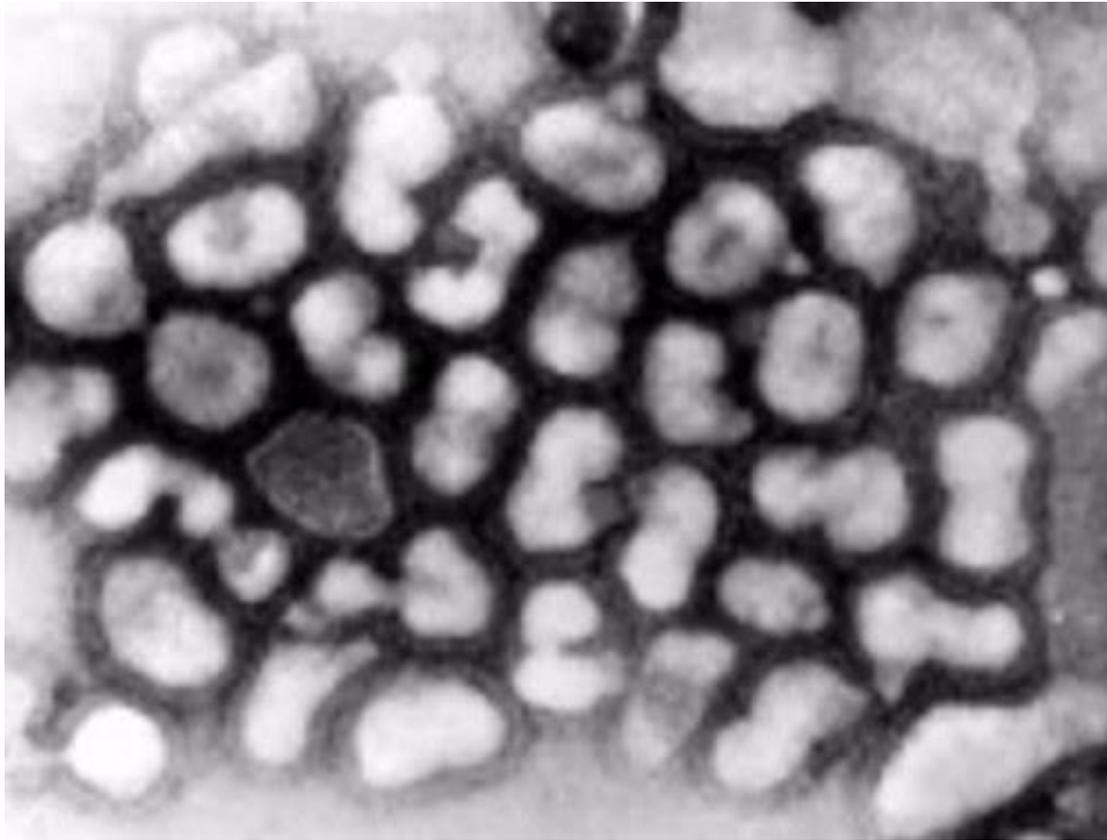


Influenza in Vulnerable Populations

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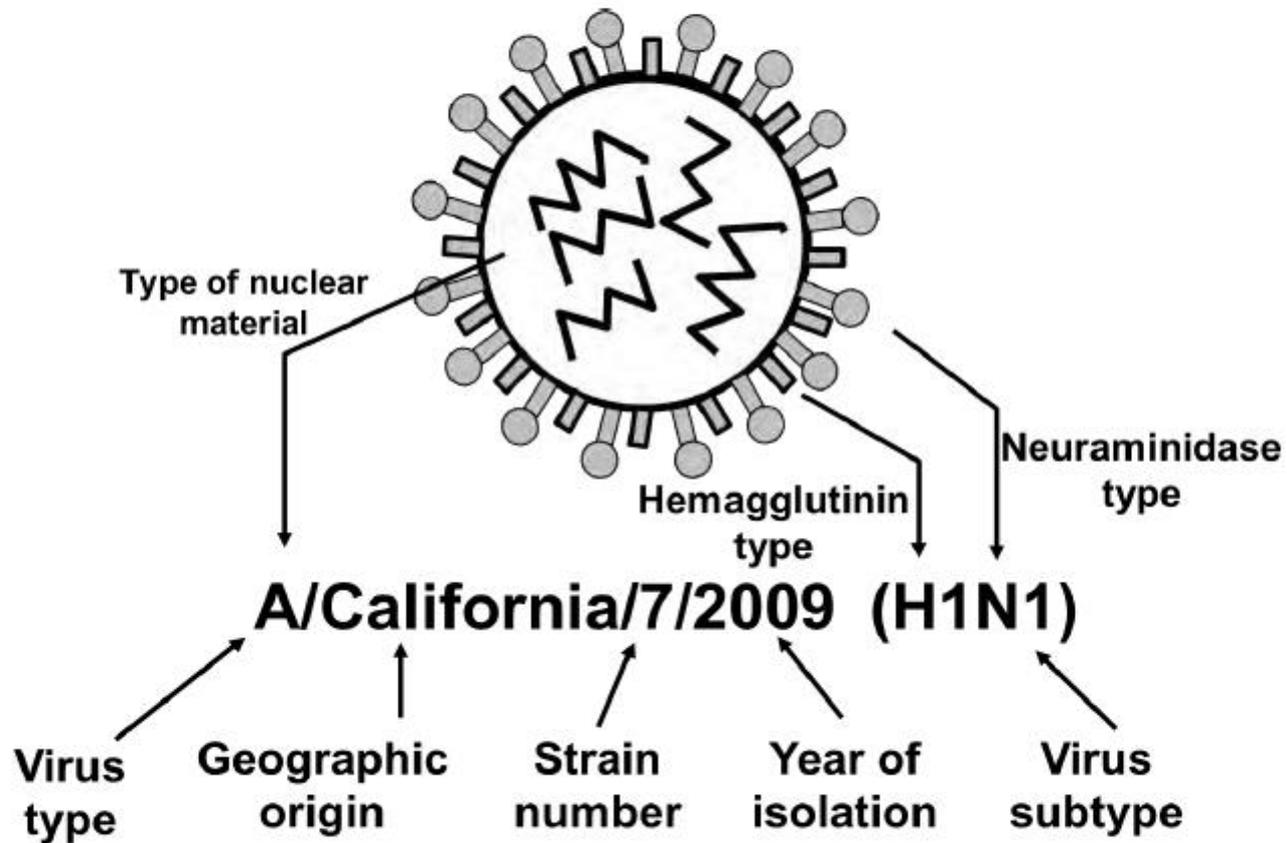
Influenza



Influenza Virus Strains

- ❑ **Type A**
 - moderate to severe illness
 - all age groups
 - humans and other animals
- ❑ **Type B**
 - milder disease
 - primarily affects children
 - humans only
- ❑ **Type C**
 - rarely reported in humans
 - no epidemics

Influenza Virus



Influenza Antigenic Changes

- ❑ Hemagglutinin and neuraminidase antigens change with time**
- ❑ Changes occur as a result of point mutations in the virus gene, or due to exchange of a gene segment with another subtype of influenza virus**
- ❑ Impact of antigenic changes depend on extent of change (more change usually means larger impact)**

Influenza Antigenic Changes

□ Antigenic Shift

- major change, new subtype
- caused by exchange of gene segments
- may result in pandemic

□ Example of antigenic shift

- H2N2 virus circulated in 1957-1967
- H3N2 virus appeared in 1968 and completely replaced H2N2 virus

Influenza Antigenic Changes

□ Antigenic Drift

- minor change, same subtype
- caused by point mutations in gene
- may result in epidemic

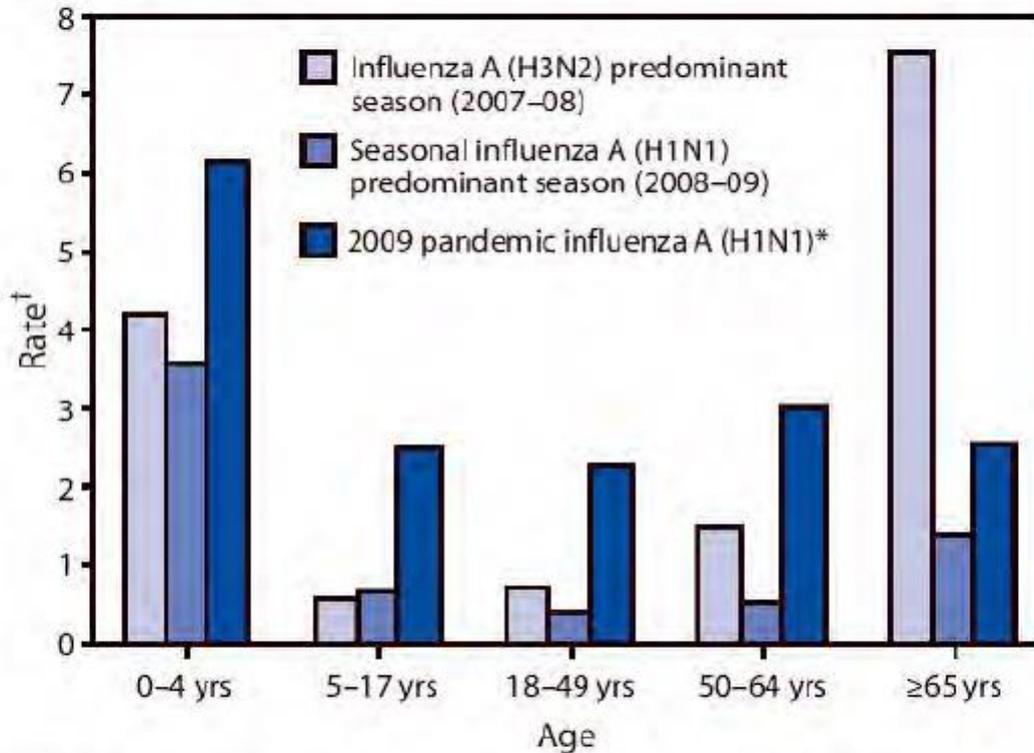
□ Example of antigenic drift

- in 2002-2003, A/Panama/2007/99 (H3N2) virus was dominant
- A/Fujian/411/2002 (H3N2) appeared in late 2003 and caused widespread illness in 2003-2004

2009 Influenza A (H1N1)

- ❑ In April 2009 a novel influenza A (H1N1) virus appeared and caused respiratory illnesses that spread across North America**
- ❑ By May 2009 the virus had spread to many areas of the world**
- ❑ Cause of the first influenza pandemic since 1968**

FIGURE 1. Cumulative rate of hospitalizations during three influenza seasons, by age group — Emerging Infections Program, United States, 2007–2010

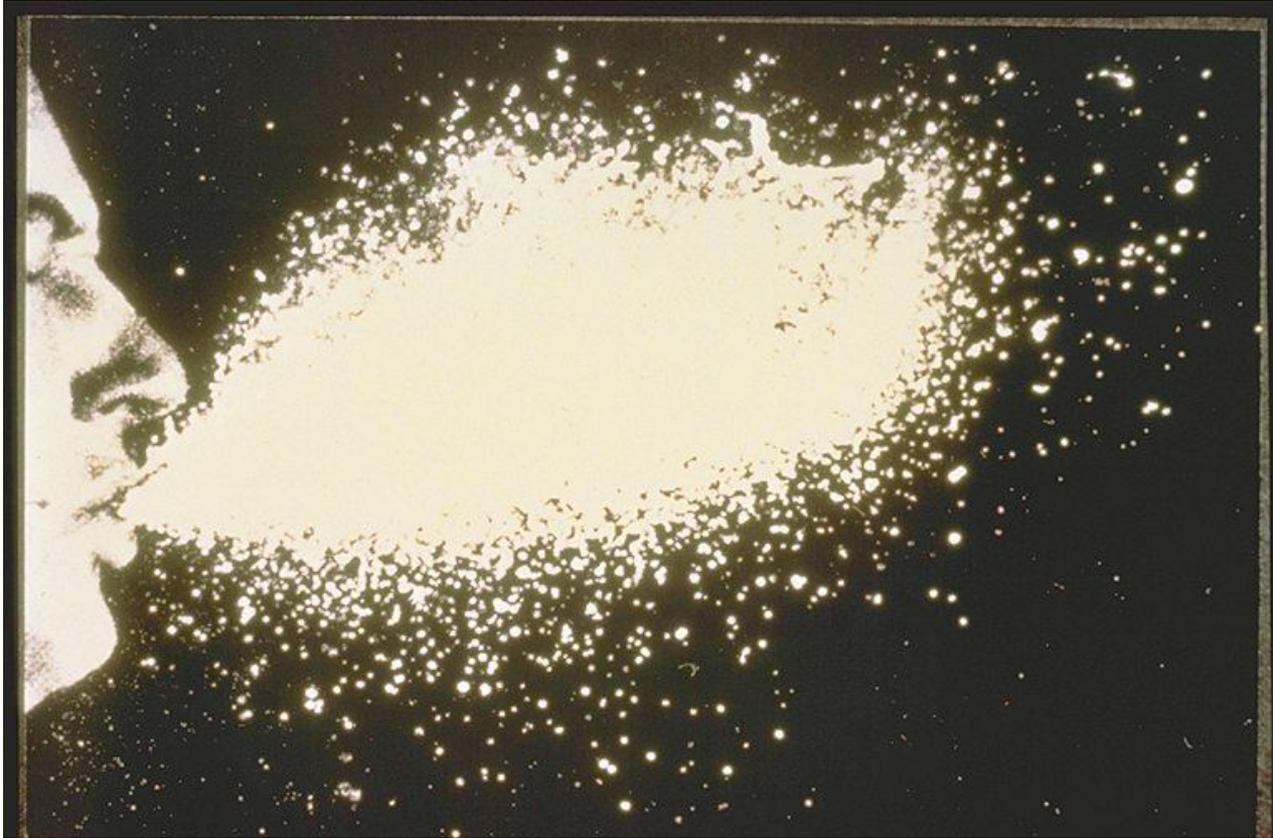


* 2009 Pandemic Influenza A(H1N1) hospitalization data from September 1, 2009–January 21, 2010.

† Per 10,000 population.

Influenza Pathogenesis

- ❑ **Respiratory transmission of virus**
- ❑ **Replication in respiratory epithelium with subsequent destruction of cells**
- ❑ **Viremia rarely documented**
- ❑ **Viral shedding in respiratory secretions for 5-10 days**



Influenza Clinical Features

- ❑ Incubation period 2 days
(range 1-4 days)**
- ❑ Abrupt onset of fever, myalgia, sore throat,
nonproductive cough, headache**
- ❑ Severity of illness depends on prior experience
with related variants**

Epidemiology

Most vulnerable patients

- Age >65 and children <2 yrs of age
- Underlying chronic conditions at any age
 - Heart and lung disease
 - Diabetes
 - Compromised immune system

Secondary complications

- Primary influenza viral pneumonia or secondary bacterial pneumonia
- Exacerbation of underlying cardiac or pulmonary disease
- Secondary or co-infection with other viral and bacterial pathogens

Deaths .5-1 per 1000 cases

Impact of Influenza-United States, 1976-2007

- ❑ The number of influenza-associated deaths varies substantially by year, influenza virus type and subtype, and age group**
- ❑ Annual influenza-associated deaths ranged from 3,349 (1985-86 season) to 48,614 (2003-04 season), with an average of 23,607 annual deaths**
- ❑ Persons 65 years of age and older account for approximately 90% of deaths**
- ❑ 2.7 times more deaths occurred during seasons when A(H3N2) viruses were prominent**

Hospitalization Rates for Influenza By Age and Risk Group*

Age Group	Rate** (high-risk)	Rate** (not high-risk)
0-11 mos	1900	496-1038
1-2 yrs	800	186
3-4 yrs	320	86
5-14 yrs	92	41
15-44 yrs	56-110	23-25
45-64 yrs	392-635	13-23
≥65 yrs	399-518	125-228

* Data from several studies 1972 - 1995

** Hospitalizations per 100,000 population

Vulnerable populations for Influenza

Two main reasons for certain populations to be at high risk

Immune deficiency either by age or condition

- Results in inability to effectively reduce viral replication and spread
- Results in inadequate response to vaccines

Damaged respiratory track

- COPD and asthma have impaired airways that are further damaged by viral infection

Influenza in Children

Children commonly need medical care because of influenza, especially before they turn 5 years old.

- Severe influenza complications are most common in children younger than 2 years old.

Children with chronic health problems like asthma, diabetes and disorders of the brain or nervous system are at especially high risk of developing serious flu complications.

Each year an average of 20,000 children under the age of 5 are hospitalized because of influenza complications.

Last influenza season, more than 140 flu-related pediatric deaths were reported

Influenza Among School-Aged Children

□ School-aged children

- typically have the highest attack rates during community outbreaks of influenza
- serve as a major source of transmission of influenza within communities

Why Emphasize Kids?

Infants with higher morbidity and mortality with influenza

Children act as major vectors for the transmission of influenza

- Use of flu vaccine does impact community spread

Children often have habits that facilitate transmission

- Sharing toys, sneezing on others, etc.

Presence of children the most important predictor of influenza in the household

Age over 65

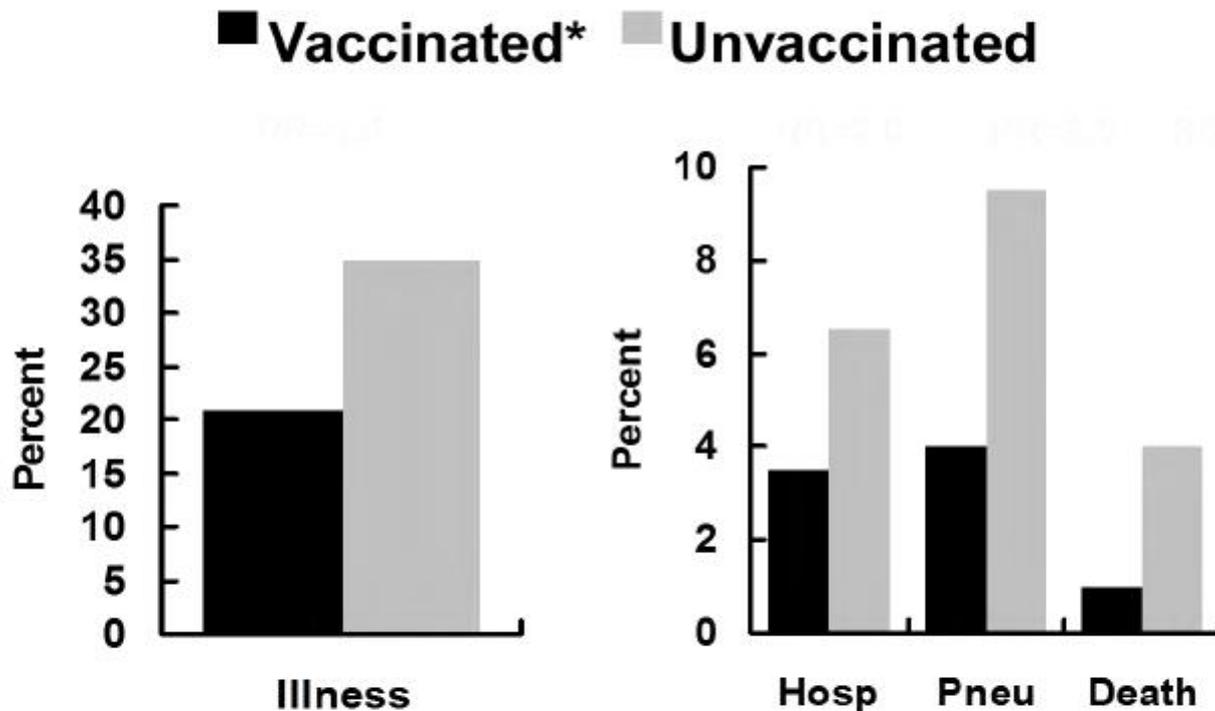
Human immune defenses become weaker with age.

During most seasons, people 65 years and older bear the greatest burden of severe flu disease.

In recent years, for example, it's estimated that between

- 80 and 90 percent of seasonal flu-related deaths have occurred in people 65 year and older
- 50 and 70 percent of seasonal flu-related hospitalizations have occurred among people in that age group.

Influenza and Complications Among Nursing Home Residents



*Inactivated influenza vaccine. Genesee County, MI, 1982-1983

Nursing Home Influenza

Vaccinate all nursing home residents!!!!

Health care personnel who get vaccinated help to reduce the following:

- Transmission of influenza
- Staff illness and absenteeism
- Influenza-related illness and death, especially among people at increased risk for severe influenza illness

Higher vaccination levels among personnel have been associated with a lower risk of health care facility-associated influenza cases.

Influenza outbreaks in hospitals and long-term care facilities have been attributed to low influenza vaccination coverage among health care personnel.

Chronic Conditions: Asthma

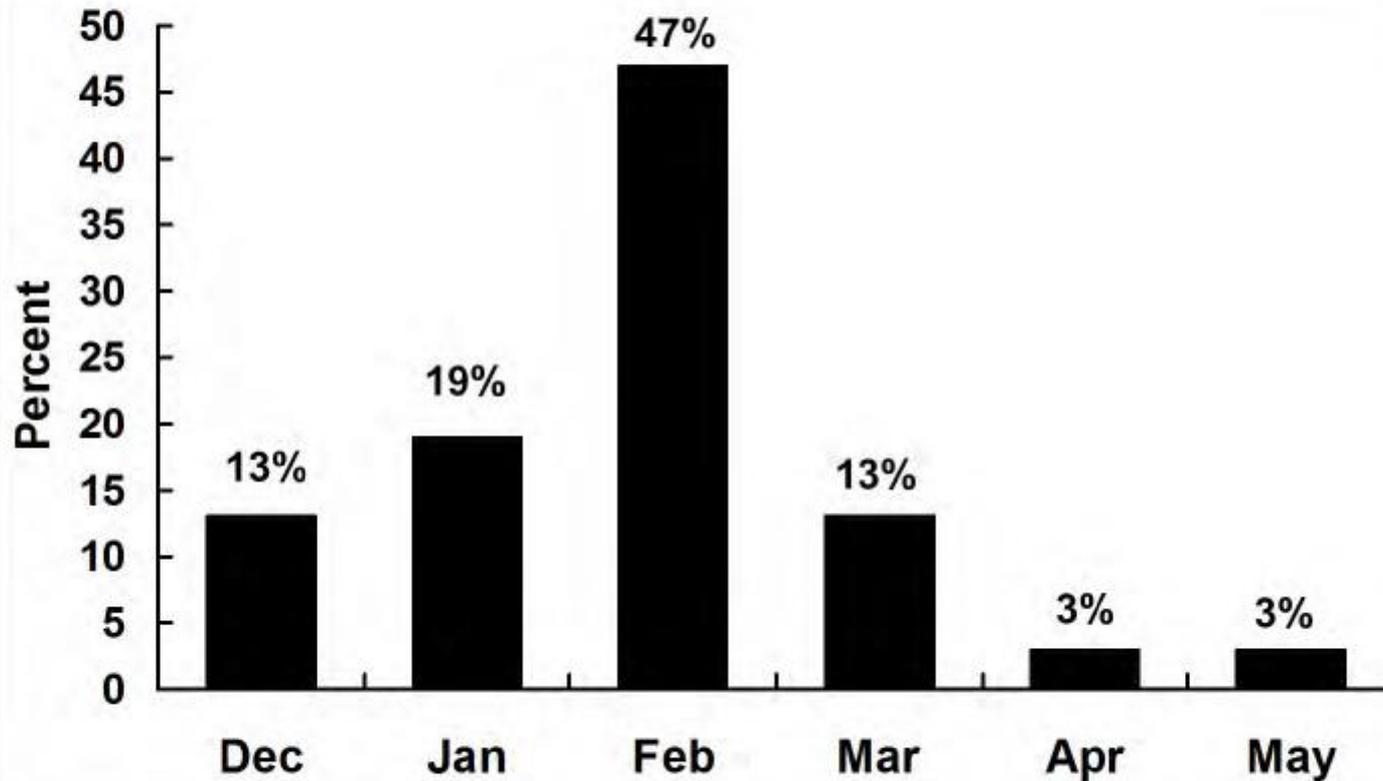
People with asthma are not more likely to get the flu but influenza (flu) can be more serious for people with asthma, even if their asthma is mild or their symptoms are well-controlled by medication.

- People with asthma have swollen and sensitive airways, and influenza can cause further inflammation of the airways and lungs.
- Influenza infection in the lungs can trigger asthma attacks and a worsening of asthma symptoms.

It can lead to pneumonia and other acute respiratory diseases.

- Adults and children with asthma are more likely to develop pneumonia than people who do not have asthma.
- Asthma is the most common medical condition among children hospitalized with the flu and one of the more common medical conditions among hospitalized adults.

Month of Peak Influenza Activity United States, 1976-2008



Influenza Vaccines

- ❑ **Inactivated subunit (TIV)**
 - intramuscular or intradermal
 - trivalent
- ❑ **Live attenuated vaccine (LAIV)**
 - intranasal
 - trivalent

Terminology

The former abbreviation TIV (Trivalent Inactivated Influenza Vaccine, previously used for inactivated influenza vaccines) has been replaced with the new abbreviation IIV (*Inactivated Influenza Vaccine*). IIVs as a class will include:

- egg-based and cell culture-based trivalent inactivated influenza vaccines (IIV3), and
- egg-based quadrivalent inactivated influenza vaccine (IIV4).

RIV refers to recombinant hemagglutinin influenza vaccine, available as a trivalent formulation (RIV3).

LAIV refers to live-attenuated influenza vaccine, available as a quadrivalent formulation (LAIV4)

Composition of the 2015-16 Influenza Vaccines

2015-16 U.S.-licensed trivalent influenza vaccines an

- A/California/7/2009 (H1N1)-like virus,
- an A/Switzerland/9715293/2013 (H3N2)-like virus, and
- a B/Phuket/3073/2013-like (Yamagata lineage) virus.

This represents changes in the influenza A (H3N2) virus and the influenza B virus as compared with the 2014–15 season.

Quadrivalent influenza vaccines will contain these vaccine viruses, and a B/Brisbane/60/2008-like (Victoria lineage) virus, which is the same Victoria lineage as 2014-15.

ACIP Recommendations

[http://www.cdc.gov/mmwr/preview/mmwr.html/mm6430a3.htm#Groups Recommended Vaccination Timing Vaccination](http://www.cdc.gov/mmwr/preview/mmwr.html/mm6430a3.htm#Groups_Recommended_Vaccination_Timing_Vaccination)

Fluzone High-Dose

- ❑ Contains 4 X amount of influenza antigen than regular Fluzone**
- ❑ Approved only for persons 65 years and older**
- ❑ Produced higher antibody levels; slightly higher local reactions**
- ❑ Studies underway to assess clinical effectiveness**
- ❑ No preference stated by ACIP for HD or regular influenza vaccination**

Fluzone Intradermal

- ❑ Licensed by FDA in May 2011**
- ❑ Approved only for persons 18 through 64 years of age**
- ❑ Dose is 0.1 mL administered by a specially designed microneedle injector system in the deltoid (not the forearm)**
- ❑ Formulated to contain more HA (27 mcg) than a 0.1 mL dose of regular Fluzone formulation (9 mcg)**

Inactivated Influenza Vaccine Efficacy

- ❑ 50% to 70% effective among healthy persons younger than 65 years of age**
- ❑ 34% to 55% effective among older persons who reside in long-term care facilities**

LAIIV Efficacy in Healthy Children

- ❑ 87% effective against culture-confirmed influenza in children 5-7 years old**
- ❑ 27% reduction in febrile otitis media (OM)**
- ❑ 28% reduction in OM with accompanying antibiotic use**
- ❑ Decreased fever and OM in vaccine recipients who developed influenza**

LAIV Efficacy in Healthy Adults

- ❑ **20% fewer severe febrile illness episodes**
- ❑ **24% fewer febrile upper respiratory illness episodes**
- ❑ **27% fewer lost work days due to febrile upper respiratory illness**
- ❑ **18%-37% fewer days of healthcare provider visits due to febrile illness**
- ❑ **41%-45% fewer days of antibiotic use**

Inactivated Influenza Vaccine Schedule

Age Group	Dose	No. Doses
6-35 mos	0.25 mL	1 or 2
3-8 yrs	0.50 mL	1 or 2
≥9 yrs	0.50 mL	1

Live Attenuated Influenza Vaccine Indications

- **Healthy*, nonpregnant persons 2 through 49 years of age, including**
 - healthy children
 - healthcare personnel
 - persons in close contact with high-risk groups
 - persons who want to reduce their risk of influenza

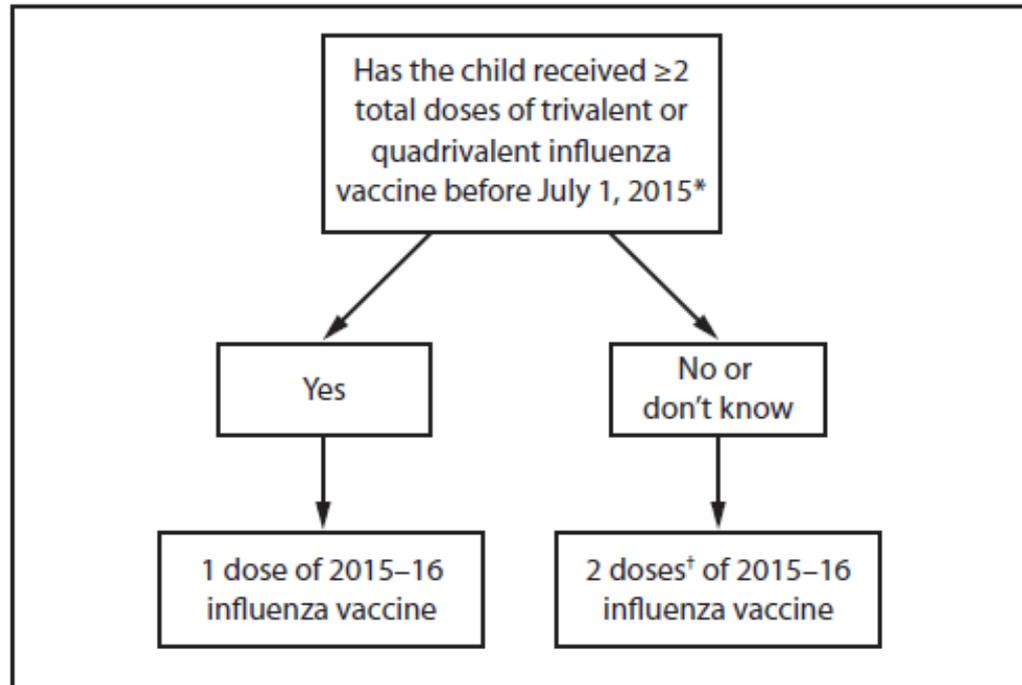
*Persons who do not have medical conditions that increase their risk for complications of influenza

Live Attenuated Influenza Vaccine Schedule

Age Group	Number of Doses
2 - 8 years, no previous influenza vaccine	2 (separated by 4 weeks)
2 - 8 years, previous influenza vaccine *	1
9 - 49 years	1

* LAIV or inactivated vaccine

Dosing for Children



* The two doses need not have been received during the same season or consecutive seasons.

† Doses should be administered ≥4 weeks apart.

Timing of Influenza Vaccine Programs

- ❑ Influenza activity can occur as early as October**
- ❑ In more than 80% of seasons since 1976, peak influenza activity has not occurred until January or later**
- ❑ In more than 60% of seasons the peak was in February or later**

Staying Healthy

Get vaccinated but also remember to:

- Wash hands
- Cover coughs
- Stay home if you are ill