

INFLUENZA VACCINATION

AMANDA MAYER, PharmD

Amanda Mayer is a graduate of the University of Montana, Skaggs School of Pharmacy. She has clinical experience working in inpatient mental health, which is her passion. She has also done fill-in work at retail pharmacies throughout her career. Amanda appreciates the wide variety of professional opportunities available to pharmacists. Amanda loves spending time with her family and spends most of her free time exploring new restaurants, hiking in the summer, and snowboarding and cross-country skiing in the winter.

Topic Overview

Influenza vaccines can be effective in preventing influenza illness. Vaccine efficacy varies based on the influenza variant, the severity of a particular flu season, and differences in the flu vaccinations that are prepared for a particular flu season. The Centers for Disease Control and Prevention recommends that everyone six months of age and older receive an annual influenza vaccination. The best way to protect against influenza includes recognition of symptoms, prevention of spread, and annual vaccination. The following is a summary of the epidemiology, symptoms, and potential complications of influenza. Antiviral medications, which are available for the treatment of influenza in patients with a higher risk of serious complications, will also be covered.

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Target Audience: This educational activity is for pharmacists.

How to Earn Credit: From August 30, 2022, through August 30, 2025, participants must:

- 1) Read the "learning objectives" and "author and planning team disclosures;"
- 2) Study the section entitled "educational activity;" and
- 3) Complete the Post-test and Evaluation form. The Post-test will be graded automatically. Following successful completion of the Post-test with a score of 70% or higher, a statement of participation will be made available immediately. (No partial credit will be given.)

Learning Objectives: Upon completion of this educational activity, participants should be able to:

1. **Identify** the types and spread of influenza virus as a worldwide concern
2. **Describe** the environmental and behavioral factors of the influenza virus
3. **Compare** the risks and corresponding complications of influenza, and the benefits and risks of vaccination

4. **Identify** influenza prevention, immunization, treatment, and preparedness in the event of an adverse reaction

Disclosures

The following individuals were involved in the development of this activity: Susan DePasquale, MSN, PMHNP-BC, Amanda Mayer, PharmD, and Jeff Goldberg, PharmD. There are no financial relationships relevant to this activity to report or disclose by any of the individuals involved in the development of this activity.

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Introduction

Influenza is a highly contagious viral illness of the respiratory tract that occurs most often in the late fall, winter, and early spring. It affects millions of people in the United States and millions more worldwide every year. Influenza vaccines can be effective at preventing influenza, decreasing the severity of illness, and may reduce the need for hospitalization. Vaccine efficacy varies based on the influenza variant, the severity of a particular flu season, and differences in the vaccination that are prepared for a particular flu season. In some cases, treatment may include antiviral medication.

Influenza Virus

Influenza is a common and highly infectious RNA virus that causes respiratory illness. There are four types of the virus: types A, B, C, and D.¹ Type A and B are the cause of the yearly, seasonal epidemics that are informally referred to as the flu season. Type C is not thought to cause human epidemics and can cause very mild respiratory illness or possibly no symptoms at all.^{1,2} Type D is found only in cattle.¹

The influenza virus is transmitted in two ways: 1) infected droplets that become airborne when someone coughs, sneezes, spits, or talks may enter the respiratory tract through the mucosal surfaces of the trachea and the bronchi; and, 2) direct contact with infected objects, *i.e.*, touching a telephone handset or shaking hands with someone whose hands are contaminated with the virus.³ A person with influenza may be contagious for days and may be able to pass the virus to someone else before they know they are sick.⁴⁻⁶ The first 3 to 4 days after the illness begins is when individuals are most contagious. One day before symptoms develop, and up to 5-7 days after feeling sick, most healthy individuals may be able to infect others. Children and those with weakened immune systems may pass the virus to others for a longer period of time.⁵

Infected Droplets

The influenza virus is spread quite easily by infected droplets, but some circumstances limit this mode of transmission. The infected droplets usually do not travel very far (usually < 6 feet).^{3,7} They do not remain in the air for a long time, and environmental conditions affect how long they are viable. For example, if the humidity in the air is low and the air temperature is cold, the survival time of infected airborne droplets will be increased.⁸ If someone has influenza, all respiratory secretions and bodily fluids are potentially contaminated.⁹

Contact Transmission

Contact transmission occurs when an uninfected person touches a surface that is contaminated with the influenza virus.^{9,10} Once the virus is on the skin of an uninfected person, it can then enter the body by contact with the mucosal surfaces of the conjunctiva, the mouth, or the nose. In all healthcare settings, including inpatient and outpatient pharmacies, it is important to clean surfaces on a regular basis to prevent the spread of communicable diseases (including influenza). Surfaces, such as credit card readers and signature pads, as well as any other surfaces that patients may touch on a regular basis, should be cleaned frequently. It is a good idea to have hand sanitizer available in these areas as well.

According to a study published by Thompson and Bennett in 2017, viable influenza virus has been found to persist for up to two weeks on environmental surfaces.¹⁰ Surface contamination with influenza virus during influenza season appears to be common, and Perry, *et al.* (2016) noted that "... fomites and surface contamination caused by large respiratory droplets may play a significant role in transmission."⁸

Epidemiology of Influenza

Influenza is highly contagious, and it is a common cause of epidemics.⁶ Each year, 10%-20% of the world's population develops an influenza infection,

and every year in the United States, millions of people get the flu. There are thousands of deaths from influenza, and hundreds of thousands of people are hospitalized due to complications of influenza infection.⁶ The most recent preliminary estimates from the CDC for the 2019-2020 flu season estimate that 35 million individuals were symptomatic, 16 million individuals required medical visits related to the flu, and 380 thousand individuals were hospitalized due to influenza.¹¹ Influenza epidemics are noteworthy for several reasons: they occur every year, but the severity and outcomes of these outbreaks can differ.¹²

Annual Epidemics

For most people, flu season has become an expected and unremarkable event that happens each winter. The human immune system develops antibodies after viral exposure, and vaccines are widely used to combat the flu.¹²

With antibodies and vaccines, one might wonder why influenza epidemics happen annually. The answer is that the influenza virus adapts.^{6,13,14} Influenza viruses can periodically change their hemagglutinin (H) and neuraminidase (N) glycoproteins on the surface of the virus that the pathogen needs to initiate and spread infection and enter cells. These glycoproteins also act as antigens and are the basis behind the names of variants (ex: H1N1, H3N2). Major changes are referred to as antigenic *shifts*.¹³ Minor changes are referred to as antigenic *drifts*.¹¹ Antigenic drifts occur almost annually, while antigenic shifts may be spaced out by years or decades.¹³ Moreover, antigenic shifts are more likely to be the cause of pandemics or epidemics, whereas antigenic drifts are usually associated with regional epidemics.¹³ Prior exposure to influenza and vaccination can provide immunity to influenza, but because of antigenic drift, which occurs almost annually, this protection may only last for several years.^{13,14} In addition, these seasonal changes make it difficult to determine the timing and formulation of the annual flu vaccine. Vaccine efficacy is particularly impacted by the timing of vaccinations because even with an effective flu vaccine formulation, the

vaccine is more effective if given in the months *before* an influenza epidemic hits its peak.¹⁵

Seasonal Variations

Influenza and influenza infections are endemic. The virus is always present, and people may get influenza infections every month of the year. The flu season varies from year to year and differs based on geographical regions and climate. In the U.S., influenza activity often begins to increase in October. “Most of the time, flu activity peaks between December and February, although significant activity can last as late as May.”¹² This variation in the occurrence of influenza infections (commonly known as the flu season) is a well-documented phenomenon. In areas with a temperate climate (like the U.S.), this may be due to low humidity/dry air, more time spent indoors (thus closer and more frequent interpersonal contacts), a seasonal decrease in immune system functioning, and decreased mucociliary clearance of the virus, which can be exacerbated by the dry air in an area with low humidity.¹⁶⁻¹⁷

Severity and Outcomes

Influenza outbreaks vary in severity. This is likely due to the number of susceptible people, the rate of vaccination, and the intrinsic virulence of a particular strain of the virus. Children are often affected first. Local surveillance data should be monitored by clinicians to determine the types and subtypes of influenza viruses circulating in communities.²

Older adults and people who have certain medical conditions are at a higher risk for complications, hospitalization, and death. The death rate from influenza has been estimated to be 1.4–16.7 per 100,000 cases, and outbreaks typically last for two to three months.¹⁸ The Centers for Disease Control and Prevention (CDC) publishes local or regional surveillance data on the annual spread of influenza.²

Clinical Features and Diagnosis

Influenza is contagious 1-2 days before an infected person becomes symptomatic and is contagious for approximately 5-7 days after symptoms begin.⁵ Viral shedding of influenza may begin 24 hours before the infected person becomes symptomatic, and the greater the degree of shedding, the more contagious the source will be. Studies show that the average duration of shedding is reported to be 4.8 days, with shedding most often ending by day 7. Children, adults with comorbid and/or chronic medical conditions, immunocompromised people, and hospitalized patients have longer periods of viral shedding.¹⁹ These individuals can infect other people somewhat longer (up to ten days) after their symptoms begin.¹⁹

In adults, influenza infection is characterized by fatigue, fever, headache, malaise, and myalgias.^{20,21} The fever is typically 100-104°F, but it can be higher. It is important to note that not everyone with the flu will have a fever.^{20,21} Respiratory signs and symptoms include a nonproductive cough, nasal congestion, runny nose, and sore throat.^{20,21} The onset is generally abrupt. The worst effects usually last several days, but many people are fatigued and weak for weeks after an influenza infection has effectively ended. Influenza infection in a child is similar, but the fever may be higher and respiratory signs can be less pronounced. A child with influenza is more likely to have gastrointestinal (GI) problems, such as anorexia, diarrhea, and vomiting, than adults.¹⁹⁻²¹

In most cases, influenza is diagnosed using clinical criteria. In 2018, the Infectious Diseases Society of America updated its guidelines on the diagnosis and treatment of seasonal influenza.²² A patient is diagnosed with influenza if the patient has the signs and symptoms that are typical of the flu and if the illness has occurred during flu season.^{21,22} "Cough and fever provide the most predictive signs and symptoms when influenza viruses are circulating in the community."²² Laboratory confirmation of the presence of the virus is not necessary or recommended unless certain criteria are present. In outpatient cases, laboratory confirmation is important to obtain for patients who are immunocompromised or who are at high risk for complications from influenza.

This would include immunocompromised patients with an illness that has flu-like symptoms during the non-flu season, pneumonia, or nonspecific respiratory illness (e.g., cough without fever).²²

In patients who need hospitalization, laboratory confirmation should be used in the following patients: patients with pneumonia or other acute respiratory illness, regardless of the presence or absence of fever; patients with an acute and deteriorating cardiopulmonary disease (e.g., asthma or congestive heart failure) to help prevent these conditions from being worsened by the flu; and patients at risk for developing respiratory distress syndrome.^{21,23} Laboratory confirmation helps clinicians make treatment and management decisions, such as prescribing antivirals.²³

The tests for influenza can be done on essentially any secretion from the respiratory tract. The rapid diagnostic test will usually be performed on a nasopharyngeal swab, and the results are typically ready (depending on the specific test) in 15 minutes.²⁴

Complications of Influenza

For most adults and children, influenza illnesses are short-lived. People who have the flu feel very sick for a few days and may experience fatigue after the acute signs or symptoms of flu have diminished. Influenza is usually self-limiting, and the patient typically fully recovers.²¹

For at-risk populations, influenza can cause dangerous complications and death.²¹ Specific higher risk groups for developing influenza complications include adults 65 and older, pregnant women and up to 2 weeks postpartum, young children, individuals with asthma, heart disease, stroke, diabetes, HIV/AIDS, cancer, chronic kidney disease, individuals with disabilities, and children with neurologic conditions.²⁵ Influenza can affect virtually every organ system of the body. The CDC has reported that influenza complications “can vary by age, immune status, and underlying medical conditions.”²³ Examples of complications include “worsening of underlying chronic medical conditions (e.g., worsening of congestive cardiac failure; asthma exacerbation;

exacerbation of chronic obstructive pulmonary disease); lower respiratory tract disease (pneumonia, bronchiolitis, croup, respiratory failure); invasive bacterial co-infection; cardiac (e.g., myocarditis); musculoskeletal (e.g., myositis, rhabdomyolysis); neurologic (e.g., encephalopathy, encephalitis); multi-organ failure (septic shock, renal failure, respiratory failure)."²³

There have been approximately 44 cases of influenza-associated myocarditis in adults, and in children, neurologic complications of influenza have been reported to be 2.8 per 100,000 cases.²³ Health clinicians should be alert that most of these uncommon, rare complications are more likely to occur in patients who are very young, very old, hospitalized, or who have one of the other risk factors.²³

Pneumonia is the most common complication of influenza.²⁶ The combination of influenza and pneumonia is a leading cause of mortality in the United States. Garg, *et al.* (2015) reported that an estimated 29% of adults hospitalized because of an influenza infection had pneumonia and other researchers studying similar populations found an incidence of pneumonia in 49% of patients (2005-2008).²⁷ The most recent number quoted by the CDC is in 2005, and it showed that the combination of influenza and pneumonia accounted for 63,000 deaths and was the eighth leading cause of death among all individuals in the United States.^{28,29} In adults and children, most cases of pneumonia caused by influenza occur in patients who have risk factors (*i.e.*, age > 65, comorbid medical conditions, or very young patients).^{27,30}

The association between influenza and asthma is not clear. Influenza outbreaks have been associated with hospitalizations for asthma exacerbations, and asthma has been reported to be the most common pre-existing disease in patients who have been hospitalized for influenza.^{31,32} However, the literature raises uncertainty about the degree of asthma exacerbation that occurs as a result of influenza.^{31,32}

Treatment and Prevention of Influenza Infection

The primary goals of treating influenza are prevention using vaccines, antivirals (when appropriate) to treat patients who have or are at risk of severe infection, standard, supportive care for all patients, and monitoring all patients for complications of influenza. During treatment, healthcare professionals must follow proper infection control techniques and precautions.³³⁻³⁶

Annual Vaccination and Vaccine Efficacy (VE)

The CDC recommends annual vaccination against influenza for everyone 6 months of age and older. Vaccination is especially important for people who have risk factors that make them susceptible to severe influenza infection or complications of influenza.³⁷ It is also critical for healthcare workers to be vaccinated as they work directly with vulnerable populations.³⁷

People who should *not* be vaccinated are children < 6 months old and anyone who has had a severe reaction to influenza vaccinations.³⁷ Also, anyone who had Guillain-Barré Syndrome within 6 weeks of influenza vaccination should avoid being vaccinated.^{37,38}

The *trivalent* preparations protect against two types of influenza A viruses and one type of influenza B virus. The *quadrivalent* preparations protect against two types of influenza A viruses and two types of influenza B viruses.³⁸⁻⁴⁰ Depending on the formulation, influenza vaccines can be given intradermally, intramuscularly, or nasally. The choice of which vaccine preparation to use depends on the year, the patient's age and comorbidities, and the risk of adverse reactions.³⁸⁻⁴⁰ Vaccination against influenza can prevent the disease. From 2009 to 2019, the effectiveness of influenza vaccination ranged from 19%-60%, and the average effectiveness from 2015-2019 was 39%.⁴¹

Influenza vaccines cannot cause influenza. Injectable influenza vaccines are currently made in two ways: 1) the vaccine is made either with viruses that have been inactivated and are not infectious, or 2) the vaccine does not contain influenza viruses at all (which is the case for recombinant influenza vaccines).⁴²⁻⁴⁴ The nasal spray influenza vaccine does contain live viruses; however, the viruses are attenuated (weakened), and, therefore, cannot cause flu illness.⁴⁴

There remains a continuing need to evaluate the efficacy of influenza vaccines with regard to their efficacy against subtypes or lineages, as well as how they perform based on timing (*i.e.*, vaccination early in the flu season versus vaccination late in the season).⁴⁵ The best time for a person to get vaccinated is before the flu begins spreading in the person's community. Generally, this means September and October of each year are good months to get vaccinated against the flu. Vaccination after this time is still recommended as flu activity can continue into May. The CDC currently recommends adults 65 and older not get vaccinated early (July or August) as protection may decrease over time. Children can get vaccinated as soon as the vaccine becomes available, even if that means they are vaccinated in July or August. Early vaccination can also be considered in the third trimester of pregnancy as it can help protect the infant during the first months of life before they are able to receive an influenza vaccine.⁴⁶

The CDC performs an analysis of data to estimate flu vaccination guidelines for the U.S. population.³⁷ Moderate to severe influenza seasons, such as the one that took place in the 2012 to 2013 flu season, showed that a vaccine for people ≥ 65 years of age with a 10% effectiveness and 66% coverage would have avoided an estimated 13,000 hospitalizations and a vaccine with 40% effectiveness would have avoided an estimated 60,000 hospitalizations.³⁸ Influenza vaccination corresponded with a lower intensive care unit (ICU) admission rate and in-hospital length of stay, as well as mortality.³⁸

Pharmacists and pharmacy technicians play a large role in influenza vaccination rates. A large portion of retail pharmacies offer flu vaccines, and many insurance companies provide them free of copay. During peak vaccination periods, it is important to keep the pharmacy appropriately staffed in order to administer vaccines as well as complete the normal workflow in the pharmacy. It may also be helpful to have a chart or list with NDC numbers available for which vaccinations are in stock, and what age groups for which they are appropriate. This will help ease order entry. Some pharmacists are also involved in community and nursing home vaccination clinics. Staying up to date on current recommendations is necessary as questions about COVID, pneumococcal, and other vaccines may be addressed at the time of influenza vaccine administration.

Antivirals

Treatment with antiviral medication can shorten the duration of influenza symptoms by approximately one to two days.⁴⁷ Additionally, antivirals may reduce the risk of complications and can reduce viral shedding and viral titers. Antiviral drugs are very helpful for people who are in a high-risk group, and compared to vaccines, the efficacy of the antivirals is not affected as much by antigenic drift.⁴⁷

The antivirals used to treat and prevent influenza are neuraminidase inhibitors.⁴⁸ These drugs work by hindering the activity of the enzyme neuraminidase, and by doing so, they prevent virions from being spread to uninfected cells. The neuraminidase inhibitors that are Food and Drug Administration (FDA) approved for treating influenza are oseltamivir (oral), peramivir (injectable), and zanamivir (nasal inhalant).⁴⁸ All three antivirals are effective against influenza A and B.⁴³ Oseltamivir and zanamivir are the most commonly used antivirals, and peramivir is given to patients who cannot tolerate oral medications and/or cannot use an inhaled medication.⁴⁸

Antivirals are indicated for patients who 1) have a severe influenza infection (*i.e.*, hospitalization is needed or a lower respiratory tract infection has occurred), 2) have risk factors for developing severe infection and/or

complications, and, 3) are pregnant women or women who are up to two weeks postpartum.⁴⁸ Antiviral treatment is not recommended for people who are < 65 years of age, do not have risk factors, and have a mild case of the flu; however, a clinician may decide that a patient in one of these categories may be helped by an antiviral and decide to initiate treatment.⁴⁸

Therapy with an antiviral should be given as soon as possible, preferably within 48 hours of the onset of influenza symptoms. The earlier treatment is initiated, the more likely it is to be successful, and antiviral treatment should not be withheld while waiting for laboratory confirmation of influenza infection.^{48,49} In a patient who is hospitalized or who has a severe case of flu, starting antiviral treatment after 48 hours may provide some benefit. For example, some studies suggest that antiviral treatment may benefit these patients even when started up to 5 days after onset of the illness.⁴⁸

The duration of antiviral therapy for the treatment of influenza is 5 days for oseltamivir and zanamivir and a one-time dose for peramivir. A longer duration of therapy can be used if the patient is seriously ill and prophylactic use of the drugs typically lasts 1 to 3 weeks.⁴⁸ Dosing for treatment and prevention typically vary, and this should always be confirmed with either the patient or provider prior to dispensing the treatment to make sure the appropriate instructions are being followed. For instance, with oseltamivir, the dosing for treatment is 75 mg twice daily for 5 days, and for prevention, it is 75 mg once daily for at least 10 days, with therapy beginning within 2 days of exposure.⁵⁰

Adverse effects of neuraminidase inhibitors are seldom severe. Nausea, vomiting, headache, and pain are common adverse effects of oseltamivir.⁴⁸ Diarrhea is a common adverse effect of peramivir. Zanamivir (aerosol inhaler) is not recommended for patients who have pre-existing airway disease, such as asthma and/or chronic obstructive pulmonary disease (COPD), as there have been reports of bronchospasm when the drug is given to this patient population.⁴⁸ Widespread prophylactic use of antiviral medication is not endorsed by the CDC; however, antiviral medication should be considered for high-risk individuals who have been exposed to influenza, people who are

immunocompromised and might not respond to vaccination, people where the influenza vaccination is contraindicated, and there has been exposure to influenza, and when treating residents of institutions (*i.e.*, long-term care facilities) during an outbreak.^{49,51}

New Antiviral

Officials with the FDA have approved baloxavir marboxil (Xofluza[®], Shionogi) for the treatment of acute, uncomplicated influenza in patients age 12 years and older who have been symptomatic for no more than 48 hours.^{52,53} The approval marks the first new antiviral flu treatment with a novel mechanism of action backed by the agency in nearly 20 years.^{52,53}

The safety and efficacy of baloxavir marboxil, an antiviral drug taken as a single oral dose, were demonstrated in 2 randomized, controlled clinical trials of 1,832 patients where participants were assigned to receive either Xofluza[®], a placebo, or another antiviral flu treatment within 48 hours of experiencing flu symptoms. In both trials, patients treated with Xofluza[®] had a shorter time to alleviate symptoms, compared with patients who took the placebo.^{51,52} In the second trial, there was no difference in the time to alleviate symptoms between subjects who received Xofluza[®] and those who received the other flu treatment.⁵³

Xofluza[®] is the first and only antiviral drug with a novel proposed mechanism of action that has demonstrated efficacy in a wide range of influenza viruses, including oseltamivir-resistant strains and avian strains (H7N9, H5N1) in non-clinical trials. It is a single-dose oral medicine. Unlike other currently available antiviral treatments, Xofluza[®] is the first in a new class of antivirals designed to inhibit polymerase acidic endonuclease, an enzyme essential for viral replication.⁵³ The most common adverse reactions in patients taking baloxavir marboxil include diarrhea and bronchitis.⁴

Infection Control

When caring for a patient who has an influenza infection, health clinicians must always use and observe Standard Precautions, Droplet Precautions, and Respiratory Hygiene and Cough Etiquette.³³⁻³⁶ Patient areas should consistently be cleaned to help prevent the spread of influenza.

Standard Precautions

Standard Precautions include hand hygiene, appropriate use of personal protective equipment (PPE), Respiratory Hygiene and Cough Etiquette, safe injection practices, and safe handling of potentially contaminated equipment or surfaces in the patient environment.³³⁻³⁶

Droplet Precautions

If a patient has confirmed or suspected influenza, healthcare providers should follow droplet precautions for 7 days after the onset of the illness or until 24 hours after the fever, and respiratory symptoms have resolved, whichever is longer. Droplet precautions include the following:³³⁻³⁶

- Patient should be in a single room.
- Clinicians should wear a mask when providing patient care or if within 3 feet of the infected person, and clinicians should perform hand hygiene before entering the room and after removing the mask.
- Clinicians should wear the appropriate PPE if contact with secretions is expected or possible, such as eye goggles, face shield, and gown.

Respiratory Hygiene/Cough Etiquette

Covering the mouth and nose with a tissue should be done when someone is coughing or sneezing.³³⁻³⁶ The used tissue should be placed in the nearest waste receptacle. Hand hygiene should be carried out by using soap and water or an alcohol-based hand sanitizer after contact with respiratory secretions or contaminated objects.³³⁻³⁶

Children and Pregnant Women

Children and pregnant women are at greater risk of presenting with a severe case of influenza or acquiring complications from it. Within the pediatric population, certain groups, such as American Indian and Alaskan Native children, also present with greater risks.

Children

Children are at greater risk of severe influenza or complications by virtue of their age.² The flu is more dangerous than the common cold for children.² Children younger than 5 years of age, especially those younger than 2 years old, are at higher risk of serious flu-related complications than older children. Children with underlying medical conditions are also at greater risk.²

Children > 6 months of age should receive a flu vaccine for their protection and the protection of others from the transmission of the flu. Children < 6 months of age are too young to be vaccinated. The best way to protect them is to make sure people around them are vaccinated.²

Children who are 6 months of age to 5 years are at risk for flu-related *hospitalization*. Children who get the flu should receive medical attention due to potential complications that may arise. Complications that can occur from the flu include pneumonia, dehydration, exacerbation of long-term medical problems (such as heart disease or asthma), brain dysfunction (such as encephalopathy), sinus problems, and ear infections. In rare cases, flu complications can lead to a child's death.²

As mentioned above, flu seasons vary in severity, but each year, millions of children get sick with seasonal flu, and thousands of children are hospitalized.² In children, less than 18 years of age, the rate of influenza has been reported to be 10-40% during a typical influenza season.² Symptomatic influenza in children < 18 years is estimated to be 9%. The CDC estimates that since 2010, flu-related hospitalizations among children younger than 5

years ranged from 7,000 to 26,000 in the United States. Even children in this age group who are otherwise healthy are at risk simply because of their age.²

American Indian and Alaskan Native Children

American Indian and Alaskan Native children are more likely to have severe flu illness that results in hospitalization or death.⁵⁵ Between 2006–2008, the lower respiratory tract infection (LRTI)-associated hospitalization rate for American Indian and Alaskan Native children (< 5 years of age) was “approximately 1.6 times higher than the corresponding general US child rate.”⁵⁵

There was a higher disparity noted in infants (< 1 year) and in children in Alaska and the Southwest regions within American Indian and Alaskan Native communities.⁵⁵ During the 2009 H1N1 influenza pandemic period, infant influenza-associated hospitalizations were approximately 3 times higher for AI/AN infants (9.9) than US infants (3.3, 95% CI: 2.7–2.9) and about 12 times higher for AI/AN infants in Alaska (38.9) for the year.⁵⁵

The immunization rates for American Indians and Alaskan Natives in U.S. communities tend to be lower than the rates reported in other groups. During the H1N1 influenza pandemic (2009–2010), the morbidity and mortality rates were higher in American Indian and Alaskan Native communities than in the general US population.⁵⁵ In 2010–2011, an estimated 67% of American Indian and Alaskan Native children (6 months to 4 years) were vaccinated. Influenza morbidity and mortality in American Indians and Alaskan Natives could be reduced with improved vaccination rates.⁵⁵

Improved influenza vaccination coverage in childcare and pre-school settings could reduce rates of influenza and hospitalizations in American Indian and Alaskan Native children. Pregnant women administered the vaccine may also correspond with lower influenza rates in infants; however, maternal influenza vaccination rates have reportedly stayed low as well.⁵⁵

Children Aged 6 months - 18 years with Chronic Health Problems

Chronic health problems in children from the ages of 6 months through 18 years include the following conditions:^{56,57}

- Asthma
- Neurological and neurodevelopmental conditions, including disorders of the brain, spinal cord, peripheral nerve, and muscle such as cerebral palsy, epilepsy (seizure disorders), stroke, intellectual disability, moderate to severe developmental delay, muscular dystrophy, or spinal cord injury
- Chronic lung disease (such as chronic obstructive pulmonary disease [COPD] and cystic fibrosis)
- Heart disease (such as congenital heart disease, congestive heart failure and coronary artery disease)
- Blood disorders (such as sickle cell disease)
- Endocrine disorders (such as diabetes mellitus)
- Kidney disorders
- Liver disorders
- Metabolic disorders (such as inherited metabolic disorders and mitochondrial disorders)
- Weakened immune system due to disease or medication (such as people with HIV or AIDS, cancer, or those on chronic steroids)
- Children who are taking aspirin or salicylate-containing medicines
- Children with extreme obesity (body mass index (BMI) of 40 or more)

Children 6 months and older should get an annual influenza vaccine. Flu shots, nasal spray vaccines, and special vaccination instructions for children should be provided by pharmacists and prescribers during well-child assessments.^{56,57} Children 6 months to 8 years of age receiving their first influenza vaccine should get two vaccines at least 4 weeks apart.^{58,59}

Advisory Committee on Immunization Practices and Pregnancy

Pregnant women have a higher risk for serious influenza complications than women who are not pregnant.⁶⁰ The signs and symptoms of an influenza

infection are the same as for other populations, and the testing and treatment are the same as well.

The Advisory Committee on Immunization Practices (ACIP) recommends that all women who are or may become pregnant during the influenza season should be given an influenza vaccination.⁶¹ Influenza vaccines are recommended in each pregnancy and may be given in any trimester.⁵⁸ The live, attenuated vaccine should be avoided in pregnant women. Pregnant women and women who are two weeks postpartum or those who have lost a pregnancy in the preceding two weeks and who have or are suspected of having an influenza infection should be promptly treated with an antiviral medication.⁶¹ These same groups should be given prophylactic antivirals if, in the opinion of a clinician, they have had significant exposure to influenza.⁶¹ Oseltamivir and zanamivir are generally considered safe for pregnant women and fetuses.⁶¹

Role of Pharmacists and Pharmacy Technicians and Interns

The CDC provides pharmacists, pharmacy technicians, and other health clinicians with ongoing information and updates on influenza outbreaks, treatments, and recommendations for seasonal influenza immunization and prevention. Pharmacists and technicians should stay educated about current guidelines in order to effectively answer questions patients may have about vaccination and also make sure that vaccination is appropriate for an individual. Pharmacists and technicians should also be familiar with inputting vaccines into the computer systems and running vaccinations through insurance.

Federal law allows state, qualified pharmacists to administer vaccines;⁶² however, several states have restrictions on which vaccines pharmacists can administer and/or age limitations on individuals a pharmacist can vaccinate. Some states also differ on the pharmacist's authority to prescribe and/or administer a vaccine without a patient-specific prescription from another healthcare clinician. *Pharmacists and technicians should familiarize themselves with the regulations regarding vaccinations specific to their state.*

Pharmacists can administer influenza vaccinations in all 50 states and the District of Columbia, with some states requiring age-specific prescriptions by other healthcare clinicians. If a state does not have specific training requirements for the pharmacist to order and administer vaccines, the pharmacist must complete a vaccination training program of at least 20 hours that is approved by the ACPE to order and administer vaccines. This training must include hands-on injection technique, clinical evaluation of indications and contraindications of vaccines, and the recognition and treatment of emergency reactions to vaccines. Pharmacists must also complete a minimum of two hours of ACPE-approved immunization-related continuing education during each state licensing period.⁶²

Qualified technicians and pharmacy interns may also administer seasonal influenza vaccinations to adults aged 19 or older via ACIP's standard immunization schedule under the Public Readiness and Emergency Preparedness Act (PREP Act). Technicians and interns administering vaccinations must be supervised by a readily available licensed pharmacist qualified to administer vaccinations. The licensed or registered pharmacy intern and qualified pharmacy technician must also complete a practical training program approved by ACPE, which also includes hands-on training, clinical evaluation, and emergency treatment topics. All individuals administering vaccinations must have a current certificate in basic cardiopulmonary resuscitation.⁶²

Pharmacists must also comply with record keeping and reporting requirements in the jurisdiction in which they administer vaccines, which may include informing the patient's primary care provider when available, submitting information to the state or local vaccine registry, reporting adverse events, and reviewing the vaccine registry if available to ensure appropriate administration. These tasks may be done with the assistance of a pharmacy technician.

Recommendations: Influenza Season 2022-2023

Although the prevention of influenza depends on the virus strain being circulated, the influenza vaccination is recommended to prevent influenza and prevent complications resulting from becoming infected. Between the 2017–2018 flu season, an estimated 7.1 million illnesses, 3.7 million medical visits, 109,000 hospitalizations, and 8,000 deaths were prevented.⁶¹ The CDC reported estimated vaccine effectiveness of “38% (62% against influenza A[H1N1]pdm09 viruses, 22% against influenza A[H3N2] viruses, and 50% against influenza B viruses).”⁶¹ During the 2021-2022 influenza season, approximately 175 million doses of influenza vaccine were distributed in the United States with no new safety concerns identified.⁶³

Vaccine Selection

The guidance for vaccine selection for specific populations is updated by the CDC, and the guidance is consistent with FDA indications and prescribing information for flu vaccination. Updated vaccination preparations will be available through the CDC website in the influenza section. The ACIP proposed that all vaccines in the 2022-2023 season will be quadrivalent vaccinations. The updates from the 2021-2022 influenza vaccinations are in the Influenza A(H3N2) and influenza B/Victoria components. Egg-based IIV4s and LAIV4 vaccinations will be composed of a combination of A/Victoria/2570/2019/(H1N1)pdm09-like, A/Darwin/9/2021(H3N2)-like, B/Austria/1359417/2021(Victoria lineage) like, and B/Phuket/3037/2013 (Yamagata lineage)-like. Cell-culture-based IIV4 and RIV4 vaccinations will be composed of a combination of A/Wisconsin/588/2019 (H1N1)pdm09-like, A/Darwin/6/2021 (H3N2)-like, B/Austria/1359417/2021 (Victoria lineage)-like, and B/Phuket/3073 (Yamagata lineage)-like.⁶³

Annual influenza vaccination (all persons aged ≥ 6 months) continues to be recommended for anyone who does not have contraindications. No influenza vaccine product is preferred over another available “licensed, recommended, and appropriate product.”⁶¹

High-Risk Populations

High-risk populations for medical complications due to influenza include those at increased risk for severe illness and complications from influenza and influenza-related outpatient, emergency department, or hospital visits. In addition to children (aged 6 through 59 months) and pregnant women, as previously noted, other persons at risk include:⁶⁴

- Children and adolescents (6 months through 18 years of age) prescribed aspirin- or salicylate-containing medications and at possible risk of Reye syndrome after influenza virus infection
- Persons aged ≥ 50 years
- Adults and children diagnosed with chronic pulmonary (including asthma), cardiovascular (excluding isolated hypertension), renal, hepatic, neurologic, hematologic, or metabolic disorders (including diabetes mellitus)
- Immunocompromised persons, for any cause, *i.e.*, medication-induced, or human immunodeficiency virus [HIV] infection
- Nursing home and other long-term care residents
- American Indians/Alaska Natives; and
- Extremely obese persons (body mass index ≥ 40 for adults).

Immunocompromised individuals can include those with a variety of conditions at risk of severe infections.⁶¹ Information on the use of influenza vaccines in immunocompromised individuals is limited. Vaccination before or after an immunocompromising intervention could be a consideration. The Infectious Diseases Society of America provides guidance on the selection and timing of vaccines in specific immunocompromised states. Persons with congenital immune deficiencies and persons receiving cancer chemotherapy or immunosuppressive medications will need to be considered case by case for consideration of influenza vaccination.⁶¹

Health care personnel with potential exposure to patients or infectious materials may receive any influenza vaccine that is indicated. The CDC states that “Persons who care for severely immunocompromised persons requiring a protected environment should receive either IIV or RIV4. ACIP and the Healthcare Infection Control Practices Advisory Committee (HICPAC) have previously recommended that health care personnel who receive LAIV should avoid providing care for severely immunosuppressed patients requiring a protected environment for 7 days after vaccination and that hospital visitors who have received LAIV should avoid contact with such persons for 7 days after vaccination. Such persons need not be restricted from caring for or visiting less severely immunosuppressed patients.”⁶¹

All standard-dose unadjuvanted IIV4s are now approved for children greater than 6 months of age.⁶³ Healthy children aged ≥ 2 years may receive LAIV4, 0.2 mL intranasally (0.1 mL in each nostril). For children aged < 2 years, LAIV4 has not been approved for administration.⁶³ Caution is needed in the administration of an age-appropriate vaccine and dose. Influenza vaccine types and doses for children of varying ages are available on the CDC website.⁶³

Pregnant and postpartum women are considered at higher risk for severe illness and complications from influenza, notably during the second and third trimesters. The American College of Obstetricians and Gynecologists has recommended that all pregnant women, or women who might be pregnant, or who are postpartum during the influenza season, receive the influenza vaccine. Licensed, recommended, and age-appropriate IIV or RIV4 may be used. LAIV4 should not be used during pregnancy.^{61,64} A pregnant woman may receive the influenza vaccine at any time during pregnancy throughout the influenza season. Influenza vaccine types and doses during pregnancy are available on the CDC website.⁶¹

For the 2022-2023 flu season, the CDC’s Advisory Committee on Immunization Practices (ACIP) voted unanimously to recommend three preferential vaccines over standard-dose unadjuvanted flu vaccines for individuals 65 and older. These recommendations include Fluzone High-Dose Quadrivalent vaccine, Flublok Quadrivalent recombinant flu vaccine, or Flud

Quadrivalent adjuvanted flu vaccine. If one of these vaccines is not available at the time of vaccination, it is recommended that the person get a standard-dose flu vaccine instead. There is no current preferential recommendation for individuals younger than 65 years of age.⁶⁵

Medical Conditions and History of Egg Allergies

Guillain-Barré Syndrome (GBS) is considered a precaution to vaccination.⁶¹ In the United States, approximately 80 to 160 cases of GBS are reported each week, and data on the association between GBS and influenza vaccination are variable and inconsistent. The benefits and risks of influenza vaccination in an individual with GBS should be considered in cases of higher risk for severe complications from influenza.⁶⁶

Egg allergies are a concern for individuals receiving flu vaccines as most flu vaccines are manufactured using egg-based technology. The vaccines do contain a small amount of egg proteins, but studies have shown that reactions due to the egg proteins in the vaccines are unlikely to cause a severe allergic reaction.^{67,68} Influenza vaccines, except for RIV4 (Flublok Quadrivalent) for people ≥ 18 years of age, and ccIIV4 (Flucelvax Quadrivalent) for those people ≥ 4 years of age, may contain trace amounts of egg proteins.⁶⁰ An office emergency plan and cardiopulmonary resuscitation preparedness should be in place for pharmacists and other healthcare professionals administering the influenza vaccine. Post-vaccination observation is not required for egg-allergic individuals. However, patients who receive an influenza vaccine are recommended to remain seated or supine for 15 minutes post administration to avoid possible syncope and injury. People with a history of an egg allergy require the following precautions:⁶¹

- For urticaria only in a person with a known egg allergy, any licensed, recommended influenza vaccine (*i.e.*, IIV, RIV4, or LAIV4) may be used.
- For reactions other than urticaria (angioedema or swelling, respiratory distress, lightheadedness, recurrent vomiting, requiring epinephrine or another emergency medical intervention), may receive any licensed, recommended influenza vaccine (*i.e.*, IIV, RIV4, or LAIV4) appropriate to

the person's age and health status. The CDC website recommends these individuals get the vaccination in an inpatient or outpatient medical setting and lists these settings, including but not limited to hospitals, clinics, health departments, and physicians' offices, with no particular mention of retail pharmacies.⁶⁷

- A previous severe allergic reaction to the influenza vaccine, regardless of the vaccine used, is a contraindication to future vaccination.⁶⁸

Travelers and Influenza Vaccination

There are variations of influenza occurring in varied geographic areas. People who travel may become exposed to influenza while traveling to regions where influenza is actively circulating or when traveling with large groups of people, such as on a plane or cruise ship. The use of influenza vaccination prior to traveling may lower the risk of influenza, and vaccination has been suggested at least 2 weeks prior to traveling. Unvaccinated residents of the U.S., are at higher risk for influenza complications during the previous Northern Hemisphere fall or winter and should consider influenza vaccine administration before traveling to the tropics, the Southern Hemisphere, or on cruise ships or with large groups traveling to any location.⁶¹ Healthcare providers and pharmacists may discuss influenza risk before a person travels.

Special Considerations of Influenza Vaccination

The dosage, administration, contraindications, and precautions of influenza vaccines licensed for use during the 2022-2023 influenza season are available at the CDC website portal for health professionals. Storage and handling of vaccines can also be reviewed at the CDC website or in the vaccine package inserts. The CDC states that influenza vaccines should be protected from light and stored at temperatures that are recommended on the package insert. Recommended storage temperatures are generally 36°F–46°F (2°C–8°C) and should be maintained at all times with adequate refrigeration and temperature monitoring. Vaccines that have frozen should be discarded. Vaccines should not be used beyond the expiration date on the label.^{61,69,70}

Influenza surveillance, prevention, and control are available at the CDC website: <https://www.cdc.gov/flu>. Surveillance data is updated weekly on FluView (<https://www.cdc.gov/flu/weekly>) and FluView Interactive (<https://www.cdc.gov/flu/weekly/fluviewinteractive.htm>).⁶¹ CDC-INFO is available at 1-800-232-4636 to health professionals and pharmacists for additional information.

The Vaccine Adverse Event Reporting System (VAERS) involves mandatory reporting, and all health professionals should report any clinically significant immunization adverse event to VAERS.⁶¹ There is also the National Vaccine Injury Compensation Program (VICP) that provides a mechanism for a person who is injured from a vaccine to receive compensation. In case of death, the appropriate person may receive compensation on behalf of the decedent.⁶¹

Vaccine Administration

Intramuscular injections of inactivated influenza vaccines should be administered with a needle long enough to reach deep into the muscle. In general, the appropriate size needles are as follows: 6 to 11 months: 1 inch, 1 to 10 years: 1 to 1¼ inches, and children and adults 11 years and older: 1 to 1½ inches, and a 22–25-gauge needle should be used. The needle should be inserted into the muscle at a 90-degree angle to the skin with a quick thrust. The entire contents of the syringe should be injected. All used needles and syringes should be disposed of in a sharps container. Appropriate injection sites include the deltoid muscle of the arm or anterolateral thigh muscle.^{71,72}

Intranasal administration of live attenuated influenza vaccine should be done with the patient in the upright position. The rubber tip protector should be removed, and the tip should be placed just inside the nostril to ensure the vaccine is delivered into the nose. During the vaccine administration, the patient should breathe normally, and with a single motion, the administrator is to depress the plunger as rapidly as possible until the dose-divider clip prevents you from going any further. After administration in the first nostril, the dose-divider clip should be removed by pinching the clip away from the

plunger, and the tip of the applicator should be inserted into the other nostril, using the same technique, and the second half of the vaccine should be administered. The applicator should be disposed of in the sharps container after use.⁷²

Proper handwashing techniques should be used prior to administering any type of vaccination. Gloves should also be worn to protect the patient and the vaccine administrator. Precaution should be taken to avoid accidental needle sticks, and all needles and syringes must be disposed of in a sharps container.

Vaccination Adverse Reactions

Pain and other injection site reactions such as redness and swelling are frequently reported after receiving the influenza vaccine. These typically resolve within a few days but may temporarily affect the ability to do daily activities. Some individuals may get a fever, malaise, myalgia, and other systemic symptoms. Allergic reactions ranging from mild reactions to anaphylaxis have also occurred. In the past, egg-based inactive influenza vaccinations have been associated with febrile seizures in young children when given in combination with 13-valent pneumococcal conjugate vaccine and diphtheria, tetanus, and pertussis vaccines. Syncope has also been reported with injected vaccines, and providers should encourage patients to stay seated and to be observed for 15 minutes post-vaccination to decrease the risk of injury should they faint.⁷³

Anaphylaxis Preparedness and Response

Influenza vaccines are administered in multiple settings and by various licensed healthcare professionals and can be found in pharmacies, schools, job sites, and medical provider offices. The CDC states: "All vaccines should be administered in settings in which personnel and equipment for rapid recognition and treatment of anaphylaxis are available. ACIP recommends that all vaccination providers be certified in cardiopulmonary resuscitation

(CPR), have an office emergency plan, and ensure that all staff is familiar with the plan.”⁶⁸ Emergency responses are also published by the CDC.⁶⁸

If vaccinations are being administered in a retail pharmacy setting and an allergic reaction does occur, it is important to either call 911 and have an ambulance ready or send the patient directly to the emergency room if they have someone to drive them and the hospital is within a close enough proximity. Epinephrine should be administered in the case of anaphylaxis, but further monitoring should be done that is beyond the scope of pharmacists and technicians. Epinephrine pens are of critical importance to have available to pharmacists and technicians administering vaccines. Make sure to communicate with the emergency medical technicians or emergency department staff any relevant information regarding what vaccine the patient received and what, if any, treatment you provided.

Infants and Children

In children, the most common signs and symptoms of anaphylaxis tend to involve the sudden onset of generalized urticaria, angioedema, flushing, and pruritus. The CDC notes that 10 to 20% of patients have no skin findings.⁶⁸⁶ Other critical rapid onset of symptoms that clinicians and patients should be aware of include stridor, wheezing, dyspnea, increased work of breathing, retractions, persistent cough, cyanosis, signs of poor perfusion, abdominal pain, vomiting, dysrhythmia, hypotension, and collapse.⁶⁸

The initial line of treatment when anaphylaxis occurs consists of administering epinephrine. The CDC states that *no* absolute contraindications to epinephrine exist in case of anaphylaxis. The recommended dose and administration of intramuscular epinephrine 1 mg/mL preparation is listed by the CDC as follows:⁶⁸

- Inject Epinephrine 0.01 mg/kg intramuscularly in the mid-outer thigh.
- Large children (>50 kg): the maximum is 0.5 mg per dose.
- No response or inadequate response: repeat injection in 5 to 15 minutes (or more frequently).

- Prompt IM injection of epinephrine: expect patients to respond to one, two, or at most, three injections.
- Poor perfusion or response to epinephrine IM injections: prepare IV epinephrine for infusion
- Epinephrine infusion: for an emergency response protocol, each site should be prepared for the administration of epinephrine 0.1 to 1 mcg/kg/minute continuous infusion (titrated to effect), following a failed or inadequate response to epinephrine intramuscular injection and intravenous saline.

Other emergency protocols include the administration of oxygen, corticosteroids, and intravenous fluids as outlined in the following table.⁶⁸ As mentioned previously, the patient should be positioned flat or reclining, as tolerated, and the lower extremities should be elevated.⁶⁸

Health clinicians and/or other emergency response teams are referred to vaccination package instructions or inserts on the preparation and administration of epinephrine for continuous intravenous infusions.

In case of anaphylaxis, the infusion of epinephrine and possibly a vasopressor will require continuous noninvasive monitoring of the patient’s blood pressure, heart rate and function, and oxygen saturation.⁶⁸ The medications listed in the table as appropriate for the treatment of anaphylaxis are not to be administered as initial or a sole treatment.⁶⁸ In a child who weighs 70 kg, the initial infusion rate of epinephrine is 7 mcg/minute (similar to the recommended range of 2 to 10 mcg/minute *non-weight-based dosing* for adults when a patient’s weight is unknown or cannot be estimated).⁶⁸

Children: Emergency Treatment for Anaphylaxis⁶⁸

AIRWAY	Immediate Intubation: For angioedema by the most experienced person to avoid complete obstruction. Be prepared for cricothyrotomy, if needed.
	Oxygen: Administer 8 to 10 L/minute by facemask or up to 100% oxygen, as needed.

INTRAVENOUS FLUID	<p>Normal Saline Rapid Bolus:</p> <ul style="list-style-type: none"> ● Infuse 20 mL/kg. ● Reevaluate and repeat fluid boluses (20 mL/kg), as needed. ● Massive fluid shifts with severe loss of intravascular volume can occur. ● Monitor urine output.
MONITORING	<p>Continuous noninvasive hemodynamic monitoring and pulse oximetry monitoring is required.</p> <p>Urine Output monitoring: For all patients with severe hypotension or shock who are receiving IV fluid resuscitation</p>
MEDICATIONS	<p>Albuterol: For bronchospasm resistant to IM epinephrine, give albuterol 0.15 mg/kg (minimum dose: 2.5 mg) in 3 mL saline inhaled via nebulizer. Repeat, as needed.</p> <p>H1 antihistamine: Consider giving diphenhydramine 1 mg/kg (max 40 mg) IV given over 5 minutes, or cetirizine (children aged 6 months to 5 years can receive 2.5 mg IV, those 6 to 11 years of age can receive 5 or 10 mg IV, over 2 minutes).</p> <p>H2 antihistamine: Consider giving famotidine 0.25 mg/kg (max 20 mg) IV, over at least 2 minutes.</p> <p>Glucocorticoid: Consider giving methylprednisolone 1 mg/kg (max 125 mg) IV.</p> <p>Vasopressors:</p> <ul style="list-style-type: none"> ● Large amounts of IV crystalloid may be needed to maintain blood pressure. ● A second vasopressor (in addition to epinephrine) may be needed. ● An infusion pump is required for all vasopressors administered intravenously. ● Titrate doses continuously according to the continuous monitoring of blood pressure, and cardiac rate/function monitored <p>Monitor oxygenation by pulse oximetry</p>

*Intramuscular = IM; Intravenous = IV

Adults

The CDC also publishes protocols for the emergency treatment of anaphylaxis in adults. In adults, the most common signs and symptoms include generalized urticaria, angioedema, flushing, and pruritus. As with children, an estimated 10-20% of patients will show no skin findings.⁶⁸ The rapid progression of symptoms is a dangerous sign and can include respiratory

distress (stridor, wheezing, dyspnea, increased work of breathing, persistent cough, and cyanosis), vomiting, abdominal pain, hypotension, dysrhythmia, chest pain, and collapse.⁶⁸ Epinephrine is also the first-line treatment when anaphylaxis occurs in adults. No absolute contraindications to epinephrine exist in the setting of anaphylaxis.⁶⁸

Epinephrine (1 mg/mL preparation) is administered as 0.3 to 0.5 mg intramuscularly, preferably in the mid-outer thigh.⁶⁸ Epinephrine can be repeated every 5 to 15 minutes or more frequently, as needed.⁶⁸ When epinephrine intramuscularly is injected promptly, most patients will respond with the administration of one, two, or three doses (at the most). Intravenous epinephrine is administered in cases of poor response.⁶⁸

The medications listed in the table below as appropriate for the treatment of anaphylaxis are not to be administered as initial or a sole treatment.^{61,68} Continuous noninvasive monitoring of blood pressure, heart rate and function, and oxygen saturation is required for all patients who receive vasopressor treatment.^{61,68} Non-weight-based dosing is recommended for all adults where the actual weight cannot be obtained or is unknown.⁶⁸

Adult: Emergency Treatment for Anaphylaxis⁶⁸

AIRWAY	Immediate Intubation: For angioedema by the most experienced person to avoid complete obstruction. Be prepared for cricothyrotomy, if needed.
	Oxygen: Administer 8 to 10 L/minute by facemask or up to 100% oxygen, as needed.
INTRAVENOUS FLUID	Normal Saline Rapid Bolus: <ul style="list-style-type: none"> ● Infuse 1-2 L IV. ● Reevaluate and repeat fluid boluses, as needed. ● Massive fluid shifts with severe loss of intravascular volume can occur. ● Monitor urine output.

MONITORING	<p>Continuous noninvasive hemodynamic monitoring and pulse oximetry monitoring are required.</p> <p>Urine Output monitoring: For all patients with severe hypotension or shock who are receiving IV fluid resuscitation</p>
MEDICATIONS	<p>Albuterol: Administer 2.5 to 5 mg in 3 mL saline via nebulizer for bronchospasm resistant to IM epinephrine. Repeat, as needed.</p> <p>H1 Antihistamine: Cetirizine 10 mg IV (over 2 minutes) or diphenhydramine 25 to 50 mg IV (over 5 minutes) for urticaria and itching only</p> <p>H2 antihistamine: Famotidine 20 mg IV (over 2 minutes).</p> <p>Glucocorticoid: Methylprednisolone 125 mg IV.</p> <p>Vasopressors:</p> <ul style="list-style-type: none"> • A second vasopressor (in addition to epinephrine) may be needed. • An infusion pump is required for all vasopressors administered intravenously. • Titrate doses continuously according to the continuous monitoring of blood pressure and cardiac rate/function monitored • Monitor oxygenation by pulse oximetry <p>Glucagon: 1 to 5 mg IV over 5 minutes, followed by infusion of 5 to 15 mcg/minute for patients prescribed beta blockers, as they may not respond to epinephrine. Vomiting can occur with rapid administration of glucagon.</p>

*Intramuscular = IM; Intravenous = IV

Summary

Influenza is a common contagious respiratory illness that affects millions of people every year. Influenza is caused by the influenza virus that is transmitted by contact and/or inhalation with infected droplets, spread by coughing, sneezing, spitting, or touching environmental objects or surfaces with contaminated hands.

Outbreaks of influenza happen every year, typically during the winter months in the northern hemisphere. Environmental and social factors are the primary causes of the seasonal occurrence of outbreaks. Three different strains of influenza virus cause the disease in humans (types A, B, and C, and

changes in the antigenic profile of the influenza virus explain why outbreaks are an annual occurrence. Most cases of influenza are mild and self-limiting. People who contract influenza typically will have cough, fever, and malaise for a few days and recover completely. However, serious complications and death are possible, particularly in high-risk populations, such as the very young, the very old, and people who have coexisting medical comorbidities.

The CDC website is an invaluable source of information about seasonal influenza. The CDC publishes current information about influenza, such as what strains are affecting the population, what vaccines should be used, and the proper storage and handling of vaccines. Vaccination is recommended for everyone at 6 months of age or older. Vaccination is particularly important for people and/or cultural groups who have risk factors for developing a serious case of influenza or for developing complications of influenza, as well as for individuals who work with vulnerable populations. Pharmacists and pharmacy technicians play a key role in the fight against influenza by providing vaccinations and information about influenza to the community.

Course Test

1. The Centers for Disease Control and Prevention recommends an annual flu vaccination once a person reaches

- a. six months of age.
- b. 12 years of age.
- c. three months of age.
- d. 65 years of age.

2. _____ is the most common complication of influenza.

- a. Ischemic heart disease
- b. Transverse myelitis
- c. Myocarditis
- d. Pneumonia

3. True or False: Influenza vaccines cause influenza in approximately 6% of vaccinated individuals.

- a. True
- b. False

4. Children who have the flu can infect other people _____ after the symptoms begin.

- a. two weeks
- b. 5-7 days
- c. up to 10 days
- d. 1-2 days

5. Which of the following statements is true about influenza vaccinations?

- a. Influenza vaccines called "trivalent vaccines" protect against two types of influenza A viruses and one type of influenza B virus.
- b. Revaccination (a booster dose) is usually needed for individuals who have been fully vaccinated during the influenza season.
- c. Pregnant women should only receive the nasal influenza vaccination.
- d. Nasal preparations do not contain live viruses.

6. _____ is not recommended for patients who have pre-existing airway disease, such as asthma and/or chronic obstructive pulmonary disease (COPD).

- a. Zanamivir
- b. Oseltamivir
- c. Peramivir
- d. Baloxavir marboxil

7. The Advisory Committee on Immunization Practices (ACIP) recommends that women who are or may become pregnant during the influenza season

- a. should be treated with a live, attenuated antiviral medication.
- b. should not take oseltamivir or zanamivir, because they are not safe for pregnant women and fetuses.
- c. should be given an influenza vaccination.
- d. All of the above

8. Pharmacists must comply with record keeping and reporting requirements in the jurisdiction in which they administer vaccines, which may include

- a. submitting information to the state or local vaccine registry.
- b. reporting adverse events.
- c. reviewing the vaccine registry if available to ensure appropriate administration.
- d. All of the above

9. If a vaccine is being administered in a retail pharmacy setting and an adverse reaction does occur,

- a. epinephrine should be administered in all cases.
- b. the patient should be monitored by the pharmacist over the following months.
- c. call 911 and have the patient taken to an emergency room.
- d. keep the patient at the pharmacy until it is safe for the patient to return home.

10. Antiviral medication should be given to a patient with influenza

- a. after laboratory confirmation of an influenza infection.
- b. only if influenza symptoms persist for more than 48 hours.
- c. as soon as possible.
- d. before, not after, the onset of influenza symptoms.

11. The best way to protect children younger than 6 months of age is to

- a. make sure people around them are vaccinated.
- b. use a nasal spray vaccine.
- c. test them for influenza infection.
- d. use the new antiviral drug, baloxavir marboxil.

12. _____ is a new antiviral that inhibits polymerase acidic endonuclease, an enzyme essential for viral replication.

- a. Zanamivir
- b. Oseltamivir
- c. Baloxavir marboxil
- d. Peramivir

13. If a patient has confirmed or suspected influenza, healthcare providers should follow droplet precautions

- a. after the onset of a fever.
- b. if respiratory symptoms are present.
- c. for a minimum of 10 days.
- d. for 7 days after flu onset or until 24 hours after the fever and respiratory symptoms have resolved, whichever is longer.

14. In children, the most common signs and symptoms of anaphylaxis tend to involve sudden onset of

- a. generalized urticaria.
- b. angioedema.
- c. flushing and pruritus.
- d. All of the above

15. A patient who was diagnosed with Guillain-Barré Syndrome (GBS) within 6 weeks of an influenza vaccination,

- a. should be vaccinated with one dose, not a second dose.
- b. may be vaccinated because there is no link between GBS and flu vaccines.
- c. should not be vaccinated.
- d. may be vaccinated and receive a second dose if needed.

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