EpiVac Pink Book Web-on-Demand Series

Influenza–2020

Immunization Services Division
National Center for Immunization and Respiratory Diseases
Centers for Disease Control and Prevention
Atlanta, GA
Learning Objectives

- For each vaccine-preventable disease, identify those for whom routine immunization is recommended.
- For each vaccine-preventable disease, describe characteristics of the vaccine used to prevent the disease.
- Describe an emerging immunization issue.
- Locate current immunization resources to increase knowledge of team’s role in program implementation for improved team performance.
- Implement disease detection and prevention health care services (e.g., smoking cessation, weight reduction, diabetes screening, blood pressure screening, immunization services) to prevent health problems and maintain health.
Today’s Agenda

EpiVac Pink Book Web-on-Demand Series: Influenza–2020

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Continuing Education Information

- CE credit, go to: www.cdc.gov/GetCE
- Search course number: WD4344-101420
- CE credit expires: July 1, 2022
- CE instructions are available on the EpiVac Pink Book Web-on-Demand Series web page
- Questions and additional help with the online CE system, e-mail CE@cdc.gov
Disclosure Statements

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Influenza and Influenza Vaccines

Epidemiology and Prevention of Vaccine-Preventable Diseases (Pink Book) Webinar Series
October 14, 2020
Disease
Influenza

- Highly infectious viral illness

- First pandemic in 1580

- At least 4 pandemics in 19th century
- Three pandemics in the 20th century
  - Estimated 50 million deaths worldwide in pandemic of 1918-1919
  - Pandemics of 1957 and 1968 of lesser severity

- Most recent pandemic (H1N1) in 2009-2010

- Virus first isolated in 1933
Influenza Virus

- Single-stranded RNA virus
- Orthomyxoviridae family
- 4 types: A, B, C, and D
- Subtypes of type A are determined by hemagglutinin and neuraminidase.
Influenza Virus Strains

- **Type A**
  - Moderate to severe illness
  - All age groups
  - Humans and other animals

- **Type B**
  - Milder epidemics
  - Primarily affects children
  - Humans only

- **Type C**
  - Rarely reported in humans
  - No epidemics

- **Type D**
  - Primarily affects cattle
  - Not known to cause disease in people
Influenza Type A Subtypes

Subtypes of type A determined by hemagglutinin (H) and neuraminidase (N)

A/California/7/2009 (H1N1)
Influenza Antigenic Changes

- **Antigenic drift**
  - Minor change, same subtype
  - Caused by point mutations in gene
  - May result in epidemic

- **Antigenic shift**
  - Major change, new subtype
  - Caused by exchange of gene segments
  - May result in pandemic
WHO declares first flu pandemic in 41 years

By Steve Sternberg, USA TODAY

The World Health Organization scaled up its flu warning to its highest level Thursday, declaring the first global influenza pandemic in 41 years as cases of H1N1 continued to mount in the USA, Europe, Latin America and Australia.

"The scientific criteria for a pandemic have been met," said Margaret Chan, director general of the WHO. "The world is now at the start of the 2009 influenza pandemic."

PHOTOS: Schools closed in Hong Kong, Vermont (and more)
INTERACTIVES: World map, how H1N1 strain emerged
FAQ: What you should know about swine flu
VIDEO: Reporters answer your questions

The decision marks the agency's formal recognition of the magnitude of the challenge posed by a novel, H1N1 flu virus now spreading unchecked among people who, because the virus is new, are virtually all susceptible to it.

The WHO is working closely with vaccine makers, who are just wrapping up production of seasonal flu vaccine for fall and gearing up to produce the first doses of an H1N1 vaccine by September. The agency urged member nations to maintain their vigilance to detect ominous changes in the virus's
Influenza Pathogenesis

- Respiratory transmission of virus

- Replication in respiratory epithelium with subsequent destruction of cells

- Viremia rarely documented

- Virus shed in respiratory secretions for 5 to 10 days
Influenza Clinical Features

- Incubation period 2 days (range 1 to 4 days)
- 50% of infected persons develop classic symptoms.
- Abrupt onset of fever (usually 101 °F to 102 °F), myalgia, sore throat, nonproductive cough, headache
Influenza Complications

- Pneumonia
  - Secondary bacterial pneumonia
  - Primary influenza pneumonia

- Reye syndrome

- Myocarditis

- Death reported in less than one per 1,000 cases
Impact of Influenza: Death—United States, 2010 through 2017

- Number of influenza-associated deaths varies substantially by year, influenza virus type and subtype, and age group.


- Persons 65 years of age and older account for 80% of deaths.

- 2.7 times more deaths during seasons when A(H3N2) viruses were prominent


- Highest rates of complications and hospitalization among persons 65 years and older, young children, and persons of any age with certain underlying medical conditions

- 2010-2011 to 2015-2016:
  - Flu-related hospitalizations in the United States ranged from a low of 140,000 (during 2011-2012) to a high of 710,000 (during 2014-2015).
  - During the 2015-2016 flu season, CDC estimated 310,000 people were hospitalized for flu-related illness.

- About 50% of hospitalizations among persons younger than 65 years of age

- Greater number of hospitalizations during years that A(H3N2) is predominant
Groups at Increased Risk for Influenza Complications and Severe Illness

- Children age 6 through 59 months and adults age 50 years and older (children under 6 months of age are also at high risk, but cannot be vaccinated)
- Persons with chronic pulmonary (including asthma) or cardiovascular (except isolated hypertension), renal, hepatic, neurologic, hematologic, or metabolic disorders (including diabetes mellitus)
- Immunosuppressed persons
- Women who are or will be pregnant during the influenza season
- Children and adolescents (age 6 months to 18 years) who are receiving aspirin therapy and who might be at risk for experiencing Reye syndrome after influenza virus infection
- Residents of nursing homes and other long-term care facilities
- American Indians/Alaska Natives
- Persons who are extremely obese (BMI greater than or equal to 40)
Influenza among School-Age Children

- School-age children
  - Typically have the highest attack rates during community outbreaks of influenza
  - Serve as a major source of transmission of influenza within communities
Influenza Epidemiology

- **Reservoir**
  - Human, animals (type A only)

- **Transmission**
  - Respiratory, probably airborne

- **Temporal pattern**
  - Peak December to March in temperate climate
  - May occur earlier or later

- **Communicability**
  - 1 day before to 5 days after onset (adults)
Influenza Diagnosis

- Clinical and epidemiological characteristics
- Isolation of influenza virus from clinical specimens (e.g., throat, nasopharynx, sputum)
- Significant rise in influenza IgG by serologic assay
## Influenza Virus Testing Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Types Detected</th>
<th>Test Time</th>
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<tbody>
<tr>
<td>Viral tissue cell culture</td>
<td>A and B</td>
<td>3-10 days</td>
</tr>
<tr>
<td>Rapid cell culture (shell vials; cell mixtures; yields live virus)</td>
<td>A and B</td>
<td>1-3 days</td>
</tr>
<tr>
<td>Immunofluorescence, direct (DFA) or indirect (IFA) Fluorescent Antibody Staining</td>
<td>A and B</td>
<td>1-4 hours</td>
</tr>
<tr>
<td>Reverse transcriptase polymerase chain reaction (RT-PCR) and other molecular assays [influenza viral RNA or nucleic acid detection]</td>
<td>A and B</td>
<td>Varies by assay (1-8 hours)</td>
</tr>
<tr>
<td>Rapid molecular assay [influenza viral RNA or nucleic acid detection]</td>
<td>A and B</td>
<td>15 to 30 minutes</td>
</tr>
<tr>
<td>Rapid influenza diagnostic tests (antigen detection)</td>
<td>A and B</td>
<td>&lt;15 min.</td>
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</tbody>
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Adapted from https://www.cdc.gov/flu/professionals/diagnosis/overview-testing-methods.htm
Pneumonia and Influenza Mortality from
the National Center for Health Statistics Mortality Surveillance System
Data through the week ending September 8, 2018, as of September 27, 2018
Influenza Surveillance

- Monitor prevalence of circulating strains and detect new strains.
- Estimate influenza-related morbidity, mortality, and economic loss,
- Rapidly detect outbreaks
- Assist disease control through rapid preventive action.
Inactivated Influenza Vaccine Effectiveness

- 40% to 60% effective among all age groups
- 74% effective in preventing PICU admissions
- 40% effective in preventing hospitalization among adults
- 82% effective in preventing ICU admissions
- 80% effective in preventing death among elderly persons

https://www.cdc.gov/flu/vaccines-work/vaccineeffect.htm
2020–2021 Influenza Vaccine Strains (Quadrivalent Vaccines)

- **Egg-based vaccine**
  - A/Guangdong-Maonan/SWL1536/2019 (H1N1)pdm09 virus *(updated)*
  - A/Hong Kong/2671/2019 (H3N2)-like virus *(updated)*
  - B/Washington/02/2019 (Victoria lineage)-like virus *(updated)*
  - B/Phuket/3073/2013 (Yamagata lineage)-like virus

- **Cell-culture/recombinant**
  - A/Hawaii/70/2019 (H1N1)pdm09 virus *(updated)*
  - A/Hong Kong/2671/2019 (H3N2)-like virus *(updated)*
  - B/Washington/02/2019 (Victoria lineage)-like virus *(updated)*
  - B/Phuket/3073/2013 (Yamagata lineage)-like virus

*Vaccine strain changed from 2017–18 vaccine*
Abbreviations

- IIV = Inactivated influenza vaccine
- LAIV4 = Live, attenuated influenza vaccine
- RIV4 = Recombinant influenza vaccine
- Prefixes:  SD = standard dose
  HD = high dose
  a = adjuvanted
  cc = cell-culture-based
- Numeric suffixes (e.g., RIV4, IIV4) indicate trivalent or quadrivalent, respectively.
Influenza Vaccines

- **IIV:**
  - Contain inactivated virus, split or subunit
    - High dose or standard dose
    - Trivalent or quadrivalent
    - Unadjuvanted or adjuvanted
    - Egg- or cell-culture-based
  - Many brands, some approved for those as young as 6 months of age
  - Intramuscular (IM) administration.

- **RIV4**
  - Contain recombinant HA
  - Egg-free
  - Quadrivalent
  - IM administration

- **LAIV4**
  - Live, attenuated virus
  - Recommended again in 2018-19
  - Intranasal (NAS) administration

[https://www.cdc.gov/mmwr/volumes/67/wr/mm6722a5.htm?s_cid=mm6722a5_w and https://www.cdc.gov/mmwr/volumes/67/rr/pdfs/rr6703a1-H.pdf](https://www.cdc.gov/mmwr/volumes/67/wr/mm6722a5.htm?s_cid=mm6722a5_w and https://www.cdc.gov/mmwr/volumes/67/rr/pdfs/rr6703a1-H.pdf)
Quick Aside about Influenza Vaccines for 6 Months–35 Months of Age

- Two potential points of confusion:
  - Four licensed products, but the dose volume differs
    - Afluria Quadrivalent: 0.25 mL
    - Fluarix Quadrivalent: 0.5 mL
    - FluLaval Quadrivalent: 0.5 mL
    - Fluzone Quadrivalent: 0.25 mL
    - Fluzone Quadrivalent: 0.5 mL

- Dose volume is distinct from number of doses needed
  - A child 6 months through 35 months who should receive 2 doses of influenza vaccine and receives FluLaval Quadrivalent 0.5 mL still needs the second dose of vaccine 4 weeks later.
Clinical Considerations
Groups Recommended for Vaccination

- Routine annual influenza vaccination is recommended for all persons ≥6 months of age who do not have contraindications.

- While vaccination is recommended for everyone in this age group, there are some for whom it is particularly important:
  - People age 6 months and older who are at high risk of complications and severe illness
  - Contacts and caregivers of these people and of infants younger than 6 months (because there is no vaccine approved for children this age)
Influenza Vaccination of Pregnant Women

- Influenza vaccination recommended by ACIP since 2004 for women who will be pregnant during influenza season
  - Increased risk for severe influenza illness in pregnant women, particularly during second and third trimesters

- Previous language stated pregnant women should receive inactivated influenza vaccine (IIV).

- For 2020-2021, pregnant women may receive any licensed, recommended, age-appropriate influenza vaccine:
  - IIV or RIV4
  - LAIV4 not recommended for pregnant women
Influenza Vaccination in COVID-19 Pandemic

Use every opportunity to administer influenza vaccine to all eligible persons, including:

- **Essential workers**, including health care personnel and other critical infrastructure workforce

- **Persons at increased risk for severe illness from COVID-19**, including older adults and those with underlying medical conditions

- Severe illness from COVID-19 has been shown to disproportionately affect members of certain racial/ethnic minority groups.

- **Persons at high risk for influenza complications**.

Timing of Vaccination

- Vaccination should occur before onset of influenza activity. Health care providers should offer vaccination by the end of October, if possible.
- To avoid missed opportunities for vaccination, providers should offer vaccination during routine health care visits and hospitalizations when vaccine is available.
- Organized campaigns should occur throughout the season.
- Vaccination in July and August might result in suboptimal immunity.

https://www.cdc.gov/mmwr/volumes/68/rr/pdfs/rr6803-H.pdf
Influenza Vaccination of Persons with Egg Allergy

- Mostly unchanged from last few seasons
  - LAIV is an option again this season.

- Egg-allergic persons can receive any licensed, recommended vaccine that is otherwise appropriate (IIV, RIV4, or LAIV4).
  - However, RIV not licensed for persons under 18 years of age

- For persons with a history of severe allergic reaction to egg (i.e., any symptom other than hives):
  - “The selected vaccine should be administered in an inpatient or outpatient medical setting (including but not necessarily limited to hospitals, clinics, health departments, and physician offices). Vaccine administration should be supervised by a health care provider who is able to recognize and manage severe allergic conditions.”
  - RIV4 and ccIIV4 are exceptions to this rule.

- No specific postvaccination observation period recommended
  - However, per the ACIP General Best Practice guidelines, providers should consider observing all recipients of any vaccine for 15 minutes to avoid injury due to syncope.
Dosing Algorithm for Children Age 6 Months through 8 Years, 2020-2021

- Similar to past two seasons
- If 2 cumulative doses received prior to July 1, 2020, only 1 dose needed for 2020-2021
- Only 1 dose needed after the 9th birthday
- For children aged 8 years who require 2 doses of vaccine, both doses should be administered even if the child turns age 9 years between receipt of dose 1 and dose 2.
Inactivated Influenza Vaccine (IIV) Adverse Reactions

- Local reactions (soreness, redness)  
  - 15% to 20%

- Fever, malaise, myalgia  
  - Less than 1%

- Allergic reactions (hives, angioedema, anaphylaxis)  
  - Rare

- Guillain-Barré syndrome
Live, Attenuated Influenza Vaccine (LAIV) Adverse Reactions

- **Children**
  - No significant increase in URI symptoms, fever, or other systemic symptoms
  - Increased risk of wheezing in children 6 through 23 months of age

- **Adults**
  - Significantly increased rate of cough, runny nose, nasal congestion, sore throat, and chills reported among vaccine recipients
  - No increase in the occurrence of fever

- No serious adverse reactions identified
Inactivated Influenza Vaccine (IIV) and RIV4
Contraindications and Precautions

Contraindication

• Severe allergic reaction (e.g., anaphylaxis) to a vaccine component or following a prior dose of inactivated influenza vaccine

Precaution

- Moderate or severe acute illness
- History of Guillain-Barré syndrome (GBS) within 6 weeks following a previous dose of influenza vaccine
<table>
<thead>
<tr>
<th>Contraindications</th>
<th>Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>• History of severe allergic reaction to any component of the vaccine† or after a previous dose of any influenza vaccine</td>
<td>• Moderate to severe acute illness with or without fever</td>
</tr>
<tr>
<td>• Concomitant aspirin or salicylate-containing therapy in children and adolescents</td>
<td>• History of Guillain-Barré syndrome within 6 weeks of receipt of influenza vaccine</td>
</tr>
<tr>
<td>• Children aged 2 through 4 years who have received a diagnosis of asthma or whose parents or caregivers report that a healthcare provider has told them during the preceding 12 months that their child had wheezing or asthma or whose medical record indicates a wheezing episode has occurred during the preceding 12 months</td>
<td>• Asthma in persons aged ≥5 years</td>
</tr>
<tr>
<td>• Children and adults who are immunocompromised due to any cause (including immunosuppression caused by medications or by HIV infection)</td>
<td>• Other underlying medical conditions that might predispose to complications after wild-type influenza infection (e.g., chronic pulmonary, cardiovascular [except isolated hypertension], renal, hepatic, neurologic, hematologic, or metabolic disorders [including diabetes mellitus])</td>
</tr>
<tr>
<td>• Close contacts and caregivers of severely immunosuppressed persons who require a protected environment</td>
<td>• Receipt of influenza antiviral medication within the previous 48 hours (oseltamivir and zanamivir), 5 days (peramivir), or 17 days (baloxavir)</td>
</tr>
<tr>
<td>• Pregnancy</td>
<td>• Cerebrospinal fluid leak</td>
</tr>
<tr>
<td>• Receipt of influenza antiviral medication within the previous 48 hours (oseltamivir and zanamivir), 5 days (peramivir), or 17 days (baloxavir)</td>
<td>• Cochlear implant</td>
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Knowledge Check

Question: A child just turned 9 years old yesterday. One month ago, he received his first ever dose of influenza vaccine. Should he receive another dose of influenza vaccine this season?

A) Yes
B) No
Question: A child just turned 9 years old yesterday. One month ago, he received his first ever dose of influenza vaccine. Should he receive another dose of influenza vaccine this season?

A) Yes
Influenza Antiviral Agents

- Amantadine and rimantadine
  - Not recommended because of documented resistance in U.S. influenza isolates

- Zanamivir, oseltamivir, peramivir, baloxavir
  - Neuraminidase inhibitors
  - Effective against influenza A and B
  - Oseltamivir and zanamivir approved for prophylaxis
Resources
CDC Website on Influenza: https://www.cdc.gov/flu/index.htm
Influenza Resources

- ACIP’s influenza recommendations web page
  www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/flu.html

- Immunization Action Coalition influenza web page
  www.immunize.org/influenza/

- Children’s Hospital of Philadelphia Vaccine Education Center influenza web page
  http://www.chop.edu/centers-programs/vaccine-education-center/vaccine-details/influenza-vaccine#.VgHMa3YpCAU
...and get a flu vaccination!
Frequently Asked Questions
Continuing Education Information

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E-mail Your Immunization Questions to Us

NIPINFO@cdc.gov

Write “Web-on-Demand–Flu” in the subject line
EpiVac Pink Book Web-on-Demand Resources

- Comprehensive list of resources for ALL sessions
- Located on the web page for this web-on-demand session at www.cdc.gov/vaccines/ed/webinar-epv/index.html
- Additional materials located on this webpage include:
  - Flu slide set
  - Web-on-demand questions and answers
  - Transcript of this session
  - Continuing education instructions
Thank You From Atlanta!