defined community, geographical area or season.
- ⌘ A single case of a communicable disease long absent from a population, or caused by an agent not previously recognized in that community or area, or the emergence of a previously unknown disease, may also constitute an outbreak and should be reported and investigated.

Communicable Disease History

- ‡ Infectious disease outbreaks have been documented throughout history
- ‡ Examples include epidemics of smallpox, leprosy, tuberculosis, meningococcal infections, and diphtheria
- ‡ From the earliest times, humans have sought to understand the natural forces and risk factors associated with the patterns of illness and death in society
- ‡ The magnitude of mortality was enormous. Medicine and religion strove to console the sick and dying. But because medical knowledge was lacking, religious explanations for disease dominated

Early Epidemiology

- ⌘ The contagious characteristic of infectious disease was recognized in early epidemics, but the knowledge of the epidemiological basis of disease spread was lacking
- ⌘ For example, leprosy was considered highly contagious and equated religiously with sin.
- ⌘ In the Middle Ages, lepers were literally stricken from society and often delivered a “Mass of Separation” wherein a Priest issued specific orders to exclude them from interacting in public

Fracastoro (1478-1553)

- ⌘ Wrote “On Contagion, Contagious Disease and Their Treatment” in 1546
- ⌘ He proposed a revolutionary theory that infectious diseases were transmitted from person to person by invisible seeds he called “*seminaria*”
- ⌘ But he held to the ancient belief that these transmissions were influenced by the alignment of three planets: Mars, Saturn, and Jupiter
- ⌘ He postulated that the environment became polluted with *seminaria* when certain atmospheric and astrologic conditions occurred
- ⌘ It wasn't until 200 years later with the invention of the microscope that his theory of *seminaria* would be confirmed with the visualization of microbes

Epidemiological Progress

- ⌘ While the exact biological basis for many diseases had not yet been determined, the science of epidemiology emerged as a valuable tool in combating disease
 - ⌘ John Snow (1813-1858) evaluated the transmission of cholera 30 years prior to the identification of the causative organism
 - ⌘ William Budd (1868-1953) chronicled the transmission of typhoid fever 35 years prior to the isolation of *Salmonella typhi*.
 - ⌘ Ignatz Semmelweiss documented an outbreak of puerperal (or childhood fever) in 1847 in a hospital due to the absence of good hand hygiene

Microorganism Discovery

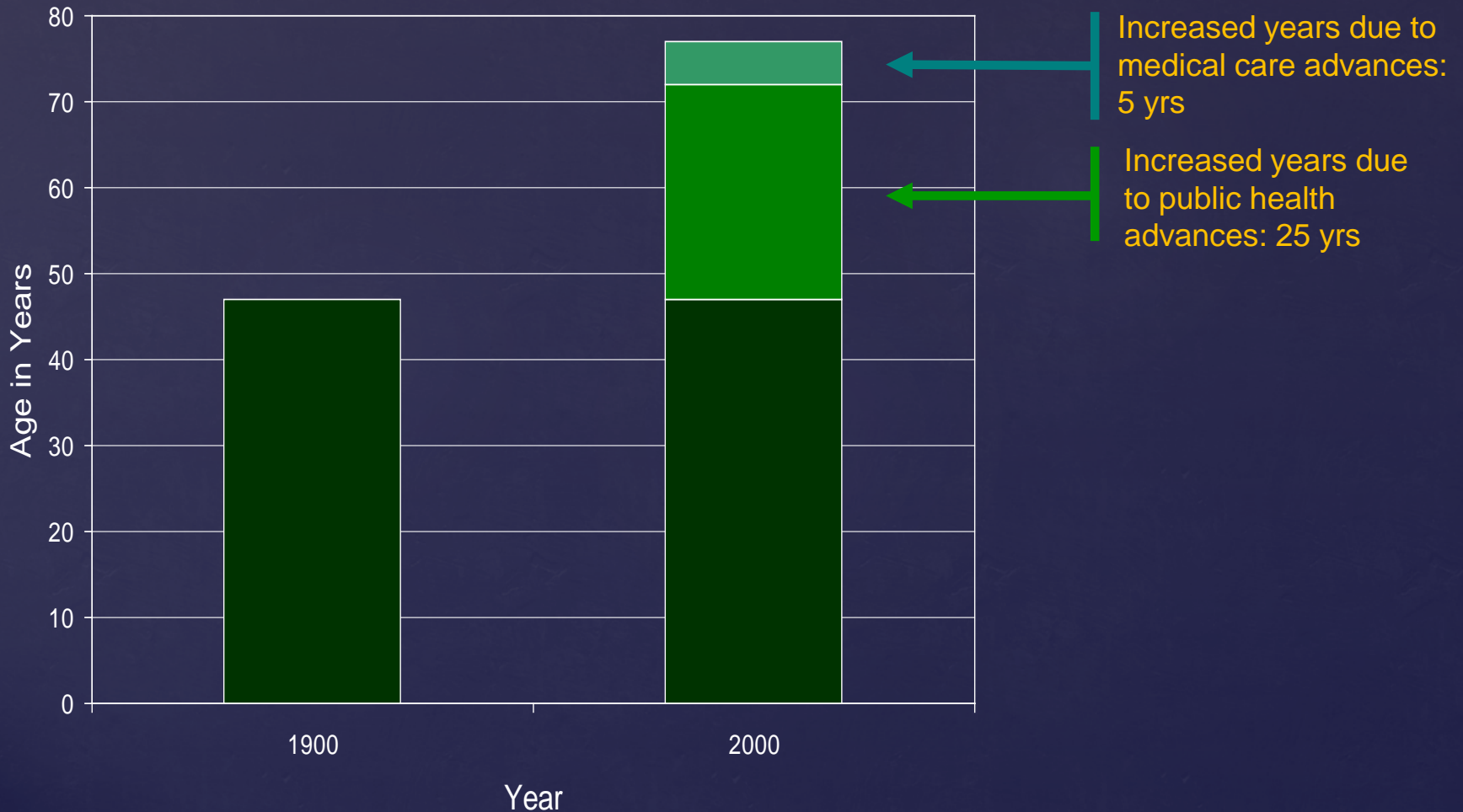
- ‡ 1683 Anton van Leeuwenhock invented the microscope and reported the presence of materials in rainwater and human excretions
- ‡ 1857 Louis Pasteur demonstrated that fermentation depended on the presence of microorganisms
- ‡ Robert Koch demonstrated in, 1876, that one could reproducibly transmit anthrax from diseased cows to mice and developed “Koch’s Postulates”

Further Progress

- ⌘ The identification of causative microorganisms lead to better epidemiological understanding of diseases
- ⌘ Microbiology, virology, and immunology emerged as professions in parallel to epidemiology, statistics and public health
- ⌘ Between 1887 and 1902 the NIH was created for “the study of infectious and contagious disease and matters pertaining to public health”
- ⌘ Better understanding of disease pathology also lead to better treatments. Vaccines for rabies, anthrax, diphtheria and tetanus were developed are considered one of the most important public health improvements of the century

The Significance of Public Health in America:

64% Increase in Average Life Expectancy Over 100 Year Period

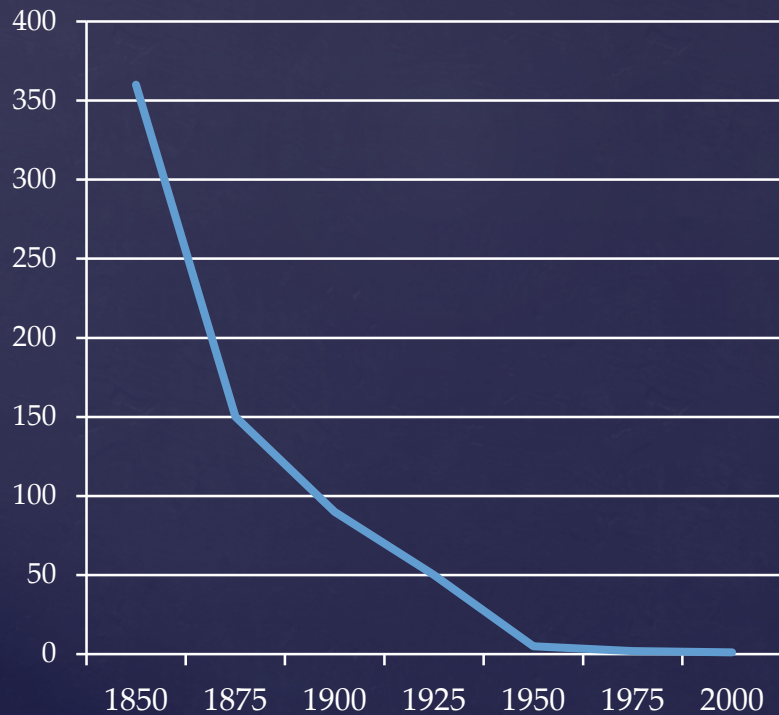


Ten Great Public Health Achievements in the United States, 1900 to 1999

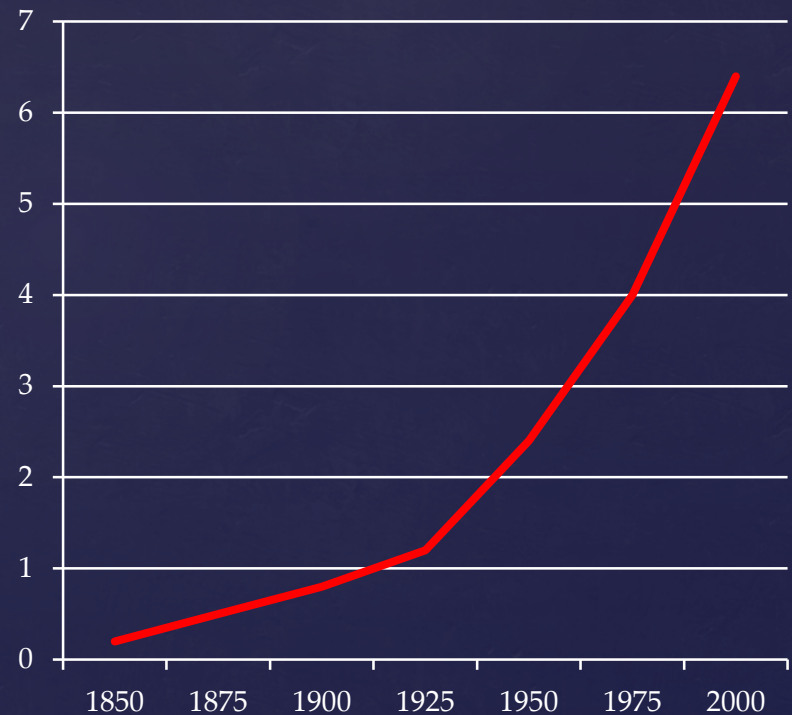
1. Vaccinations
2. Motor-vehicle safety
3. Safer workplaces
4. Control of infectious disease
5. Decline in deaths from coronary heart diseases and stroke
6. Safer and healthier foods
7. Healthier mothers and babies
8. Family planning
9. Fluoridation of drinking water
10. Recognition of tobacco use as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

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

Continued Disease Burden and Associated Professions

- ⌘ 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 22X 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.

**Registered Environmental Health Specialist
(Registered Sanitarian)**

Primarily focused on protection of **public**
from infection from
food, water, housing, waste

Professional organization: National
Environmental Health Association
(NEHA)
Certification: RHES/RS



Infection Preventionist

Primarily focused on protection of
patients in clinical settings

Professional organization: Association for
Professionals in Infection Control and
Epidemiology (APIC)
Certification: CIC



Biosafety

Primarily focused on
protection of **workers** in
labs

Professional organization:
American Biological Safety
Association (ABSA)
Certification: CBSP



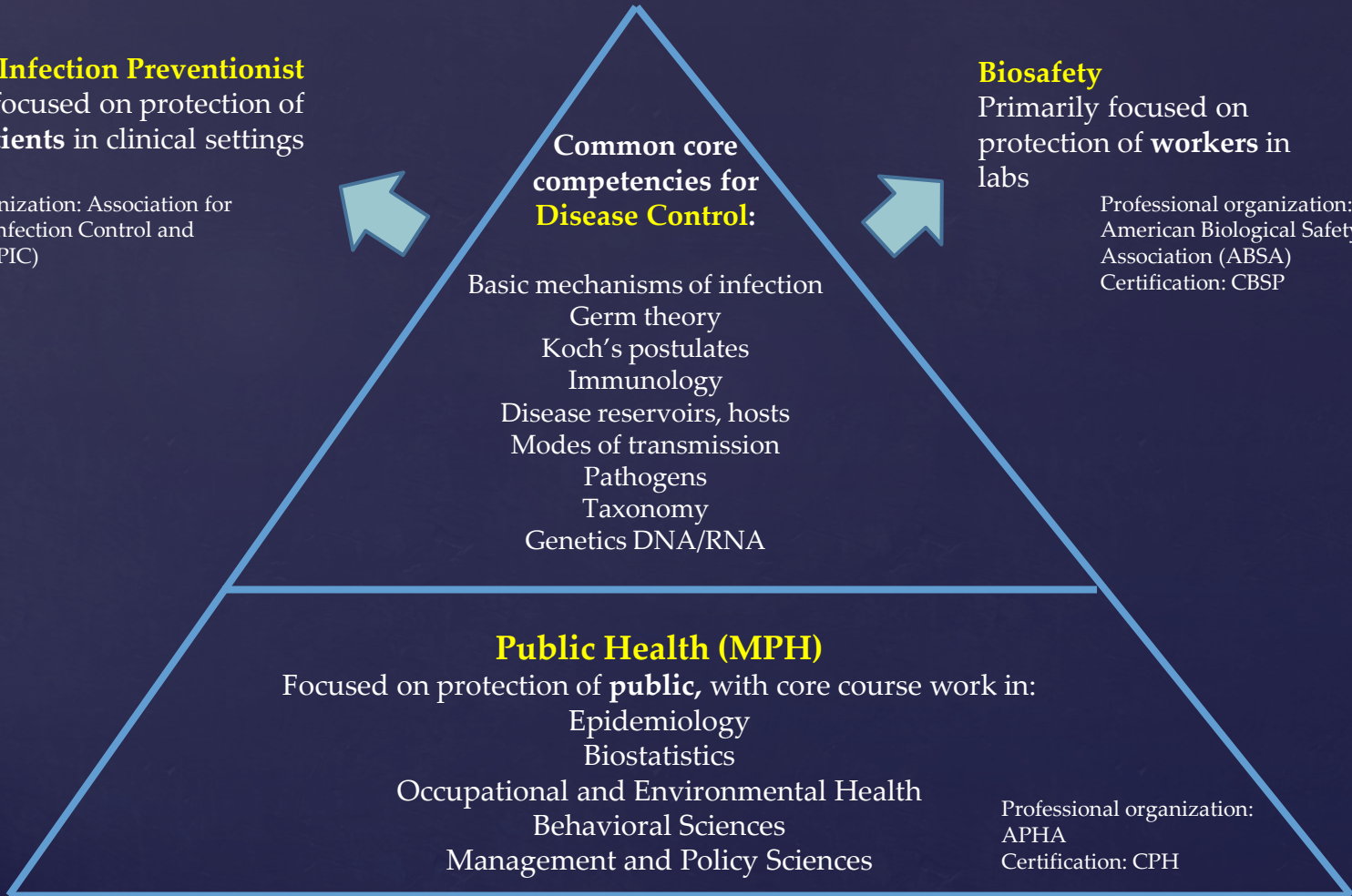
**Common core
competencies for
Disease Control:**

Basic mechanisms of infection
Germ theory
Koch's postulates
Immunology
Disease reservoirs, hosts
Modes of transmission
Pathogens
Taxonomy
Genetics DNA/RNA

Public Health (MPH)

Focused on protection of **public**, with core course work in:
Epidemiology
Biostatistics
Occupational and Environmental Health
Behavioral Sciences
Management and Policy Sciences

Professional organization:
APHA
Certification: CPH



Infection Preventionists

- ⌘ 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

Registered Environmental Health Specialist

- ⌘ Primarily focused on protection of **public** from infection from food, water, housing, waste
- ⌘ Example areas of concern:
 - ⌘ Foodborne illness –
 - ⌘ Norovirus
 - ⌘ *Clostridium perfringens*
 - ⌘ *Camphylobacter* 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

Biosafety Professional

- ⌘ 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

Public Health Professional

- ⌘ 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”

Key Resource Across All Professions

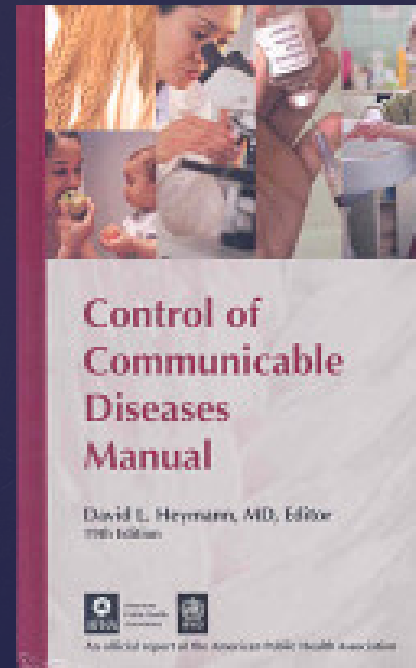
*“Preventing the transmission of infectious diseases has never been more challenging than today in a world that is characterized by tremendous globalization, connectivity, and speed. I can think of no other resources more vital than the APHA’s **Control of Communicable Diseases Manual** for health professionals to meet these challenges head-on”*

✎ **Dr. Julie Gerberding, former Director, CDC**



APHA Control of Communicable Disease Manual Consistent Format

- ⌘ Identification
- ⌘ Infectious agent
- ⌘ Occurrence
- ⌘ Reservoir
- ⌘ Modes of transmission
- ⌘ Incubation period
- ⌘ Period of communicability
- ⌘ Susceptibility
- ⌘ Methods of control



Texas DSHS Infectious Disease Outbreak Webpage

- Disease Prevention
- Health Services
- Licenses and Regulation

Vision: A Healthy Texas

Mission: To improve health and well-being in Texas



Ebola - Nov. 10, 2014

Officials continue to monitor all travelers who return to Texas from countries with widespread Ebola outbreaks. Since late October, there have been about 50 people who returned to Texas from those areas.

One of those travelers, a Central Texas nurse who cared for Ebola patients in Sierra Leone, is considered to be at "some risk" of exposure to Ebola and has agreed to stay home until she reaches the 21-day mark. The rest are considered to be "low risk" contacts and are being monitored for symptoms.

[Texas Guidelines for Returning Travelers](#)

Texas has had three confirmed cases of Ebola. Health officials closely monitored about 340 people who had contact with them to watch for symptoms. The last person was cleared from monitoring Nov. 7. No additional cases were diagnosed.

Enterovirus - Nov. 6, 2014

DSHS has confirmed 22 Texas cases of enterovirus D68, a virus that has been responsible for cases of severe respiratory illness in more than 40 states. The children with confirmed cases were residents of Anderson, Bexar (3), Collin, Dallas (7), Denton, Harris, Johnson, Lubbock (5), Midland and Tarrant counties. One additional confirmed case was in a resident of another state.

Enterovirus D68 is one of more than 100 enteroviruses that cause mild to severe respiratory illness and usually peak in the summer and fall. EV-D68 prompted concern this summer when health officials in Chicago and Kansas City identified unusual clusters of severe respiratory illness in children. More than half of the children involved had a history of asthma or wheezing, so parents and caregivers of children with asthma should be on guard for unusual symptoms. Similar clusters have not been reported in Texas.

People should protect themselves from respiratory illnesses by:

- Covering all coughs and sneezes.
- Washing hands frequently with soap and water.
- Avoiding touching eyes and mouth with unwashed hands.
- Disinfecting frequently touched surfaces.
- Staying home if sick.

If a child is having difficulty breathing, parents or other caregivers should seek medical treatment immediately.

[Additional information from CDC](#)

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West Nile in Texas - Nov. 10, 2014

DSHS has confirmed 284 cases of human West Nile illness in Texas this year, including four deaths (Hidalgo, Montgomery, Midland and Tom Green counties).

West Nile is a mosquito-borne virus. There are two forms of the illness, West Nile neuroinvasive disease (WNND) and West Nile fever (WN fever). The symptoms of severe infection from West Nile neuroinvasive disease include headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness and paralysis. West Nile fever is the milder form of the illness. Symptoms include fever, headache, body aches, and occasionally a skin rash on the trunk of the body and swollen lymph glands.

DSHS reminds Texans to reduce the risk of exposure by eliminating standing water and other mosquito breeding areas; making sure door, porch and window screens are in good condition; and using a repellent that contains DEET, picaridin, oil of lemon eucalyptus, IR3535 or para-menthane-diol products when outdoors.

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

Examples

- ⌘ Consider the recent outbreaks of:
 - ⌘ Middle East Respiratory Syndrome (MERS)
 - ⌘ H7N9 influenza
 - ⌘ Ebola
- ⌘ Are all revealing gaps in the global system for managing emerging biological threats
- ⌘ The term “security” is used because healthier countries are more stable and prosperous, hence fewer failed states
- ⌘ The need for enhanced leadership to strengthen global capabilities to prevent, detect, and respond to biological threats, whether naturally occurring, deliberate, or accidental, is acute.

Basic Reproduction Number or Rate (R_0)

R_0 is the estimate of the number of cases a single case generates, on average, during the course of its infectious period

Disease	Transmission	R_0
Measles	Airborne	12 - 18
Pertussis	Airborne droplet	12 - 17
Smallpox	Airborne droplet	5 - 7
Polio	Fecal-oral	5 - 7
Mumps	Airborne droplet	4 - 7
HIV/AIDS	Sexual contact	2 - 5
SARS	Airborne droplet	2 - 5
Ebola	Bodily fluids	1 - 2



DISEASE CAN SPREAD NEARLY ANYWHERE WITHIN 24 HOURS

Image from openflights.org



SARS cost the world

\$30 billion
IN JUST 4 MONTHS



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 biosurveillance
- ∞ 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 biosurveillance workforce

∞ Respond Rapidly and Effectively

- ∞ Develop an interconnected global network of Emergency Operations Centers and multisectoral response to biological incidents
- ∞ Improve global access to medical and non-medical countermeasures during health emergencies

What Can/Should You Do?

⌘ For yourself and your family

⌘ Make sure you and your family are immunized

⌘ Develop good health habits – regular hand washing

⌘ Discuss the issues and monitor for developments (and as we've learned with Ebola, while effectively managing the data)

What Can/Should You Do?

⌘ For your workplace:

- ⌘ Appoint someone to regularly monitor for developments – worldwide
 - ⌘ Subscribe to the Health Alert Network (HAN) hosted by the CDC
 - ⌘ Monitor State Health Department outbreak website

- ⌘ Procure the key reference for communicable diseases so you will have the facts – not media hype
 - ⌘ APHA Control of Communicable Diseases Manual

- ⌘ Evaluate international impacts (supply chain and travel) – assess health warnings

- ⌘ Dedicate some of your professional development training efforts towards a better understanding of infectious disease

What Can/Should You Do?

⌘ For your workplace (continued):

- ⌘ Plan ahead – how might an outbreak (real or perceived) affect your business? Here and abroad?
- ⌘ Make sure outbreaks are one of the perils considered in your emergency response and business continuity plans
- ⌘ Policies for sick leave and time away from work
- ⌘ Consider stockpiles of protective equipment, cleaners, thermometers
- ⌘ Consider how you will communicate with employees and how work might be accomplished in a modified manner
- ⌘ Provide tips to workers about protecting their families

Summary

- ⌘ The five sources of threat to our Global Health Security consists of :
 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

- ⌘ The national strategy to address these threats consists of:
 - ⌘ Preventing avoidable outbreaks
 - ⌘ Detecting threats early
 - ⌘ Responding rapidly and effectively

Summary (con't.)

- ⌘ Although there are four main professions focused on the control and prevention of infection.....
 1. Infection prevention
 2. Biosafety professional
 3. Registered environmental health specialists
 4. Public health

- ⌘ No single profession is sufficient to address this global challenge, hence why it is prudent for health and safety professionals of all types to be knowledgeable of the threat in order to aid in preparedness and response efforts

Final Quote

From Dr. Robert Earl in a July 2015 editorial in Forbes on the issue of Global Health Security:

“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.”

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
 - ⌘ APHA Control of Communicable Diseases Manual
<http://secure.apha.org/imis/ItemDetail?iProductCode=978-087553-0185&CATEGORY=BK>
- ⌘ 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
- ⌘ White House Fact Sheet <http://www.whitehouse.gov/the-press-office/2011/09/22/fact-sheet-global-health-security>
- ⌘ Texas DSHS outbreak website:
<http://www.dshs.state.tx.us/news/updates.shtm>



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