

Ministering to the Community in a Time of Crisis



**Existing Viruses that Could
Cause the Next Pandemic**

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- These PowerPoint Presentations are written and provided to prepare the Body of Christ for disasters such as the current pandemic
- These trainings are meant to enable people to safely care for themselves and minister to their neighbors
- By being properly equipped we are then able to bring the gospel of our Lord, Jesus Christ into the situation
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- Even before COVID-19 emerged and caused a global disease, scientists have been watching other viruses that could cause a worldwide pandemic.
- With these existing viruses in circulation, and perhaps others that are still unknown, the world can still experience another pandemic.

- Dependent on the virus and it's lethality, a pandemic with a greater mortality rate is still very possible.
- In fact, it is not only possible, it is very probable.
- This presentation will list a few of the viruses that exist and continue to pose a threat to the world.

The Next Pandemic - Objectives

- The following topics will be discussed
 - The characteristics of a virus that cause alarm
 - A list of the viruses that cause concern
 - Information and the current status of each

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Virus Characteristics

- Viral characteristics that cause concern for world health officials:
 - RNA rather than DNA – the genetic material
 - Zoonotic viruses (originating in animals) that jump from animals to people
 - It's transmissibility – the quality of a disease being able to be passed on from one person or organism to another
 - How the virus spreads

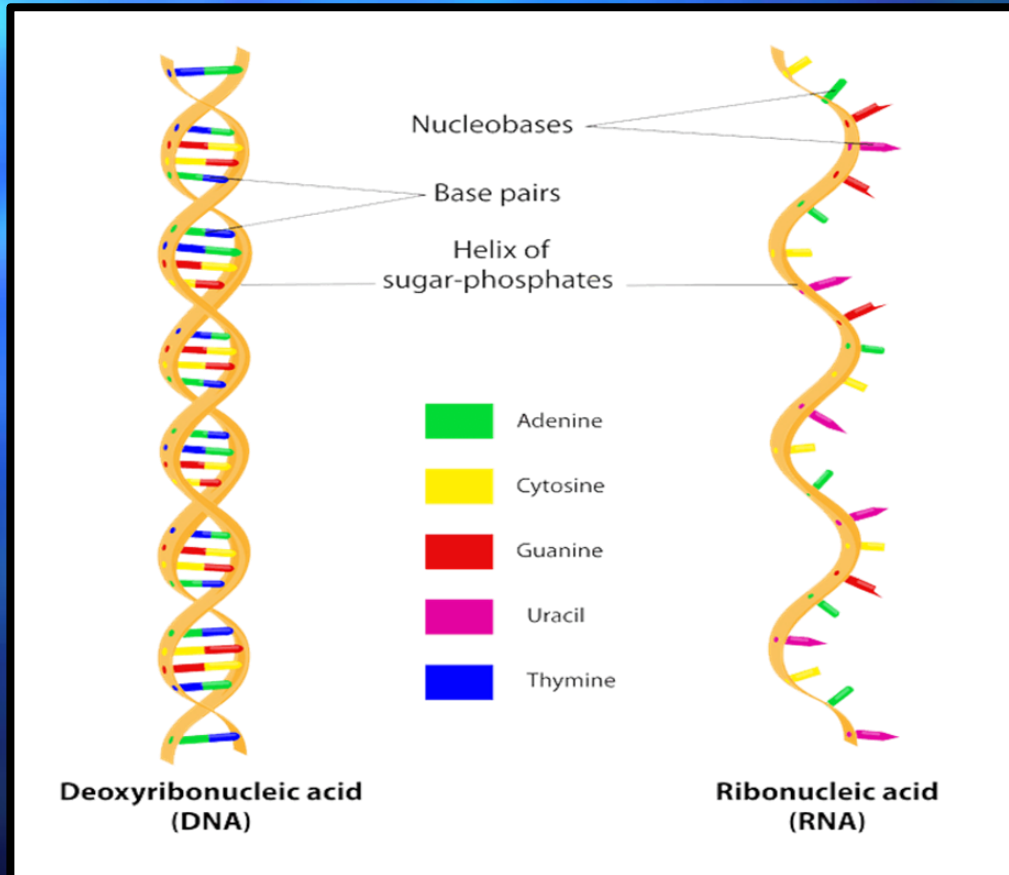
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Virus Characteristics

- RNA vs DNA
 - Nucleic acid contains genetic material
 - In most life forms it is made of Deoxyribonucleic Acid (DNA)
 - Holds genetic instructions used in development and functioning of all known living organisms
 - Like the blueprints for a building

The Next Pandemic Virus Characteristics

■ RNA vs DNA



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Virus Characteristics

- RNA vs DNA
 - DNA (Deoxyribonucleic Acid)
 - Double strand
 - “Deoxy” means there are no hydroxyl groups (-OH)
 - Absence of hydroxyl groups means chemical bonds are not easily broken down into water (H₂O)

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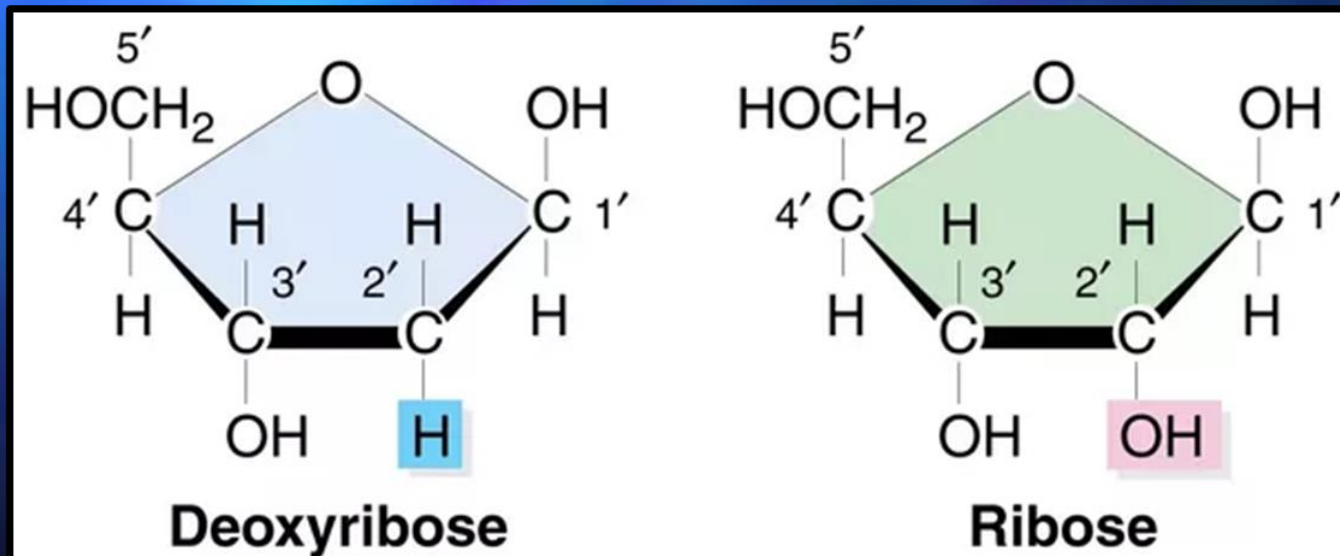
Virus Characteristics

- RNA vs DNA
 - DNA is completely protected by the body
 - The body destroys enzymes that attach to DNA
 - DNA has smaller grooves where the damaging enzyme can attach which makes it harder for the enzyme to attack DNA
 - Has a built-in proof-reading system when reproducing itself

The Next Pandemic Virus Characteristics

■ RNA vs DNA

- Deoxyribose sugar in DNA is less reactive because of C-H bonds
- Stable in alkaline conditions



The Next Pandemic Virus Characteristics

- RNA vs DNA
 - RNA (Ribonucleic acid)
 - Single strand
 - Contains hydroxyl groups
 - Chemical bonds are easily broken into water (H₂O) called hydrolysis
 - More fragile
 - Strands are easily broken

The Next Pandemic Virus Characteristics

- RNA vs DNA

- RNA (Ribonucleic acid)

- Ribose sugar is more reactive because of OH (hydroxyl) bonds
 - Not stable in alkaline conditions
 - Has larger grooves which makes it easier to be attacked by enzymes

The Next Pandemic Virus Characteristics

- RNA vs DNA
 - RNA (Ribonucleic acid)
 - Contains no proof-reading system
 - Mistakes happen called mutations
 - One virus can produce many variations of itself
 - RNA viruses can mutate up to 1 million times faster than DNA viruses

The Next Pandemic

Virus Characteristics

- RNA vs DNA
 - RNA (Ribonucleic acid)
 - Contains no proof-reading system
 - Mistakes happen called mutations
 - One virus can produce many variations of itself
 - RNA viruses can mutate up to 1 million times faster than DNA viruses

The Next Pandemic Virus Characteristics

- RNA vs DNA
 - RNA (Ribonucleic acid)
 - “RNA viruses can change and become more adaptable to human infection and human transmission,” Steve Luby, Epidemiologist, Stanford University

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Virus Characteristics

- Zoonotic virus' ability to jump to humans
 - Virus that originates in an animal not human
 - Some zoonotic viruses have a higher track record of jumping to humans:
 - Avian
 - Swine
 - Bats
 - It is estimated that 80% of the most devastating infections to humans originated in animals

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Virus Characteristics

- Zoonotic virus' ability to jump to humans
 - Once virus jumps to humans
 - Must then transmit from one person to the next (person-to-person transmission)
 - Some less transmissible virus can mutate to increase potential to spread rapidly

The Next Pandemic Virus Characteristics

- Some zoonotic virus' that have jumped to humans include:
 - Smallpox
 - Measles
 - Ebola
 - HIV

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Virus Characteristics

- Zoonotic virus' ability to jump to human
 - Currently wet markets in Asia pose a great risk of zoonotic leaps
 - The close proximity of humans and animals allow for great opportunity for viruses to jump



The Next Pandemic Virus Characteristics

■ Transmissibility

- How a virus is transmitted is another factor
 - Most concerning is spread through respiratory droplets
 - Allows for transmission with close interaction

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Viruses that Cause Concern

- Some viruses that cause concern for world health officials:
 - Bird Flu viruses
 - H5N1
 - H7N9
 - Corona Viruses
 - SARS-CoV-2
 - MERS
 - Hemorrhagic Fever
 - Ebola
 - Nipah

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Viruses that Cause Concern

- Some viruses that cause concern for world health officials:
 - These viruses meet the criteria for concern
 - RNA viruses
 - Zoonotic that have jumped species
 - Transmitted from human-to-human

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Viruses that Cause Concern

- H5N1 Influenza aka Bird Flu



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Viruses that Cause Concern

What is H5N1?

- Subtype of influenza A virus
- Causes a highly infectious, severe respiratory disease in birds
- Classified as Highly Pathogenic Avian Influenza (HPAI)

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Viruses that Cause Concern

What is H5N1?

- Mostly reported in poultry and aquatic migratory birds
- Highly contagious to birds through:
 - Saliva
 - Nasal secretions
 - Feces



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Viruses that Cause Concern

What is H5N1?

- Classified by virulence to birds (not humans)
 - High Pathogenicity Avian Influenza (HPAI)
 - Causes severe disease in birds
 - Low Pathogenicity Avian Influenza (LPAI)
 - Causes mild or asymptomatic disease in birds

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Viruses that Cause Concern

Where did H5N1 originate?

- Qinghai Lake, China – Epicenter
 - China's largest inland expanse of salt water
 - High diversity of migratory birds
 - Outbreaks reported since 2005



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Viruses that Cause Concern

Where did H5N1 originate?

- Qinghai Lake, China
 - 2005-
Unprecedented outbreak HPAI H5N1
 - Killed thousands of birds



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Viruses that Cause Concern

How Does H5N1 Spread to Humans?

- Cases associated with close contact with infected birds through
 - Defeathering
 - Crystallized saliva
 - Feces
 - Body fluids
 - Cooking infected poultry



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Viruses that Cause Concern

How Does H5N1 Spread to Humans?

- Few cases of human-to-human transmission
 - Usually obtained by close contact with infected family member
 - Currently no evidence of sustained human-to-human transmission

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Viruses that Cause Concern

Where is the H5N1?

- As of December 2020:
 - Over 400 countries reporting outbreaks in birds
 - Considered endemic in birds:
 - China
 - Bangladesh
 - Africa
 - India
 - Europe
 - Viet Nam
 - The Middle East

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Viruses that Cause Concern

Where is the H5N1?

- As of December 2020:
 - 17 Countries with reported human cases
 - 862 confirmed human cases
 - 455 deaths
 - 52.8% mortality rate



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Viruses that Cause Concern

How does H5N1 spread around the world?

- Migratory waterfowl are natural carriers
 - As birds travel between countries during seasonal migration – the virus is spread between flocks
 - Infected birds carry virus to other countries

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Viruses that Cause Concern

Is the H5N1 in the USA?

- December 2014 – detections first began
 - Mid June 2015 – reported in 21 states (including North Carolina)
 - January 2016 – Commercial Flock in Indiana
 - March 2017 – Lincoln County, Tennessee
 - Subsequently – Alabama, Kentucky, Georgia

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Viruses that Cause Concern

H5N1 Facts

- Infection in humans causes severe disease
- Has a high mortality rate (60%)
- Similar pathogenicity as 1918 Influenza
- If mutations allow for human-to-human transmission it could cause a serious and lethal pandemic

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Viruses that Cause Concern

What is the latest news?

- It has been determined that the H5N1 is only four mutations from becoming human-to-human transmissible
- There has been a surge in cases reported since 2015
 - Believed to be due to mutations allowing of more ease of transmission

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Viruses that Cause Concern

- Today world health officials are saying:
 - Extreme concern is raised
 - So many concurrent outbreaks of HPAI
 - There has been a “fundamental change” in the natural history of influenza viruses
 - We cannot afford to miss the early signs of a possible human flu pandemic
 - Before COVID-19 considered the worst pandemic threat in last 100 years

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Viruses that Cause Concern

■ H7N9



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Viruses that Cause Concern

What is H7N9?

- Group of influenza viruses that normally circulate among birds
- Most H7 viruses in wild birds and poultry are low pathogenic avian influenza (LPAI)
 - Usually cause only mild disease in poultry
- However highly pathogenic avian influenza (HPAI) viruses can develop from LPAI viruses

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Viruses that Cause Concern

Does H7N9 infect humans?

- First human case of HPAI virus H7 was reported February 2013 in China
- Infection associated with severe respiratory illness and death
- Although less deadly than the H5N1
 - Genetic instability during replication could lead to a more virulent and deadly form

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Viruses that Cause Concern

Does H7N9 infect humans?

- As of 2020
 - 1568 Laboratory confirmed cases
 - 616 reported deaths
- Fifth epidemic wave since October 1, 2016 is greater than any earlier wave
 - Virus shows antigenic drift
 - Poses public health concern

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Viruses that Cause Concern

What is the concern for H7N9?

- Does not cause serious disease in birds
 - Difficult to follow routes of migration
 - Difficult to determine outbreaks



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Viruses that Cause Concern

What is the concern for H7N9?

- Evidence shows that H7N9 is more adaptable to infect humans than other avian viruses:
 - Able to bind to receptors in upper respiratory tract
 - Able to replicate in lower temperatures
 - Characteristic to mammals than birds
 - More easily transmissible human-to-human

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Viruses that Cause Concern

What is the concern for H7N9?

- Experts have found cases of people with no symptoms
 - Virus is more widespread than confirmed lab cases
 - Without knowing total number of infections, impossible to calculate fatality rate

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Viruses that Cause Concern

What is the concern for H7N9?

- China does not allow independent studies
 - Samples are provided to outside scientists
 - Surveillance is restricted
- Cases have been discovered outside mainland China
 - Further studies can now be performed

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Viruses that Cause Concern

What is the current situation?

- 2017 has been “the worst bird-flu season” since the virus first appeared in China in 2013



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Viruses that Cause Concern

What is the current situation?

- In the current fifth wave of infections
 - Human illnesses have been reported from a much wider geographic range
 - February 2017 - A highly pathogenic form emerged in Southern China
 - Now spread to flocks in country's north
 - Human illness involve this subtype

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Viruses that Cause Concern

- People from both urban and rural areas will buy, feed, and slaughter live poultry
- This habit has increased the risk of spreading the disease



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Viruses that Cause Concern

- Middle Eastern Respiratory Syndrome (MERS)

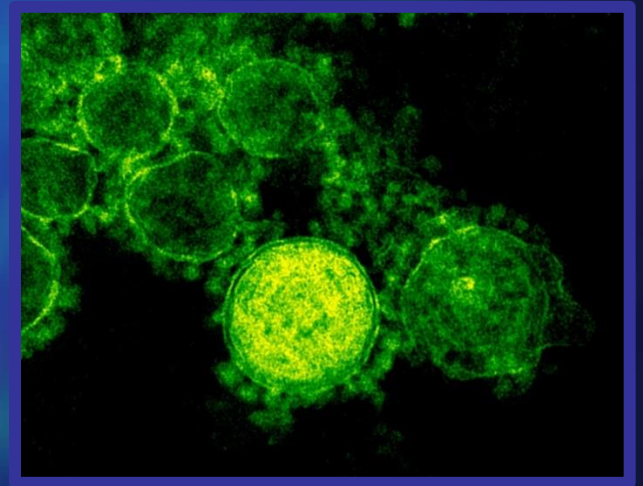


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Viruses that Cause Concern

What is MERS?

- Middle East Respiratory Syndrome (MERS)
 - Caused by coronavirus MERS-CoV
 - Called coronavirus due to crown like appearance
 - Single-stranded RNA virus



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Viruses that Cause Concern

What is MERS?

- Similar to Severe Acute Respiratory Syndrome (SARS)
 - Another single stranded RNA coronavirus
 - Caused global outbreak 2003



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Viruses that Cause Concern

What is MERS?

- Causes severe human infections
 - Resulting in high mortality rate
 - Demonstrated ability to transmit between humans
 - Observed non-sustained human-to-human transmission has occurred mainly in healthcare settings

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Viruses that Cause Concern

What is the origin of MERS?

- The virus appears to have originated in bats
 - Evidence suggests that viruses have been present in bats for some time
 - Spread to camels in mid 1990s
 - Spread to human in early 2010s
 - The original bat host species has yet to be determined

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Viruses that Cause Concern

What is the origin of MERS?

- Countries like Saudi Arabia and United Arab Emirates
 - Produce and consume large amounts of camel meat
 - Study on dromedary camels from Saudi Arabia in December 2013
 - 90% had MERS

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Viruses that Cause Concern

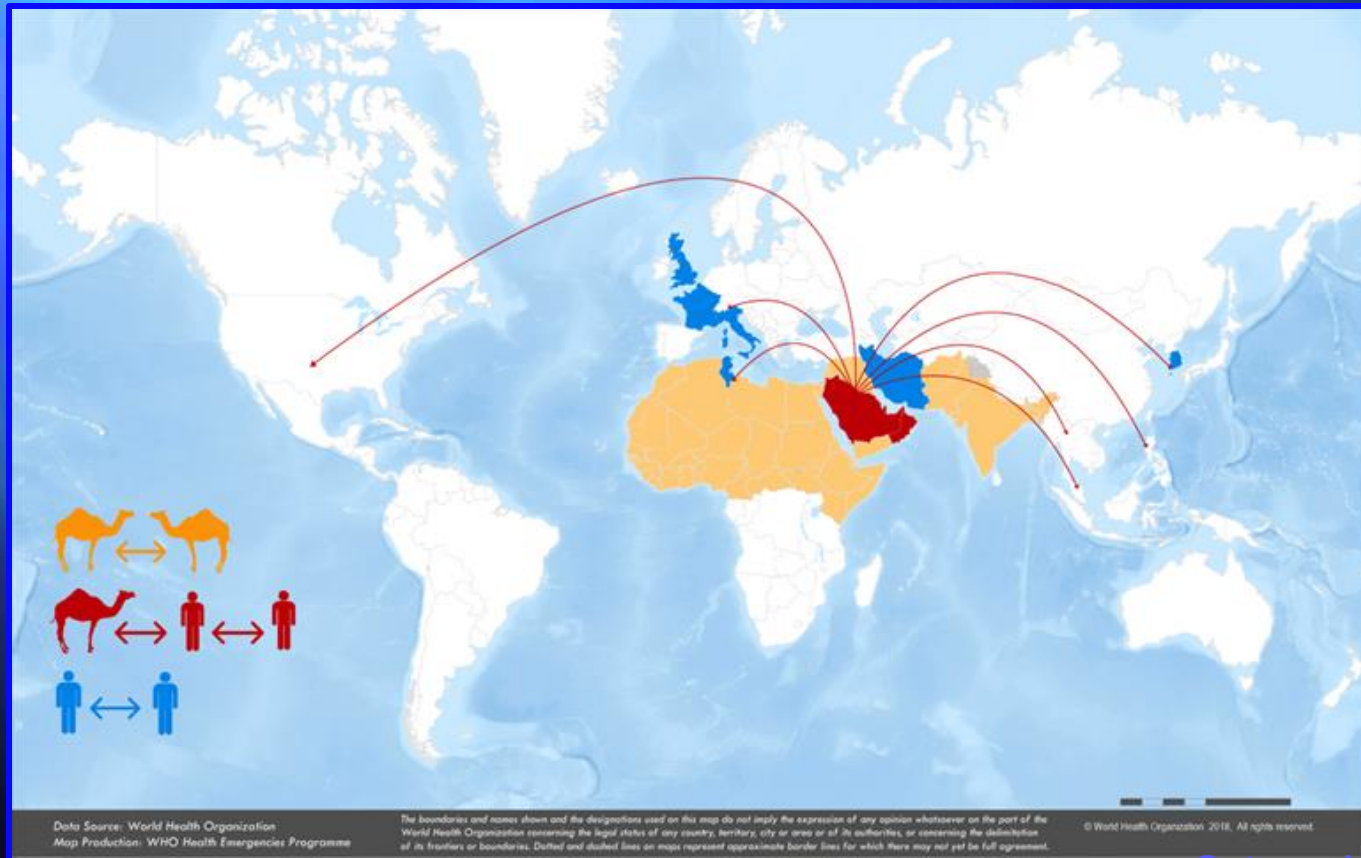
Where is MERS?

- First reported in Saudi Arabia in 2012
- Spread to 27 countries
 - Middle East
 - Africa
 - South Asia
 - South Korea



The Next Pandemic Viruses that Cause Concern

Where is MERS?



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Viruses that Cause Concern

How does MERS spread?

- Thought to be spread through respiratory secretions
 - Precise way has not been determined
 - Has spread simply by close contact
 - Spread in healthcare settings



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Viruses that Cause Concern

How does MERS kill its' victims?

- Similar pathophysiology as SARS and H5N1
 - Sudden acute respiratory syndrome
 - Immune response induces release of proinflammatory cytokines
 - Leads to severe inflammation and tissue damage

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Viruses that Cause Concern

What is the latest news on MERS?

- Has infected more than 2,000 people
 - Killed at least 858 (35% mortality rate)
- Spread to 27 countries
- Saudi Arabia has underreported cases and deaths



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Viruses that Cause Concern

What is the latest news on MERS?

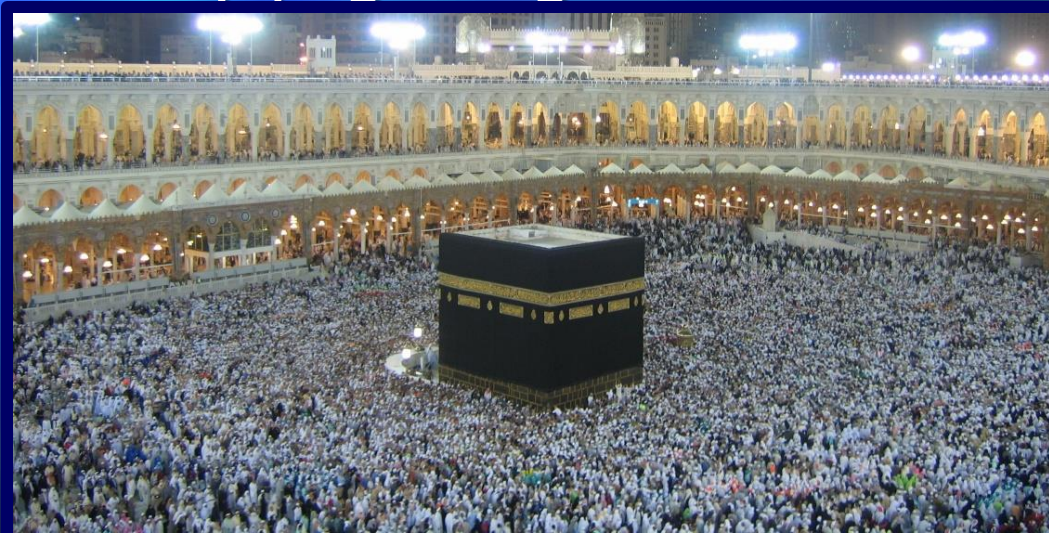
- No sustained human-to-human transmission
- Limited non-sustained human-to-human transmission in healthcare facilities

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Viruses that Cause Concern

What is the potential for MERS to spread?

- Millions meet during mass gatherings
 - Umrah – Pilgrimage any time; particularly Ramadan
 - Hajj – five-day pilgrimage at least one in lifetime



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Viruses that Cause Concern

What is the potential for MERS to spread?

- Millions of foreign pilgrims congregating could acquire MERS
 - Then return to their homes around the world



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Viruses that Cause Concern

■ Ebola



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Viruses that Cause Concern

- What is Ebola?
 - Non-segmented, single stranded RNA virus
 - Filoviridae classification
 - Thread like filament appearance
 - Capsid contains genetic materials
 - Similar to Marburg virus



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Viruses that Cause Concern

- What is Ebola?
 - Often fatal hemorrhagic disease
 - In humans and non-human primates (monkeys, gorillas, and chimpanzees)
 - Intermittently appeared since 1976
 - First named after a river in the Democratic Republic of the Congo

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Viruses that Cause Concern

- How does Ebola spread?
 - By direct contact with
 - Blood or body fluids of infected person
 - Contaminated object
 - Infected animal



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Viruses that Cause Concern

- How does Ebola spread?
 - Can remain in certain body fluids of people who have recovered from Ebola
 - Semen
 - Fluids in the eye
 - Cerebrospinal fluid



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Viruses that Cause Concern

- How does Ebola spread?
 - Most feared potential Ebola mutation
 - Transmission through airborne particles
 - Since 1980's researchers suspect this is possible



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Viruses that Cause Concern

- How does Ebola kill its victims?
 - Virus enters through broken skin or unprotected mucous membranes
 - Once inside host it finds receptors in the lymph nodes
 - Able to spread rapidly in the blood to other areas



The Next Pandemic

Viruses that Cause Concern

- How does Ebola kill its victims?
 - Virus attacks cells in the following order
 - Fibroblastic reticular cells
 - Form the supportive framework of tissue or organ
 - Loose connective tissue under the skin
 - Endothelial cells lining the closed internal spaces of the body
 - Epithelial cells (connective, muscle, nervous tissue)

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Viruses that Cause Concern

- What was the largest outbreak of Ebola?
 - West Africa Ebola Outbreak of 2013-2016
 - Infected 28,616
 - Killed 11,310 in six countries
 - The virus adapted to more effectively target human cells
 - Studies show
 - Genetic mutation GP-A82V was likely responsible for 90% of Ebola cases

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Viruses that Cause Concern

- What is the treatment for Ebola?
 - Difficult to distinguish Ebola from other infectious diseases
 - Lab testing must be performed to confirm
 - Should be conducted under maximum biological containment conditions



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Viruses that Cause Concern

- What was the latest outbreak of Ebola?
 - Democratic Republic of Congo 2017
 - Outbreak in densely forested part of Bas-Uele Province
 - First case April 22, 2017
 - Outbreak declared over July 2, 2017
 - 8 reported cases/4 deaths
 - Cases in four separate regions
 - Difficult to reach due to no paved roads

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Viruses that Cause Concern

- Is there a vaccine for Ebola?
 - Experimental Ebola vaccine has proven highly protective against virus
 - rVsV-ZEBOV
 - Trials done in Guinea
 - Manufactured by Merck, Sharpe & Dohme

The Next Pandemic

Viruses that Cause Concern

- Nipah Virus



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Viruses that Cause Concern

- What is Nipah?
 - Zoonotic virus (bat-borne) causes Nipah virus infection
 - Belongs to a group of paramyxoviruses
 - Now called Henipavirus
 - Distant cousin to the measles virus



The Next Pandemic

Viruses that Cause Concern

- What is Nipah?
 - Affects humans and other animals
 - Human-to-human transmission
 - Potential to cause a global pandemic
 - Can be transmitted through contaminated food



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Viruses that Cause Concern

- Where is Nipah?
 - First identified in 1998
 - Numerous outbreaks occurred in Australia, South and Southeast Asia
 - Annual outbreaks in Bangladesh and India
 - Name refers to Sungai Nipa – the source of the human case that it was first isolated

The Next Pandemic

Viruses that Cause Concern

■ What is Nipah?

- Affects humans and other animals
- Infected bats can spread disease to other animals

- Pigs
- Dogs
- Cats
- Goats
- Horses
- Sheep



The Next Pandemic

Viruses that Cause Concern

- What are the Symptoms Nipah?
 - Primarily encephalitis in humans
 - Disorientation
 - Drowsiness or confusion
 - Seizures
 - Coma
 - Fever
 - Respiratory symptoms
 - Cough, Sore Throat
 - Difficulty breathing

The Next Pandemic

Viruses that Cause Concern

- Why the Concern for Nipah?
 - Disease has a high mortality rate
 - Can be spread human-to-human
 - Identified by WHO as a likely cause of a future epidemic
 - According to health officials:
 - “If Nipah moved efficiently from person to person and mutates this would be devastating.”
Rebecca Dutch, molecular biologist at the University of Kentucky.

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Viruses that Cause Concern

- It is impossible to predict when the next pandemic will occur
 - The genetic changes and the proliferation of outbreaks of the current bird flu viruses certainly give rise of concern that a bird flu pandemic will occur
 - The close proximity of humans and animals allowing for zoonotic viral jumps also raise concern

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Viruses that Cause Concern

- As these RNA viruses are constantly mutating, a more dangerous virus can appear at any time
- As the world deals with the current pandemic caused by the SARS-CoV-2 virus, we cannot ignore that other viruses still cast a shadow of threat to the world population as becoming the next pandemic



Questions

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