American Academy of Pediatrics
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Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

POLICY STATEMENT

Recommendations for Prevention and Control of Influenza in Children, 2013–2014

COMMITTEE ON INFECTIOUS DISEASES

KEY WORDS
influenza, immunization, live-attenuated influenza vaccine, inactivated influenza vaccine, vaccine, children, pediatrics

ABBREVIATIONS
AAP—American Academy of Pediatrics
ccIIV3—trivalent cell culture-based inactivated influenza vaccine
CDC—Centers for Disease Control and Prevention
FDA—US Food and Drug Administration
ID—intradermal
IIV—inactivated influenza vaccine
IIV3—trivalent inactivated influenza vaccine
IIV4—quadrivalent inactivated influenza vaccine
IM—intramuscular
HCP—health care personnel
LAIV—live-attenuated influenza vaccine
LAIV3—trivalent live-attenuated influenza vaccine
LAIV4—quadrivalent live-attenuated influenza vaccine
PCV13—13-valent pneumococcal conjugate vaccine
pH1N1—influenza A (H1N1) pdm09 pandemic virus
RIV3—trivalent recombinant influenza vaccine

(Continued on last page)

abstract

FREE

The purpose of this statement is to update recommendations for routine use of seasonal influenza vaccine and antiviral medications for the prevention and treatment of influenza in children. Highlights for the upcoming 2013–2014 season include (1) this year's trivalent influenza vaccine contains an A/California/7/2009 (H1N1) pdm09-like virus (same as 2012–2013); an A/Texas/50/2012 (H3N2) virus (antigenically like the 2012–2013 strain); and a B/Massachusetts/2/2012-like virus (a B/Yamagata lineage like 2012–2013 but a different virus); (2) new quadrivalent influenza vaccines with an additional B virus (B/Brisbane/60/2008-like virus [B/Victoria lineage]) have been licensed by the US Food and Drug Administration; (3) annual universal influenza immunization is indicated with either a trivalent or quadrivalent vaccine (no preference); and (4) the dosing algorithm for administration of influenza vaccine to children 6 months through 8 years of age is unchanged from 2012–2013. As always, pediatricians, nurses, and all health care personnel should promote influenza vaccine use and infection control measures. In addition, pediatricians should promptly identify influenza infections to enable rapid antiviral treatment, when indicated, to reduce morbidity and mortality. *Pediatrics* 2013;132:e1089–e1104

INTRODUCTION

The American Academy of Pediatrics (AAP) recommends annual seasonal influenza immunization for all people, including *all* children and adolescents, 6 months of age and older during the 2013–2014 influenza season. In addition, special effort should be made to vaccinate people in the following groups:

- All children, including infants born preterm, who are 6 months of age and older with conditions that increase the risk of complications from influenza (eg, children with chronic medical conditions, such as asthma, diabetes mellitus, hemodynamically significant cardiac disease, immunosuppression, or neurologic and neurodevelopmental disorders)
- Children of American Indian/Alaskan Native heritage
- All household contacts and out-of-home care providers of
  - children with high-risk conditions; and
  - children younger than 5 years, especially infants younger than 6 months

- All health care personnel (HCP)
- All women who are pregnant, are considering pregnancy, have recently delivered, or are breastfeeding during the influenza season

KEY POINTS RELEVANT FOR THE 2013–2014 INFLUENZA SEASON

1. **Annual seasonal influenza vaccine is recommended for *all* people, including all children and adolescents, 6 months of age and older during the 2013–2014 influenza season.** It is important that household contacts and out-of-home care providers of children younger than 5 years, especially infants younger than 6 months and children of any age at high risk of complications of influenza (eg, children with chronic medical conditions, such as asthma, diabetes mellitus, hemodynamically significant cardiac disease, immunosuppression, or neurologic and neurodevelopmental disorders) receive annual influenza vaccine. In the United States, more than two-thirds of children younger than 6 years and almost all children 6 years and older spend significant time in child care and school settings outside the home. Exposure to groups of children increases the risk of contracting infectious diseases. Children younger than 2 years are at an increased risk of hospitalization and complications attributable to influenza. School-age children bear a large influenza disease burden and have a significantly higher chance of seeking influenza-related medical care compared with healthy adults. Therefore, reducing influenza virus transmission among children who attend child care or school has been shown to decrease the burden of childhood influenza and transmission of influenza virus to household contacts and community members of all ages.
2. The 2012–2013 influenza season was moderately severe, with a higher percentage of outpatient visits for influenza-like illness, higher rates of hospitalization, and more deaths attributed to pneumonia and influenza compared with the 2011–2012 influenza season. As of August 10, 2013, 158 laboratory-confirmed influenza-associated pediatric deaths were reported to the Centers for Disease Control and Prevention (CDC) during the 2012–2013 influenza season. Influenza A (H3N2) viruses predominated overall, but influenza B viruses and, to a lesser extent, A (H1N1) pdm09 (pH1N1) viruses also were reported in the United States. Eighty-two of the 158 deaths were associated with influenza B viruses, 32 deaths were associated with influenza A (H3) viruses, and 4 deaths were associated with pH1N1 viruses. Thirty-seven deaths were associated with an influenza A virus for which the subtype was not determined, 1 death was associated with an undetermined type of influenza virus, and 2 deaths were associated with both influenza A and B viruses. The majority of pediatric deaths were among children who had not been immunized against influenza. Among children hospitalized with influenza and for whom medical chart data were available, approximately 44% did not have any recorded underlying condition, whereas 23% had underlying asthma or reactive airway disease (Fig 1). Although children with certain conditions are at higher risk of complications, substantial proportions of seasonal influenza morbidity and mortality occur among healthy children.
3. Both trivalent and quadrivalent influenza vaccines are licensed and available in the United States for the 2013–2014 season. Neither vaccine formulation is preferred over the other. The trivalent vaccine contains an A/California/7/2009 (H1N1) pdm09-like virus (same as 2012–2013), an A/Texas/50/2012 (H3N2) virus (antigenically like the 2012–2013 strain), and a B/Massachusetts/2/2012-like virus (a B/Yamagata lineage like 2012-2013 but a different virus). The new quadrivalent influenza vaccines include an additional B virus (B/Brisbane/60/2008-like virus [B/Victoria lineage]). In addition, 2 trivalent influenza vaccines manufactured using new technologies that do not use eggs will also be available during the 2013–2014 season: cell culture-based inactivated influenza vaccine (ccIIV3) and recombinant influenza vaccine (RIV3).
4. The number of seasonal influenza vaccine doses to be administered in the 2013–2014 influenza season depends on the child's age at the time of the first administered dose and his or her vaccine history (Fig 2):
   - Influenza vaccines are not licensed for administration to infants younger than 6 months of age.
   - Children 9 years and older need only 1 dose.
   - Children 6 months through 8 years of age receiving the seasonal influenza vaccine for the first time should receive a second dose this season at least 4 weeks after the first dose.
   - Children 6 months through 8 years of age who received seasonal influenza vaccine before the 2013–2014 influenza season
     - need only 1 dose of vaccine, if they previously received 2 or more doses of seasonal vaccine since July 1, 2010.
     - need 2 doses of vaccine, if they have not previously received 2 or more doses of seasonal vaccine since July 1, 2010.

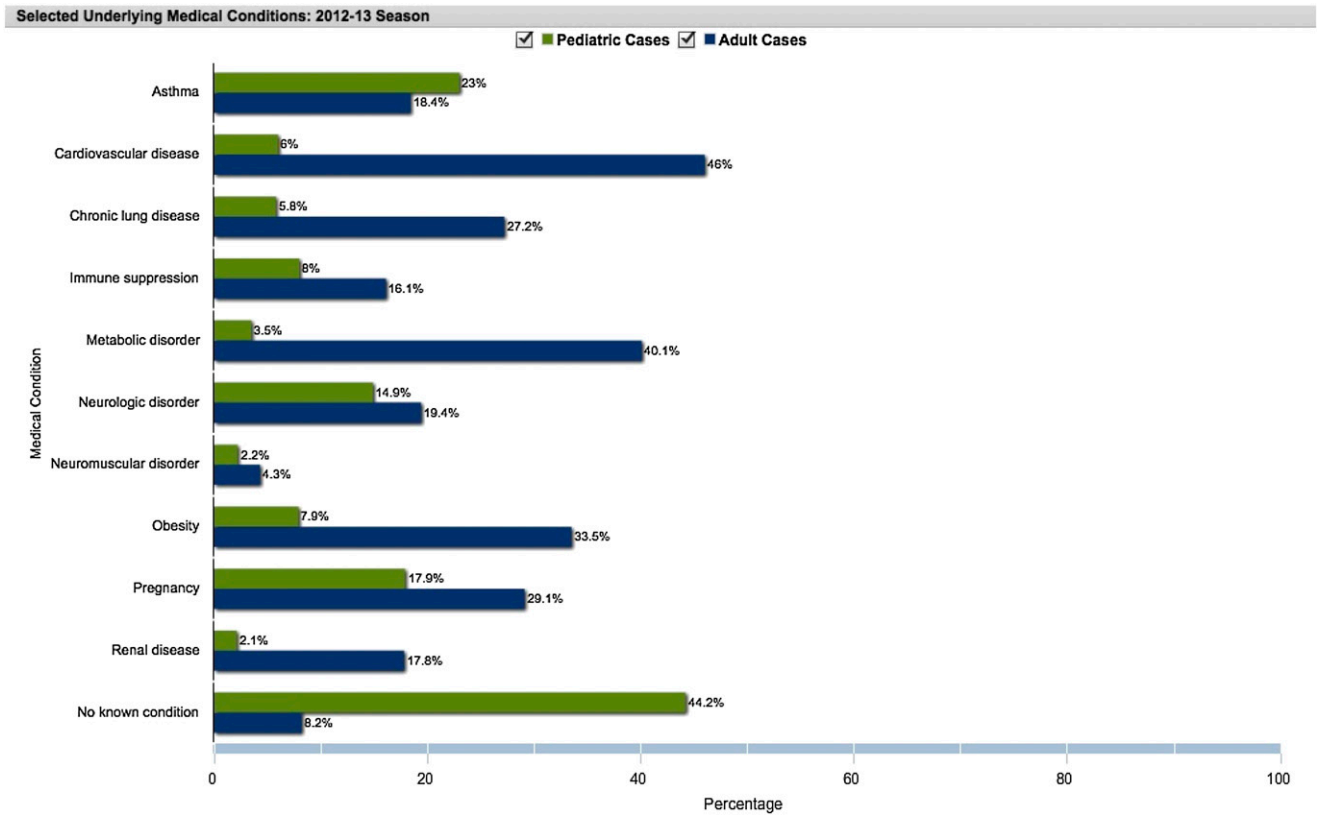

FIGURE 1

Selected underlying medical conditions in patients hospitalized with influenza, FluSurv-NET 2012–2013. Source: Centers for Disease Control and Prevention. FluView 2012–2013 Preliminary Data as of August 10, 2013. Available at: http://gis.cdc.gov/grasp/fluview/FluHospChars.html. FluSurv-NET data are preliminary and displayed as they become available. Therefore, figures are based on varying denominators because some variables represent information that may require more time to be collected. Data are refreshed and updated weekly. Asthma includes a medical diagnosis of asthma or reactive airway disease. Cardiovascular disease includes include conditions such as coronary heart disease, cardiac valve disorders, congestive heart failure, pulmonary hypertension, and aortic stenosis. It does not include hypertension disease only. Chronic lung disease includes conditions such as bronchitis obliterans, chronic aspiration pneumonia, and interstitial lung disease. Immune suppression includes conditions such as immunoglobulin deficiency, leukemia, lymphoma, HIV/AIDS, and individuals taking immunosuppression medications. Metabolic disorder includes conditions such as diabetes mellitus, thyroid dysfunction, adrenal insufficiency, and liver disease. Neurologic disorder includes conditions such as seizure disorders, cerebral palsy, and cognitive dysfunction. Neuromuscular disorder includes conditions such as multiple sclerosis and muscular dystrophy. Obesity was assigned if indicated in patients' medical chart or if BMI was >30. Pregnancy percentage was calculated using number of female cases aged between 15 and 44 years as the denominator. Renal disease includes conditions such as acute or chronic renal failure, nephrotic syndrome, glomerulonephritis, and impaired creatinine clearance. No known condition indicates that the case did not have any known underlying medical condition indicated in the medical chart at the time of hospitalization.

- need only 1 dose of influenza vaccine if there is clear documentation of having received at least 2 seasonal influenza vaccines from any previous season and at least 1 dose of a pH1N1-containing vaccine, which could have been in 1 of the seasonal vaccines (2010–2011, 2011–2012, or 2012–2013) or as the monovalent pH1N1 vaccine from 2009–2010.

Vaccination should not be delayed to obtain a specific product for either dose. Any available, age-appropriate trivalent or quadrivalent vaccine can be used. A child who receives only 1 of the 2 doses as a quadrivalent formulation is likely to be less primed against the additional B virus.

5. Pediatric offices should consider serving as alternate venues for providing influenza immunization to parents and other adults who care for children, if this approach is acceptable to both the pediatrician and the adult to be immunized.[1] There are important medical liability issues and medical record documentation requirements that need to be addressed before a pediatrician begins immunizing adults (see details at www.aapredbook.org/implementation). Pediatricians are reminded to document the recommendation for adult immunization in the vulnerable child's medical record. In addition, adults should still be encouraged to have a medical home and communicate their immunization status to their primary care provider. Immunization of close contacts of children at high risk of influenza-related complications is

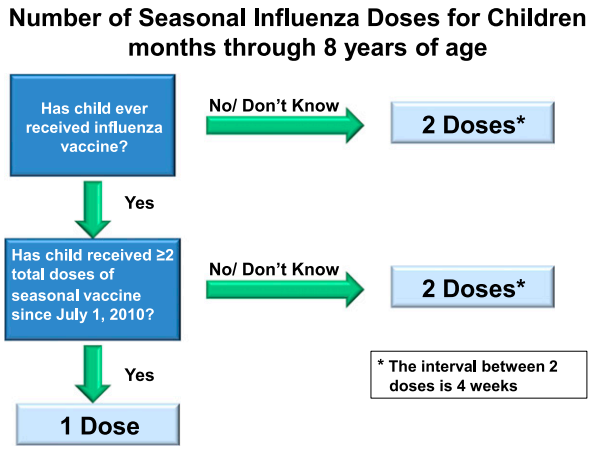

FIGURE 2
Number of 2013–2014 seasonal influenza vaccine doses for children 6 months through 8 years of age.

intended to reduce their risk of contagion (ie, "cocooning"). The concept of cocooning is particularly important to help protect infants younger than 6 months, because they are too young to be immunized with influenza vaccine. Infants younger than 6 months of age can also be protected through vaccination of their mothers during pregnancy with transplacental transfer of antibodies. The risk of influenza-associated hospitalization in healthy children aged younger than 24 months has been shown to be greater than the risk of hospitalization in previously recognized high-risk groups, such as the elderly, during influenza season. Children 24 through 59 months of age have shown increased rates of outpatient visits and antimicrobial use associated with influenza-like illnesses.

6. As soon as the seasonal influenza vaccine is available locally, HCP should be immunized, parents and caregivers should be notified about vaccine availability, and immunization of all children 6 months and older, especially children at high risk of complications from influenza, should begin. HCP endorsement plays a major role in vaccine uptake. A strong correlation exists between HCP endorsement of influenza vaccine and patient acceptance.[2] Prompt initiation of influenza immunization and continuance of immunization throughout the influenza season, whether or not influenza is circulating (or has circulated) in the community, are critical components of an effective immunization strategy. Giving the vaccine promptly and early during the influenza season is not felt to pose a significant risk that immunity might wane before the end of the season. The seasonal vaccine is not perfect, but it still is the best strategy available for preventing illness from influenza. It is moderately effective in reducing the risk for outpatient medical visits caused by circulating influenza viruses by approximately one-half to two-thirds in most people. Even a moderately effective influenza vaccine has been shown to reduce illness, antibiotic use, doctor visits, time lost from work, hospitalizations, and deaths.
7. Providers should continue to offer vaccine until the vaccine expiration date because influenza is unpredictable. Protective immune responses persist throughout the influenza season, which can have >1 disease peak and often extends into March or later. Although most influenza activity in the United States tends to occur in January through March, influenza activity can occur in early fall (ie, October and November) or late spring (eg, influenza circulated through the third week in May during the 2012–2013 season). This approach also provides ample opportunity to administer a second dose of vaccine because children aged <9 years may require 2 doses to confer optimal protection. In addition, with international travel so common, there is potential exposure to influenza at virtually all times of the year.
8. HCP, influenza campaign organizers, and public health agencies should collaborate to develop improved strategies for planning, communication, and administration of vaccines.
   - Plan to make seasonal influenza vaccine easily accessible for all children. Examples include creating walk-in influenza clinics; extending hours beyond routine times during peak vaccination periods; administering influenza vaccine during both well and sick visits; considering how to immunize parents, adult caregivers, and siblings at the same time in the same office setting as children[1]; and working with other institutions (eg, schools, child-care centers, and religious organizations) or alternative care sites, such as emergency departments, to expand venues for administering vaccine. If a child or adult receives influenza vaccine outside of his or her medical home, such as at a pharmacy or other retail-based clinic, appropriate documentation of immunization

must be provided to the medical home.

- Concerted efforts among the aforementioned groups, plus vaccine manufacturers, distributors, and payers, also are necessary to prioritize distribution appropriately to the primary care office setting and patient-centered medical home before other venues, especially when vaccine supplies are delayed or limited.
- Vaccine safety, effectiveness, and indications must be properly communicated to the public. HCP should act as role models by receiving influenza immunization annually as well as recommending annual immunizations to both colleagues and patients. Influenza immunization programs for HCP benefit the health of employees, their patients, and members of the community.[2] Beginning in 2012, as an immunization core measure, the Centers for Medicare and Medicaid Services, the US federal agency that administers Medicare, Medicaid, and the State Children's Health Insurance Program, began requiring hospitals and certain other inpatient facilities to screen for a history of influenza vaccination and to administer influence vaccine to all unimmunized hospitalized patients 6 months and older between October and March unless contraindicated or the patient or family refuses.

9. Antiviral medications also are important in the control of influenza but are not a substitute for influenza immunization. The neuraminidase inhibitors oral oseltamivir (Tamiflu; Roche Laboratories, Nutley, NJ) and inhaled zanamivir (Relenza; GlaxoSmithKline, Research Triangle Park, NC) are the only antiviral medications routinely recommended for chemoprophylaxis or treatment of influenza during the 2013–2014 season. Intravenous preparations of oseltamivir, zanamivir, and peramivir are not currently approved by the US Food and Drug Administration (FDA) and are not routinely available. However, with consultation with infectious diseases specialists, experimental intravenous antiviral medications could be considered for some critically ill children, especially those who are immunocompromised. Recent viral surveillance and resistance data indicate that the majority of currently circulating influenza viruses likely to cause 2013–2014 seasonal influenza in North America continue to be sensitive to oseltamivir and zanamivir. In contrast, amantadine and rimantadine should not be used because circulating influenza A viruses have sustained high levels of resistance to these drugs, and they are not effective against influenza B viruses. Resistance characteristics may change rapidly; pediatricians should verify susceptibility data at the start of the influenza season and monitor it during the season. Up-to-date information can be found on the AAP Web site (www.aap.org or www.aapredbook.org/flu), through state-specific AAP chapter Web sites, or on the CDC Web site (www.cdc.gov/flu/index.htm).

SEASONAL INFLUENZA VACCINES

During previous influenza seasons, only trivalent influenza vaccines that included antigen from 1 influenza B virus were available. However, since 1985, 2 antigenically distinct lineages (ie, Victoria or Yamagata) of influenza B viruses have circulated globally. In most years, vaccination against a B virus of 1 lineage confers little cross-protection against a B virus strain from the other lineage. Thus, trivalent vaccines offer limited immunity against circulating influenza B strains of the lineage not present in the vaccine. Furthermore, in recent years, it has proven difficult to consistently predict which B lineage will predominate during a given influenza season. Therefore, a quadrivalent influenza vaccine with influenza B strains of both lineages may offer improved protection. Postmarketing safety and vaccine effectiveness data are not yet available, prohibiting a full risk-benefit analysis of newer versus previously available products.

For the 2013–2014 season, the inactivated influenza vaccines (IIVs) will be available for intramuscular (IM) injection in both trivalent (IIV3) and quadrivalent (IIV4) formulations. Note that the abbreviation IIV has replaced TIV (trivalent inactivated influenza vaccine) because inactivated influenza vaccines now contain either 3 or 4 virus strains. The intranasally administered live-attenuated influenza vaccine (LAIV) will be available only in a quadrivalent formulation (LAIV4). IIV4 and LAIV4 will contain the identical influenza strains anticipated to circulate during the 2013–2014 influenza season.

IIVs contain no live virus. IIV3 formulations are now available for IM and intradermal (ID) use. The IM formulation of IIV3 is licensed and recommended for children 6 months of age and older and adults, including people with and without chronic medical conditions. The most common adverse events after IIV administration are local injection site pain and tenderness. Fever may occur within 24 hours after immunization in approximately 10% to 35% of children younger than 2 years but rarely in older children and adults. Mild systemic symptoms, such as nausea, lethargy, headache, muscle

aches, and chills, may occur after administration of IIV3.

An ID formulation of IIV3 is licensed for use in people 18 through 64 years of age. ID vaccine administration involves a microinjection with a shorter needle than needles used for IM administration. The most common adverse events are redness, induration, swelling, pain, and itching, which occur at the site of administration; although all adverse events occur at a slightly higher rate with the IM formulation of IIV3, the rate of pain was similar between ID and IM. Headache, myalgia, and malaise may occur and tend to occur at the same rate as that with the IM formulation of IIV3. There is no preference for IM or ID immunization with IIV3 in people 18 years or older. Therefore, pediatricians may choose to use either the IM or ID product in their late adolescent and young adult patients as well as for any adults they may be vaccinating (ie, as part of a cocooning strategy).

IIV4 is available in IM but not ID formulations. One formulation is licensed for use in children as young as 6 months of age. In children, the most common injection site adverse reactions were pain, redness, and swelling. The most common systemic adverse events were drowsiness, irritability, loss of appetite, fatigue, muscle aches, headache, arthralgia, and gastrointestinal tract symptoms. These events were reported with comparable frequency among participants receiving the licensed comparator trivalent vaccines. IIV4 is an acceptable alternative to other approved vaccines indicated for persons 6 months or older when otherwise appropriate and may offer greater protection than IIV3. The relative quantity of doses of IIV4 that will be available is not certain and likely to be limited.

During the 2010–2011 and 2011–2012 influenza seasons, increased reports of febrile seizures in the United States were noted by the Vaccine Adverse Event Reporting System and were associated with IIV3 manufactured by Sanofi Pasteur (Fluzone), mainly in children in the 12- through 23-month age group (the peak age for febrile seizures). The most common vaccine administered concomitantly with IIV3 when a febrile seizure was reported was the 13-valent pneumococcal conjugate vaccine (PCV13). This disproportionate reporting of febrile seizures did not persist through the most recent 2012–2013 influenza season. On the basis of these data, simultaneous administration of IIV and PCV13 for the 2013–2014 influenza season continues to be recommended when both vaccines are indicated.

LAIV4 is a quadrivalent live-attenuated influenza vaccine that is administered intranasally and replaces the previous trivalent formulation of LAIV (LAIV3). It is licensed by the FDA for previously healthy people aged 2 through 49 years. It is not recommended for people with a history of asthma, diabetes mellitus, or other high-risk medical conditions associated with an increased risk of complications from influenza (see Contraindications and Precautions). LAIV4 has a similar safety profile to that of LAIV3. The most commonly reported reactions in children were runny nose/nasal congestion, headache, decreased activity/lethargy, and sore throat. LAIV should not be administered to people with notable nasal congestion that would impede vaccine delivery.

Two trivalent influenza vaccines manufactured using new technologies that do not use eggs will also be available for people 18 years or older during the 2013–2014 season: ccIIV3 and recombinant influenza vaccine (RIV3). These manufacturing methods are beneficial because they would be expected to permit a more rapid scale up of vaccine production when needed, such as during a pandemic.

ccIIV3 is a trivalent cell culture–based inactivated influenza vaccine indicated for people 18 years or older, administered as an IM injection. ccIIV3 has comparable immunogenicity to US-licensed comparator vaccines. Although ccIIV3 is manufactured from virus propagated in Madin Darby Canine Kidney cells rather than embryonated eggs, before production, seed virus is created using the World Health Organization reference virus strains that have been passaged in eggs. However, egg protein is not detectable in the final vaccine, and egg allergy is not mentioned in the package insert. Contraindications are similar to those for other IIVs. The most common solicited adverse reactions included injection site pain, erythema at the injection site, headache, fatigue, myalgia, and malaise.

RIV3 is a recombinant hemagglutinin vaccine. It is indicated for people 18 through 49 years of age and is administered via IM injection. The most frequently reported adverse events were pain, headache, myalgia, and fatigue.

Tables 1 and 2 summarize information on the types of 2013–2014 seasonal influenza vaccines licensed for immunization of children and adults. With the addition of 5 newly licensed vaccines, it is likely that more than 1 type or brand of vaccine may be appropriate for vaccine recipients. However, no preferential recommendation is made for use of any influenza vaccine product over another. Vaccination should not be delayed to obtain a specific product.

A large body of scientific evidence demonstrates that thimerosal-containing vaccines are not associated with increased risk of autism spectrum disorders in children. As such, the AAP extends its strongest support to the recent World Health Organization recommendations to retain the use of thimerosal in the global vaccine supply.

Some people may still raise concerns about the minute amounts of thimerosal in IIV vaccines, and in some states, there is a legislated restriction on the use of thimerosal-containing vaccines. The benefits of protecting children against the known risks of influenza are clear. Therefore, children should receive any available formulation of IIV rather than delaying immunization while waiting for vaccines with reduced-thimerosal content or thimerosal-free vaccine. Although some formulations of IIV contain only a trace amount of thimerosal, certain types can be obtained thimerosal free. LAIV does not contain thimerosal. Vaccine manufacturers are delivering increasing amounts of thimerosal-free influenza vaccine each year.

INFLUENZA VACCINES AND EGG ALLERGY

Almost all IIV and LAIV are produced in eggs and contain measurable amounts of egg protein, expressed as the concentration of ovalbumin per dose. However, recent data have shown that IIV administered in a single, age-appropriate dose is well tolerated by virtually all recipients who have egg allergy. More conservative approaches, such as skin testing or a 2-step graded challenge, are no longer recommended. No data exist on the safety of administering LAIV to egg-allergic recipients.

As a precaution, pediatricians should continue to determine whether the presumed egg allergy is based on a mild (ie, hives alone) or severe (ie, anaphylaxis involving cardiovascular changes, respiratory and/or gastrointestinal tract symptoms, or reactions that required the use of epinephrine) reaction. Pediatricians should consult with an allergist for children with a history of severe reaction. Most vaccine administration to individuals with egg allergy can happen without the need for referral. Data indicate that approximately 1% of children have immunoglobulin E-mediated sensitivity to egg, and of those, a rare minority has a severe allergy.

Standard immunization practice should include the ability to respond to acute hypersensitivity reactions. Therefore, influenza vaccine should be given to people with egg allergy with the following preconditions (Fig 3):

TABLE 1 Recommended Seasonal Influenza Vaccines for Different Age Groups: United States, 2013–2014 Influenza Season

Vaccine	Trade Name	Manufacturer	Presentation	Thimerosal Mercury Content[a]	Age Group
Inactivated					
IIV3	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
IIV3	Fluzone Intradermal	Sanofi Pasteur	0.1-mL prefilled microinjection	0	18–64 y
IIV3	Fluzone HD	Sanofi Pasteur	0.5-mL prefilled syringe	0	≥65 y
IIV3	Fluvirin	Novartis	0.5-mL prefilled syringe	≤1.0	≥4 y
			5.0-mL multidose vial	25	≥4 y
IIV3	Agriflu	Novartis	0.5-mL prefilled syringe	0	≥18 y
IIV3	Fluarix	GlaxoSmithKline	0.5-mL prefilled syringe	0	≥36 mo
IIV3	FluLaval	ID Biomedical Corporation of Quebec (distributed by GlaxoSmithKline)	5.0-mL multidose vial	25	≥3 y
IIV3	Afluria	CSL Biotherapies (distributed by Merck)	0.5-mL prefilled syringe	0	≥9 y[b]
			5-mL multidose vial	24.5	≥9 y[b]
ccIIV3	Flucelvax	Novartis Vaccines	0.5-mL prefilled syringe	0	≥18 y
IIV4	Fluzone Quadrivalent	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
IIV4	Fluarix Quadrivalent	GlaxoSmithKline	0.5-mL prefilled syringe	0	≥36 mo
IIV4	FluLaval Quadrivalent	ID Biomedical Corporation of Quebec (distributed by GlaxoSmithKline)	5.0-mL multidose vial	25	≥3 y
Recombinant					
RIV3	FluBlok	Protein Sciences	0.5-mL vial	0	18–49 y
Live-attenuated					
LAIV4	FluMist Quadrivalent	MedImmune	0.2-mL sprayer	0	2–49 y

Data sources: American Academy of Pediatrics, Committee on Infectious Diseases. Recommendations for prevention and control of influenza in children, 2012–2013. *Pediatrics.* 2012;130(4):780–792; Centers for Disease Control and Prevention. Prevention and control of influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices (ACIP)—United States, 2012–13 influenza season. *MMWR Morb Mortal Wkly Rep.* 2012;61(32):613–618; and Centers for Disease Control and Prevention. Prevention and control of influenza with vaccines: interim recommendations of the Advisory Committee on Immunization Practices (ACIP), 2013. *MMWR Morb Mortal Wkly Rep.* 2013;62(18):356.

[a] Microgram of Hg/0.5-mL dose.

[b] Age indication per package insert is ≥5 y; however, the Advisory Committee on Immunization Practices recommends Afluria not be used in children 6 months through 8 years of age because of increased reports of febrile reactions noted in this age group. If no other age-appropriate, licensed, inactivated seasonal influenza vaccine is available for a child 5 through 8 years of age who has a medical condition that increases the child's risk of influenza complications, Afluria can be used; however, pediatricians should discuss with the parents or caregivers the benefits and risks of influenza vaccination with Afluria before administering this vaccine.

TABLE 2 LAIV4 Compared With IIV3 and IIV4

Vaccine Characteristic	LAIV4	IIV3	IIV4
Route of administration	Intranasal spray	IM or ID injection[a]	IM injection[a]
Type of vaccine	Live virus	Killed virus	Killed virus
Product	Attenuated, cold-adapted	Inactivated subvirion or surface antigen	Inactivated subvirion or surface antigen
No. of included virus strains	4 (2 influenza A, 2 influenza B)	3 (2 influenza A, 1 influenza B)	4 (2 influenza A, 2 influenza B)
Vaccine virus strains updated	Annually	Annually	Annually
Frequency of administration[b]	Annually	Annually	Annually
Approved age groups	All healthy people aged 2–49 y	All people aged ≥6 mo (ID 18–64 y)	All people aged ≥6 mo
Interval between 2 doses in children	4 wk	4 wk	4 wk
Can be given to people with medical risk factors for influenza-related complications?	No	Yes	Yes
Can be given to children with asthma or children aged 2–4 y with wheezing in the previous year?	No[c]	Yes	Yes
Can be simultaneously administered with other vaccines?	Yes[d]	Yes[d]	Yes[d]
If not simultaneously administered, can be administered within 4 wk of another live vaccine?	No, prudent to space 4 wk apart	Yes	Yes
Can be administered within 4 wk of an inactivated vaccine?	Yes	Yes	Yes

Data sources: American Academy of Pediatrics, Committee on Infectious Diseases. Recommendations for prevention and control of influenza in children, 2012–2013. *Pediatrics*. 2012;130(4):780–792; Centers for Disease Control and Prevention. Prevention and control of influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices (ACIP)—United States, 2012–13 influenza season. *MMWR Morb Mortal Wkly Rep*. 2012;61(32):613–618; and Centers for Disease Control and Prevention. Prevention and control of influenza with vaccines: interim recommendations of the Advisory Committee on Immunization Practices (ACIP), 2013. *MMWR Morb Mortal Wkly Rep*. 2013;62(18):356.

[a] The preferred site of IIV intramuscular injection for infants and young children is the anterolateral aspect of the thigh.

[b] See Fig 2 for decision algorithm to determine number of doses of seasonal influenza vaccine recommended for children during the 2013–2014 influenza season.

[c] LAIV4 is not recommended for children with a history of asthma. In the 2- through 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 2 through 4 years of age with recurrent wheezing or a wheezing episode in the previous 12 months should not receive LAIV4. When offering LAIV4 to children in this age group, a pediatrician should screen those who might be at higher risk of asthma by asking the parents/guardians of 2-, 3-, and 4-year-olds (24- through 59-month-olds) the question: "In the previous 12 months, has a health care professional ever told you that your child had wheezing?" If the parents answer yes to this question, LAIV4 is not recommended for these children.

[d] LAIV4 coadministration has been evaluated systematically only among children 12 to 15 months of age with measles-mumps-rubella and varicella vaccines. IIV coadministration has been evaluated systematically only among adults with pneumococcal polysaccharide and zoster vaccines.

- Appropriate resuscitative equipment must be readily available.[3]
- The vaccine recipient should be observed in the office for 30 minutes after immunization, the standard observation time for receiving immunotherapy.

Providers may consider use of ccIIV3 or RIV3 vaccines produced via non-egg-based technologies for adults with egg allergy in settings in which these vaccines are available and otherwise age appropriate. Because there is no known safe threshold for ovalbumin content in vaccines, ccIIV3, which does contain trace amounts of ovalbumin, should be administered according to the guidance for other IIVs (Fig 3). In contrast, RIV3, which contains no ovalbumin, may be administered to people with egg allergy of any severity who are 18 through 49 years of age and do not have other contraindications. However, vaccination of individuals with mild egg allergy should not be delayed if RIV3 or ccIIV3 are not available. Instead, any licensed, age-appropriate IIV should be used.

VACCINE STORAGE AND ADMINISTRATION

The AAP Storage and Handling Tip Sheet provides resources for practices to develop comprehensive vaccine management protocols to keep their vaccine supply safe during a power failure or other disaster (www2.aap.org/immunization/pediatricians/pdf/DisasterPlanning.pdf). Any of the influenza vaccines can be administered at the same visit with all other recommended routine vaccines.

IM Vaccine

The IM formulation of IIV is shipped and stored at 2°C to 8°C (35°F–46°F). It is administered intramuscularly into the anterolateral thigh of infants and young children and into the deltoid muscle of older children and adults. The volume of vaccine is age dependent; infants and toddlers 6 months through 35 months of age should receive a dose of 0.25 mL, and all people 3 years (36 months) and older should receive 0.5 mL/dose.

ID Vaccine

The ID formulation of IIV is also shipped and stored at 2°C to 8°C (35°F–46°F). It is administered intradermally only to people 18 through 64 years of age, preferably over the deltoid muscle, and only using the device included in the vaccine package. Vaccine is supplied in a single-dose, prefilled microinjection system (0.1 mL) for adults. The package insert should be reviewed for full administration details of this product.

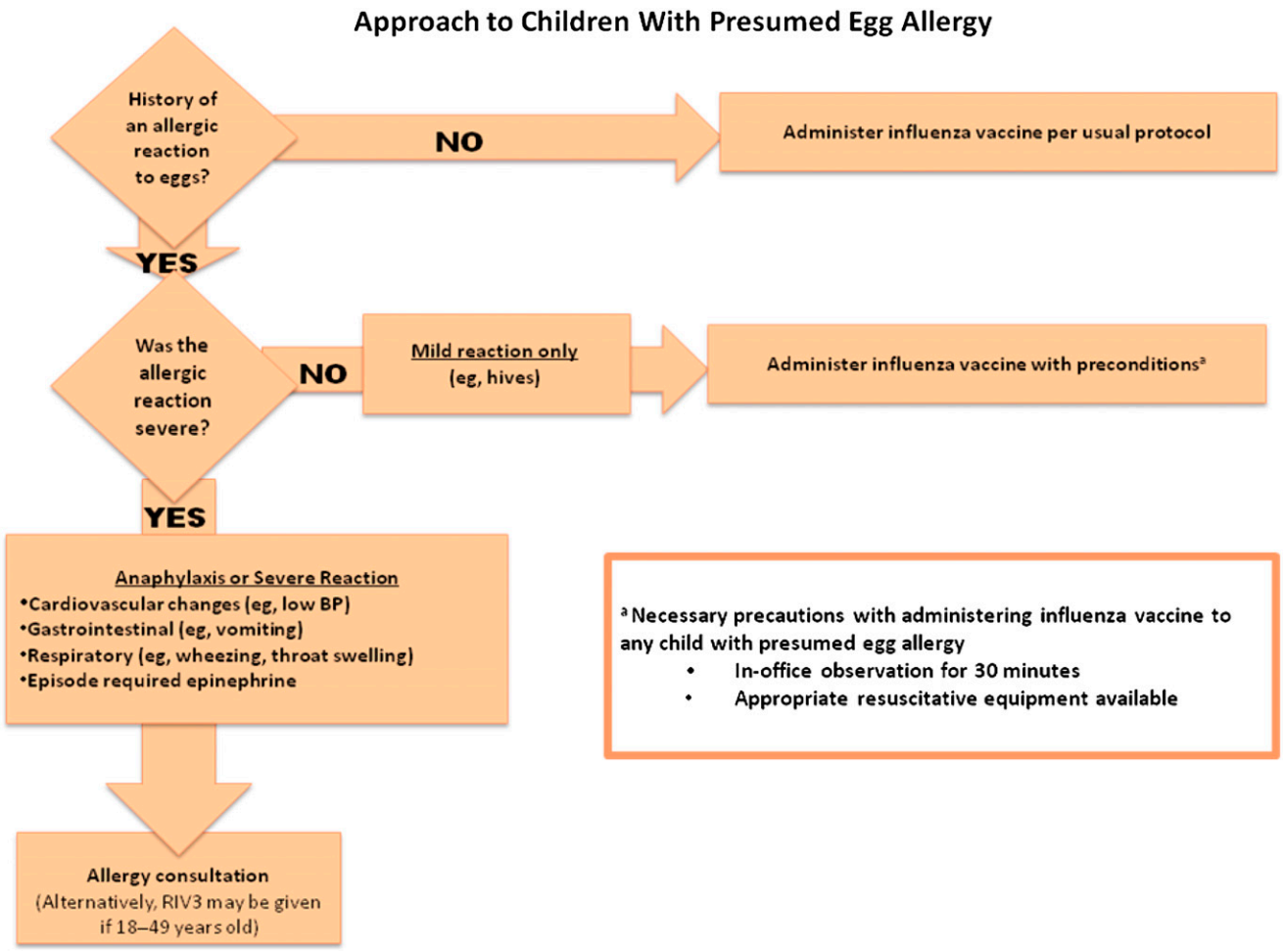

FIGURE 3
Precautions for administering IIV to presumed egg-allergic individuals. BP, blood pressure.

Live-Attenuated (Intranasal) Vaccine

The cold-adapted, temperature sensitive LAIV formulation currently licensed in the United States must be shipped and stored at 2°C to 8°C (35°F–46°F) and administered intranasally in a prefilled, single-use sprayer containing 0.2 mL of vaccine. A removable dose-divider clip is attached to the sprayer to administer 0.1 mL separately into each nostril. After administration of any live-virus vaccine, at least 4 weeks should pass before another live-virus vaccine is administered.

CURRENT RECOMMENDATIONS

Seasonal influenza immunization is recommended for all children 6 months and older. Healthy children 2 years and older can receive either IIV or LAIV. Particular focus should be on the administration of IIV for all children and adolescents with underlying medical conditions associated with an increased risk of complications from influenza, including the following:

- 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
- Any condition that can compromise respiratory function or handling of secretions or can increase the risk of aspiration, such as neurodevelopmental disorders, spinal cord injuries, seizure disorders, or neuromuscular abnormalities.

Although universal immunization for all people 6 months and older is recommended for the 2013–2014 influenza season, particular immunization

efforts with either IIV or LAIV should be made for the following groups to prevent transmission of influenza to those at risk, unless contraindicated:

- Household contacts and out-of-home care providers of children younger than 5 years of age and at-risk children of all ages (healthy contacts 2 through 49 years of age can receive either IIV or LAIV).
- Any woman who is pregnant, is considering pregnancy, has recently delivered, or is breastfeeding during the influenza season (IIV only). Studies have shown that infants born to immunized women have better influenza-related health outcomes. However, according to Internet panel surveys conducted by the CDC, only 47% of pregnant women reported receiving an influenza vaccine during the 2011–2012 season, even though both pregnant women and their infants are at higher risk of complications. In addition, data from some studies suggest that influenza vaccination in pregnancy may decrease the risk of preterm birth as well as giving birth to infants who are small for gestational age. Pregnant women can safely receive the influenza vaccine during any trimester.
- Children and adolescents of American Indian/Alaskan Native heritage.
- HCP or health care volunteers. Despite the recent AAP recommendation for mandatory influenza immunization for all HCP,[2] many HCP remain unvaccinated. As of November 2012, the CDC estimated that only 62.9% of HCP received the seasonal influenza vaccine. The AAP recommends mandatory vaccination of HCP, because they frequently come into contact with patients at high risk of influenza illness in their clinical settings.
- Close contacts of immunosuppressed people.

CONTRAINDICATIONS AND PRECAUTIONS

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

Children Who Should Not Be Vaccinated With IIV

- Infants younger than 6 months.
- Children who have a moderate-to-severe febrile illness on the basis of clinical judgment of the clinician.

Children Who Should Not Be Vaccinated With LAIV

- Children younger than 2 years.
- Children who have a moderate-to-severe febrile illness.
- Children with an amount of nasal congestion that would notably impede vaccine delivery.
- Children with chronic underlying medical conditions, including metabolic disease, diabetes mellitus, asthma, other chronic disorders of the pulmonary or cardiovascular systems, renal dysfunction, or hemoglobinopathies.
- Children 2 through 4 years of age with a history of recurrent wheezing or a medically attended wheezing episode in the previous 12 months because of the potential for increased wheezing after immunization. In this age range, many children have a history of wheezing with respiratory tract illnesses and are eventually diagnosed with asthma. Therefore, when offering LAIV to children 24 through 59 months of age, the pediatrician should screen them by asking the parent/guardian the question, "In the previous 12 months, has a health care professional ever told you that your child had wheezing?" If a parent answers yes to this question, LAIV is not recommended for the child. IIV would be recommended for the child to whom LAIV is not given.
- Children who have received other live-virus vaccines within the past 4 weeks; however, other live-virus vaccines can be given on the same day as LAIV.
- Children who have known or suspected immunodeficiency disease or who are receiving immunosuppressive or immunomodulatory therapies.
- Children who are receiving aspirin or other salicylates.
- Any woman who is pregnant or considering pregnancy.
- Children with any condition that can compromise respiratory function or handling of secretions or can increase the risk for aspiration, such as neurodevelopmental disorders, spinal cord injuries, seizure disorders, or neuromuscular abnormalities.
- Children taking an influenza antiviral medication should not receive LAIV until 48 hours after stopping the influenza antiviral therapy. If a child recently received LAIV but has an influenza illness for which antiviral agents are appropriate, the antiviral agents should be given. Reimmunization may be indicated because of the potential effects of antiviral medications on LAIV replication and immunogenicity.

IIV is the vaccine of choice for anyone in close contact with a subset of severely immunocompromised people (ie, individuals in a protected environment). IIV is preferred over LAIV for contacts of severely immunocompromised people (ie, in a protected environment) because of the theoretical risk of infection in an immunocompromised contact of a LAIV-immunized person. Available data indicate a low risk of transmission of the virus in both children and adults vaccinated

with LAIV. HCP immunized with LAIV may continue to work in most units of a hospital, including the NICU and general oncology wards, using standard infection-control techniques. As a precautionary measure, people recently vaccinated with LAIV should restrict contact with severely immunocompromised patients (eg, hematopoietic stem cell transplant recipients during periods that require a protected environment) for 7 days after immunization, although there have been no reports of LAIV transmission from a vaccinated person to an immunocompromised person. In the theoretical scenario in which symptomatic LAIV infection develops in an immunocompromised host, oseltamivir or zanamivir could be prescribed because LAIV strains are susceptible to these antiviral medications.

SURVEILLANCE

Information about influenza surveillance is available through the CDC Voice Information System (influenza update, 888-232-3228) or at www.cdc.gov/flu/index.htm. 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 2012–2013 influenza surveillance data and use them as a guide to empirical 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).

VACCINE IMPLEMENTATION

These updated recommendations for prevention and control of influenza in children will have considerable operational and fiscal effects on pediatric practice. Therefore, the AAP has developed implementation guidance on supply, payment, coding, and liability issues; these documents can be found at www.aapredbook.org/implementation.

In addition, the AAP's Partnership for Policy Implementation has developed a series of definitions using accepted health information technology standards to assist in the implementation of this guideline in computer systems and quality measurement efforts. This document is available at www2.aap.org/informatics/PPI.html.

USE OF ANTIVIRAL MEDICATIONS

Oseltamivir remains the antiviral drug of choice for the management of influenza infections. Zanamivir is an acceptable alternative but is more difficult to administer. Antiviral resistance can emerge quickly from one season to the next. If local or national influenza surveillance data indicate a predominance of a particular influenza strain with known antiviral susceptibility profile, then empirical treatment can be directed toward that strain. For example, among 2123 influenza A (H3N2) viruses tested, 1 (0.05%) was found to be resistant to oseltamivir alone and 1 (0.05%) to both oseltamivir and zanamivir. Among the 542 pH1N1 viruses tested for resistance to oseltamivir, 2 (0.4%) were resistant, and all of the 258 viruses tested for resistance to zanamivir were sensitive. In contrast, high levels of resistance to amantadine and rimantadine exist, so these drugs should not be used in the upcoming season unless resistance patterns change significantly.

- Current treatment guidelines for antiviral medications (Table 3) are applicable to both infants and children with suspected influenza when known virus strains are circulating in the community or when infants or children are confirmed to have seasonal influenza.
- Oseltamivir is available in capsule and oral-suspension formulations. The commercially manufactured liquid formulation has a concentration of 6 mg/mL. If the commercially manufactured oral suspension is not available, the capsule may be opened and the contents mixed with simple syrup or Oral-Sweet SF (sugar-free) by retail pharmacies to a final concentration of 6 mg/mL (Table 3, footnote a).
- Continuous monitoring of the epidemiology, change in severity, and resistance patterns of influenza strains may lead to new guidance.

Treatment should be offered for the following:

- Any child hospitalized with presumed influenza or with severe, complicated, or progressive illness attributable to influenza, regardless of influenza immunization status.
- Influenza infection of any severity in children at high risk of complications of influenza infection (Table 4).

Treatment should be considered for the following:

- Any otherwise healthy child with influenza infection for whom a decrease in duration of clinical symptoms is felt to be warranted by his or her pediatrician; the greatest impact on outcome will occur if treatment can be initiated within 48 hours of illness onset.

Reviews of available studies by the CDC, the World Health Organization, and independent investigators have consistently found that timely oseltamivir treatment can reduce the risks of complications, including those resulting in hospitalization and death. Although a 2012 Cochrane review suggested that oseltamivir may not be effective in preventing complications or hospitalizations from influenza, its authors correctly pointed out that the data reviewed were not always complete, were analyzed in a variety of treated populations, and used a number of clinical trial designs. Regardless, treatment with oseltamivir for children with presumed serious, complicated, or progressive disease, irrespective of

influenza immunization status and/or even if illness began > 48 hours before admission, continues to be recommended. Earlier treatment provides optimal clinical responses. However, treatment after 48 hours of symptoms in adults and children with moderate-to-severe disease or with progressive disease has been shown to provide some benefit and should be strongly considered.

Dosages for antiviral agents for both treatment and chemoprophylaxis in children can be found in Table 3 and on the CDC Web site (http://www.cdc.gov/flu/professionals/antivirals/index.htm). Children younger than 2 years are at an increased risk of hospitalization and complications attributable to influenza. The FDA recently licensed oseltamivir down to 2 weeks of age. Given its known safety profile, oseltamivir can be used to treat influenza in both term and preterm infants from birth.

Clinical judgment (on the basis of underlying conditions, disease severity, time since symptom onset, and local influenza activity) is an important factor in treatment decisions for pediatric patients who present with influenza-like illness. Antiviral treatment should be started as soon as possible after illness onset and should not be delayed while waiting for a definitive influenza test result. Currently available rapid antigen tests have low sensitivity, particularly for the pH1N1 virus strain, and should not be used to exclude influenza infection. Although negative results from rapid antigen tests should not be used to make treatment or infection-control decisions, positive results are helpful because they may reduce additional testing to identify the cause of the child's influenza-like illness. Nucleic-acid-based molecular diagnostic techniques (eg, polymerase chain reaction–based) are more widely available and have greater sensitivity than antigen tests for influenza infection.

People with suspected influenza who present with an uncomplicated febrile illness typically do not require treatment with antiviral medications unless they are at higher risk of influenza complications (eg, children with chronic medical conditions such as asthma, diabetes mellitus, hemodynamically significant

TABLE 3 Recommended Dosage and Schedule of Influenza Antiviral Medications for Treatment and Chemoprophylaxis for the 2013–2014 Influenza Season: United States

Medication	Treatment (5 d)	Chemoprophylaxis (10 d)
Oseltamivir[a]		
Adults	75 mg twice daily	75 mg once daily
Children ≥12 mo		
≤15 kg (≤33 lb)	30 mg twice daily	30 mg once daily
>15–23 kg (33–51 lb)	45 mg twice daily	45 mg once daily
>23–40 kg (>51–88 lb)	60 mg twice daily	60 mg once daily
>40 kg (>88 lb)	75 mg twice daily	75 mg once daily
Infants 9 through 11 mo[b]	3.5 mg/kg/dose twice daily	3.5 mg/kg/dose once per day
Term Infants 0 through 8 mo[b]	3 mg/kg/dose twice daily[c]	3 mg/kg/dose once daily for infants 3 through 8 mo; not recommended for infants younger than 3 mo, unless situation judged critical, because of limited safety and efficacy data in this age group
Zanamivir[d]		
Adults	10 mg (two 5-mg inhalations) twice daily	10 mg (two 5-mg inhalations) once daily
Children (≥7 y for treatment, ≥5 y for chemoprophylaxis)	10 mg (two 5-mg inhalations) twice daily	10 mg (two 5-mg inhalations) once daily

Sources: Centers for Disease Control and Prevention. Antiviral agents for the treatment and chemoprophylaxis of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep.* 2011;60(RR-1):1–24; Kimberlin DW, Acosta EP, Prichard MN, et al. National Institute of Allergy and Infectious Diseases Collaborative Antiviral Study Group. Oseltamivir pharmacokinetics, dosing, and resistance among children aged <2 y with influenza. *J Infect Dis.* 2013;207(5):709–720.

[a] Oseltamivir is administered orally without regard to meals, although administration with meals may improve gastrointestinal tolerability. Oseltamivir is available as Tamiflu in 30-mg, 45-mg, and 75-mg capsules and as a powder for oral suspension that is reconstituted to provide a final concentration of 6 mg/mL. For the 6-mg/mL suspension, a 30-mg dose is given with 5 mL of oral suspension, a 45-mg dose is given with 7.5 mL oral suspension; a 60-mg dose is given with 10 mL oral suspension, and a 75-mg dose is given with 12.5 mL oral suspension. If the commercially manufactured oral suspension is not available, a suspension can be compounded by retail pharmacies (final concentration also 6 mg/mL), based on instructions on the package label. In patients with renal insufficiency, the dose should be adjusted on the basis of creatinine clearance. For treatment of patients with creatinine clearance 10 to 30 mL/min: 75 mg once daily for 5 days. For chemoprophylaxis of patients with creatinine clearance 10 to 30 mL/min: 30 mg, once daily, for 10 days after exposure or 75 mg, once every other day, for 10 days after exposure (5 doses). See http://www.cdc.gov/flu/professionals/antivirals/antiviral-drug-resistance.htm.

[b] Approved by the FDA down to 2 weeks of age. Given its known safety profile, oseltamivir can be used to treat influenza in both term and preterm infants from birth.

[c] Oseltamivir dosing for preterm infants. The weight-based dosing recommendation for preterm infants is lower than for term infants. Preterm infants may have lower clearance of oseltamivir because of immature renal function, and doses recommended for full-term infants may lead to high drug concentrations in this age group. Limited data from the National Institute of Allergy and Infectious Diseases Collaborative Antiviral Study Group provide the basis for dosing preterm infants using their postmenstrual age (gestational age + chronological age): 1.0 mg/kg/dose, orally, twice daily, for those <38 weeks' postmenstrual age; 1.5 mg/kg/dose, orally, twice daily, for those 38 through 40 weeks' postmenstrual age; 3.0 mg/kg/dose, orally, twice daily, for those >40 weeks' postmenstrual age.

[d] Zanamivir is administered by inhalation using a proprietary "Diskhaler" device distributed together with the medication. Zanamivir is a dry powder, not an aerosol, and should not be administered using nebulizers, ventilators, or other devices typically used for administering medications in aerosolized solutions. Zanamivir is not recommended for people with chronic respiratory diseases, such as asthma or chronic obstructive pulmonary disease, which increase the risk of bronchospasm.

TABLE 4 People at Higher Risk of Influenza Complications Recommended for Antiviral Treatment of Suspected or Confirmed Influenza

Children <2 y
Adults ≥65 y
People with chronic pulmonary (including asthma), cardiovascular (except hypertension alone), renal, hepatic, hematologic (including sickle cell disease), or metabolic disorders (including diabetes mellitus) or neurologic and neurodevelopment conditions (including disorders of the brain, spinal cord, peripheral nerve, and muscle such as cerebral palsy, epilepsy [seizure disorders], stroke, intellectual disability [mental retardation], moderate to severe developmental delay, muscular dystrophy, or spinal cord injury)
People with immunosuppression, including that caused by medications or by HIV infection
Women who are pregnant or postpartum (within 2 wk after delivery)
People <19 y who are receiving long-term aspirin therapy
American Indian/Alaska Native people
People who are morbidly obese (ie, BMI ≥40)
Residents of nursing homes and other chronic-care facilities

Source: Centers for Disease Control and Prevention. Antiviral agents for the treatment and chemoprophylaxis of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep.* 2011;60(RR-1):1–24

cardiac disease, immunosuppression, or neurologic and neurodevelopmental disorders), especially in situations with limited antiviral medication availability. Should there be a shortage of antiviral medications, local public health authorities will provide additional guidance about testing and treatment.

Randomized placebo-controlled studies showed that oseltamivir and zanamivir were efficacious when administered as chemoprophylaxis to household contacts after a family member had laboratory confirmed influenza. During the 2009 pandemic, the emergence of oseltamivir resistance was observed among people receiving postexposure prophylaxis. Decisions on whether to administer antiviral agents for chemoprophylaxis should take into account the exposed person's risk of influenza complications, vaccination status, the type and duration of contact, recommendations from local or public health authorities, and clinical judgment. Optimally, postexposure chemoprophylaxis should only be used when antiviral agents can be started within 48 hours of exposure. Early treatment of high-risk patients without waiting for laboratory confirmation is an alternative strategy.

Although immunization is the preferred approach to prevention of infection, chemoprophylaxis during an influenza outbreak, as defined by the CDC, is recommended:

- For children at high risk of complications from influenza for whom influenza vaccine is contraindicated.
- For children at high risk during the 2 weeks after influenza immunization.
- For family members or HCP who are unimmunized and are likely to have ongoing, close exposure to
  - unimmunized children at high risk; or
  - unimmunized infants and toddlers who are younger than 24 months.
- For control of influenza outbreaks for unimmunized staff and children in a closed institutional setting with children at high risk (eg, extended-care facilities).
- As a supplement to immunization among children at high risk, including children who are immunocompromised and may not respond to vaccine.
- As postexposure prophylaxis for family members and close contacts of an infected person if those people are at high risk of complications from influenza.
- For children at high risk and their family members and close contacts, as well as HCP, when circulating strains of influenza virus in the community are not matched with seasonal influenza vaccine strains, on the basis of current data from the CDC and local health departments.

These recommendations apply to routine circumstances, but it should be noted that guidance may change on the basis of updated recommendations from the CDC in concert with antiviral availability, local resources, clinical judgment, recommendations from local or public health authorities, risk of influenza complications, type and duration of exposure contact, and change in epidemiology or severity of influenza. Chemoprophylaxis is not recommended for infants younger than 3 months, unless the situation is judged critical, because of limited safety and efficacy data in this age group.

Chemoprophylaxis should not be considered a substitute for immunization.

Influenza vaccine should always be offered when not contraindicated, even when influenza virus is circulating in the community. Antiviral medications currently licensed are important adjuncts to influenza immunization for control and prevention of influenza disease, but there are toxicities associated with antiviral agents, and indiscriminate use might limit availability. Pediatricians should inform recipients of antiviral chemoprophylaxis that risk of influenza is lowered but remains while taking the medication, and susceptibility to influenza returns when medication is discontinued. For recommendations about treatment and chemoprophylaxis against influenza, see Table 3. Updates will be available at www.aapredbook.org/flu and http://www.cdc.gov/flu/professionals/antivirals/index.htm.

FUTURE NEEDS

Currently, within the approved indications and recommendations, no preferential recommendation is made for any type or brand of influenza vaccine over another. This is partly because the supply of newer vaccines may be limited during the 2013–2014 season. Moreover, postmarketing safety and vaccine effectiveness data are not yet available, prohibiting a full risk-benefit analysis of newer versus previously available products. However, such analyses will be performed as the data become available and, in the future, specific vaccines may be preferentially recommended for particular groups.

A large body of evidence indicates that even children with severe (anaphylactic) allergic reactions to the ingestion of eggs tolerate IIV in a single, age-appropriate dose. Examination of Vaccine Adverse Event Reporting System data after new Advisory Committee on Immunization Practices guidelines recommending influenza vaccine for egg-allergic recipients indicated no disproportionate reporting of allergy or anaphylaxis. Studies are also underway examining the safety of LAIV in egg-allergic recipients. If, as expected, additional safety monitoring continues to show no increased risk for anaphylactic reactions in egg-allergic recipients of influenza vaccine, special precautions regarding allergy referral and waiting periods after administration to egg-allergic recipients beyond those recommended for any vaccine may no longer be recommended.

Efforts should be made to create adequate outreach and infrastructure to ensure an optimal distribution of vaccine so that more people are immunized. Pediatricians should also become more involved in pandemic preparedness or disaster planning efforts. A bidirectional partner dialogue between pediatricians and public health decision makers ensures that children's issues are addressed during the initial state, regional, and local plan development stages. Further information concerning disaster preparedness can be found at www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/children-and-disasters/Pages/Pediatric-Preparedness-Resource-Kit.aspx.

Health care for children should be provided in the child's medical home. However, medical homes may have limited capacity to accommodate all patients (and their families) seeking influenza immunization. Because of the increased demand for immunization during each influenza season, the AAP and the CDC recommend vaccine administration at any visit to the medical home during influenza season when it is not contraindicated, at specially arranged "vaccine-only" sessions, and through cooperation with community sites, schools, and child care centers to provide influenza vaccine. If alternate venues are used, including pharmacies and other retail-based clinics, a system of patient record transfer is beneficial to ensuring maintenance of accurate immunization records. Immunization information systems should be used whenever available. The use of 2-dimensional barcodes may help facilitate more efficient and accurate documentation of vaccine administration. Multiple barriers appear to have an impact on influenza vaccination coverage for children in foster care, refugee and immigrant children, and homeless children. Access to care issues, lack of immunization records, and questions regarding who can provide consent may be addressed by linking children with a medical home, using all health care encounters as vaccination opportunities, and more consistently using immunization registry data.

Cost-effectiveness and logistic feasibility of vaccinating everyone continue to be concerns. With universal immunization, particular attention is being paid to vaccine supply, distribution, implementation, and financing. Potential benefits of more widespread childhood immunization among recipients, their contacts, and the community 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 parent work time. To optimally administer antiviral therapy in hospitalized patients with influenza who cannot tolerate oral or inhaled antiviral agents, FDA-approved intravenous neuraminidase inhibitors for children also are needed.

Continued evaluation of the safety, immunogenicity, and effectiveness of influenza vaccine, especially for children younger than 2 years, is important. The potential role of previous influenza vaccination on overall vaccine effectiveness by virus strain and subject age in preventing outpatient medical visits, hospitalizations, and deaths continues to be explored. There is also a need for more systematic health services research on influenza vaccine uptake and refusal as well as identification of methods to enhance uptake. In addition, development of a safe, immunogenic vaccine for infants younger than 6 months is essential. Until such a vaccine is available for infants younger than 6 months, vaccination of their mothers while pregnant is the best way to protect them. Breastfeeding is also recommended to protect against influenza viruses by activating innate antiviral mechanisms, specifically type 1 interferons, in the host. Mandatory annual influenza immunization of all HCP has been implemented successfully at an increasing number of pediatric institutions. Future efforts should include broader implementation of mandatory immunization programs. Optimal prevention of influenza in the health care setting depends on the vaccination of at least 90% of HCP.

Additional studies are needed to investigate the extent of offering to immunize parents and adult child care providers in the pediatric office setting; the level of family contact satisfaction with this practice; how practices handle the logistic, liability, legal, and financial barriers that limit or complicate this service; and, most important, how this practice will affect disease rates in children and adults. In addition, adjuvants have been shown to enhance immune responses to influenza vaccines, but certain adjuvants have been associated with the development of narcolepsy in some studies. Additional studies on the effectiveness and safety of influenza vaccines containing adjuvants are needed. Finally, as mentioned earlier, efforts to improve the vaccine-development process to allow for a shorter interval between identification of vaccine strains and vaccine production continue.

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