Emerging Infectious Disease

- **Objectives :**

1- Understand the viral antigenic variations of influenza virus .
2- List the different hosts for influenza (according to influenza type), MERS-Cov and SARS .
3- Be familiar with the famous pandemics for each of these viral infections, and measures used to contain spread .
4- Identify the different elements in the infection cycle for these viral infections .
5- Provide appropriate prevention and control measures for each of these viral infections .
6- Outline how to take history of risk factors, and how to give preventive advise.

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- **Resources :**

Slides.
Doctor's notes.

[Colors index : Important | Notes | Note | Slides | Extra] [Editing file | Share note]

What is an emerging infectious diseases?

Emerging infectious diseases are those that:

1.Occur among humans for the first time

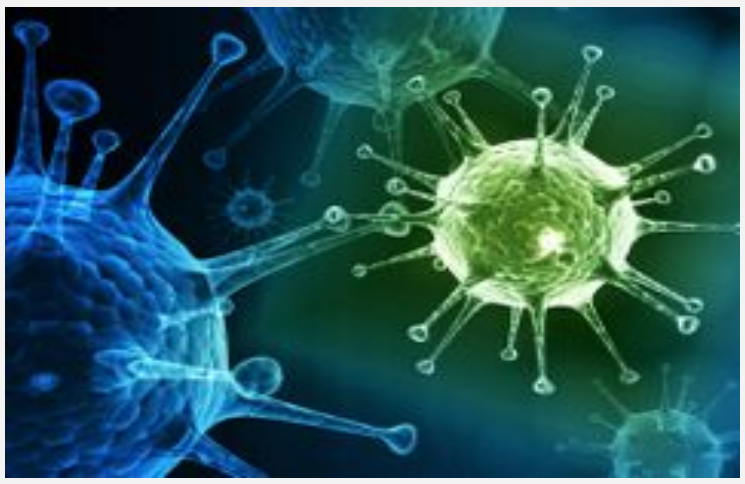
2.Occurred previously in a small number and suddenly increased in number

3.Have been occurring throughout history but only recently recognized as distinct diseases

1. Influenza virus it cause epidemic and endemic infection

- **Orthomyxoviridae**
- Virus subtypes are antigenically distinct (no cross-immunity)
- Frequently subject to antigenic variation
- Antigenic changes occur in types A or Type B, with type C being stable

All of us get influenza and next year we do not get influenza why? Bc immunity but if virus change in it is antigen you may get infected



Influenza Virus: Types and Variation

Antigenic Types of Influenza Virus:

Antigen type	Who does it infect?	What does it cause ?
A	Human	Seasonal epidemic, pandemic
B	Human	Seasonal epidemic
C	Human	Mild respiratory illness
D	Cattle	--

Influenza Virus: Types and Variation

Why we should know (H)and (N) ? bc every one has it is own function

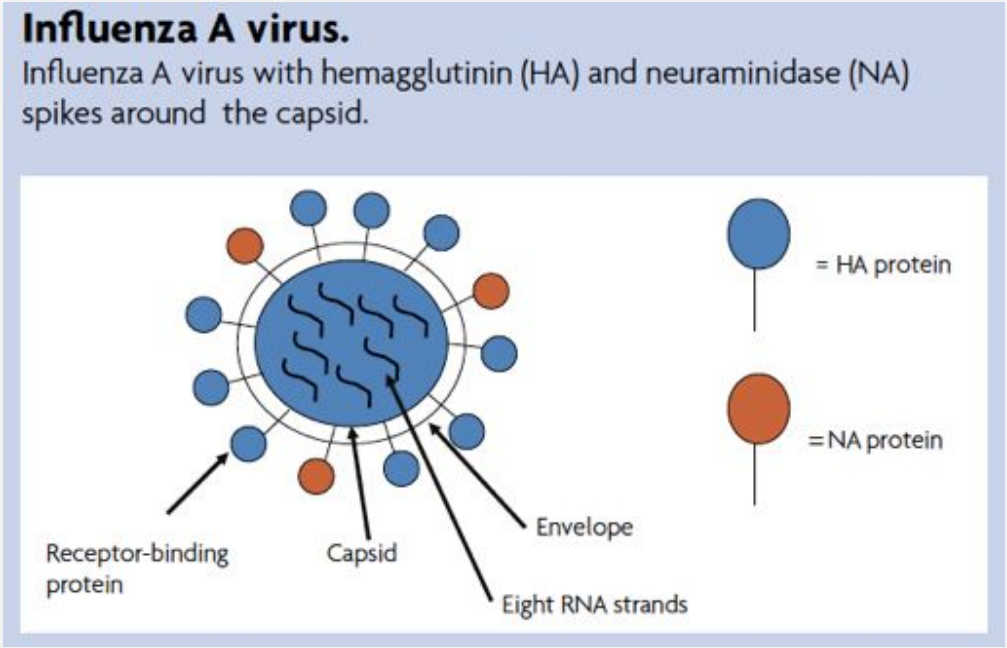
Influenza A subtypes

Subtypes are based on the two surface proteins;

- ❏ Hemagglutinin (H); antigen initiates infection
- ❏ Neuraminidase (N); antigen releases virus into cell

There are:

- ❏ 18 hemagglutinin subtypes (H1 to H18)
- ❏ 11 neuraminidase subtypes (N1 to N11)



Influenza A subtypes infective to humans:

Currently circulating viruses type A are:

¤ H_1N_1

¤ H_3N_2

vaccine try to manipulate the function of (H) and (N)

Influenza Type B:

- ❏ Type B influenza does not have subtypes
- ❏ It can be divided into two lineages:

¤ B/Yagamata

¤ B/Victoria

Antigenic variations: it occurred in two mechanism

1.**Antigenic Shift** **reassortment of RNA of virus that mean virus produce new RNA different from previou RNA r**

¤ Complete sudden change

¤ Results from genetic recombination of human virus with animal or avian virus Responsible for pandemic strains

2.**Antigenic drift** **there is mutation it will produce new virus you may susceptible to infection may not**

¤ Happens continually over time

¤ Results from point mutation of the gene -> changes in surface proteins

What does this mean?

- Antigenic drifts produce viruses with similar antigenic properties -> coss-pretection
- Antigenic shifts happen less frequently than antigenic drifts no cross immunity
- Type A viruses undergo both antigenic drift and shift
- Type B viruses undergo antigenic drift only

Several antigenic drifts can occur over time producing viruses to which the human does not have immunity, thus causing infection. This is the reason why people can get the flu more than one time.

Influenza Virus: Types and Variation

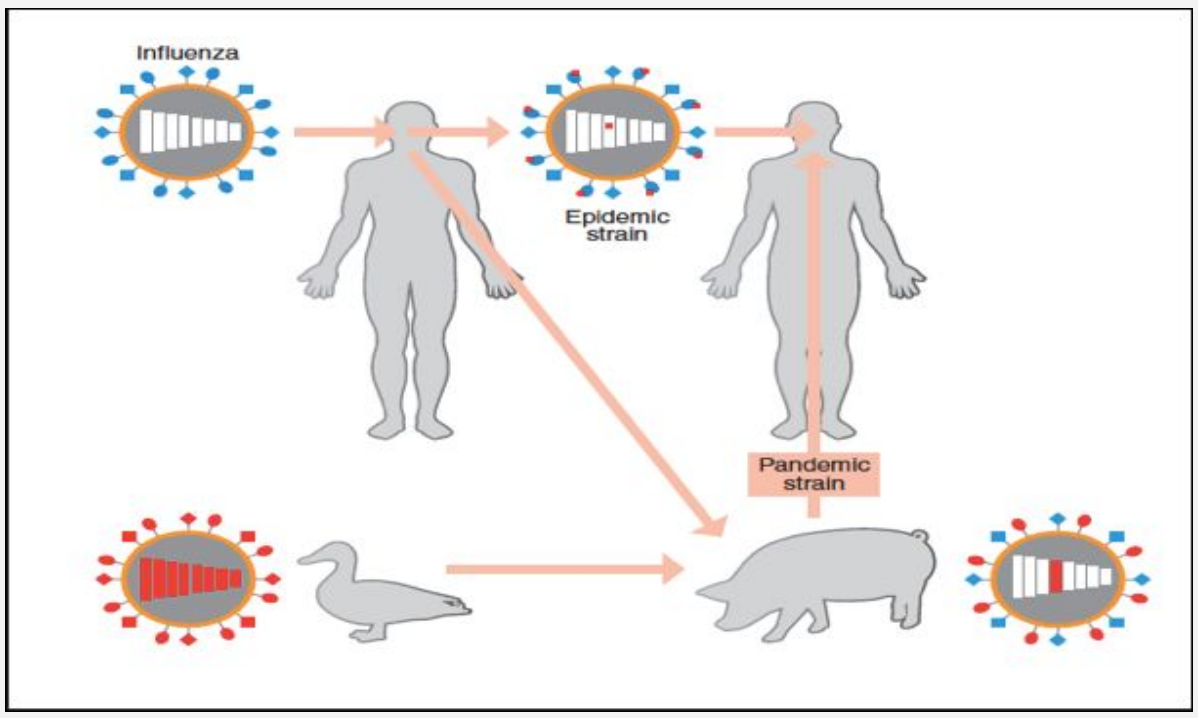
Antigenic shift:

Three different methods for antigenic shift:

1- virus from human and avian reassort in the swine.

2- virus jumps from avian to human.

3- virus jumps from avian to swine to human without Reassortment.



Naming of influenza viruses:

These are named in the following order:

- The antigenic type (e.g., A, B, C)
- The host of origin (e.g., swine. For human-origin viruses, no host of origin designation is given.)
- Geographical origin
- Strain number
- Year of isolation
- For influenza A viruses, the hemagglutinin and neuraminidase antigen description in parentheses

Example of naming:

¨**What does this mean?**

A/duck/Alberta/35/76 (H1N1)

Antigen **host of origin** **geographic Origin** **strain** **year** **hemagglutinin and neuraminidase subtypes**

Number

- A/Perth/16/2009 (H3N2) No host origin because from human

Reservoir, Mode of Transmission, Symptoms, and Diagnosis

Reservoir of influenza:

- Animals (swine, horses, dogs, cats)
- Birds (poultry, wild birds)
- human

Reservoir, Mode of Transmission, Symptoms, and Diagnosis

Characteristics of influenza infection:

- Source of infection is an infected host (a case or subclinical)
- Secretions of respiratory tract are infective
- ***Period of infectivity:*** 1-2 days prior to symptoms, and 5-7 days after symptom onset
- ***Portal of entry:*** respiratory tract
- ***Incubation period:*** 18 – 72 hrs (short)

Symptoms:

- Fever, chills, aches, coughing, generalized malaise
- Fever lasts for 1-5 days (average 3 days)

Raye syndrome: Rapid hepatic failure and encephalopathy associated with aspirin use in children in a variety of viral infections. Particularly related to type B. Mortality is 30%.

Complications:

- ❏ Secondary bacterial infection
- ❏ Pneumonia
- ❏ Raye syndrome
- ❏ Sinusitis
- ❏ Otitis media
- ❏ Bronchitis

What is raye syndrome? Liver failure due to administration of aspirin in children who have viral infection it may cause hepatic encephalopathy

Diagnosis: based on sign and symptoms

- Testing should not be done for all we do not do biopsy in patient who have influenza except if we suspect bacterial infection
- Useful in order to verify if the influenza is a cause of an outbreak
- Specimen collected within 3-4 days of illness:
- Nasopharyngeal swab; nasal swab; nasal wash or aspirate; lower respiratory tract

Lab tests: to confirm diagnosis

- Viral culture
- Serology
- rRT-PCR (best one)

Mode of transmission: is it airborne ? no it is not

- person-to-person by droplet or droplet nuclei
- Touching surface contaminated with influenza virus

Risk factors for infection: this what we ask when we take history

- Season: Winter or rainy season
- Age: More severe disease in older age and children younger than 18 m
- Overcrowding
- Contact with infected individual
- Immunity

¤ Antibody against H antigen vs. antibody against N antigen

¤ High risk for severe disease:

- Chronic diseases; pregnant; elderly; DM; CHD; CLD; Immunocompromised

Historical Pandemics

Date of pandemic	Influenza subtype	Death toll
1918-1919	Spanish influenza H_1N_1	50 million
1957-1958	Asian influenza H_2N_2	2 million
1968-1969	Hong kong influenza H_3N_2 Notice (H) change every year	1 million
2009-2010	H_1N_1 (swine flu) - novel subtype	18.2 thousand + Less die why ? better control

Signs of an outbreak :

Starts with few cases

Sudden outburst of disease

Increased febrile illness in children followed by adults

Increased hospitalization due to illness

Attack rates are high: 5-10% in adults; 20-30% children

Epidemic peaks within 3-4 weeks then declines

What makes influenza easy to spread?

-Short incubation period

-Increased number of susceptible population

-No cross immunity

Large number of subclinical individuals

Control of Infection and Prevention

Prevention of influenza : educate people how to cough and how to watch hand

- Follow cough etiquette (cover mouth and nose while sneezing)
- Wash hands
- Vaccination to prevent severe disease

Influenza vaccine:

- Provides 90% protection in healthy adults
- Reduce severity of disease by 60%; death by 80%
- Usually takes two weeks after vaccination for body to produce immunity
- One vaccine for northern hemisphere and one for southern hemisphere
- Immunity against two type A (H_1N_1; H_3N_2) , and B (trivalent)
- Immunity against two type A and two B

Control of Infection and Prevention

Flu vaccines available in KSA:

Injection vaccine:

•Inactivated virus
•Ages 6 months and above
•Safe for pregnant women
•Targets H antigen

Nasal spray vaccine:

•Live weakened virus
•Ages 2y to 49 y
•NOT safe for pregnant women
•Targets both H and A antigens (N)

According to the MOH the following are recommended for flu vaccination

- All Diabetics
- Individuals with asthma; COPD
- Patients with chronic cardiac diseases; chronic renal diseases; chronic liver diseases
- Neurological Disorders
- Immune deficiency patients
- Morbidly obese individuals
- Pregnant women
- 6 m - 18 y on long term Aspirin therapy
- Children aged 6m – 5y; adults 50+ y
- All health care workers

Vaccine complications and contraindications:

Complications include symptoms that appear for no more than 48 hours:

- Mild redness or swelling at the injection site
- Slight rise in temperature
- Minor body aches
- Sore throat

Contraindications:

- Those who have severe egg allergy
- Previous history of severe allergy to influenza vaccine
- History of Guillain Barre Syndrome after taking the vaccine
- Children under 6 months
- People suffering from very high or moderate temperature

2. Middle Eastern Respiratory Syndrome (MERS-CoV)

MERS-CoV :

- Caused by the coronavirus
- First discovered in Saudi Arabia in 2012
- It was a novel virus
- Majority of infections occurred in healthcare setting (unprotected healthcare provision)
- Countries in which the virus was reported:

¤ *Algeria, Austria, Bahrain, China, Egypt, France, Germany, Greece, Islamic Republic of Iran, Italy, Jordan, Kuwait, Lebanon, Malaysia, the Netherlands, Oman, Philippines, Qatar, Republic of Korea, Saudi Arabia, Thailand, Tunisia, Turkey, United Arab Emirates, United Kingdom, United States, and Yemen*

- Around 80% of cases reported in Saudi Arabia

Reservoir, Mode of Transmission, Symptoms, and Diagnosis

Source of MERS-CoV :

- Animal source in the Arabian peninsula
- The virus has also been found in camels (Dromedary camels)
- May have originated in bats then transmitted to camels sometime in the past ?

Symptoms :

- Fever
- Cough
- Shortness of breath
- Could present with mild symptoms
- Could be asymptomatic
- GI symptoms

Complications most common complication respiratory failure

- Pneumonia ; respiratory failure -> ventilator
- Death reported in 30% to 40% of infected people

MERS-CoV :

- **Incubation period**

¤ 2 – 14 days

- **Mode of transmission**

¤ Person-to-person (close contact) ; from patient to healthcare worker; family members; between patients

100 percent we sure bc it happen in health care facilitate

¤ From camels to humans; Exact route of transmission and role of camel in the infection cycle is not known

Reservoir, Mode of Transmission, Symptoms, and Diagnosis

Risk factors for infection MERS-CoV :

- People who have had close contact, such as caring for or living with, a confirmed case of MERS
- Healthcare personnel who do not use recommended infection-control precautions
- People who have had contact with camels; visiting farms
- Consumption of raw animal products
- Elderly; immunocompromised; chronic disease

Diagnosis of MERS-CoV :

- Nasopharyngeal swab -> rRT-PCR
- If negative -> retest lower respiratory specimen
- Cases should be reported within 24 hrs (category 1 reportable disease)

Treatment of MERS-CoV :

- No treatment is available
- Only treatment to relieve symptoms
- Support vital organ functions in severe cases
- No vaccine is available

Prevention of MERS-CoV :

- Handwashing
- Cough etiquette
- Avoid touching your eyes, nose and mouth with unwashed hands
- Avoid personal contact, or sharing cups or eating utensils, with sick people
- Clean and disinfect frequently touched surfaces and objects, such as doorknobs
- Healthcare workers practice infection control precautions; *negative pressure room, masks…etc*

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3. Sever Acute Respiratory Syndrome (SARS-CoV)

SARS-CoV:

- Also an infection caused by coronavirus
- First reported in Asia in 2003
- Spread to more than 24 countries around the world
- 8,098 cases -> 774 deaths
- No cases have been reported after 2004

Reservoir :

- Horseshoe bat

3. Sever Acute Respiratory Syndrome (SARS-CoV)

Mode of transmission:

- Direct: Person-to-person; respiratory droplet
- Indirect: Contacting surface contaminated

with respiratory droplet

- May be airborne ? bc it spread very quickly they think it may be airborne
- In healthcare setting: Aerosol-generating

procedures

- Virus shed in stool – not clear feco-oral

transmission

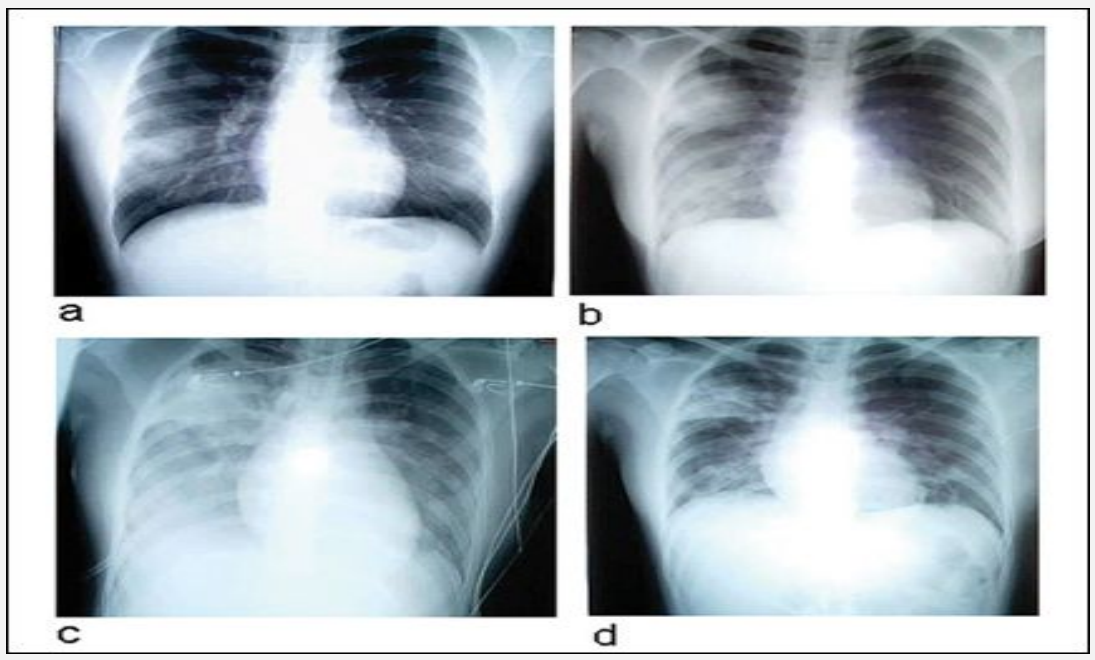
- Incubation period: 2 – 7 days

Symptoms:

- High fever
- Headache
- Overall feeling of discomfort
- Generalized body aches
- Mild respiratory symptoms
- Dry cough
- Diarrhea

Complications

- Pneumonia; pulmonary decompensation; ARDS



Signs on chest x-ray :

Unilateral patchy shadowing (in beginning of disease)

After 1-2 days: bilateral interstitial infiltration

Later: Air-space opacities

Diagnosis :

- Usually based on clinical history
- If history suggestive of SARS and x-ray normal -> thin cut CT help to confirm diagnosis
- Laboratory: rRT-PCR

Treatment :

- No clear scientifically proven treatment available
- Severe cases require intensive care
- Antiviral treatment is questionable; some studies suggest poorer outcomes for those receiving antiviral agents

Prevention and control : no treatment no vaccine people die quickly

- No vaccine available
- Handwashing and infection control precautions
- In case of reported cases, early identification and efficient reporting of cases
- Isolation of patients with infection
- Exit screening for international travelers
- Appropriate protection of medical staff caring for patients

Summary

virus	Reservoir/ source + transmission	Risk factors	Symptoms	complications	Dx	Prevention & vaccines	Tx
Influenza Has: -Naming order -Antigenic shift & drift. - types A, B, C & D	Animal (swine , horses, dogs…) Birds (poultry) + Person to person droplet or droplet nuclei	Seasons Age : -older age. - children Overcrowding Immunity	Fever, chills, aches, coughing, generalized malaise Fever lasts for 1-5 days -I.P : 18-72 Hrs	-Secondary bacterial infection -Otitis media -Sinusitis -Bronchitis -Pneumonia -Raye syndrome	-Not be done for all. - swab. -nasal wash. - aspirate.	Follow infection control. Vaccination to prevent severe disease	
MERS-CoV	Animal source in KSA found in camels + Person to person contact or camel contact	-relatives of infective pt. -camel contact -consumption of raw animal product -immunocompromised.	Fever Cough Shortness of breath Could present with mild symptoms asymptomatic GI symptoms -I.P: 2-14 days	Pneumonia ; respiratory failure -> ventilator Death reported in 30% to 40% of infected people	Nasopharyngeal swab -> rRT-PCR If negative -> retest lower respiratory specimen	No vaccine is available Infection control	No treatment Support & relieve the symptoms
SARS-CoV	Horseshoe bat + Respiratory droplet	------	High fever Headache Overall feeling of discomfort Generalized body aches Mild respiratory symptoms Dry cough Diarrhea -I.P: 2-7 days	Pneumonia; ARDS	--------	No vaccine available Handwashing and infection control precautions	

MCQs

Q1: A virologist has been tracking a virus for almost 7 years, he notice that the virus continually changing overtime without causing disease for the controlled immune sample, the virus injected in bird and change all of a sudden and cause disease for the controlled immune sample, what is the type of virus that the virologist is dealing with ?

A- Type A influenza viruses
B- Type B influenza viruses
C- Type C influenza viruses
D- Coronavirus

Q2: “Increased hospitalization due to illness of infectious disease ” is sign of :

A- Emerging infectious disease
B- Outbreak
C- Poor health services

Q3: which of the following you have to report it within 24 h ?

A- Type A influenza viruses.
B- MERS-CoV
C- SARS-CoV.
D- Type C influenza viruses

Q4: What’s the reservoir of SARS-CoV?

A- Hoopoe Bird
B- Camel
C- chicken
D- Horseshoe bat

ANS : 1.A 2.A 3.B 4.D