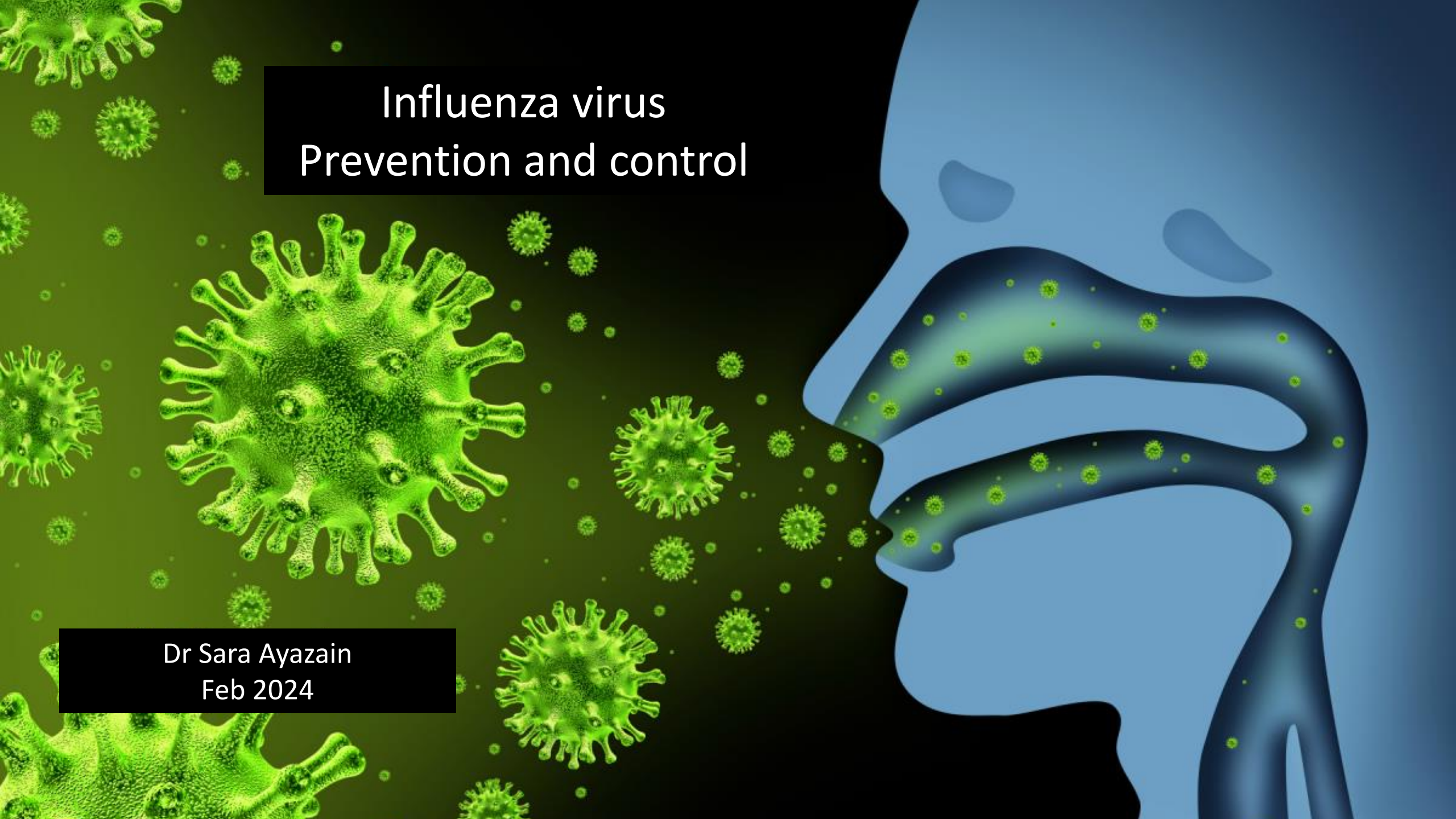
Influenza virus
Prevention and control



Dr Sara Ayazain
Feb 2024

Leading Causes of Deaths in the US

- **Heart Disease**
- **Cancer**
- **CVD**
- **Chr Obst Lung Dis**
- **Accidents**
- **Pneumonia & Influenza**
- **Diabetes Mellitus**
- **HIV**
- **Suicide**
- **Homicide**

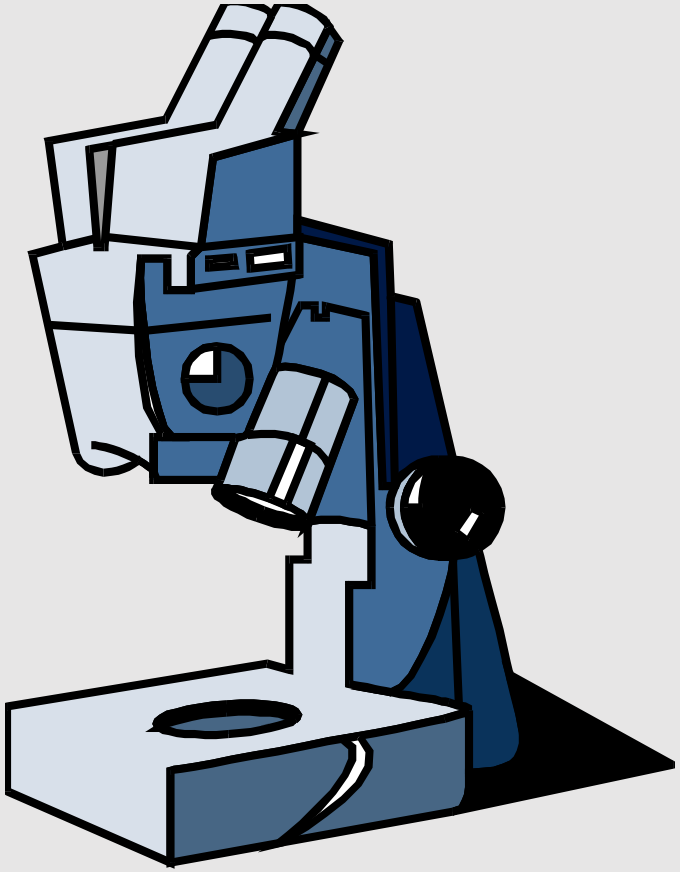
Leading Causes of Deaths in Iran

- بیماریهای کرونری قلب
- انفارکتوس مغزی
- تصادفات جاده ای
- فشارخون بالا
- آنفلوانزا و پنومونی
- کم وزنی
- سرطان معده
- سرطان مری
- سایر حوادث و جراحات
- بیماریهای اسهالی

Importance of Influenza

- **One of the most important Emerging and Reemerging infectious diseases**
- **Causes high morbidity and mortality in communities (epidemic) and worldwide (pandemic)**
- **Epidemics are associated with excess mortality**

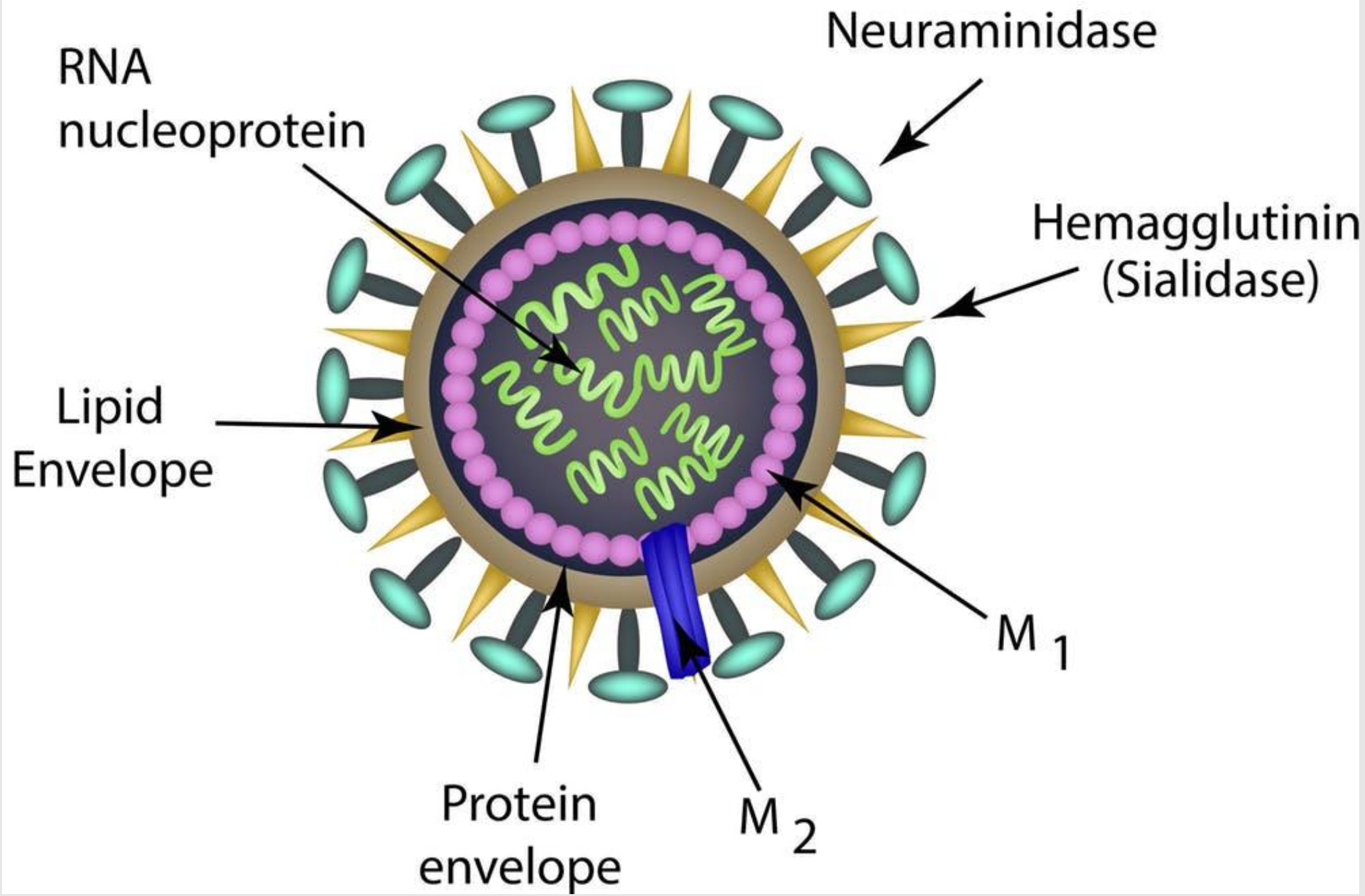
Discovery of Influenza Virus



- First isolated from a pig in 1931 (swine flu)
- Isolated from human in 1933

Causative Agent of Influenza

- **Caused by a virus belonging to the MYXOVIRUS group which comprises of Orthomyxovirus and Paramyxovirus**
- **Influenza virus is an Orthomyxovirus**


Neuraminidase
RNA
nucleoprotein
Hemagglutinin
(Sialidase)
Lipid
Envelope
M 1
Protein
envelope
M 2

Characteristics of Influenza Virus

- **Types A, B, C**
- **Diameter 80 - 120 nm**
- **Pleomorphic, spherical, filamentous particles**
- **Single-stranded RNA**
- **Segmented genome, 8 segments in A and B**
- **Hemagglutinin and Neuraminidase on surface of virion**

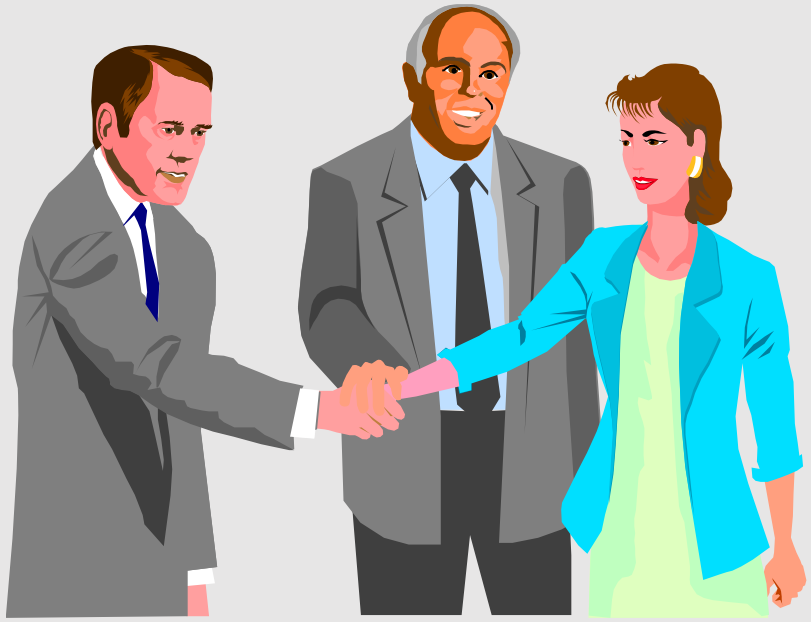
Classification of Influenza virus

- **Classified on the basis of hemagglutinin (HA) and neuraminidase (NA)**
- **15 subtypes of HA and 9 subtypes of NA are known to exist in animals (HA 1-15, NA 1-9)**
- **3 subtypes of HA (1-3) and 2 subtypes of NA (1-2) are human influenza viruses. HA 5, 7, 9 and NA 7 can also infect humans**

Nomenclature of Human Influenza Virus

Type	Subtype	Prototype
A	H1N1	A/PR/8/34
		A/NJ/8/76
	H2N2	A/JP/305/57
	H3N2	A/HK/1/68
B	None	B/Lee/40
C	None	C/Taylor/47

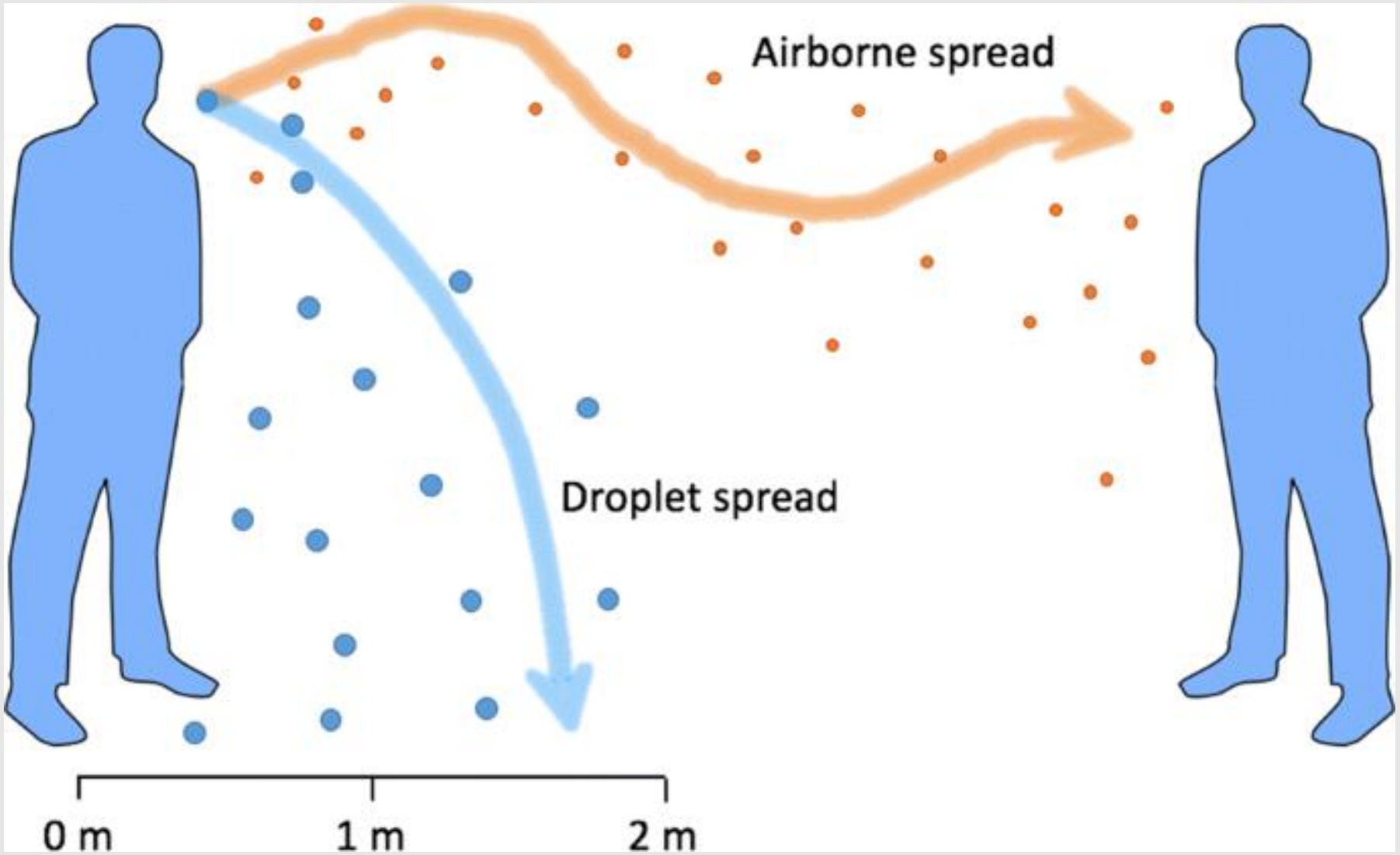
Mode of Transmission In Human



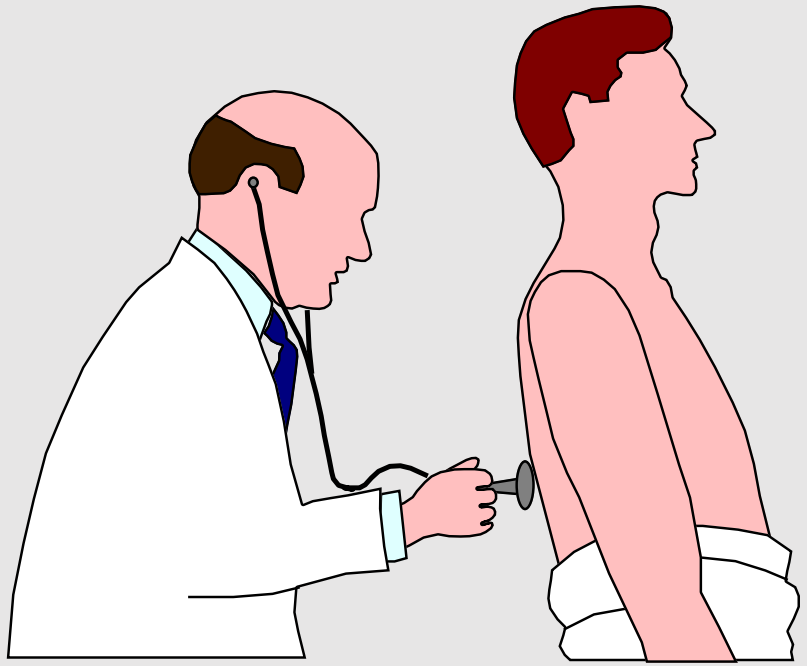
- The virus is spread from person- to- person through respiratory secretions either as droplets (close contact) or as airborne infection by droplet nuclei suspended in the air.
- Incubation period 1-3 days
- High attack rate:

Adults 5-10%

Children 20-30%


Airborne spread
Droplet spread
0 m
1 m
2 m

Clinical Manifestations



- Influenza is an acute respiratory infectiouse illness characterized by fever, headache, myalgia, sore throat and cough.(systemic presentation of disease, flu like disease)
- Cough is frequently severe and protracted.
- Duration of illness is usually 2-7 days.

Clinical Diagnosis

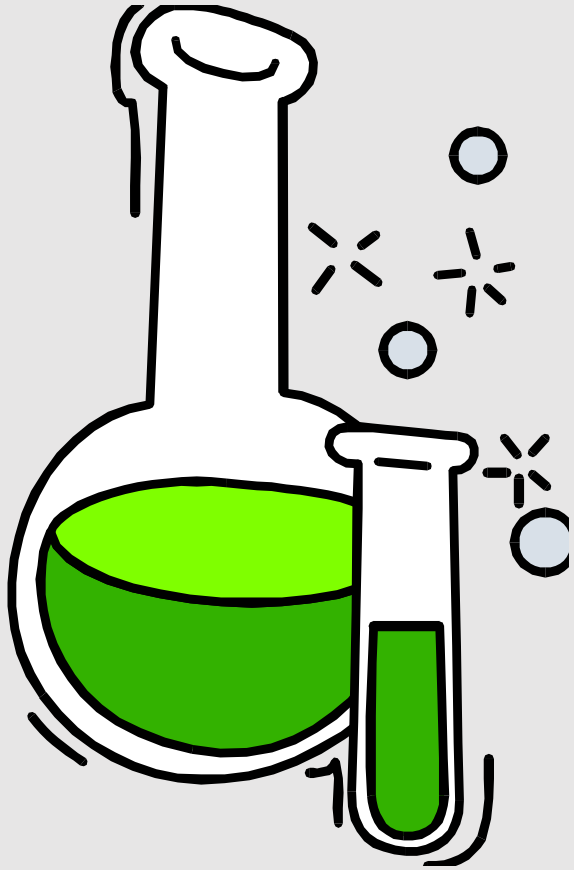
- **The clinical picture of influenza is nonspecific.**

- **Influenza-like illness can be caused by many microbial agents other than influenzavirus, such as adenovirus, parainfluenza viruses, coronavirus, Mycoplasma pneumoniae, Chlamydia pneumoniae, beta-hemolytic streptococcus.**

Laboratory Diagnosis

- Since the clinical picture of influenza is nonspecific, its specific diagnosis must be confirmed by laboratory tests.

- This is usually made by virus isolation, identification of specific antigens or antibody rise.
- BM suppression (Leukopenia, Thrombocytopenia, Anemia)
- ALT, AST, ESR, CRP, LDH, CPK, CK MB



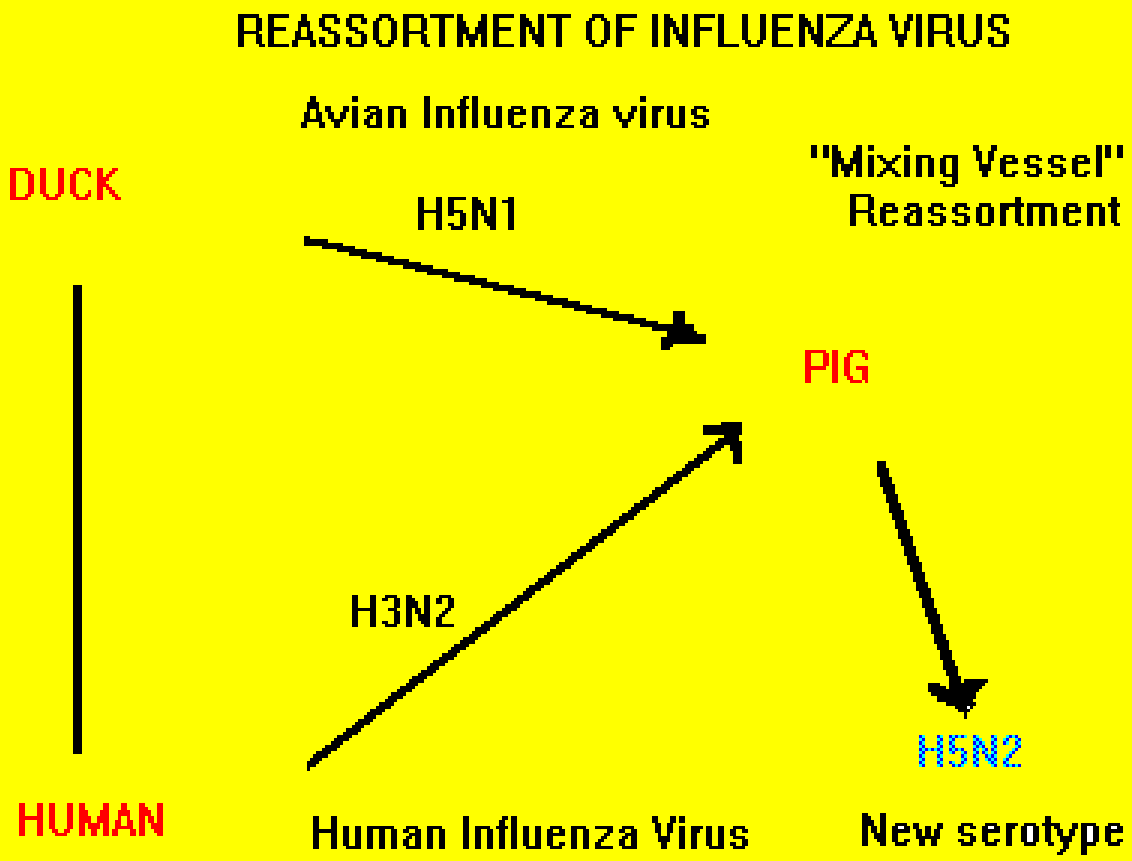
Antigenic Variation

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 hemagglutinin and neuraminidase 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.**

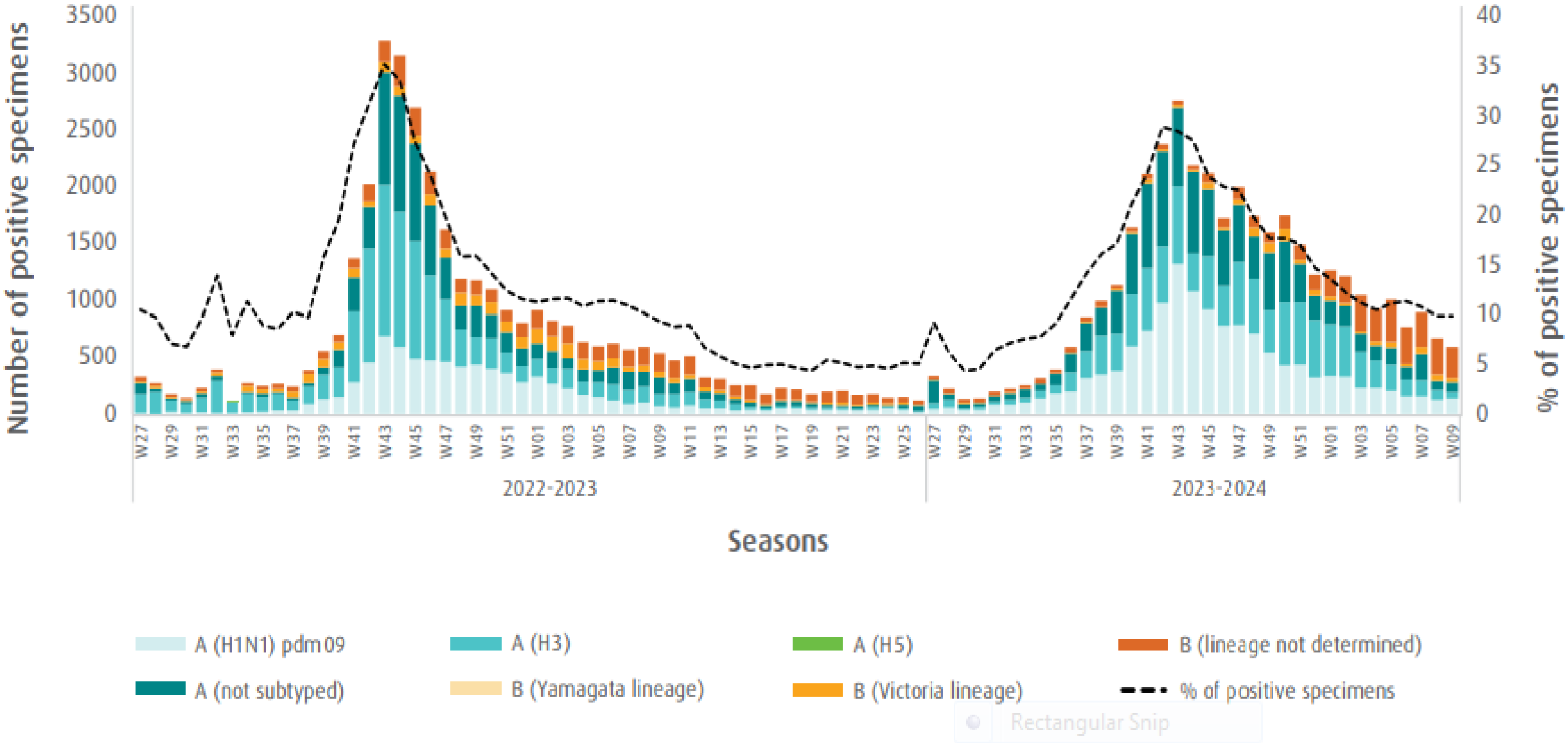

REASSORTMENT OF INFLUENZA VIRUS
Avian Influenza virus
DUCK
H5N1
"Mixing Vessel"
Reassortment
PIG
H3N2
H5N2
HUMAN
Human Influenza Virus
New serotype

Pandemic Influenza Viruses

Pandemic	Subtype
1889	H2N?
1899	H3N8
1918	H1N1
1957	H2N2
1968	H3N2
1977	H1N1

Antigenic Drift

- **This term denotes MINOR changes in hemagglutinin and neuraminidase 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.**


Number of positive specimens
3500
3000
2500
2000
1500
1000
500
0
% of positive specimens
40
35
30
25
20
15
10
5
0
W27 W29 W31 W33 W35 W37 W39 W41 W43 W45 W47 W49 W51 W01 W03 W05 W07 W09 W11 W13 W15 W17 W19 W21 W23 W25
2022-2023
W27 W29 W31 W33 W35 W37 W39 W41 W43 W45 W47 W49 W51 W01 W03 W05 W07 W09
2023-2024
Seasons
A (H1N1) pdm09
A (H3)
A (H5)
B (lineage not determined)
A (not subtyped)
B (Yamagata lineage)
B (Victoria lineage)
% of positive specimens

Reservoirs of Influenza Viruses

- **Aquatic birds**
- **Pigs**
- **Humans**

Control Measures

- Immunoprophylaxis with vaccine
- Chemoprophylaxis and chemotherapy

Antiviral Drugs

- Amantadine, rimantadine. Previously effective for prevention and treatment of flu A (now resistant)

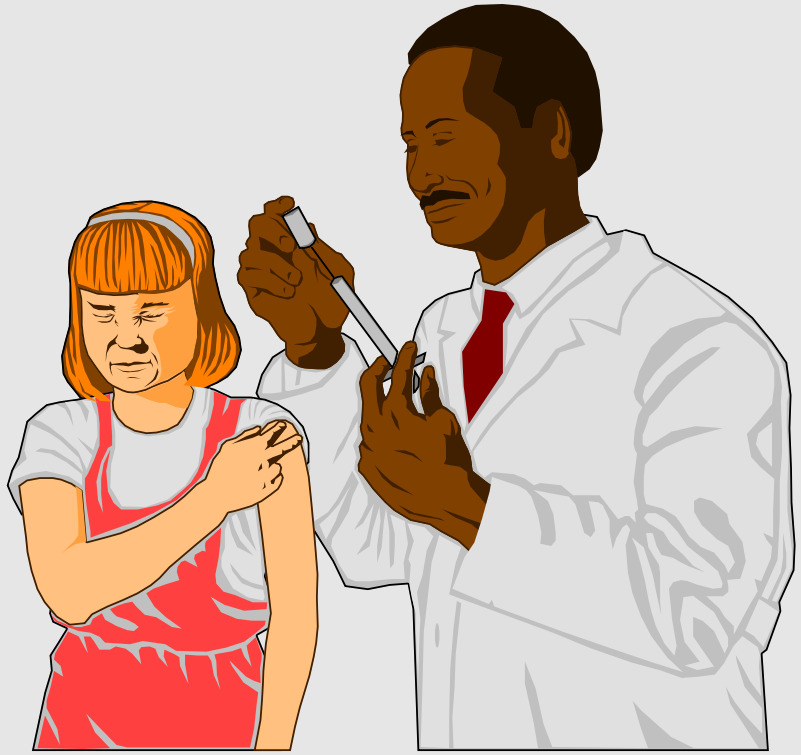
- Zanamivir, oseltamivir are approved for treatment of flu A & B; oseltamivir also approved for prophylaxis.

- Prophylaxis must be continued throughout the epidemic; treatment must begin within 24 hrs of onset of illness.
- In case of bacterial super infection antibiotic therapy is needed.

Types of Vaccine

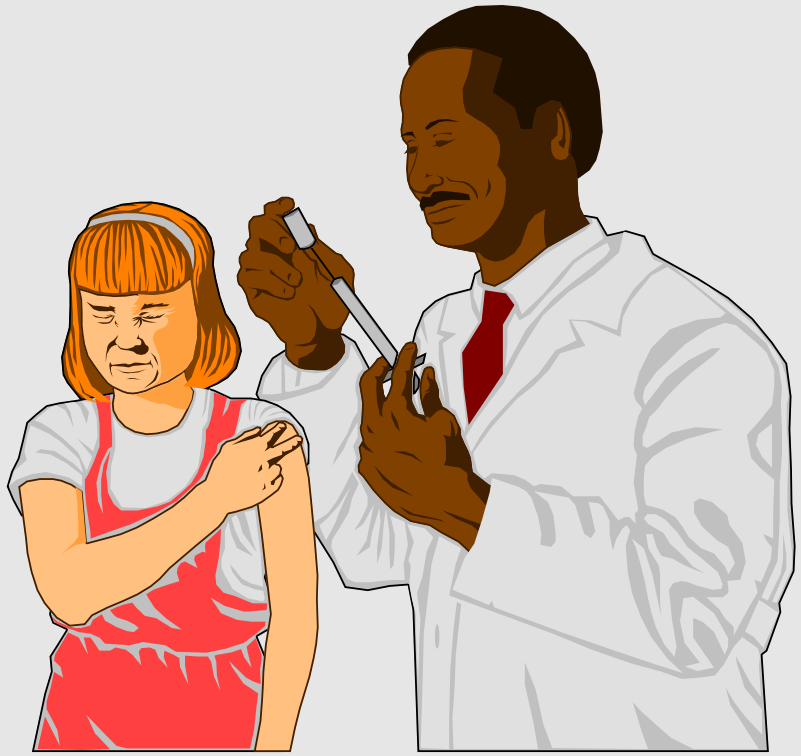
- **Inactivated**, consisting of (1) whole-virus, (2) subvirion, (3) purified surface antigen. Only subvirion or purified antigen should be used in children. Any of the three can be used for adults.
- **Live attenuated**

Influenza Vaccine, who should receive it



- Persons 65 yrs or older
- Persons with heart, pulmonary, renal and metabolic diseases.
- Persons in nursing homes and other long-term care facilities
- Persons 6 mos-18 yrs old receiving aspirin therapy

Influenza vaccine recipients--continued



- Women in 2nd or 3rd trimester of pregnancy during flu season.
- Household members of persons in high-risk groups
- Health care workers and others providing essential community services.

Influenza vaccines

Inactivated subunit (TIV)

Intramascular

trivalent

Split virus and subunit types

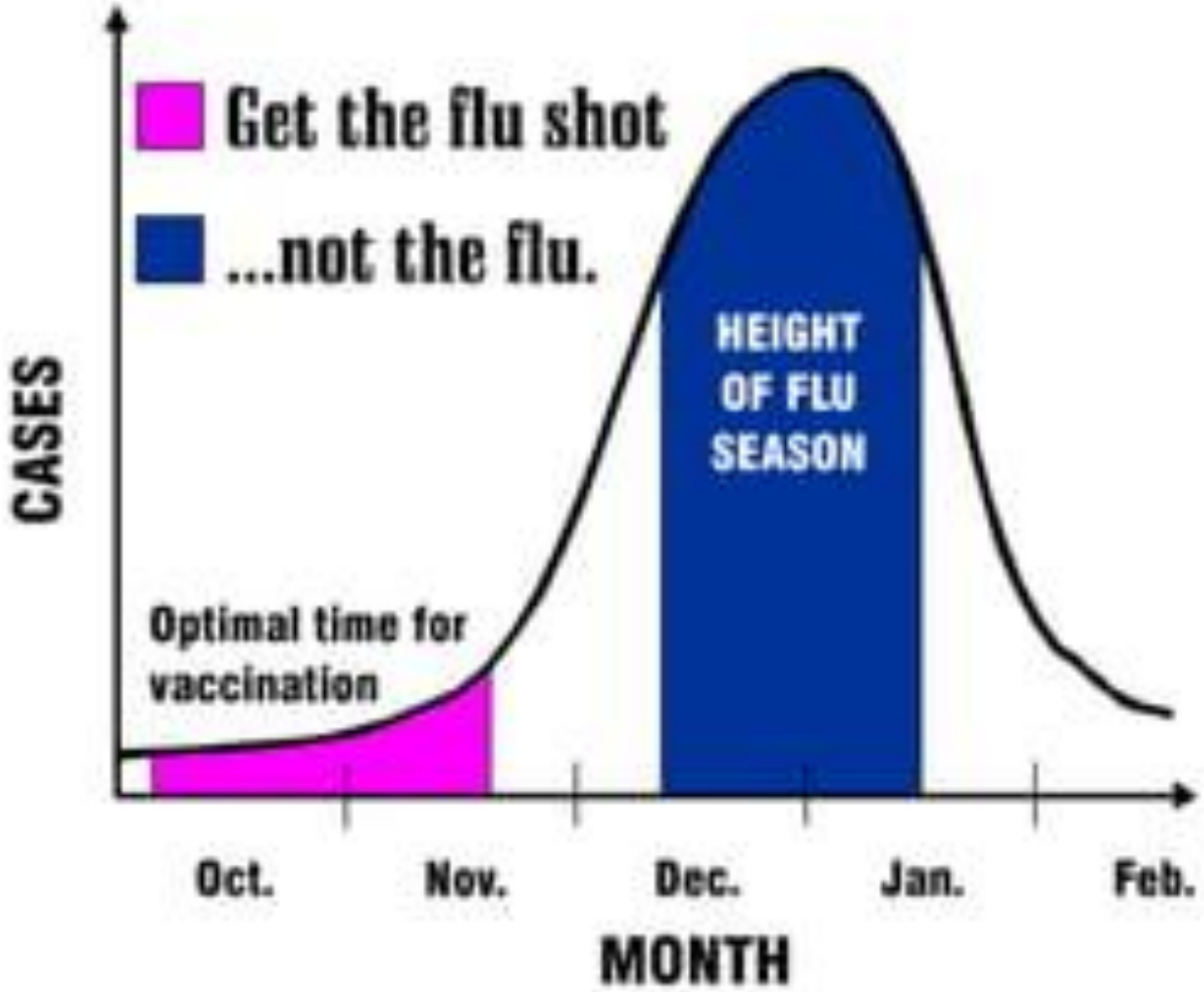
Duration of immunity 1 year or less

Live attenuated vaccines (LAIV)

Intranasal

trivalent

Duration of immunity at least 1 year


Get the flu shot
...not the flu.
CASES
HEIGHT OF FLU SEASON
Optimal time for vaccination
Oct.
Nov.
Dec.
Jan.
Feb.
MONTH

Vaccines schedules

Age group	Dosage (Im/Sc)	No. of doses
6-35 months	0.5 ml (previously 0.25)	1 or 2 *
3-8 years	0.5 ml	1 or 2 *
> 9 years	0.5 ml	1

* 2 doses at least 1 month apart for children receiving the vaccine for the first time

flumist®: Efficacy and Limitations

- Live viruses with limited replication in upper respiratory tract
- Nasal spray
- Prevents >90% of disease symptoms
- Limited use: only approved for people 5 to 49 years old in good health condition
- Children between 5 to 8 years old : two doses with an interval of 60 days (if not previously vaccinated with Flumist®
- Expensive (70$) cold adoped influenza virus

Influvac

- واکسن غیر فعال
- شرکت Abbott
- ساخت هلند (هند)
- چهار ظرفیتی
- آنتی ژنهای سطحی هماگلوتینین و نورآمینیداز
- شایعترین سوشهای در گردش سال جاری
- از تایپ B و ساب تایپهای H1N1 و H3N2
- کشت در تخم مرغ جنین دار
- حاوی مقادیری اووالبومین و پروتیینهای جوجه ، جنتامایسین ، تری متیل آمونیوم بروماید و پلی سوربات ۸۰
- قابل مصرف در بالغین و کودکان بالای ۶ ماه
- در زنان باردار و شیرده منع مصرف ندارد

vaxigrip

- واکسن غیر فعال
- شرکت Sanofi Pasteur
- ساخت فرانسه
- چهار ظرفیتی
- ویروس تکه شده split
- شایعترین سوشهای در گردش سال جاری
- از تایپ B و ساب تایپهای H1N1 و H3N2
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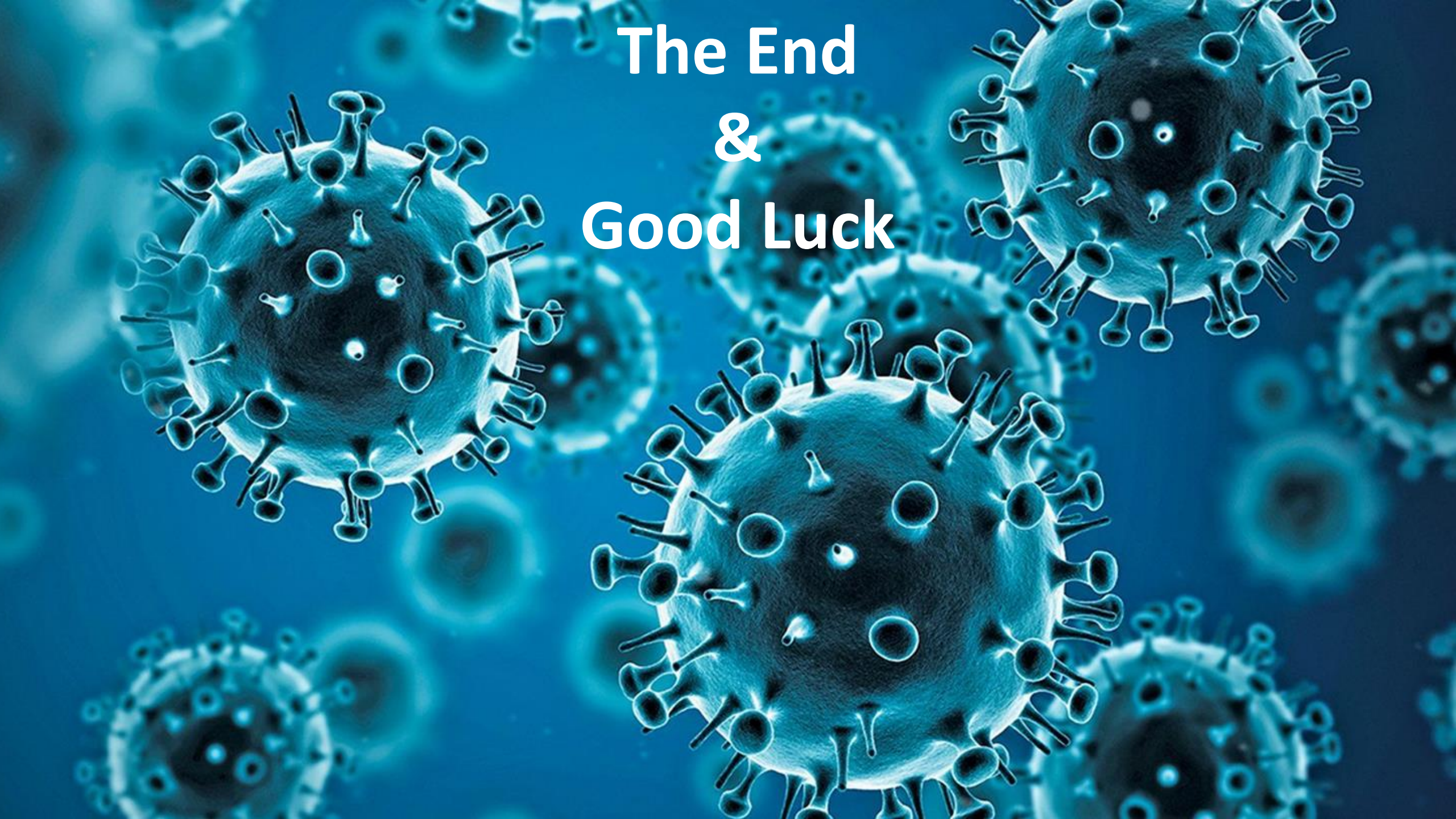
- در زنان باردار و شیرده منع مصرف ندارد

fluguard

- واکسن نوترکیب
- شرکت آریوژن فارمد
- ساخت ایران
- چهار ظرفیتی
- پروتیین نوترکیب هماگلوتینین
- شایعترین سوشهای در گردش سال جاری
- از تایپ B و ساب تایپهای H1N1 و H3N2
- فاقد پروتیینهای تخم مرغ یا جوجه ح
- قابل مصرف در افراد بالای ۱۸ سال


The End
&
Good Luck