“Threats of Emerging & Re-emerging Infectious Diseases”

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Coverage of Presentation

• Definition
• Major Factors Contributing to Emerging Infections
• SARS
• Avian Influenza
• Pandemic (H1N1) 2009
• Preventing Emerging Infectious Diseases
• MERSCoV
• Ebola Virus Disease
• Emerging Infections
  – Newly identified or previously unknown infections
  – New or drug-resistant infections whose incidence in humans has increased within the past two decades or whose incidence threatens to increase in the near future

• Re-emerging Infections
  – Secondary to the reappearance of a previously eliminated infection or an unexpected increase in the number of a previously known infectious disease
The Global Threat of Infectious Diseases

Emerging and re-emerging diseases

Adapted from Morens, Folkers, Fauci 2004 Nature 430; 242-9
What did these Epidemic Infectious Diseases have in Common?

- Most were caused by zoonotic pathogens
- All spread by modern transportation
- Most had Asian origin
- Laboratory and clinical diagnoses were problematic
- Poor communication among countries
- Major economic impact
Major Factors Contributing to Emerging Infections

- Human demographics and behavior
- Technology and Industry
- Economic development and land use
- International travel and commerce
- Microbial adaptation and change
- Breakdown of public health measures
- Human vulnerability
Major Factors Contributing to Emerging Infections

- Climate & weather
- Changing ecosystems
- Poverty & social inequality
- War & famine
- Lack of political will
- Intent to harm
Human Demographics, Behavior, Vulnerability

• More people, more crowding
• Changing sexual mores (HIV, STDs)
• Injection drug use (HIV, Hepatitis C)
• Changing eating habits: out more, more produce (foodborne infections)
• More populations with weakened immune system: elderly, HIV/AIDS, cancer patients and survivors, persons taking antibiotics and other drugs
Technology and Industry

• Mass food production (Campylobacter, E.coli, etc...)
• Use of antibiotics in food animals (antibiotic-resistant bacteria)
• More organ transplants and blood transfusions (Hepatitis C...)
• New drugs for humans (prolonging immunosuppression)
Economic Development, Land Use, Changing Ecosystems

• Changing ecology influencing waterborne, vectorborne disease transmission (e.g. dams, deforestation)
• Contamination of watershed areas (Cryptosporidium)
• More exposure to wild animals and vectors
International Travel & Commerce

• Persons infected with an exotic disease anywhere in the world can be in another country within hours (SARS...)

• Foods from other countries imported routinely (Cyclospora,....)

• Vectors hitchhiking on imported products (Asian tiger mosquitoes....)
Microbial Adaptation & Change

• Increased antibiotic resistance with increased use of antibiotics in humans and food animals (VRE, VRSA, penicillin- and macrolide-resistant Strep pneumonia, multidrug-resistant Salmonella,....)

• Increase virulence (Group A Strep?)

• Jumping species from animals to humans (avian influenza, HIV?, SARS?)
Poverty, Social Inequality, Breakdown of Public Health Measures

- Lack of basic hygienic infrastructure (safe water, safe foods, etc.)
- Inadequate vaccinations (measles, diphtheria)
- Discontinued mosquito control efforts (dengue, malaria)
- Lack of monitoring and reporting (SARS)
Intent to Harm

- Bioterrorism: Anthrax
- Bio-Crimes: Salmonella, Shigella
- Potential agents: Smallpox, Botulism toxin, Plague, Tularemia....
Trends in Infectious Diseases

• Major infectious disease problems in developed countries are related to:
  – Changing life-styles
  – Technical advances that create groups with increase susceptibility to infectious disease agents
  – Change in the age distribution of susceptible population resulting from incomplete immunization program
  – Emergence of new agents of disease
The single biggest threat to man’s continued dominance on the planet is the virus.

Joshua Lederburg, Ph D
Nobel laureate
Microbial Threats to Health
**Chain of transmission among guests at Hotel M—Hong Kong, 2003**

Guangdong Province, China

- **A**: Hotel M, Hong Kong
  - 4 family members
  - 10 HCWs
  - 37 close contacts
  - 99 HCWs (includes 17 medical students)
- **B**: Hospital 2, Hong Kong
  - 2 family members
  - 4 HCWs*
  - 30 HCWs
  - 156 close contacts of HCWs and patients
- **C**: Hospital 3, Hong Kong
  - 3 HCWs
  - 99 HCWs (includes 17 medical students)
- **D**: Hospital 4, Hong Kong
  - 0 HCWs
  - 28 HCWs
- **E**: Other Hong Kong Hospitals
  - 4 other Hong Kong Hospitals
  - 99 HCWs (includes 17 medical students)

**Locations**
- **A**: Hotel M, Hong Kong
- **B**: Hospital 2, Hong Kong
- **C**: Hospital 3, Hong Kong
- **D**: Hospital 4, Hong Kong
- **E**: Other Hong Kong Hospitals
- **F**: Canada
  - 2 family members
  - 4 family members
  - 2 close contacts
- **G**: Germany
  - 4 family members
  - 10 HCWs
  - 37 close contacts
- **H**: Singapore
  - 37 close contacts
  - 34 HCWs
  - Unknown number close contacts
- **I**: United States
  - 10 HCWs
  - 37 close contacts
- **J**: Vietnam
  - 37 HCWs
  - 37 close contacts
- **K**: Ireland
  - 2 family members
  - 10 HCWs
  - 37 close contacts
- **L**: Canada
  - 2 family members
  - 4 HCWs*
  - 3 HCWs
- **M**: Germany
  - 2 family members

**Guests and Staff**
- **A**: Guest A,在香港客商酒店
- **G**: Guest G, 在香港客商酒店
- **K**: Guest K, 在香港客商酒店
- **L**: Guest L, in Canada
- **M**: Guest M, in Canada

**Data as of 3/28/03**

* 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.
Influenza A Virus History

• Epidemics & pandemics of severe respiratory illness recorded since 16th century
• Influenza pandemic of 1918 killed 20 – 100 millions worldwide
• First influenza virus isolated from pigs in 1931 – “the swine flu” H1N1
• Swine flu found to be responsible for the 1918 pandemic
• First human influenza vaccine (1937 – 1944)
• Bird flu
  – Infections of humans with avian virus, 1997
• Pandemic (H1N1) 2009
Avian Influenza (H5N1)

- The virus is not fully adapted to human
- High case fatality rate (60%)
- Human to human transmission not sustained
Present Philippine Situation

- Absence of bird flu
- Presence of ban on importing poultry, birds & their products
- Migratory wild birds & long coastline
- Illegal entry of exotic birds
- Smuggling of chicken
- No specific human vaccine, little immune protection & re-assortment in humans
Shift of Response to Influenza A (H1N1)

**Containment**
- Prevent and delay entry of virus into area of responsibility
- Stop transmission as early as possible
- Establish nationwide partnerships & cooperation

**Mitigation**
- Ensure quality and efficiency in responding to the pandemic
- Provide adequate care to increasing number of confirmed cases who need special care
- Prepare health system for sustained control & surveillance
Severity Assessment

• Virological factor (Properties of the virus)
  – Self-limiting infections in majority of infected individuals
  – Can cause very severe form of infections among the high risk group

• Population vulnerability
  – Relatively high in the Philippines

• Capacity to respond
  – Established outbreak response mechanism at national & regional levels
Components/Framework of Response

- Command system
- Surveillance
- Health facility response
- Public health interventions
- Risk communication
Pandemic Response

Medical response
- Antiviral drugs
- Vaccines, etc.
- Medical care, PPE

Non-Medical interventions
- Personal hygiene
- Travel advisories
- Quarantine
- Social distancing (school closures, etc.)
- Risk Communication

Social and Economic Systems (keep a society functioning)
- Security
- Food production/distribution
- Energy/power supply
- Telecommunications
- Water & sanitation
- Finance & banking
- Others (i.e. the basic family unit, private businesses)

Disease Prevention & Control Bureau, DOH
Prevention of Emerging Infectious Diseases Will Require Action in Each of These Areas

- Surveillance and Response
- Applied Research
- Infrastructure and Training
- Prevention and Control
Surveillance and Response

Detect, investigate, and monitor emerging pathogens, the diseases they cause, and the factors influencing their emergence, and respond to problems as they are identified.
Applied Research

Integrate laboratory science and epidemiology to increase the effectiveness of public health practice.
Infrastructure & Training

Strengthen public health infrastructures to support surveillance, response, and research and to implement prevention and control programs.

Provide the public health work force with the knowledge and tools it needs.
Prevention & Control

Ensure prompt implementation of prevention strategies and enhance communication of public health information about emerging diseases.
Challenge to Reverse the Trend

- Prevent movement of pathogens and vectors via modern transportation
- Improve international cooperation and data sharing
- Improve effective laboratory-based surveillance
- Rebuild public health infrastructure to prevent & control vector-borne and zoonotic diseases
  - Trained personnel
  - Laboratory and epidemiologic capacity
  - Tools (vaccines, drugs, insecticides, mosquito control, etc)
  - Understanding disease ecology
- Political will
  - Economic support
  - Regional prevention and control programs
Preventing Emerging Infectious Diseases: More to Do

- Enhance communication: locally, regionally, nationally, globally
- Increase global collaboration
- Share technical expertise and resources
- Provide training and infrastructure support globally
- Ensure political support
- Ensure judicious use of antibiotics
- Vaccines for all

Disease Prevention & Control Bureau, DOH
The 2014 Ebola Virus Disease in West Africa

• The outbreak of Ebola in West Africa is the largest in history in terms of the number of cases, deaths and geographic spread.
• The epidemic began in Guinea during December 2013, and the WHO was officially notified of the rapidly evolving outbreak on March 23, 2014. The cases have spread to its capital city and to its neighboring countries of Liberia and Sierra Leone, after being initially confined to a rural area Guinea.
• On July 25, Nigeria reported its first probable case and death. Senegal reported its first confirmed case on August 29.
Ebola Virus Disease (EVD) Updates (as of November 4, 2014)

• A total of 13,268 cases of Ebola Virus Disease, including 4,960 deaths, have been reported in seven affected countries

With widespread & intense transmission:
• Guinea
• Liberia
• Sierra Leone

With initial case/s or with localized transmission:
• Nigeria
  – declared Ebola-free on Oct. 20
• Senegal
  • declared Ebola-free on Oct. 17
• Spain
• United States of America
• Mali
## Countries with Widespread or Intense Transmission (as of 4 November 2014)

<table>
<thead>
<tr>
<th>Country</th>
<th>No. of Cases</th>
<th>No. of Deaths</th>
<th>No. of Overseas Filipino Workers</th>
<th>No. of Filipino UN Peacekeepers</th>
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</thead>
<tbody>
<tr>
<td>Guinea</td>
<td>1,760</td>
<td>1,054</td>
<td>511</td>
<td>0</td>
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<tr>
<td>Liberia</td>
<td>6,619</td>
<td>2,766</td>
<td>200</td>
<td>142</td>
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<tr>
<td>Sierra Leone</td>
<td>4,862</td>
<td>1,130</td>
<td>1,044</td>
<td>0</td>
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<tr>
<td>Total</td>
<td>13,241</td>
<td>4,950</td>
<td>1,755</td>
<td>142</td>
</tr>
</tbody>
</table>

Disease Prevention & Control Bureau, DOH
What is Ebola Virus Disease?

• Severe, infectious, often fatal disease in humans and non-human primates (monkeys, gorillas and chimpanzees) caused by infection with Ebola virus

• Very infectious, kills in a short time but can be prevented

• Ebola virus can cause outbreaks in humans with case fatality rate of 50%
Appearance and Spread

• Ebola first appeared in 1976 in two simultaneous outbreaks in Sudan & in Zaire
• The disease took its name from the Ebola River near the affected village in Zaire
• The Ebola virus is comprised of five distinct species:
  – Bundibugyo
  – Sudan
  – Zaire
  – Ivory Coast
  – Reston
Transmission of the Ebola Virus

- Natural reservoir is suspected to be fruit bats
- Transmission is through the broken skin or mucous membranes due to:
  - Close contact with blood, secretions, organs or other bodily fluids of infected animals
  - Direct physical contact with blood, saliva, stool, urine, sweat and other body fluids of an infected person and soiled linen of a patient
  - Contact with objects, such as needles, contaminated with infected secretions
  - Direct contact with a deceased infected person during burial ceremonies
How do people get sick with EVD?

• Incubation period is 2-21 days before onset of signs & symptoms
• Health care workers have frequently been infected while treating Ebola patients
• Occurs through close contact without use of correct infection control precautions & adequate barrier nursing procedures
• Those with EVD are infectious as long as their blood & secretions contain the virus
Signs & Symptoms

- EVD is a severe acute viral illness often characterized by sudden onset of fever and accompanied by fatigue, muscle pain, headache and sore throat.
- Followed by vomiting, diarrhea, rash, symptoms of impaired kidney and liver function
- In some cases, there may be both internal and external bleeding (oozing from gums & body openings; blood in stools)
Diagnosis

Laboratory findings:
- low counts of white blood cells and platelets
- elevated liver enzymes

Confirmation is by:
- Antibody tests (ELISA)
- Antigen tests
- Serum neutralization test
- Reverse transcriptase polymerase chain reaction assay
- Electron microscopy
- Virus isolation by cell culture
Treatment & Vaccine

• Persons suspected to be suffering from Ebola should be taken to the nearest health unit immediately for medical attention
• Severe cases require intensive supportive care
• No vaccine is yet available for EVD but several vaccines are being tested and it could be several years before large quantities are made available
• Mode of treatment is mainly supportive care for severe dehydration and electrolyte imbalance as well as possible blood transfusions for bleeding complications.
• New drug therapies show promising results in lab studies & currently being evaluated
Prevention

- Raising awareness of the risk factors of Ebola infection and the protective measures individuals can take is the primary strategy in the prevention and containment of EVD spread.
How Contagious is Ebola?

The number of people that one sick person will infect (on average) is called $R_0$. Here are the maximum $R_0$ values for a few viruses.
DOH Interim Guidelines

• Inter-Agency Coordination on Prevention or Minimization of Entry/Spread of Ebola
• Procedures for Isolation, Case Management and Infection Control for Ebola
• Ebola Virus Disease Surveillance and Reporting
• Ensuring Health Security of OFWs in Guinea, Liberia, Sierra Leone Against Ebola
• Ensuring Health Security of Filipino UN Peacekeepers in Liberia Against Ebola
• Risk Assessment for Ebola Virus Disease in the Deployment of Overseas Filipino Workers in West Africa
Inter-Agency Coordination

DOH has worked with different agencies in facilitating the development of guidelines to address the situation in Guinea, Liberia and Sierra Leone:

• repatriation of OFW
• repatriation of Filipino UN Peacekeepers
National Summit on Ebola Virus Disease  
(Oct. 10, 2014)

• National Plan of Action presented
• Pledge of commitment from Government Agencies, Medical Community and Private Sector

#ebolafreeeph
Monitoring of OFWs and UN Peacekeepers arriving from Guinea, Liberia & Sierra Leone

• In coordination with DOLE-POEA and DFA, the Philippines has already repatriated 126 OFWs from Sierra Leone as of Oct. 15, 2014; monitored by the DOH

• UN Peacekeepers will undergo a 21-day quarantine period in a designated military facility upon arrival in the Philippines
Next Steps

• Conduct of capacity building for identified dedicated hospital staff to attend to possible Ebola cases with resource persons contributed by the WHO from the Johns Hopkins University, the Doctors Without Borders and Australia
  – October 28-30 (DOH Referral Hospitals, UP-PGH, AFP Medical Center and PNP General Hospital) (DONE)
  – November 4-6 (Selected Private Hospitals) (DONE)
  – November 11-13 (Selected LGU Hospitals) (ONGOING)
• Procurement of additional Personal Protective Equipment
• Strengthening of RITM Laboratory
• Mobile field hospital set-up in Lung Center of the Philippines
Salamat po!