Biosafety Transport:

Emerging Infectious Disease in EMS
Identify, Isolate, and Inform

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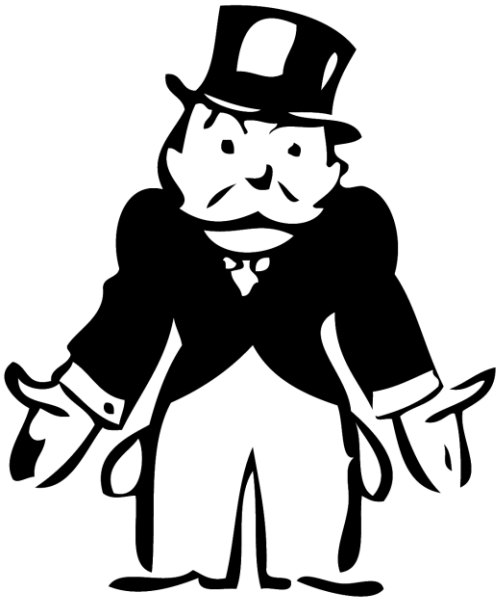
EMORY

4 March 2020

No Conflicts to Report



This course is supported by the National Institute of Environmental Health Sciences – Worker Training Program Grant UH4 ES027093-01 (Ebola Biosafety and Infectious Disease Response)

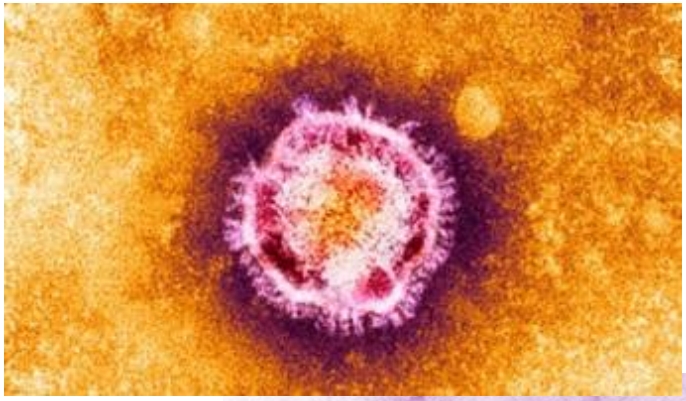
Objectives

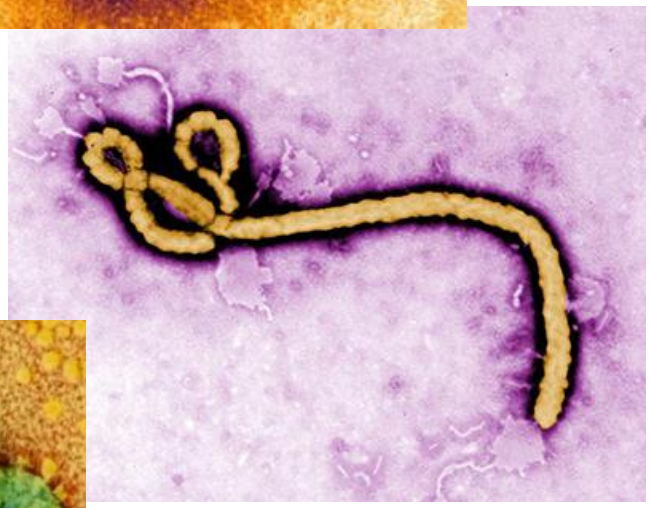
- Discuss current infectious disease threats applicable to the pre-hospital environment
- Describe a methodology to increase the likelihood of identifying infectious disease risks in the workplace – Identify, Isolate and Inform
- Describe strategies to prevent transmission of disease

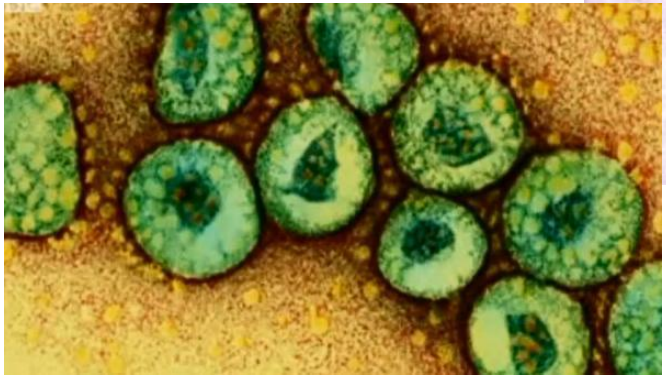
THREATS

Serious Communicable Disease Threats

- Novel Coronaviruses
- Ebola
- Novel and seasonal flu







Novel Coronavirus
SARS, MERS and COVID-19

SARS
(Severe Acute Respiratory Syndrome)

- Viral respiratory illness caused by a coronavirus
- First reported in Asia in FEB 2003
- 8098 people known to have been ill in 29 countries
- 774 died
- 8 people in the US were affected
- Last reported case APR 2004 in China

SARS Clinical Symptoms

- Fever > 100.4
- Headache, malaise, myalgias
- 10-20% have diarrhea
- After 2-7 days – dry cough
- Progress to pneumonia
- Roughly 6-10% reported mortality rate

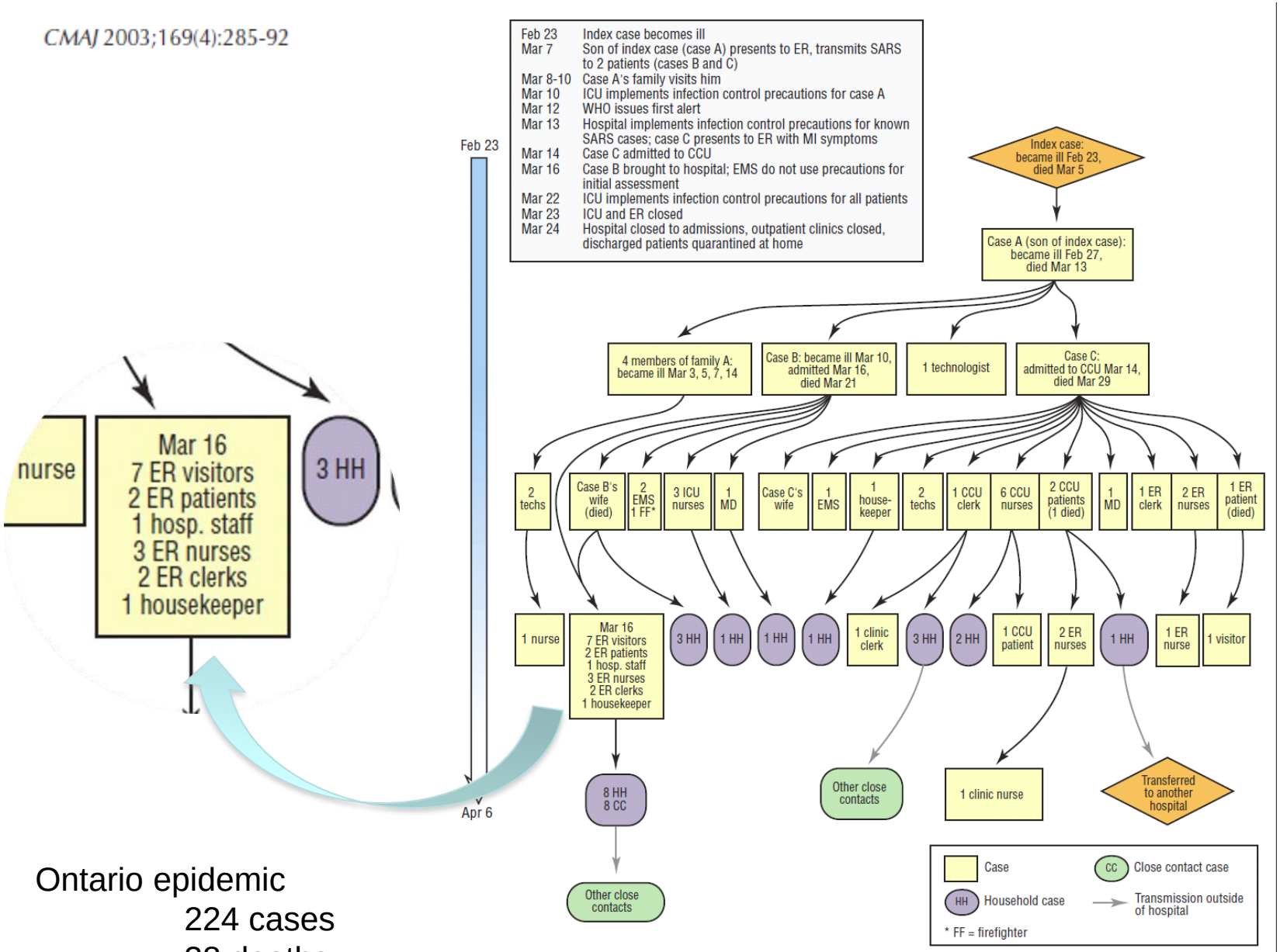
SARS transmission

- Mostly by close contact with respiratory secretions
- Droplets from coughing or sneezing
- Also evidence for airborne transmission
- Has been transmitted in health care settings primarily before infection control measures effected

Hong Kong – of 138 secondary and tertiary cases 62% HCW
Toronto – of 73 secondary and tertiary cases 51% HCW

Investigation of a nosocomial outbreak of severe acute respiratory syndrome (SARS) in Toronto, Canada

CMAJ 2003;169(4):285-92



Ontario epidemic

224 cases

38 deaths

PUBLIC HEALTH

SARS outbreak in the Greater Toronto Area: the emergency department experience

JAMC • 23 NOV. 2004; 171 (11)

- Overcrowding
- Open observation area for respiratory complaints
- Nebulized medications
- Poor compliance with handwashing
- Unrestricted access to visitors

MMWR™

Weekly

May 16, 2003 / 52(19);433-436

Cluster of Severe Acute Respiratory Syndrome Cases Among Protected Health-Care Workers --- Toronto, Canada, April 2003

Donning and Doffing of PPE

Select Your PPE Combination

N95 Respirator & Gown

N95 Respirator & Coverall

PAPR & Gown

PAPR & Coverall

Trained Observer for All PPE

http://www.cdc.gov/vhf/ebola/hcp/ppe-training/index.html

Aerosol Producing Procedures

- Nebulized medications
- Airway suctioning
- Endotracheal intubation
- Positive pressure ventilation (BVM, CPAP, BiPAP)

SARS – The Toronto EMS Experience

- 526 paramedics required quarantine
  - 74% unprotected exposure at a facility with a SARS outbreak
  - 14% unprotected exposure to a colleague
  - 8% failed daily screening
  - 4% exposed to patients with SARS like sx
  - 13% (68) developed sx, 5 diagnosed

ACAD EMERG MED September 2004, Vol. 11, No. 9

SARS Transmission

- No evidence that virus was transmitted from an asymptomatic individual
- Most contagious in second week of illness

SARS
The Toronto EMS Experience

- SARS 1 (30 days)
  - 234 medics on HQ – peak 146 on day 12
  - Total of 1615 HQ days
  - Peak 5 days = 664 HQ days
- SARS 2 (18 days)
  - 292 medics on HQ or WQ – 236 on day 7 (78)
  - Total of 1637 HQ or WQ days
  - Peak 5 days = 910 HQ or WQ (708)

SARS

- Infection control
  - Standard + contact + airborne + eye protection
  - Limit aerosol producing procedures
- Treatment is supportive
- No vaccine

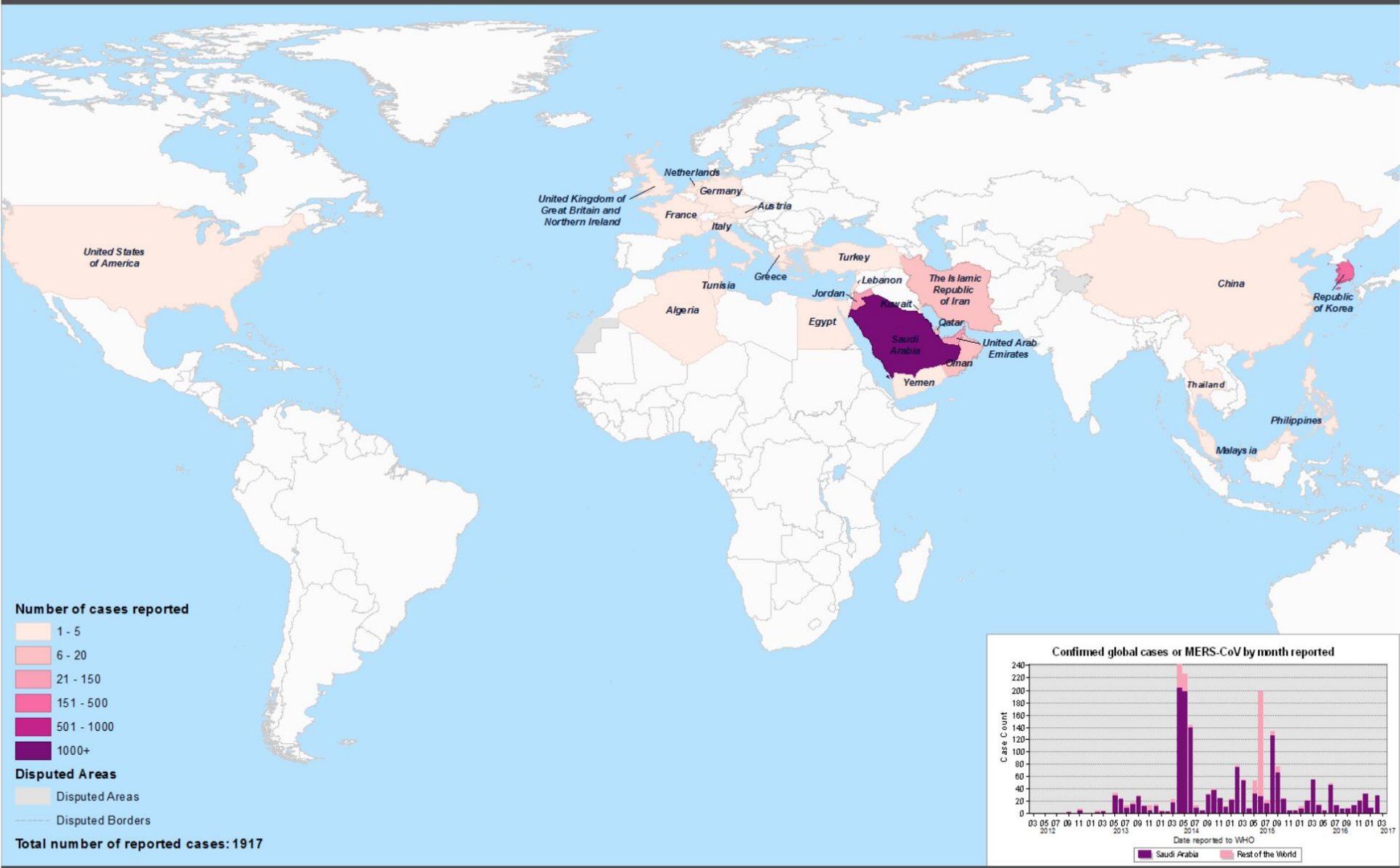
MERS
Middle Eastern Respiratory Syndrome

- Viral respiratory illness caused by a novel coronavirus
- First reported in Saudi Arabia in 2012
- Most likely acquired from an animal source
- All cases linked to travel in or near the Arabian peninsula
- As of DEC 2019 there have been 2499 lab confirmed cases and 861 deaths
- In MAY 2014 two people in the US tested positive

MERS
Middle Eastern Respiratory Syndrome

- Signs and symptoms
  - Fever
  - Cough
  - Shortness of breath
  - Some with diarrhea and nausea vomiting
  - Many proceed to have complications from pneumonia and kidney failure
- Incubation period
  - 2-14 days (typically 5-6 days)
- Transmission through contact with respiratory secretions

CONFIRMED GLOBAL CASES OF MERS-COV 2012 - 2017



Map Scale (A3): 1:1,109,175,783
1 cm = 11,092 km
Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

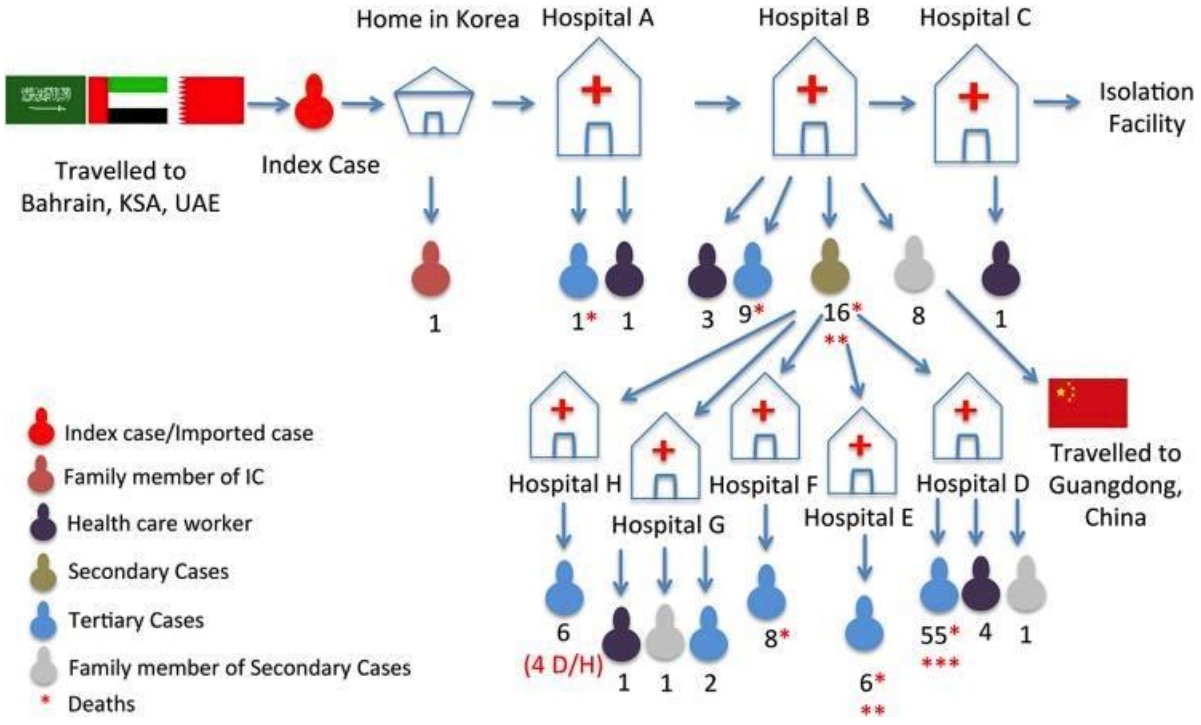
Data Source: World Health Organization

Map date: 03/03/2017

World Health Organization

MERS – South Korea

- 185 cases, 35 deaths
- Case imported May 20th, 2015
- Largest transmission cluster to date
- Over 3000 people quarantined and 700 schools closed



J Infect Dev Ctries 2015; 9(6):543-546.

MERS
Middle Eastern Respiratory Syndrome

- Travel in the last 14 days to the Arabian peninsula or a neighboring country*?
- Signs and symptoms of illness – fever and symptoms of respiratory illness?
- Close contact with others who meet this criteria in the last 14 days?
- Visit to healthcare facility with confirmed MERS in last 14 days?

* Bahrain; Iraq; Iran; Israel, the West Bank, and Gaza; Jordan; Kuwait; Lebanon; Oman; Qatar; Saudi Arabia; Syria; the United Arab Emirates (UAE); and Yemen.

MERS
Middle Eastern Respiratory Syndrome

- Infection control
  - Minimize exposure
  - Standard + contact + airborne precautions + eye protection
  - Limit aerosol producing procedures
- Treatment
  - Supportive
- Vaccine/prophylaxis/PEP
  - None

COVID-19
Novel coronavirus

- Viral respiratory illness caused by a novel coronavirus
- First reported in Wuhan City, China in DEC 2019
- Most likely acquired from an animal source
- Widespread human to human transmission in China - exported to over 60 countries with several reporting sustained human to human transmission
- Over 88,000 cases and over 3000 deaths – 3/2/2020
- Over 90 cases in the US – expect more

COVID-19
Novel coronavirus

- Too early to know case fatality rate – over 80% cases considered mild
- Underlying medical problems associated with increased risk of complications
- Patients may progress to more serious illness in the second week of infection
- Unknown if or how easily asymptomatic shedding occurs

Public Health Emergency of International Concern

COVID-19
Novel coronavirus

- Signs and symptoms
  - Fever
  - Cough
  - Shortness of breath
- Incubation period
  - 2-14 days (typically 5 days)
- Transmission through contact with respiratory secretions

Novel coronavirus PUI criteria (1/31/20)

Clinical Features	&	Epidemiologic Risk
Fever[1] **or** signs/symptoms of lower respiratory illness (e.g. cough or shortness of breath)	**AND**	Any person, including health care workers, who has had close contact[2] with a laboratory-confirmed[3,4] 2019-nCoV patient within 14 days of symptom onset
Fever[1] **and** signs/symptoms of a lower respiratory illness (e.g., cough or shortness of breath)	**AND**	A history of travel from **Hubei Province**, China within 14 days of symptom onset
Fever[1] **and** signs/symptoms of a lower respiratory illness (e.g., cough or shortness of breath) requiring hospitalization[4]	**AND**	A history of travel from mainland **China** within 14 days of symptom onset

Novel coronavirus PUI criteria (3/2/20)

Clinical Features	&	Epidemiologic Risk
Fever[1] **or** signs/symptoms of lower respiratory illness (e.g. cough or shortness of breath)	**AND**	Any person, including healthcare workers[2], who has had close contact[3] with a laboratory-confirmed[4] COVID-19 patient within 14 days of symptom onset
Fever[1] **and** signs/symptoms of a lower respiratory illness (e.g., cough or shortness of breath) requiring hospitalization	**AND**	A history of travel from affected geographic areas[5] (see below) within 14 days of symptom onset
Fever[1] with severe acute lower respiratory illness (e.g., pneumonia, ARDS) requiring hospitalization and without alternative explanatory diagnosis (e.g., influenza)[6]	**AND**	No source of exposure has been identified

COVID-19
Novel coronavirus

- Infection control
  - Minimize exposure
  - Standard + contact + airborne precautions
    - + eye protection
  - Caution with aerosol producing procedures
- Treatment
  - Supportive
- Vaccine/prophylaxis/PEP
  - None

Novel Coronavirus Review

- Acute respiratory illness with significant mortality
- Healthcare workers at risk due to failure to implement infection prevention procedures
- Impact of aerosol producing procedures
- Importance of proper donning/doffing of PPE
- Can interrupt transmission through implementation of infection control procedures

Ebola Virus Disease

Ebola outbreak 2014-2015

28,616

A total of 28,616 Ebola cases have been reported in Guinea, Liberia and Sierra Leone, with 11,310 deaths.

10,000

Today, there are over 10,000 survivors of Ebola virus disease.

Ebola outbreak in DRC ends: WHO calls for international efforts to stop other deadly

24 July 2018 | **Read**

54 people were infected and 33 died

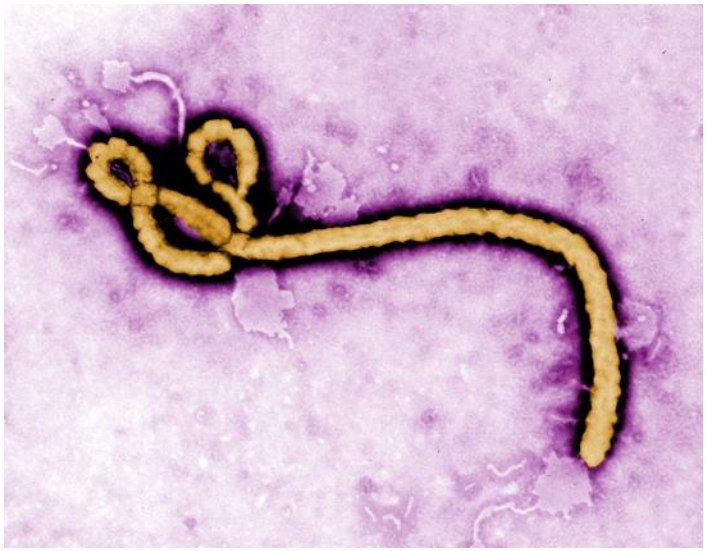
WHO Director-General updates on Ebola outbreak in DRC

MAR 3, 2020
3444 CASES
2264 DEATHS
1168 SURVIVORS

Public Health Emergency of International Concern

Ebola Virus Disease

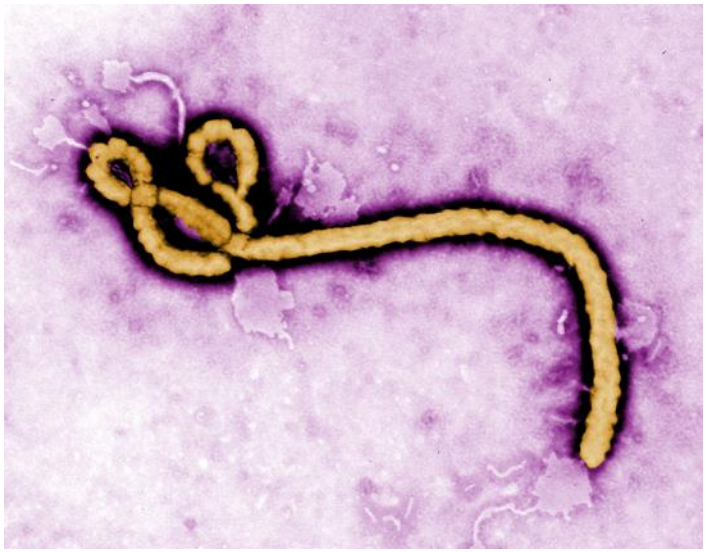
- Exposure
  - Close Contact
    - Blood or infected fluids of person ill with EVD
  - Incubation
    - 2-21 days
    - More typically 8-10 days



CDC/Fredrick Murphy

Ebola Virus Disease

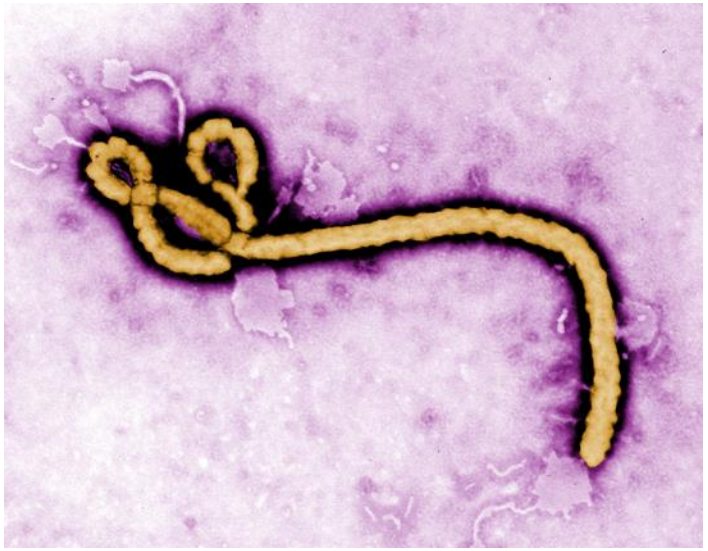
- Signs and symptoms
  - Sudden fever, chills, muscle aches, with diarrhea, nausea, vomiting, abdominal pain
  - Also headache, shortness of breath, chest pain
  - More severe
    - Internal and external bleeding, mental status changes, multi-system organ failure, shock



CDC/Fredrick Murphy

Ebola Virus Disease

- Transmission
  - Exposure to infectious blood or bodily fluids
  - Not contagious until symptoms develop
  - People are more contagious later in the course of their disease
  - Infection control posture
    - Standard + Contact + Droplet
      + Airborne if performing an aerosol producing procedure
- Treatment – supportive
- Vaccine – Good vaccine trial data
  - Pending ACIP recommendations and FDA approval



CDC/Fredrick Murphy

Ebola Virus Disease

- Person Under Investigation Criteria
  - Travel to the Democratic Republic of Congo in the last 21 days
  - Fever or signs and symptoms of illness
    - Severe headache
    - Fatigue
    - Muscle pain
    - Vomiting
    - Diarrhea
    - Abdominal pain
    - Unexplained bleeding

Ebola review

- Asymptomatic patients are not contagious
- Risk of transmission of EVD increases with severity of illness
- Primary infection control principle is preventing exposure to blood and infectious bodily fluid
- Standard + contact + droplet
  - +airborne if performing an aerosol producing procedure
- Treatment is supportive
- Vaccine trial is promising

Influenza Virus

Seasonal Influenza

- Types of influenza viruses
  - Influenza A and Influenza B viruses can cause flu epidemics in humans
    - Influenza A types H1N1 and H3N2
    - Influenza B
  - What is the H and the N?
    - Surface proteins
      - Hemagglutinin – 18 sub-types
      - Neuraminidase – 11 sub-types

Seasonal Influenza

- Contagious respiratory illness
- Fever, chills, cough, sore throat, muscle aches, headache, fatigue
- Transmitted by direct and indirect contact with infectious droplets
- Onset of sx 1-4 days after exposure
- Viral shedding 1 day before onset of symptoms

Seasonal Influenza

- Risk for more serious illness
  - Age >65 and young children
  - Pregnant
  - Chronic medical conditions
    - Asthma
    - Diabetes
    - Heart disease
- Vaccine
  - Safe and can't "give you the flu"
  - Effectiveness

Seasonal Influenza

- Anti-viral treatment
  - Tamilfu, Relenza
  - Can shorten the duration of illness by 1-2 days
  - Can help prevent complications of flu
- Infection control measures
  - Standard + droplet

NBC NEWS

HEALTH

MAR 3 2017, 5:56 PM ET

CDC Concerned by H7N9 Bird Flu's Sudden Spread in China

by MAGGIE FOX

HEALTH

JAN 26 2017, 12:33 PM ET

CDC Issues H7N9 Bird Flu Travel Warning

by MAGGIE FOX

Other Influenza Viruses

- Avian (bird) flu
  - Examples H7N9, H5N1
- Swine/Variant flu
  - Example H3N2v
- Pandemic flu
  - Example 2009 H1N1 pandemic

H7N9 Avian Influenza

- Type A influenza virus
- Human exposure to virus can result after close contact with affected poultry on farms and in markets
- Can cause severe human infection
  - China March 2013
  - 5 epidemic waves caused
    - Total human cases 1567
    - 615 deaths

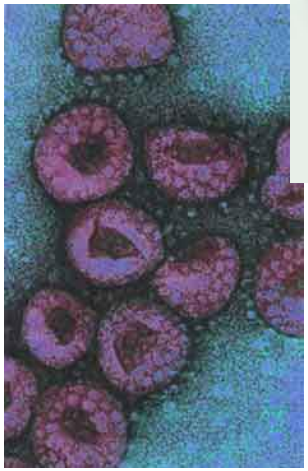
H7N9 Avian Influenza

- Rare human to human spread
- No sustained human or community transmission
- No travel restrictions

Novel Avian Influenza

- Preventing transmission
  - Avoid sources of exposure
  - Infection prevention guidance
    - Standard + Contact + Airborne
      - Eye protection also required
      - Contagious, but very limited human to human transmission
      - Why airborne precautions?
        - » Highly lethal
        - » Human epidemiology is not yet well known
- Vaccines and treatments?

Pandemic Influenza



- Global disease outbreak
- Three criteria
  - A novel influenza virus to which there is little human immunity
  - Makes people ill
  - Virus spreads efficiently from person to person

What's the Difference?

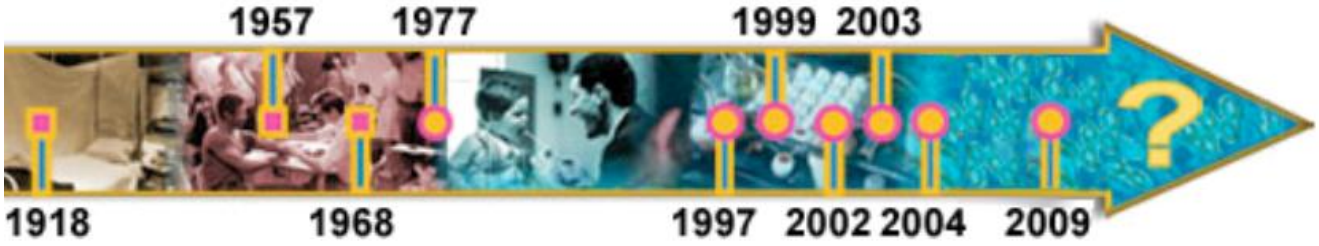
Seasonal

- Annual
- 5-20% infectivity
- 36,000 US deaths
- 500K to 1 million deaths worldwide
- 7-10 day recovery
- Affects the elderly and ill
- Vaccine

Pandemic

- 3-4 times per 100 yrs
- 15-40% infectivity
- 500,000 US deaths
- 50-100 million deaths worldwide
- Longer
- May affect young and healthy
- No vaccine

Pandemic influenza



- 1918 – Spanish Flu (H1N1) – killed 500K in US and 20-50 million worldwide
- 1957 – Asian Flu (H2N2) – Killed 70K in US
- 1968-9 – Hong Kong Flu (H3N2) – Killed 34K in US
- 2009 – H1N1 2009 Killed 12.5K in the US

Pandemic Influenza

- Considerations
  - Measures to prevent transmission
    - Cough etiquette
    - Hand hygiene
    - Isolation of suspected cases
    - Good infection control practice
  - Guidance regarding: PEP, Vaccine, Return to Work criteria, PPE

Guidance will come from public health

Threat Recognition and Management

Identify, Isolate and Inform

Identify

Risk assessment:

What is the likelihood that this patient harbors a serious communicable disease?

- Signs and symptoms

  AND
- For geographically constrained diseases, the travel history

Identify

Risk assessment: COVID-19

Apply a simple face mask to any patient with a cough and fever

Fever and cough or difficulty breathing
+

International Areas with Sustained (Ongoing) Transmission
Last updated February 28, 2020

- China (Level 3 Travel Health Notice)
- Iran (Level 3 Travel Health Notice)
- Italy (Level 3 Travel Health Notice)
- Japan (Level 2 Travel Health Notice)
- South Korea (Level 3 Travel Health Notice)

Graphic/CDC

Identify

Risk assessment: COVID-19

Apply a simple face mask to any patient with a cough and fever

Clinical Features	&	Epidemiologic Risk
Fever[1] **or** signs/symptoms of lower respiratory illness (e.g. cough or shortness of breath)	**AND**	Any person, including health care workers, who has had close contact[2] with a laboratory-confirmed[3,4] 2019-nCoV patient within 14 days of symptom onset
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Fever[1] **and** signs/symptoms of a lower respiratory illness (e.g., cough or shortness of breath) requiring hospitalization[4]	**AND**	A history of travel from mainland **China** within 14 days of symptom onset

Graphic/CDC

Isolate

- Place patient in an area that will limit contact with unprotected personnel
- Limit the number of HCW making patient contact to the minimum required to safely manage the patient
- Determine what PPE is required (to implement the recommended standard transmission-based precautions)
- Restrict contact with patient unless in appropriate PPE

Isolate

- **Considerations:**
  - Place a surgical mask on the coughing patient if tolerated
  - 6 foot or greater distance may protect against droplet exposure
  - Only expose medical equipment necessary for management of the patient to minimize contamination
  - Must protect HCP while avoiding delays in delivering essential care

Inform

- Inform other responders about need to implement infection prevention procedures
- Inform staff at receiving facility
- Inform supervisor/medical director/local public health agency, as directed by local protocol

EMS Biosafety transport

Development and implementation of:

- environmental controls
- administrative policies
- work practices
- safety equipment
- to prevent transmission of biological agents to workers, other persons and the environment

Education, training, competencies

Infection Prevention

- Isolate driver compartment from patient compartment
  - Ventilation system on high and non-recirculating
  - Exhaust fan on high
- Limit exposure of personnel

Infection Prevention

- Appropriate application of PPE
  - Simple face mask on patient
  - Standard and transmission-based precautions
  - Driver should wear N-95 respirator to guard against droplet nuclei potentially carried by the air handling system
- Caution with aerosol producing procedures
- Donning and doffing checklists with observers

Mission Recovery

- Cleaning and disinfection of ambulance –
  - Wear appropriate PPE when cleaning and disinfecting the ambulance
  - Keep doors open, and ventilation systems turned on
  - Clean visibly soiled surfaces
  - Use EPA registered, hospital grade disinfectants
    - Examine claims against pathogens
    - Examine contact time
- Waste management
  - Category A waste – e.g. EVD
  - Category B waste – e.g. novel coronavirus
    - regulated medical waste (red bag)

Post-mission Health Awareness

- Healthcare personnel should be alert for fever or respiratory symptoms for one incubation cycle
- If symptoms develop, self-isolate and notify supervisors or public health per protocol to arrange for an evaluation

Photo/CDC

Objectives

- Provide good supportive care for the patient
- Protect the healthcare worker (EMS + hospital)
- Protect the members of the community

Resources

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Interim Guidance for Emergency Medical Services (EMS) Systems and 911 Public Safety Answering Points (PSAPs) for 2019-nCoV in the United States

EMS INFECTIOUS DISEASE PLAYBOOK

TRACIE

ASPRTRACIE.HHS/GOV

NETEC eLearning Center

courses.netec.org

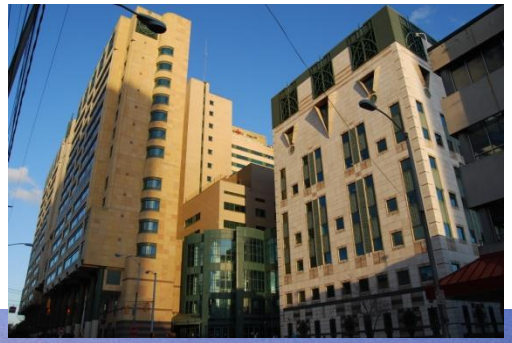
EMS Biosafety Transport Courses
Awareness, Operator and Technician

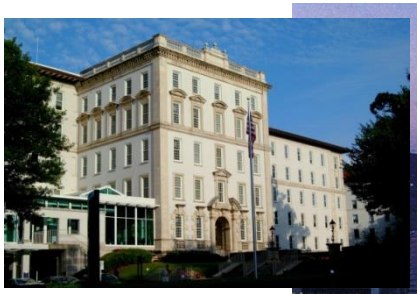
NIH National Institute of Environmental Health Sciences
Worker Training Program

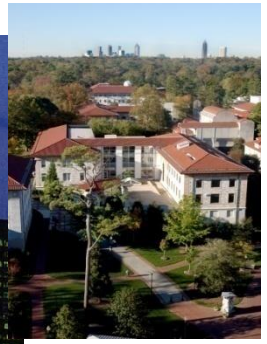
Important Themes

- Identify, isolate and inform
- Vigilance for communicable diseases and bodily fluid exposures
- Good infection prevention practices
- Communicate risks to others
- Exercise processes to avoid delays in care
- Be aware of standards designed to protect the healthcare worker

Questions?







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