

Epidemiology of Influenza

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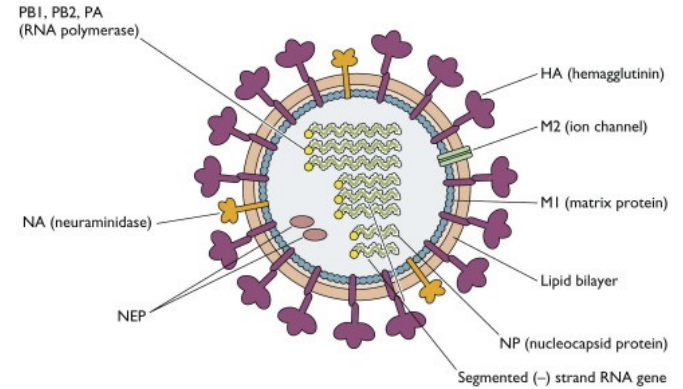
Objectives

By the end of the session the students should be able to:

- know what is influenza and the important characteristics of the influenza virus.
- understand the viral antigenic variations of influenza virus
- know the epidemiology of influenza and examples of pandemics
- understand the control measures and treatment of influenza

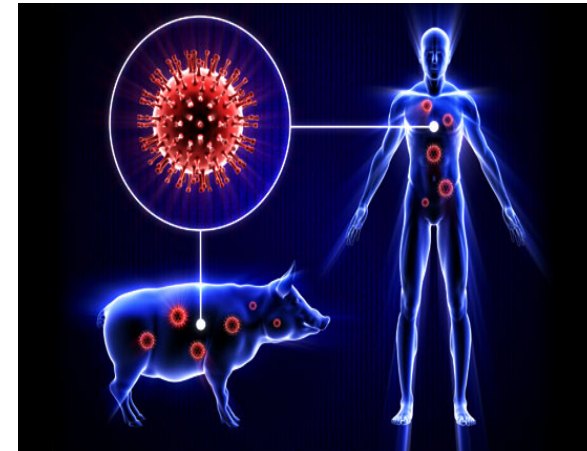
Influenza Virus

- Consists of eight segments of negative-sense single-stranded RNA within a Helical capsid.
- The viruses envelope contains 2 projecting glycoprotein spikes:
 1. Haemagglutinin (HA)
 2. Neuroamindase (NA)
 - Classified on the basis of hemagglutinin (HA) and neuraminidase (NA) into 3 types:
 1. Influenza A
 2. Influenza B
 3. Influenza C



Influenza Virus

- Influenza viruses are members of the Orthomyxoviridae family of viruses
- Influenza A viruses of particular subtypes have been isolated from a variety of animal species, such as H1N1 viruses from swine and H3N8 from horses. Different subtypes have not been identified among influenza B viruses.



Influenza Virus

- The long-term epidemiologic success of influenza viruses is primarily due to **antigenic variation** that takes place in the two surface glycoproteins of the virus, the HA and NA. Antigenic variation renders an individual susceptible to new strains despite previous infection by influenza viruses or previous vaccination.

Antigenic Variation

- Influenza viruses tend to undergo changes from time to time. There are two types of changes: (1) antigenic shift, (2) antigenic drift. These changes in the antigenic characteristics of influenza viruses determine the extent and severity of influenza epidemics.

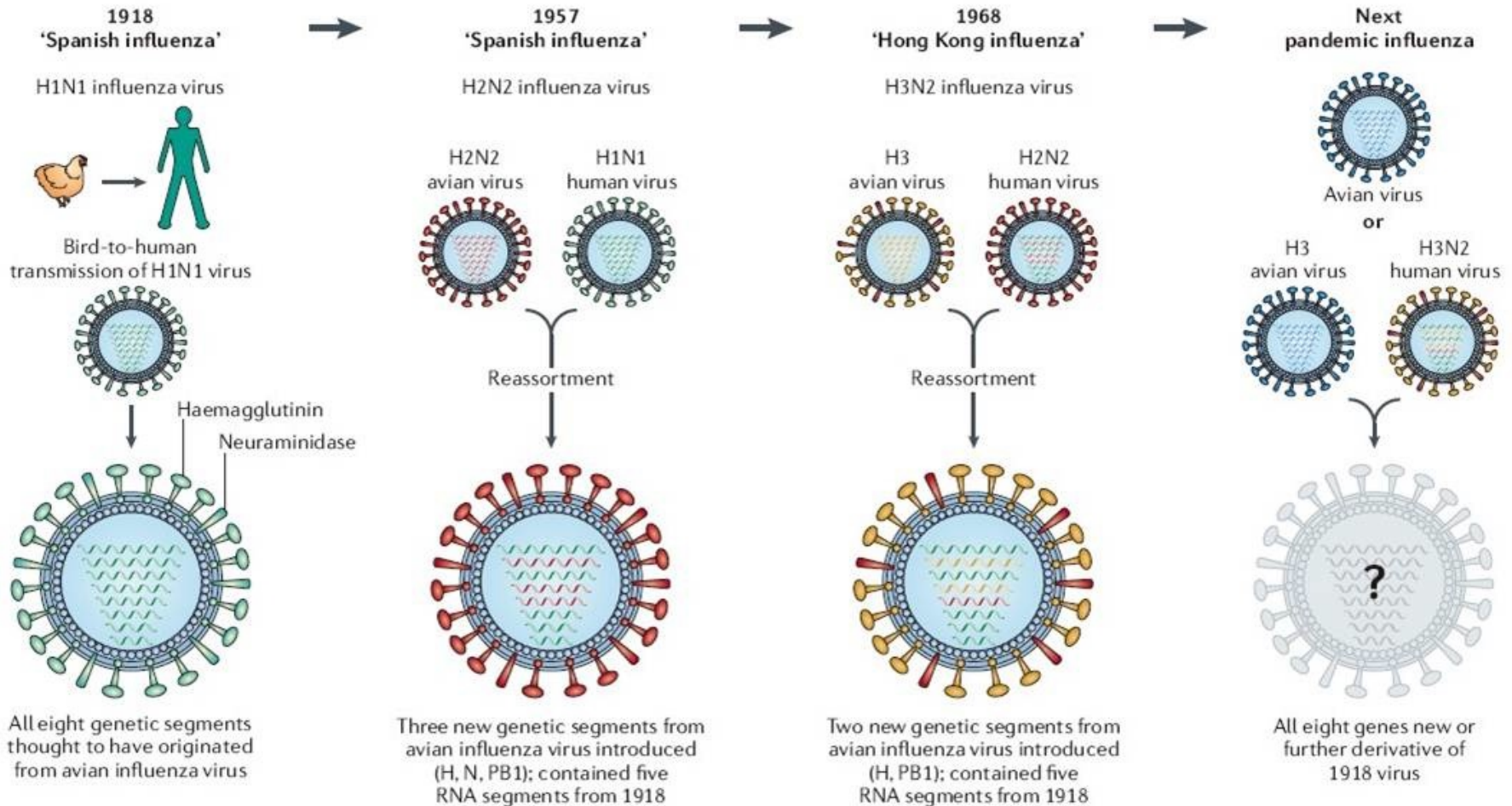
Antigenic Shift

- This term denotes MAJOR changes in HA and NA resulting from reassortment of gene segments involving two different influenza viruses.
- When this occurs, worldwide epidemics may be the consequence since the entire population is susceptible to the virus.

Antigenic Drift

- This term denotes MINOR changes in HA and NA of influenza virus.
- This results from mutation in the RNA segments coding for either the HA or NA
- This involves no change in serotype; there is merely an alteration in amino acid sequence of HA or NA leading to change in antigenicity.

How the Flu Virus Can Change: “Drift” and “Shift”



Importance of Influenza

- One of the most important emerging and reemerging infectious diseases.
- Causes high morbidity and mortality in communities (epidemic) and worldwide (pandemic).

Mode of Transmission In Human



- Influenza transmission not fully understood
- Influenza viruses are spread primarily by small-particle aerosols of virus-laden respiratory secretions that are expelled into the air by infected persons during coughing, sneezing, or talking. It is also generally accepted that direct person-to-person spread is the mechanism for maintenance of influenza viruses in the human population.



Symptoms

These can include:

- Fever
- Nasal congestion or runny nose
- Sneezing
- Headache
- Sore throat
- Coughing
- Chills
- Myalgia



Symptoms

- These symptoms typically begin one to four days after exposure to the virus and usually last for about 7 days
- Most people recover from flu after around a week.
However, for older people, pregnant women, newborn babies and people with other health problems, for example heart disease or chest problems, flu can be more serious.

Clinical Diagnosis

- The clinical picture of influenza is nonspecific.
- Influenza-like illness can be caused by many microbial agents other than influenza virus, such as adenovirus, parainfluenza viruses, coronavirus, *Mycoplasma pneumoniae*.

Complications

- Pneumonia (Most common)
- Bacterial infection
- Dehydration
- Ear infections
- Sinus infections, especially in children.
- May worsen long-term medical conditions, like congestive heart failure, asthma, or diabetes.
- Myocarditis
- Pericarditis



People at High Risk for Developing Flu-Related Complications

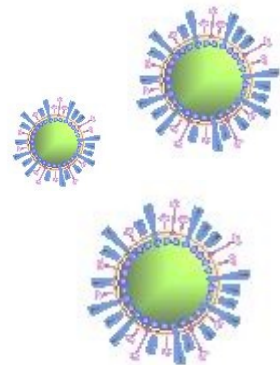
- Children younger less than 2 years.
- Adults 65 years of age and older.
- Persons of any age with certain medical conditions (pregnant, CVD, pulmonary, renal, hepatic or metabolic disorders).

Seasonal Influenza

- Influenza reaches peak prevalence in winter, and because the Northern and Southern Hemispheres have winter at different times of the year, there are actually two different flu seasons each year.
- It occurs globally with an annual attack rate estimated at 5%–10% in adults and 20%–30% in children.
- An influenza epidemic can take an economic toll through lost workforce productivity and strain health services.

Seasonal Influenza

- Seasonal influenza is an acute viral infection caused by influenza virus.
- There are 3 types of seasonal influenza viruses – A (H1N1, H3N2), B and C. Type C influenza cases occur much less frequently than A and B. That is why only influenza A and B viruses are included in seasonal influenza vaccines.



EPIDEMIOLOGY OF INFLUENZA WORLDWIDE

- The World Health Organization (WHO) reports that throughout the world, annual outbreaks result in 3–5 million severe cases and between 250,000 and 500,000 deaths
- In the Northern and Southern parts of the world outbreaks occur mainly in winter while in areas around the equator outbreaks may occur at any time of the year.
- Yearly, influenza epidemics can affect all populations.

EPIDEMIOLOGY OF INFLUENZA WORLDWIDE

- With the growth of global trade and travel, a localized epidemic can transform into a pandemic rapidly, with little time to prepare a public health response.

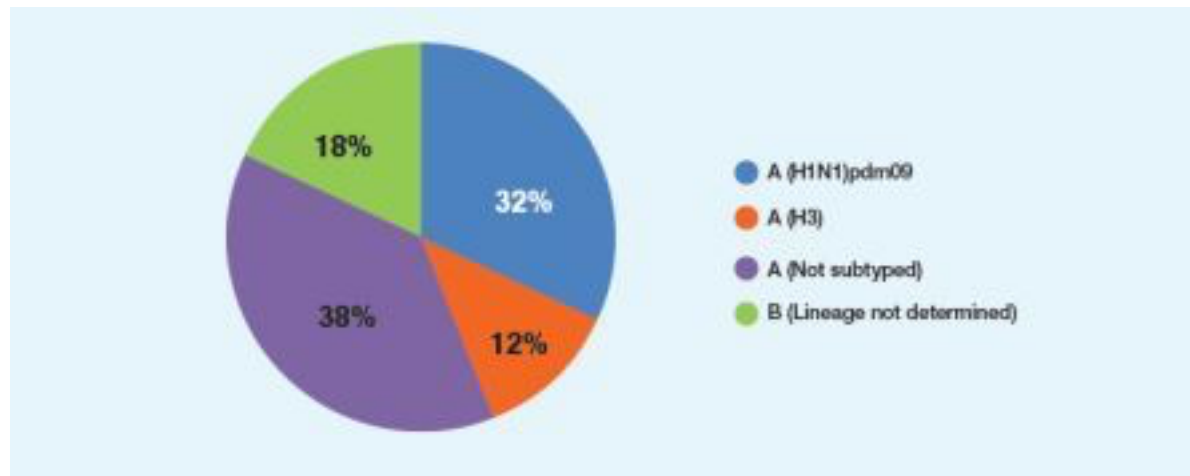
Flu Pandemics

- Several Influenza pandemics accrued through out history.

Name of pandemic	Date	Deaths	Case fatality rate	Subtype involved	Pandemic Severity Index
1889–1890 flu pandemic (Asiatic or Russian Flu)	1889–1890	1 million	0.15%	possibly H3N8 or H2N2	N/A
1918 flu pandemic (Spanish flu)	1918–1920	50 to 100 million	2%	H1N1	5
Asian Flu	1957–1958	1 to 1.5 million	0.13%	H2N2	2
Hong Kong Flu	1968–1969	0.75 to 1 million	<0.1%	H3N2	2
Russian flu	1977–1978	no accurate count	N/A	H1N1	N/A
2009 flu pandemic	2009–2010	105,700-395,600	0.03%	H1N1	N/A

EPIDEMIOLOGY OF INFLUENZA IN SAUDI ARABIA

- Outbreaks of infectious diseases that spread through respiratory route, such as influenza, are highly frequent among Hajj.
- In July 2017 Saudi Arabia reported circulation of influenza A (novel H1N1) and influenza.



H5N1 (2003)

- Human infections with avian and zoonotic influenza viruses have been reported. Human infections are primarily acquired through direct contact with infected animals or contaminated environments
- In 1997, human infections with the HPAI A(H5N1) virus were reported during an outbreak in poultry in Hong Kong, China. Since 2003, this avian virus has spread from Asia to Europe and Africa, and has become entrenched in poultry populations in some countries. Outbreaks have resulted in millions of poultry infections, several hundred human cases, and many human deaths.

H5N1 Epidemic in Saudi Arabia

- In March 2007 Saudi Arabia saw its first major outbreak of H5N1 Avian flu
- Outbreaks.....epidemics
- Millions of birds have died of H5N1 influenza and hundreds of millions of birds have been slaughtered and disposed of, to limit the spread of the virus.

H1N1 (2009-2010)

- Swine fluvirus was first identified in Mexico in April 2009 and was also known as Mexican flu. It became known as swine flu because the virus closely resembled known influenza viruses that cause illness in pigs.
- It spread rapidly from country to country because it was a new type of flu virus that only few people were immune to.
- In **2010**, the WHO declared the pandemic was officially over.
- The virus now circulates worldwide as one of three seasonal flu viruses.

H1N1 Epidemic in Saudi Arabia

- The MOH has announced in June, 2009 the detection of the first case of swine flu in Saudi Arabia.
- The MOH applied the national plan for the prevention of swine flu in accordance with WHO's recommendations. Accordingly, patients were isolated and treated.
- According to the Saudi MOH, the number of laboratory-confirmed cases in Saudi Arabia as of December 30, 2009 was 15850, with 124 deaths.

Control Measures

- Immunoprophylaxis with vaccine.
- Chemoprophylaxis and chemotherapy.

Immunoprophylaxis with vaccine

- The most effective way to prevent the disease and/or its severe complications is to keep taking the vaccine annually.
- Among healthy adults, influenza vaccine can provide up to 90% protection, the vaccine may reduce severity of disease by 60% amongst the elderly and incidence of complications and deaths by 80%.

Route of admission of influenza vaccines

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graph TD; A[Route of admission of influenza vaccines] --> B[Influenza vaccine by nasal spray (Nasal-Spray Flu Vaccine)]; A --> C[Influenza vaccine by injection]; B --> D[a vaccine that contains a live weakened virus vaccine that does not cause influenza infection. This is given to people between the age of 2 years to 49 years and is not given to pregnant women, children under two years nor the elderly over 65 years.]; C --> E[it is a vaccine that contains inactivated virus (Inactivated Vaccine), injected to people aged 6 months and above, including healthy adults, pregnant women and those suffering from chronic diseases.];
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Influenza vaccine by nasal spray (Nasal-Spray Flu Vaccine)

a vaccine that contains a live weakened virus vaccine that does not cause influenza infection. This is given to people between the age of 2 years to 49 years and is not given to pregnant women, children under two years nor the elderly over 65 years.

Influenza vaccine by injection

it is a vaccine that contains inactivated virus (Inactivated Vaccine), injected to people aged 6 months and above, including healthy adults, pregnant women and those suffering from chronic diseases.

Immunoprophylaxis with vaccine

- The immune system produces antibodies to fight the virus, which may take two weeks, after that the body acquires protective immunity against seasonal influenza infection

Immunoprophylaxis with vaccine

The influenza vaccination is most effective when the vaccine provided closely matches the circulating viruses each year.

Flu Vaccine Update

- Vaccination against seasonal flu is available now 2017 in hospitals and primary health care centres in KSA.
- According to the CDC, It is advisable to get the flu vaccine before the end of October.
- The recommendation to **not** use the nasal spray flu vaccine was renewed for the 2017-2018 season. Only injectable flu shots are recommended for use again this season. (Efficacy issue)

What is the correct dose (volume) of vaccine?

- The amount of inactivated (injectable) vaccine that should be administered intramuscularly is based on the age of the patient and the vaccine product you are using.
- For children 6–35 months of age, the correct dose is:
 - 0.25 mL for Fluzone Quadrivalent
 - 0.5 mL for FluLaval Quadrivalent
- For persons 3 years of age and older, the correct dose is 0.5 mL for all inactivated influenza vaccine products

- Administer 2 doses of seasonal influenza vaccine separated by at least 4 weeks to children age 6 months through 8 years of age who:
 - Have never been vaccinated against influenza or have an unknown vaccination history
 - Have not received at least 2 doses of seasonal influenza vaccine (trivalent or quadrivalent) before July 1, 2016
- Administer 1 dose of seasonal influenza vaccine to persons:
 - 6 months through 8 years of age who have received at least 2 doses of seasonal influenza vaccine (trivalent or quadrivalent) before July 1, 2016
 - 9 years of age and older, regardless of their immunization history (persons 9 years of age and older should receive 1 dose of influenza vaccine each season)

Antiviral Drugs

- Amantadine, rimantadine. Effective for prevention and treatment of flu A only.
- Zanamivir, oseltamivir are approved for treatment of uncomplicated flu A & B; oseltamivir also approved for prophylaxis.
- Prophylaxis must be continued throughout the epidemic; treatment must begin within 24 hrs of onset of illness.

Prevention and Control

- Washing your hands frequently with soap and water.
- Other ways to stay healthy include the following:
 - Avoid close contact with people who are ill.
 - Eat a well-balanced diet and drink plenty of fluids.
 - Exercise regularly.
 - Get proper amounts of rest.
 - Manage stress levels.

Treatment

- Rest
- Hydration
- Relieve flu symptoms using over-the-counter medications

References

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- http://www.who.int/mediacentre/factsheets/avian_influenza/en/
- <https://www.cdc.gov/h1n1flu/cdcresponse.htm>

- [https://www.cdc.gov/flu/about/qa/vaxadmin.
htm](https://www.cdc.gov/flu/about/qa/vaxadmin.htm)

Thank You