



Policy Statement—Recommendations for the Prevention and Treatment of Influenza in Children, 2009–2010

abstract

The purpose of this statement is to update current recommendations for routine use of trivalent seasonal influenza vaccine and antiviral medications for the prevention and treatment of influenza in children. *Pediatrics* 2009;124:1216–1226

INTRODUCTION

The American Academy of Pediatrics (AAP) recommends annual trivalent seasonal influenza immunization for the following groups:

- All children, both healthy and with conditions that increase the risk of complications from influenza, aged 6 months through 18 years
- Household contacts and out-of-home care providers of
 - children with conditions that place them at high risk
 - healthy children younger than 5 years
- Health care professionals
- Pregnant women

KEY POINTS RELEVANT FOR THE 2009–2010 INFLUENZA SEASON

1. All children 6 months through 18 years of age should receive annual trivalent seasonal influenza immunization, with particular attention to those at high risk of influenza complications (eg, children with chronic medical conditions or immunosuppression). School-aged children bear the greatest influenza disease burden and are at significantly higher risk of needing influenza-related medical care compared with healthy adults. In addition, reducing influenza transmission among school-aged children is expected to reduce transmission of influenza to household contacts and community members.
2. Household members and out-of-home care providers of all children and adolescents at high risk and of all healthy children younger than 5 years of age should also receive influenza vaccine each year. Immunization of the close contacts of children at high risk is intended to reduce the risk of exposure to influenza for these young children, who are at serious risk of influenza infection, hospitalization, and complications. The risk of influenza-associated hospitalization of healthy children younger than 24 months has been shown to be equal to or greater than the risk in previously recognized high-

COMMITTEE ON INFECTIOUS DISEASES

KEY WORDS

influenza, novel influenza A (H1N1) virus, immunization, live-attenuated influenza vaccine, trivalent inactivated influenza vaccine, vaccine, children, pediatrics

ABBREVIATIONS

AAP—American Academy of Pediatrics
TIV—trivalent inactivated influenza vaccine
LAIV—live-attenuated influenza vaccine
FDA—Food and Drug Administration
GBS—Guillain-Barré syndrome
CDC—Centers for Disease Control and Prevention

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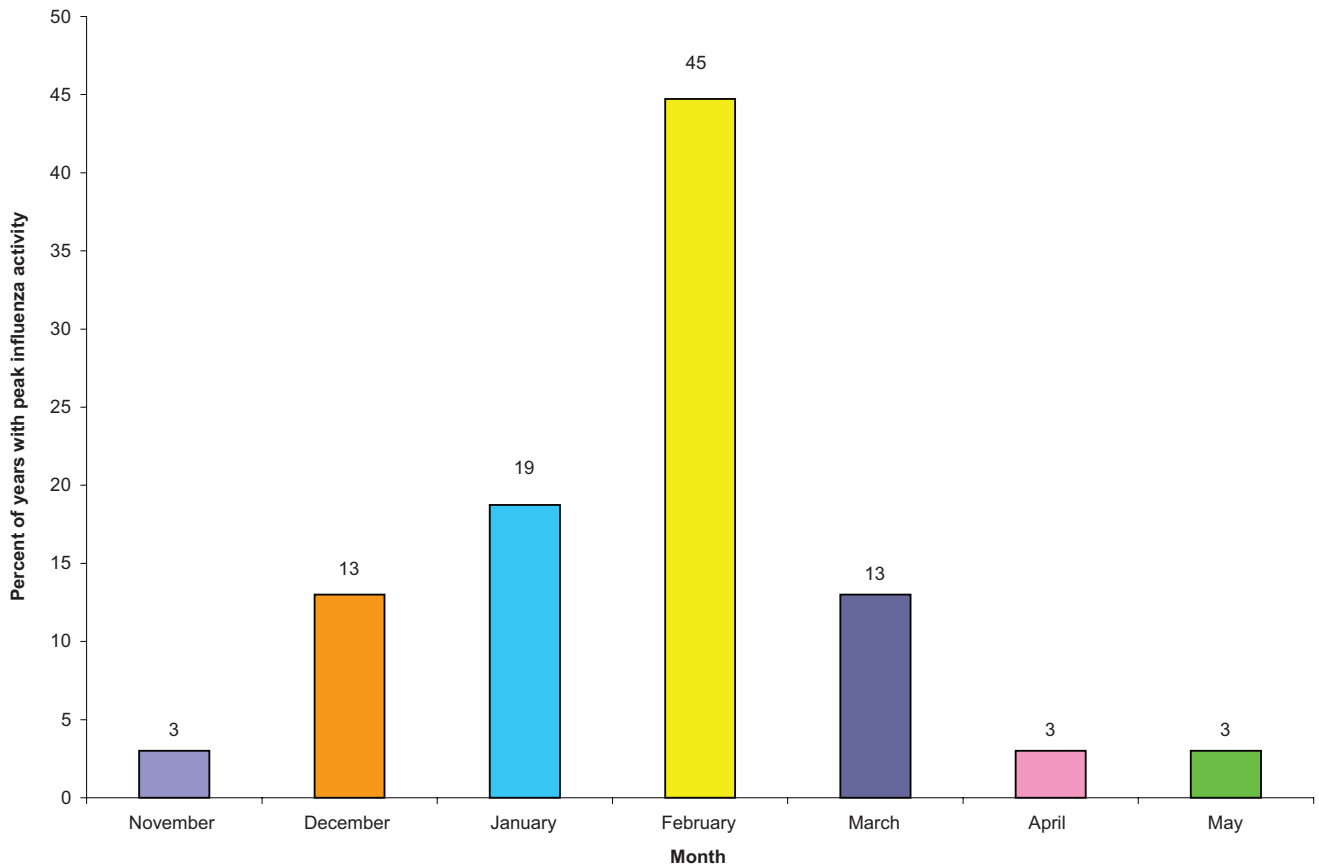


FIGURE 1

Month of peak influenza activity (%) from 1976–1977 through 2008–2009. Note that the peak week of influenza activity was defined as the week with the greatest percentage of positive respiratory specimens for influenza. The number of peak weeks in each month was then summed, and a percentage was calculated. Data source: United States–World Health Organization Collaborating Laboratory (CDC, unpublished data, 1976–2008).

risk groups. Children aged 24 through 59 months experience increased morbidity as a result of influenza illness, with increased rates of outpatient visits and antimicrobial agent use. Influenza vaccine has not been approved for children younger than 6 months.

- All children aged 6 months through 18 years, especially those at high risk of complications from influenza, should be identified, and their parents should be informed, when possible, that annual influenza immunization is available and recommended.
- On the basis of global surveillance of circulating influenza strains, the B vaccine strain has been changed in the trivalent seasonal vaccine for

the 2009–2010 influenza season to match the anticipated predominant strain.

- The declaration of a pandemic by the World Health Organization supports the ongoing development of a vaccine to protect against the novel influenza A (H1N1) virus. The novel strain's pattern of spread during the influenza season in the Southern Hemisphere is expected to help guide recommendations for the use of an additional monovalent pandemic influenza vaccine in the 2009–2010 season. It is critically important for providers to be aware of their local and state health department recommendations. Up-to-date information can be found at www.cdc.gov/flu and www.aapredbook.org/flu.

Details regarding novel influenza A (H1N1) virus for pediatricians and families will be updated frequently on the AAP Web site (www.aap.org).

- Seasonal influenza vaccine should be offered to all children as soon as vaccine is available, even as early as August or September; a protective response to immunization remains throughout the influenza season. Immunization efforts should continue throughout the entire influenza season, even after influenza activity has been documented in a community. Each influenza season often extends well into March and beyond (Fig 1), and there may be more than 1 peak of activity in the same season. Thus, immuni-

zation through at least May 1 can still protect recipients during that particular season and also provide ample opportunity to administer a second dose of vaccine to children who require 2 doses in that season.

7. The number of trivalent seasonal influenza vaccine dose(s) to be administered is age dependent (Fig 2):

- Children aged 9 years and older who previously have not received the trivalent seasonal influenza vaccine need only 1 dose in their first season of immunization.
- In contrast, any child younger than 9 years who is receiving the trivalent seasonal influenza vaccine for the first time should receive a second dose during the same season and at least 4 weeks after the first.
- Children younger than 9 years who received only 1 dose of trivalent seasonal influenza vaccine in the first season they were vaccinated should receive 2 doses of trivalent seasonal influenza vaccine the following season and 1 dose each season thereafter. This recommendation applies only to the influenza season that follows the first year that a child younger than 9 years receives influenza vaccine. Data are not available for other trivalent seasonal influenza vaccine-administration scenarios.

8. The use of antiviral medications (amantadine, rimantadine, oseltamivir, and zanamivir) recommended for chemoprophylaxis or treatment remains more complex than in previous years because of the anticipated concurrent circulation of multiple strains of influenza with different susceptibility patterns during the 2009–2010 influenza season (Table 1).

9. Health care professionals, influenza campaign organizers, and public health agencies should cooperate to develop and implement plans for expanding outreach and infrastructure to achieve the target immunization of all children 6 months through 18 years of age. Efforts to consider in making trivalent seasonal influenza vaccine easily accessible for all children include creating walk-in influenza clinics, making vaccine available during all clinical hours, extending hours during vaccination periods, and working with other institutions (eg, schools, child care centers, churches) to expand venues for administering vaccine. Concerted effort among the aforementioned groups, plus vaccine manufacturers, distributors, and payers, also is necessary to appropriately prioritize administration of trivalent seasonal influenza vaccine whenever vaccine supplies are delayed or limited.

TRIVALENT SEASONAL INFLUENZA VACCINES

Tables 2 and 3 summarize information on the 2 types of trivalent seasonal influenza vaccine used to immunize both children and adults: trivalent inactivated influenza vaccine (TIV) and live-attenuated influenza vaccine (LAIV). Both vaccines contain the same 2 strains of influenza A subtypes (ie, H1N1 and H3N2) and the 1 strain of influenza B anticipated to circulate during the upcoming influenza season. The 2009–2010 trivalent seasonal influenza vaccine virus strains are an A/Brisbane/59/2007 (H1N1)-like virus, an A/Brisbane/10/2007 (H3N2)-like virus, and a B/Brisbane 60/2008-like (Victoria lineage) virus. The A strains will remain unchanged, and the B strain will be changed from the Yamagata lineage strain used in the 2008–2009 vaccines.

TIV is an inactivated vaccine that contains viral protein but no live virus and, therefore, cannot produce an active virus infection. TIV is administered intramuscularly to people who are 6 months and older, including those who are healthy and those with chronic medical conditions. The most common symptoms associated with TIV administration are soreness at the injection site and fever. Any fever usually occurs within 24 hours after immunization and affects approximately 10% to 35% of children younger than 2 years; the frequency of fever after TIV injection is much lower in older children and adults. Mild systemic symptoms, such as nausea, lethargy, headache, muscle aches, and chills, also can occur with TIV injection.

Oculorespiratory syndrome, an acute, self-limited, rare reaction with prominent ocular and respiratory symptoms (eg, bilateral red eyes and/or facial edema and/or respiratory symptoms), has been reported within 24 hours after TIV administration. The symptoms are generally mild, may not typically be concerning enough to cause vaccine recipients to seek medical care, and usually resolve quickly without treatment. The cause of oculorespiratory syndrome has not been established, but 1 study suggests the reaction is not immunoglobulin E-mediated.

LAIV is a live-attenuated influenza vaccine that is administered intranasally and is licensed by the US Food and Drug Administration (FDA) for healthy people 2 through 49 years of age. Safety and effectiveness have not been demonstrated for people with chronic medical conditions that confer higher risk of influenza complications; therefore, LAIV should not be administered to persons in these groups. LAIV has the potential to produce mild signs or symptoms related to attenuated influenza virus infection, including fever.

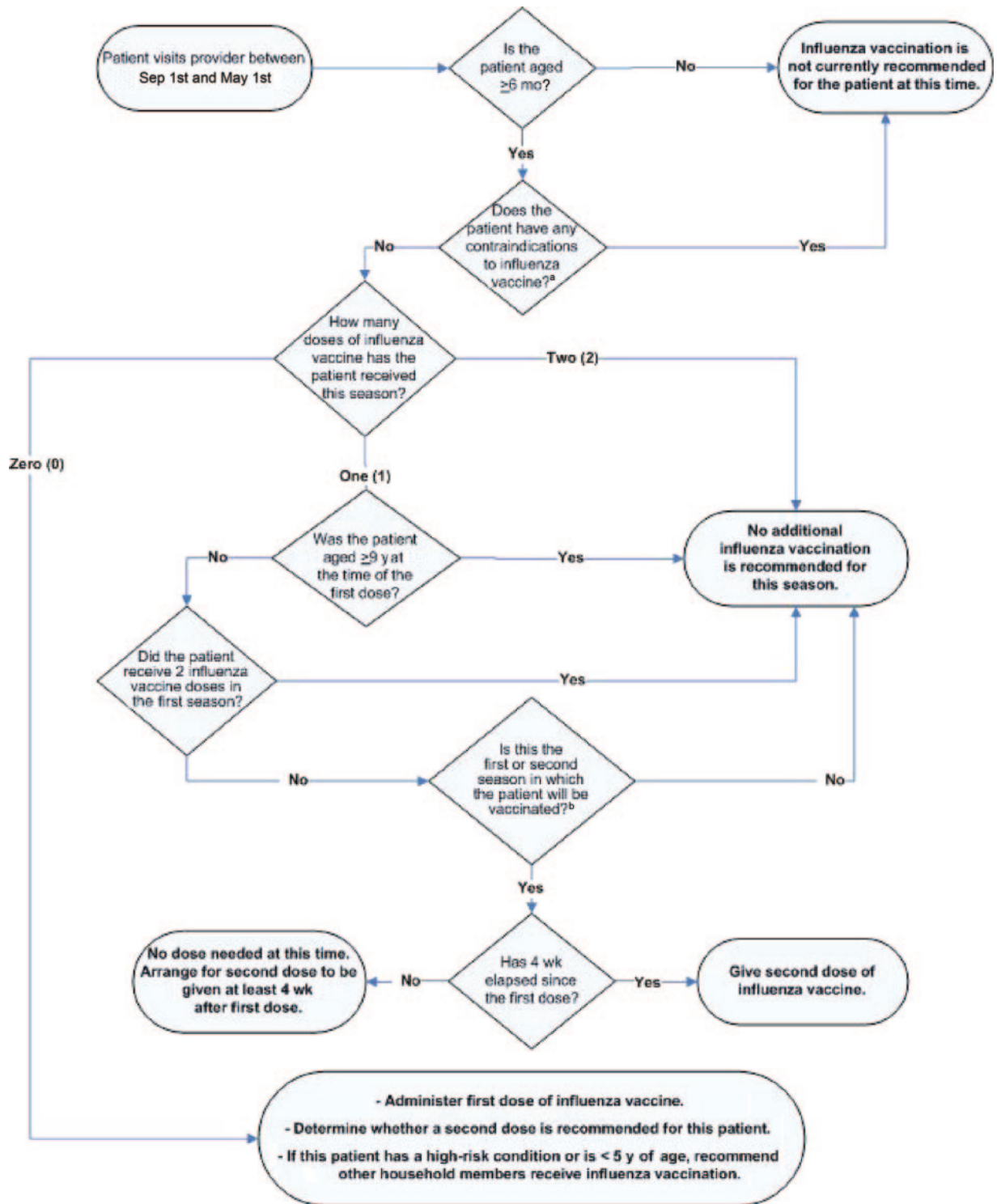


FIGURE 2

Influenza algorithm for determining recommended 2009–2010 influenza immunization. ^a Contraindications: please refer to page 7 of the policy statement for a list of contraindications for both TIV and LAIV. ^b If children younger than 9 years received their first influenza vaccine last year and received only 1 dose, it is recommended that 2 doses be administered in the current season. This recommendation applies for this season only. No data are available for other influenza vaccine-administration scenarios. Data source: American Academy of Pediatrics, Committee on Infectious Diseases. Prevention of influenza: recommendations for influenza immunization of children, 2008–2009. *Pediatrics*. 2008;122(5):1135–1141.

TABLE 1 Antiviral Drug Sensitivities of Influenza Strains Expected to Circulate During the 2009–2010 Influenza Season

Influenza Strain (2009–2010)	Amantadine (Symmetrel)/ Rimantadine (Flumadine)	Oseltamivir (Tamiflu)	Zanamivir (Relenza)
Seasonal influenza A (H1N1) virus (A/Brisbane/59/2007)	Susceptible	Resistant	Susceptible
Pandemic influenza A (H1N1) virus	Resistant	Susceptible	Susceptible
Seasonal influenza A (H3N2) virus (A/Brisbane/10/2007)	Resistant	Susceptible	Susceptible
Seasonal influenza B (B/Brisbane 60/2008, Victoria lineage)	Resistant	Susceptible	Susceptible

For current recommendations about chemoprophylaxis and treatment of influenza, see www.cdc.gov/flu/professionals/antivirals/index.htm or www.aapredbook.org/flu.

LAIV should not be delivered to people with nasal congestion if the amount of congestion is anticipated to impede the delivery of the vaccine to the nasopharyngeal mucosa until the congestion-inducing illness is resolved.

Because viruses for both vaccines are grown in eggs, neither should be administered to anyone with known allergic reactions (ie, hives, angioedema, allergic asthma, and systemic anaphylaxis) to chicken and egg proteins. Less severe or local manifestations of allergy to eggs or feathers are not contraindications to administration of influenza vaccine.

Although the efficacy of TIV and LAIV vary depending on recipient age and dosage, both vaccines are cost-effective strategies for preventing influenza among children and their fam-

ilies when circulating and vaccine strains are closely matched. Current data directly comparing the efficacy or effectiveness of these 2 vaccines are limited, because studies were conducted in a variety of settings and in populations using several different clinical end points. In 1 study that compared LAIV with TIV in infants and young children without severe asthma or a recent history of wheezing, LAIV showed significantly better efficacy than TIV.

Concerns about the minute amounts of thimerosal in vaccines continue to be raised by some people. There is no evidence that the incidence of autism spectrum disorders is higher among children who receive thimerosal-containing vaccines than among children who do not. The benefits of pro-

tecting children against the known risks of influenza are clear. Therefore, children should receive the formulation of TIV available rather than have immunization delayed because of the thimerosal content of the available vaccine; this includes children at high risk with underlying central nervous system disorders. Some formulations of TIV contain only a trace amount of thimerosal, but certain thimerosal-free types can be obtained (eg, single-dose Fluzone [Sanofi Pasteur, Swiftwater, PA]). LAIV does not contain thimerosal. Vaccine manufacturers are delivering increasing amounts of thimerosal-free influenza vaccine each year.

VACCINE STORAGE AND ADMINISTRATION

TIV is a split-virus vaccine made up of inactivated, disrupted virus particles administered intramuscularly into the anterolateral thigh of infants and young children and into the deltoid muscle of older children and adults. The cold-adapted LAIV formulation currently licensed in the United States must be shipped and stored at 2°C to 8°C. LAIV doses are administered intranasally, in a prefilled single-use sprayer containing 0.2 mL of vaccine. A

TABLE 2 Approved Trivalent Seasonal Influenza Vaccines for Different Age Groups: United States, 2009–2010 Influenza Season

Vaccine	Trade Name	Manufacturer	Dose/Presentation	Thimerosal Mercury Content, μg of Hg per 0.5-mL dose	Age Group
Inactivated					
TIV	Fluzone	Sanofi Pasteur	0.25-mL prefilled syringe	0	6–35 mo
			0.5-mL prefilled syringe	0	≥ 36 mo
			0.5-mL vial	0	≥ 36 mo
			5.0-mL multidose vial	25	≥ 6 mo
TIV	Fluvirin	Novartis (formerly Chiron)	0.5-mL prefilled syringe	<1.0	≥ 4 y
			5.0-mL multidose vial	24.5	≥ 4 y
TIV	Fluarix	GlaxoSmithKline	0.5-mL prefilled syringe	<1.0	≥ 18 y
TIV	FluLaval	GlaxoSmithKline	5.0-mL multidose vial	25	≥ 18 y
TIV	Afluria	CSL Biotherapies	0.5-mL prefilled syringe	0	≥ 18 y
			5.0-mL multidose vial (10 doses)	25	
Live-attenuated					
LAIV	FluMist	MedImmune	0.2-mL sprayer	0	2–49 y

Data sources: American Academy of Pediatrics, Committee on Infectious Diseases. Prevention of influenza: recommendations for influenza immunization of children, 2008–2009. *Pediatrics*. 2008;122(5):1135–1141; and Centers for Disease Control and Prevention. Prevention and control of influenza with vaccines. Recommendations of the Advisory Committee on Immunization Practices (ACIP) 2009. *MMWR Recomm Rep*. 2009;58(RR-8):1–52

TABLE 3 LAIV Compared With TIV

Vaccine Characteristic	LAIV	TIV
Route of administration	Intranasal spray	Intramuscular injection
Type of vaccine	Live virus	Killed virus
Product	Attenuated, cold-adapted	Inactivated subvirion or surface antigen
No. of included virus strains	3 (2 influenza A, 1 influenza B)	3 (2 influenza A, 1 influenza B)
Vaccine virus strains updated	Annually	Annually
Frequency of administration ^a	Annually	Annually
Approved age and risk groups	Healthy persons aged 2–49 y ^b	Persons aged ≥6 mo
Interval between 2 doses in children	4 wk	4 wk
Can be simultaneously administered with other vaccines	Yes ^c	Yes ^c
If not simultaneously administered,		
can be administered within 4 wk of another live vaccine	No, prudent to space 4 wk apart	Yes
can be administered within 4 wk of an inactivated vaccine	Yes	Yes

^a Two doses may be needed for children younger than 9 years, depending on individual circumstances.

^b LAIV is not recommended for children with a history of asthma. In the 2- to 4-year age group, there are children who have a history of wheezing with respiratory illnesses in whom reactive airways disease is diagnosed and in whom asthma may later be diagnosed. Therefore, because of the potential for increased wheezing after immunization, children younger than 5 years with recurrent wheezing or a wheezing episode in the past 12 months should not receive LAIV. When offering LAIV to children younger than 5 years, a clinician should screen young children who might be at higher risk of asthma by asking parents/guardians of 2-, 3-, and 4-year-olds (24- to 59-month-olds) the question: "In the past 12 months, has a health care professional ever told you that your child had wheezing?" If parents answer "yes" to this question, LAIV is not recommended for those children.

^c LAIV coadministration has been evaluated systematically only among children aged 12 to 15 months with measles-mumps-rubella and varicella vaccines. TIV coadministration has been evaluated systematically only among adults with pneumococcal polysaccharide and zoster vaccines.

Data sources: American Academy of Pediatrics, Committee on Infectious Diseases. Prevention of influenza: recommendations for influenza immunization of children, 2008–2009. *Pediatrics*. 2008;122(5):1135–1141; and Centers for Disease Control and Prevention. Prevention and control of influenza with vaccines. Recommendations of the Advisory Committee on Immunization Practices (ACIP) 2009. *MMWR Recomm Rep*. 2009;58(RR-8):1–52.

removable dose-divider clip is attached to the sprayer to administer 0.1 mL separately into each nostril. How concurrent administration of LAIV with other vaccines affects the safety or efficacy of either LAIV or the simultaneously administered vaccine has not been well studied, but general consensus is that inactivated or live vaccines can be administered simultaneously with LAIV. After administration of a live vaccine, at least 4 weeks should pass before another live vaccine is administered.

CURRENT RECOMMENDATIONS

Trivalent seasonal influenza immunization is recommended for all children aged 6 months through 18 years. Healthy children aged 2 through 18 years can receive either TIV or LAIV. Immunization efforts should continue to focus on

- Use of TIV (not LAIV) for all children and adolescents with underlying medical conditions that are associated with an increased risk for complications from influenza, including

- asthma or other chronic pulmonary diseases, including cystic fibrosis;
- hemodynamically significant cardiac disease;
- immunosuppressive disorders or therapy;
- HIV infection;
- sickle cell anemia and other hemoglobinopathies;
- diseases that require long-term aspirin therapy, including juvenile idiopathic arthritis or Kawasaki disease;
- chronic renal dysfunction;
- chronic metabolic disease, including diabetes mellitus; or
- any condition that can compromise respiratory function or handling of secretions or can increase the risk for aspiration, such as cognitive dysfunction, spinal cord injuries, seizure disorders, or other neuromuscular disorders.
- Household contacts and out-of-home care providers of children

younger than 5 years and children of all ages who are at risk. Young children are at serious risk of influenza infection, hospitalization, and complications. The risk of influenza-associated hospitalization of healthy children younger than 24 months has been shown to be equal to or greater than the risk in previously recognized high-risk groups. Children aged 24 through 59 months experience increased morbidity as a result of influenza illness, with increased rates of outpatient visits and antimicrobial agent use. Immunization of close contacts of children younger than 6 months is particularly important, because these infants are too young to be immunized. Healthy contacts 2 through 49 years of age can receive either TIV or LAIV.

- Any female who will be pregnant during influenza season (TIV only).
- Health care professionals.

In addition, immunization with either TIV or LAIV is recommended for the following people to prevent transmission

of influenza to those at risk, unless contraindicated:

- healthy contacts and caregivers of other children or adults at high risk of complications from influenza infection;
- close contacts of immunosuppressed people; and
- health care professionals or volunteers.

CONTRAINDICATIONS AND PRECAUTIONS

Minor illnesses, with or without fever, do not contraindicate the use of influenza vaccines, particularly among children with mild upper respiratory infection symptoms or allergic rhinitis.

Children Who Should Not Be Vaccinated With TIV

- those younger than 6 months;
- those who have a moderate-to-severe febrile illness;
- those who have a history of hypersensitivity, including anaphylaxis, to eggs, to any previous influenza vaccine dose, or to any of the vaccine components; and
- those who are known to have experienced Guillain-Barré syndrome (GBS) within 6 weeks after a previous influenza vaccination (whether influenza vaccination specifically might increase the risk for recurrence of GBS is unknown).

Children Who Should Not Be Vaccinated With LAIV

- those younger than 2 years;
- those who have a moderate-to-severe febrile illness;
- those who have received other live vaccines within the last 4 weeks (however, other live vaccines can be given on the same day as LAIV);
- those with asthma, reactive airways disease, or other chronic disorders

of the pulmonary or cardiovascular systems;

- those with underlying medical conditions, including metabolic disease such as diabetes mellitus, renal dysfunction, and hemoglobinopathies;
- those who have known or suspected immunodeficiency disease or are receiving immunosuppressive therapies;
- those who are receiving aspirin or other salicylates;
- those who are known to have experienced GBS within 6 weeks after a previous influenza vaccination (whether influenza vaccination specifically might increase the risk for recurrence of GBS is unknown);
- adolescents who are pregnant;
- those who have a history of hypersensitivity, including anaphylaxis, to eggs, to any previous influenza vaccine dose, or to any of its components; and
- those with any condition that can compromise respiratory function or handling of secretions or can increase the risk for aspiration, such as cognitive dysfunction, spinal cord injuries, seizure disorders, or other neuromuscular disorders.

PRECAUTIONS

LAIV is not recommended for children with a history of asthma. In the 2-through 4-year-old age group, there are children who have a history of wheezing with respiratory tract illnesses in whom reactive airways disease is diagnosed and in whom asthma may later be diagnosed. Therefore, because of the potential for increased wheezing after immunization, children younger than 5 years with recurrent wheezing or a wheezing episode in the past 12 months should not routinely receive LAIV.

When offering LAIV to children younger than 5 years, a clinician should screen

young children who might be at higher risk of asthma by asking parents/guardians of 2-, 3-, and 4-year-olds (24-through 59-month-olds) the question: “In the past 12 months, has a health care professional ever told you that your child had wheezing?” If the parents answer “yes” to this question, LAIV is not recommended for those children. TIV would be recommended for the child for whom LAIV is not given because of history of wheezing.

In addition, TIV is the trivalent seasonal influenza vaccine of choice for anyone in close contact with a person who is severely compromised (ie, in a protected environment). The preference of TIV over LAIV for these people is because of the theoretical risk of infection in an immunocompromised contact of an LAIV-immunized child. Available data indicate that both children and adults vaccinated with LAIV can shed vaccine virus after vaccination. As a precautionary measure, recently vaccinated people should restrict contact with severely immunocompromised patients (eg, hematopoietic stem cell transplant recipients during periods that require a protected environment) for 7 days after LAIV immunization, although there have been no reports of LAIV transmission from a vaccinated person to an immunocompromised person. No data exist on treatment of symptomatic LAIV infections in immunocompromised hosts.

Information about influenza surveillance is available through the Centers for Disease Control and Prevention (CDC) voice information system (influenza update, 888-232-3228) or at www.cdc.gov/flu.

USE OF ANTIVIRAL MEDICATIONS

Although current influenza-season data on circulating strains do not necessarily predict which, and in what proportion, strains will circulate in the

subsequent season, it is instructive to be aware of 2008–2009 influenza surveillance data and use them as a guide to empiric therapy until current seasonal data are available from the CDC. Information is posted weekly on the CDC Web site (www.cdc.gov/flu/weekly/fluactivity.htm). From the 2008–2009 season, roughly equal percentages of seasonal A H1N1, novel influenza A (H1N1) virus, and seasonal B influenza were reported, and seasonal A H3N2 was found less frequently.

Because of the complex resistance patterns of circulating influenza strains, empiric therapy of serious influenza-like illness during the influenza season depends on the availability of rapid testing for influenza A or B virus. Routine laboratory testing is not generally available to distinguish between strains of influenza A (eg, H1N1 seasonal, novel H1N1, and H3N2 seasonal) or to determine antiviral susceptibility.

- If no testing is available or performed, or if rapid testing results document influenza A and treatment is considered, both oseltamivir and an adamantane (amantadine or rimantadine) should be provided. Note that for children aged 7 years and older, zanamivir may be used as single-drug therapy, similar to past recommendations in the 2008–2009 season.
- If rapid testing results document influenza B infection, then either oseltamivir or zanamivir can be used as single-drug empiric therapy.
- If local or national influenza surveillance data indicate a predominance of a particular influenza strain with a known antiviral susceptibility profile, then empiric treatment can be directed toward that strain. For example, during the summer of 2009, more than 98% of influenza viruses tested were a novel influenza A (H1N1) virus. Treatment and chemoprophylaxis

recommendations from the CDC have indicated that either oseltamivir or zanamivir could be used. Novel influenza A (H1N1) virus is resistant to adamantane medications.

- The accuracy of rapid tests for novel influenza A (H1N1) virus has not been studied extensively. One report suggested a sensitivity of 50%.
- Current treatment guidelines (Tables 4 and 5) are applicable to infants and children documented to have infection caused by known seasonal strains or novel influenza A (H1N1) virus. The morbidity and mortality rates of the novel influenza A (H1N1) virus in the United States do not seem to be substantially different from seasonal influenza strains. Continuous monitoring of the epidemiology, change in severity, and resistance patterns of influenza strains may lead to new guidance.

Treatment should be considered for

- Influenza infection of any severity in children at high risk, regardless of immunization status.
- Any otherwise healthy child with influenza infection who may benefit from the decrease in duration of clinical symptoms documented to occur with therapy. Earlier treatment provides more optimal clinical responses. Dosages for antiviral agents for both treatment and chemoprophylaxis in children, including emergency-use dosing recommendations for oseltamivir in infants, can be found on the CDC Web site at www.cdc.gov/flu/professionals/antivirals/index.htm.

Clinical judgment is an important factor in treatment decisions. Antiviral treatment should be started as soon as possible after illness onset. Persons with suspected influenza who present with an uncomplicated febrile illness typically do not require

treatment unless they are at higher risk of influenza complications. In areas with limited antiviral medication availability, local public health authorities might provide additional guidance about diagnostic testing and prioritizing treatment within groups at higher risk of infection.

Recommendations for chemoprophylaxis when there is a seasonal influenza outbreak in a community remain unchanged. This applies to routine circumstances, but it should be noted that guidance may change on the basis of updated antiviral recommendations from the CDC in concert with antiviral availability and local resources.

- Children at high risk during the 2 weeks after influenza immunization
- Children at high risk for whom influenza vaccine is contraindicated
- Family members or health care providers who are unimmunized and are likely to have ongoing, close exposure to
 - unimmunized children at high risk; or
 - infants and toddlers who are younger than 24 months
- Control of influenza outbreaks for unimmunized staff and children in a closed institutional setting with high-risk pediatric residents (eg, extended-care facilities)
- As a supplement to immunization among children at high risk, including those who are immunocompromised and may not respond to vaccine
- Postexposure prophylaxis in a family setting
- Children at high risk and their family members and close contacts, as well as health care workers, when circulating strains of influenza virus in the community are not matched with trivalent seasonal influenza vaccine strains

TABLE 4 Recommended Dosage and Schedule of Influenza Antiviral Medications for Treatment and Chemoprophylaxis for the 2009–2010 Influenza Season: United States

Antiviral Agent	Age Group, y			
	1–6 ^a	7–9	10–12	13–21
Zanamivir	Treatment, influenza A and B Chemoprophylaxis, influenza A and B	NA ^b NA (ages 1–4)	10 mg (2 inhalations) twice daily 10 mg (2 inhalations) once daily (ages 5–9)	10 mg (2 inhalations) twice daily 10 mg (2 inhalations) once daily
Oseltamivir	Treatment, influenza A and B ^b Chemoprophylaxis, influenza A and B	Dose varies according to child's weight ^c Dose varies according to child's weight ^d	Dose varies according to child's weight ^c Dose varies according to child's weight ^d	Dose varies according to child's weight ^c Dose varies according to child's weight ^d
Amantadine ^e	Treatment, influenza A	5 mg/kg body weight per d up to 150 mg in 2 divided doses ^f	5 mg/kg body weight per d up to 150 mg in 2 divided doses ^f	100 mg twice daily
	Prophylaxis, influenza A	5 mg/kg body weight per d up to 150 mg in 2 divided doses ^f	5 mg/kg body weight per d up to 150 mg in 2 divided doses ^f	100 mg twice daily ^c
Rimantadine ^h	Treatment, influenza A ⁱ Prophylaxis, influenza A	NA 5 mg/kg body weight per d up to 150 mg in 2 divided doses ^f	NA 5 mg/kg body weight per d up to 150 mg in 2 divided doses ^f	100 mg twice daily ^{e,k} 100 mg twice daily ^c
Duration of treatment		Recommended duration for antiviral treatment is 5 d		
Duration of treatment		Recommended duration is 10 d when given after a household exposure and 5–7 d after last known exposure in other situations		
		For control of outbreaks in long-term care facilities and hospitals, the CDC recommends antiviral chemoprophylaxis for a minimum of 2 wk and up to 1 wk after the last known case was identified		

Zanamivir is manufactured by GlaxoSmithKline (Relenza [inhaled powder]) and is approved for treatment of persons 7 years and older and for chemoprophylaxis of persons 5 years and older. Zanamivir is administered through oral inhalation by using a plastic device included in the medication package. Patients will benefit from instruction and demonstration of the correct use of the device. Zanamivir is not recommended for persons with underlying airway disease. Oseltamivir is manufactured by Roche Pharmaceuticals (Tamiflu [tablet]) and is approved for treatment or chemoprophylaxis of persons aged 1 year and older. Amantadine manufacturers include Endo Pharmaceuticals (Symmetrel [tablet and syrup]), Geneva Pharms Tech (Amantadine HCl [capsule]), USL Pharma (Amantadine HCl [capsule and tablet]), and AlphaPharma, Carolina Medical, Copley Pharmaceutical, HiTech Pharma, Mikart, Morton Grove, and Pharmaceutical Associates (Amantadine HCl [syrup]), and Sandoz. Rimantadine is manufactured by Forest Laboratories (Flumadine [tablet and syrup]), CorePharma and Impax Labs (Rimantadine HCl [tablet]), and Amide Pharmaceuticals (Rimantadine HCl [tablet]). This information is based on data published by the FDA. NA indicates not applicable.

^a See Table 5 for information about the use of oseltamivir for infants younger than 1 year.

^b A reduction in the dose of oseltamivir is recommended for persons with creatinine clearance of <30 mL/minute.

^c The treatment dosing recommendation for children who weigh ≤15 kg is 30 mg twice a day. For children who weigh >15 kg and up to 23 kg, the dose is 45 mg twice a day. For children who weigh >23 kg and up to 40 kg, the dose is 60 mg twice a day. For children who weigh >40 kg, the dose is 75 mg twice a day.

^d The chemoprophylaxis dosing recommendation for children who weigh ≤15 kg is 30 mg once a day. For children who weigh >15 kg and up to 23 kg, the dose is 45 mg once a day. For children who weigh >23 kg and up to 40 kg, the dose is 60 mg once a day. For children who weigh >40 kg, the dose is 75 mg once a day.

^e The drug package insert should be consulted for dosage recommendations for administering amantadine to persons with creatinine clearance of ≤50 mL/minute per 1.73 m².

^f Amantadine or rimantadine syrup: 55 mg/kg body weight = 1 teaspoon/22 lb.

^g Children 10 years and older who weigh <40 kg should be administered amantadine or rimantadine at a dosage of 5 mg/kg per day.

^h A reduction in dosage to 100 mg/day of rimantadine is recommended for persons who have severe hepatic dysfunction or those with creatinine clearance of <10 mL/minute. Other persons with less severe hepatic or renal dysfunction taking 100 mg/day of rimantadine should be observed closely, and the dosage should be reduced or the drug discontinued, if necessary.

ⁱ Only approved by the FDA for treatment among adults.

^k Rimantadine is approved by the FDA for treatment of influenza A among adults. However, certain specialists in the management of influenza A consider rimantadine appropriate for treatment of influenza A among children. Studies that have evaluated the efficacy of amantadine and rimantadine in children are limited, but they have indicated that treatment with either drug diminishes the severity of influenza A infection when administered within 48 hours of illness onset. Data source: Centers for Disease Control and Prevention. Antiviral agents for the prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR*, 2009; In press.

TABLE 5 Oseltamivir Dosing Recommendations for Antiviral Treatment and Chemoprophylaxis of Children Younger Than 1 Year With Suspected or Confirmed Novel Influenza A (H1N1)

Age	Treatment Dose for 5 d	Chemoprophylaxis Dose for 10 d
<3 mo	12 mg twice daily	Not recommended unless situation judged critical because of limited data on use in this age group
3–5 mo	20 mg twice daily	20 mg once daily
6–11 mo	25 mg twice daily	25 mg once daily

This emergency-use authorization was issued by the FDA on April 28, 2009, for a period of 1 year and was intended for use as guidance to clinicians who were considering use of oseltamivir for preventing influenza in infants younger than 1 year. However, seasonal influenza A (H3N2) and B viruses have similar sensitivity to oseltamivir. As of June 2009, nearly all seasonal influenza A (H1N1) viruses were resistant to oseltamivir.

Data source: Centers for Disease Control and Prevention. Antiviral agents for the prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep*. 2009; In press.

Chemoprophylaxis should not be considered a substitute for immunization in most cases. However, the influenza antiviral medications currently licensed are important adjuncts to influenza immunization for control and prevention of influenza disease. Because of high rates of resistance to amantadine and rimantadine among influenza A (H3N2), novel influenza A (H1N1), and B strains and resistance to oseltamivir in seasonal influenza A (H1N1), recommendations for use of these drugs for chemoprophylaxis may vary according to location and season, depending on susceptibility patterns (Table 1). In addition, recommendations for chemoprophylaxis against novel influenza A (H1N1) virus are important to consider. No natural immunity existed for this virus in the pediatric population before the 2008–2009 influenza season, and no previously administered trivalent seasonal influenza vaccine provides protection against novel influenza A (H1N1) virus.

For recommendations about chemoprophylaxis and treatment against influenza, see Tables 4 and 5. Updates will be made on www.cdc.gov/flu/professionals/antivirals/index.htm or www.aapredbook.org/flu.

FUTURE NEEDS

Although expansion of the recommended age cohort of children for annual immunization can be seen as progress toward universal immuniza-

tion, the resulting increases in demand for vaccine and overall costs of coverage pose public health challenges that must be faced.

The CDC estimates that the new universal childhood influenza vaccination policy adds 30 million more children to be immunized. Manufacturers anticipate being able to provide adequate supplies of vaccine.

Efforts to build outreach and infrastructure are being created to ensure an optimal distribution of vaccine so that more people are immunized. Health care for children should be provided in the child's medical home. However, medical homes may have limited capacity to accommodate all patients who seek influenza immunization. Because of the increased demand for immunization during each influenza season, the AAP and the CDC have suggested providing the vaccine at any visit to the medical home during influenza season when it is not contraindicated or at specially arranged "shot-only" sessions and cooperating with community clinics, schools, and child care centers to provide influenza vaccine. If alternate venues are indeed used, a system of patient-record transfer is optimal to ensure maintenance of accurate immunization records. Immunization-information systems should be used whenever available.

Cost-effectiveness and logistic feasibility of vaccinating such a large segment

of the population continue to be legitimate concerns for many. As plans for immunization are made, particular attention is being paid to vaccine supply, distribution, implementation, and financing. Also, population-based studies from the 2008–2009 influenza season are being analyzed to determine the cost-effectiveness of universal expansion to this childhood age group. Potential benefits among recipients, their contacts, and the community of more widespread childhood immunization include fewer influenza cases, fewer outpatient visits and hospitalizations for influenza infection, and a decrease in the use of antimicrobial agents, absenteeism from school, and lost work time for parents.

Continued evaluation of the safety, immunogenicity, and effectiveness of LAIV for young children is important. Development of a safe, immunogenic vaccine for infants younger than 6 months also would be valuable. Consideration of how best to administer influenza vaccine to the parents of patients in the office is being explored. Lastly, efforts are being explored to improve the vaccine-development process to allow for a shorter interval between identification of vaccine strains to be included each year and vaccine production. This idea has been put to the test most recently with the novel influenza A (H1N1) virus strain pandemic outbreak, which began in Mexico in April 2009.

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IMPORTANT RESOURCES

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