Policy Statement
Recommendations for Prevention and Control of Influenza in Children, 2010-2011
COMMITTEE ON INFECTIOUS DISEASES
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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. The 2009 influenza A (H1N1) pandemic virus is expected to circulate, with infants and children at increased risk of severe illness and death. This year’s trivalent seasonal influenza vaccine contains A/California/7/2009 (H1N1)-like antigen (derived from the 2009 pandemic influenza A [H1N1] virus); A/Perth/16/2009 (H3N2)-like antigen; and B/Brisbane/60/2008-like antigen. Pediatricians continue to have a leadership role in the prevention of influenza through vaccine use and public education. In addition, pediatricians should promptly identify influenza infections to enable rapid treatment of influenza, when indicated, to reduce childhood morbidity and mortality. *Pediatrics* 2010;126:000

INTRODUCTION

The American Academy of Pediatrics (AAP) recommends annual trivalent seasonal influenza immunization for all children and adolescents 6 months of age and older during the 2010–2011 influenza season. Special outreach efforts should be made to the following groups:

- All children, both healthy and with conditions that increase the risk of complications from influenza, 6 months of age and older
- Household contacts and out-of-home care providers of
  - children with high-risk conditions, and
  - healthy children younger than 5 years
- Health care personnel (HCP)
- Pregnant women

KEY POINTS RELEVANT FOR THE 2010–2011 INFLUENZA SEASON

1. All children 6 months of age and older should receive trivalent seasonal influenza vaccine each year, especially those at high risk of influenza complications (eg, children with chronic medical conditions such as asthma, diabetes, morbid obesity, immunosuppression, or neurologic disorders). Young children are at an increased risk of influenza infection, hospitalization, and complications. School-aged children bear a large influenza disease burden and have a significantly higher chance of needing influenza-related medical care compared with healthy adults. Additionally, reducing influenza transmission among school-aged children should decrease transmission of influenza to household contacts and community members.
2. Annual trivalent seasonal influenza vaccine is important for household members and out-of-home care providers of children and adolescents at high risk, healthy children younger than 5 years, and infants younger than 6 months. Immunization of close contacts of children at high risk (ie, “cocooning”) is intended to reduce the risk of influenza exposure for these children, who are at increased risk of influenza-related complications; this is particularly important to help protect infants younger than 6 months, because they are too young to be immunized with influenza vaccine. The risk of influenza-associated hospitalization in healthy children younger than 24 months has been shown to be equal to (or greater than) the risk in previously recognized high-risk groups such as elderly people. Children 24 through 59 months of age experience increased morbidity as a result of influenza illness and have shown increased rates of outpatient visits and antimicrobial-agent use.

3. Beginning in March 2009, a novel influenza A (H1N1) virus (swine flu) spread from Mexico and California across North America and around the world and led to declaration of an influenza pandemic by the World Health Organization. This pandemic was associated with 2 waves of substantial influenza activity, occurring in spring and fall of 2009, with extension into winter 2010. During this time, nearly all influenza isolates were characterized as A/California/7/2009 (H1N1) virus. Using technology currently available for seasonal influenza vaccine production, a monovalent vaccine was produced as quickly as possible to protect against this 2009 pandemic influenza A (H1N1) virus and was recommended for administration in addition to the 2009–2010 seasonal influenza vaccine. The 2009 pandemic influenza A (H1N1) virus is expected to again circulate during the 2010–2011 influenza season, in combination with 1 or more of the other seasonal influenza strains.

4. The current 2009 influenza A (H1N1) pandemic virus presents a unique situation, because morbidity and mortality during the pandemic have affected the pediatric population disproportionately, when compared with the usual seasonal influenza strains (Fig 1). In the 2009–2010 influenza season (August 30, 2009 to June 12, 2010), the number of laboratory-confirmed, influenza-associated pediatric deaths reported (279) was nearly 4 times the average number reported in the previous 5 influenza seasons (Fig 2). The total for the entire pandemic period that started 5 months earlier in April 2009 was 344, with some estimates of more than 1000 deaths.

5. Although 2 influenza vaccines were recommended last year, only a single vaccine is being manufactured for the current 2010–2011 seasonal influenza vaccine schedule. The 2009 pandemic influenza A (H1N1) strain has replaced the 2009 seasonal influenza A (H1N1) strain in this 2010–2011 trivalent seasonal influenza vaccine. Therefore, the recommended trivalent vaccine for the 2010–2011 influenza season contains these 3 virus strains:

- A/California/7/2009 (H1N1)–like antigen (derived from 2009 pandemic influenza A [H1N1] virus);
- A/Perth/16/2009 (H3N2)–like antigen; and
- B/Brisbane/60/2008–like antigen.

6. Millions of previously unvaccinated or incompletely vaccinated children may remain susceptible to 2009 influenza A (H1N1) pandemic virus this season. The number of trivalent seasonal influenza vaccine doses to be administered this year depends on the child’s age and vaccine history (Fig 3):

- Infants younger than 6 months are too young to be immunized with influenza vaccine.
- Children 9 years of age and older need only 1 dose regardless of whether they received earlier doses of influenza vaccine.
- Children younger than 9 years need a minimum of 2 doses of 2009 pandemic H1N1 vaccine strain for adequate protection (based on age-specific immunogenicity data).
- Children younger than 9 years who receive the trivalent seasonal influenza vaccine (either administered by injection or intranasally) for the first time last season, but only received 1 dose, should receive 2 doses of trivalent seasonal influenza vaccine this year.
- Children younger than 9 years who received trivalent seasonal influenza vaccine in the 2009–2010 season, but for whom it is unclear whether it was a seasonal or monovalent vaccine, should receive 2 doses of the 2010–2011 trivalent seasonal vaccine.

7. Health care providers should publicize to parents and caregivers of all children aged 6 months and older, especially those at high risk of complications from influenza, as soon as trivalent seasonal influenza vaccine is available. Protective immune responses persist throughout the influenza season, which can have more than 1 disease peak and/or often extends into March or later. Prompt initiation of influenza immunization and continuing to immunize throughout the entire season, even if influenza is circulating (or has circulated) in the community, are critical components of an effective immunization strategy. This approach also provides ample opportunity to administer a second dose of vaccine, because children younger than 9 years may require 2 doses to confer optimal protection.

8. HCP, influenza campaign organizers, and public health agencies should collaborate and build on relationships forged during the 2009 H1N1 experience and develop improved strategies...
for planning, communication, and administration of vaccines to achieve the immunization of all children 6 months and older.

- The importance of collaboration and partnership at the local level was highlighted last year when the 2009 H1N1 pandemic created the immediate need to vaccinate as many people as possible with the monovalent vaccine.
- Plan to make trivalent seasonal influenza vaccine easily accessible for all children. Examples might include creating walk-in influenza clinics, making vaccine available during all office hours, extending hours beyond routine times during peak vaccination periods, and working with other institutions (e.g., schools, child care centers, churches) to expand venues for administering vaccine, with appropriate documentation of immunization to be provided to the child’s medical home if possible.

- Concerted efforts among the aforementioned groups, plus vaccine manufacturers, distributors, and payers, also are necessary to appropriately prioritize distribution to the primary care office setting, especially when vaccine supplies are delayed or limited.

9. The neuraminidase inhibitors oseltamivir (Tamiflu [Roche Laboratories, Nutley, NJ]) and zanamivir (Relenza [GlaxoSmithKline, Research Triangle Park, NC]) are the only antiviral medications routinely recommended for chemoprophylaxis or treatment during the 2010–2011 season. All strains of influenza currently anticipated to circulate are susceptible to them but are resistant to amantadine and rimantadine (Table 1). Resistance characteristics may change rapidly, and susceptibility data should be verified at the start of the influenza season, either on the Centers for Disease Control and Prevention (CDC) Web site (www.cdc.gov/flu/index.htm) or the AAP Web site (www.aap.org or http://aapredbook.aappublications.org/flu).

10. As the 2010–2011 influenza season unfolds, it is critically important for health care providers to...
be aware of new recommendations from their local and state health departments. Up-to-date information can be found on the CDC Web site (www.cdc.gov/flu/index.htm) and the AAP Web site (www.aap.org or http://aapredbook.aappublications.org/flu).

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: injectable trivalent inactivated influenza vaccine (TIV) and intranasally administered live-attenuated influenza vaccine (LAIV). Both 2010–2011 vaccines contain the identical strains of influenza A subtypes (ie, H1N1 and H3N2) and influenza B anticipated to circulate during the upcoming influenza season:

- The A/California/7/2009 (H1N1)—like antigen is derived from the pandemic 2009 influenza A (H1N1) virus and is the same antigen used in the 2009 monovalent pandemic H1N1 vaccine.
- The 2009 pandemic influenza A (H1N1) virus seems to have replaced the influenza A (H1N1) virus that has circulated worldwide since 1977.
- Administration of the 2009 H1N1 monovalent vaccine was initially recommended through June 30, 2010, although the expiration date of some vaccine lots may extend into 2011.
- Unused doses of the 2009 H1N1 monovalent vaccine should not be discarded to cover for possible surges in cases before the trivalent seasonal influenza vaccine arrives in local communities.
- The A/Perth/16/2009 (H3N2)—like antigen is a drift strain that differs from the H3N2-like antigen recommended during the 2009–2010 Northern Hemisphere seasonal influenza vaccine.
- The influenza B vaccine strain will remain B/Brisbane/60/2008 and is the same strain that is in the 2009–2010 Northern Hemisphere seasonal influenza vaccine.

TIV is an inactivated vaccine that contains viral antigens but no live virus and, therefore, cannot produce an active virus infection. TIV is administered intramuscularly to people who are 6 months of age and older, including those who are healthy and those with chronic medical conditions. The most common adverse events after administration are local pain and tenderness. Fever is also seen within 24 hours after immunization in approximately 10% to 35% of children younger than 2 years (statistics similar to those for the influenza A [H1N1] 2009 monovalent vaccine) but rarely in older children and adults. Mild systemic symptoms such as nausea, lethargy, headache, muscle aches, and chills also can occur after administration of TIV. With 1 of the 3 strains in the 2010–2011 trivalent seasonal influenza vaccine being derived from the 2009 pandemic influenza A (H1N1) virus, it is important to note that recently published data from surveillance systems monitor-

### TABLE 2 Approved Trivalent Seasonal Influenza Vaccines for Different Age Groups: United States, 2010–2011 Influenza Season

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Trade Name</th>
<th>Manufacturer</th>
<th>Presentation</th>
<th>Thimerosal Mercury Content, µg of Hg per 0.5-mL Dose</th>
<th>Age Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIV</td>
<td>Fluzone</td>
<td>Sanofi Pasteur</td>
<td>0.25-mL prefilled syringe</td>
<td>0</td>
<td>6–35 mo</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.5-mL prefilled syringe</td>
<td>0</td>
<td>≥36 mo</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.5-mL vial</td>
<td>0</td>
<td>≥36 mo</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5.0-mL multidose vial</td>
<td>25</td>
<td>≥6 mo</td>
</tr>
<tr>
<td>TIV</td>
<td>Fluzone HD</td>
<td>Sanofi Pasteur</td>
<td>0.5-mL prefilled syringe</td>
<td>0</td>
<td>≥64 y</td>
</tr>
<tr>
<td>TIV</td>
<td>Fluvirin</td>
<td>Novartis (formerly Chiron)</td>
<td>0.5-mL prefilled syringe</td>
<td>&lt;1.0</td>
<td>≥4 y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5.0-mL multidose vial</td>
<td>24.5</td>
<td>≥4 y</td>
</tr>
<tr>
<td>TIV</td>
<td>Agriflu</td>
<td>Novartis (formerly Chiron)</td>
<td>0.5-mL prefilled syringe</td>
<td>0</td>
<td>≥18 y</td>
</tr>
<tr>
<td>TIV</td>
<td>Fluarix</td>
<td>GlaxoSmithKline</td>
<td>0.5-mL prefilled syringe</td>
<td>0</td>
<td>≥3 y</td>
</tr>
<tr>
<td>TIV</td>
<td>FluLaval</td>
<td>GlaxoSmithKline</td>
<td>5.0-mL multidose vial</td>
<td>25</td>
<td>≥18 y</td>
</tr>
<tr>
<td>TIV</td>
<td>Affuria**</td>
<td>CSL Biotherapies</td>
<td>0.5-mL prefilled syringe</td>
<td>0</td>
<td>≥9 y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5-mL multidose vial</td>
<td>25</td>
<td>≥9 y</td>
</tr>
</tbody>
</table>


**Although licensed by the Food and Drug Administration for children 36 months and older, this year’s recommendation is to limit the use of the vaccine only to children 9 years and older. This vaccine can be used in children 5 through 8 years of age at high risk of influenza complications only if no other age-appropriate formulation of seasonal trivalent influenza vaccine is available.
TABLE 3 LAIV Compared With TIV

<table>
<thead>
<tr>
<th>Vaccine Characteristic</th>
<th>LAIV</th>
<th>TIV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route of administration</td>
<td>Intranasal spray</td>
<td>Intramuscular injection</td>
</tr>
<tr>
<td>Type of vaccine</td>
<td>Live virus</td>
<td>Killed virus</td>
</tr>
<tr>
<td>Product</td>
<td>Attenuated, cold-adapted</td>
<td>Inactivated subvirion or surface antigen</td>
</tr>
<tr>
<td>No. of included virus strains</td>
<td>3 (2 influenza A, 1 influenza B)</td>
<td>3 (2 influenza A, 1 influenza B)</td>
</tr>
<tr>
<td>Vaccine virus strains updated</td>
<td>Annually</td>
<td>Annually</td>
</tr>
<tr>
<td>Frequency of administration</td>
<td>Annually</td>
<td>Annually</td>
</tr>
<tr>
<td>Approved age groups</td>
<td>All healthy persons aged 2–4 y</td>
<td>All persons aged ≥6 mo</td>
</tr>
<tr>
<td>Interval between 2 doses in children</td>
<td>4 wk</td>
<td>4 wk</td>
</tr>
<tr>
<td>Can be given to persons with medical</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>risk factors for influenza-related</td>
<td></td>
<td></td>
</tr>
<tr>
<td>complications?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can be given to children with asthma</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>or children aged 2–4 y with wheezing in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the previous year?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can be simultaneously administered</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>with other vaccines?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If not simultaneously administered, can</td>
<td>No, prudent to space 4 wk apart</td>
<td>Yes</td>
</tr>
<tr>
<td>be administered within 4 wk of another</td>
<td></td>
<td></td>
</tr>
<tr>
<td>live vaccine?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>can be administered within 4 wk of an</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>inactivated vaccine?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The preferred site of TIV intramuscular injection for infants and young children is the anterolateral aspect of the thigh.

* See Fig 3 for decision algorithm to determine number of doses of 2010–2011 seasonal influenza vaccine recommended for children this year.

* LAIV is not recommended for children with a history of asthma. In the 2–4-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 LAIV. When offering LAIV to children in this age group, a clinician should screen those who might be at higher risk of asthma by asking the parents/guardians of 2-, 3-, and 4-year-olds (24- to 59-month-olds) the question, “In the previous 12 months, has a healthcare professional ever told you that your child had wheezing?” If the parents answer “yes” to this question, LAIV is not recommended for those children.

known risks of influenza are clear. Therefore, children should receive the available formulation of TIV rather than delay immunization while waiting for reduced-thimerosal-content or thimerosal-free vaccine. Some formulations of TIV contain only a trace amount of thimerosal, but 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.

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 and is 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. Although not extensively studied, the general consensus is that either vaccine can be administered at the same visit with all other recommended routine vaccines. After administration of any 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 6 months of age and older. Healthy children 2 years of age and older can receive either TIV or LAIV. Particular focus should be on the administration of TIV for all children and adolescents with underlying medical conditions associated with an increased risk of 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 neurodevelopmental disorders, spinal cord injuries, seizure disorders, or neuromuscular abnormalities.

Although 2010–2011 policy recommends universal immunization for all people 6 months of age and older, particular immunization efforts with either TIV 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 and at-risk children of all ages (healthy contacts 2–49 years of age can receive either TIV or LAIV);
- any female who is pregnant or considering pregnancy during the influenza season (TIV only);
- HCP or volunteers (Although vaccine is recommended for this group, many HCP remain unvaccinated. As of January 2010, the CDC estimated that 61.9% of HCP received the seasonal vaccine and only 37.1% received the 2009 H1N1 monovalent vaccine. As employees of health care institutions, HCP frequently come into contact with patients at high risk for influenza illness. It is paramount that HCP protect themselves against influenza so that they remain influenza-free, avoid lost productivity, and prevent disease transmission to patient populations at high risk); and
- 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 TIV

- Those younger than 6 months.
- Those who have a moderate-to-severe febrile illness.
- Those who have a history of known anaphylactic reactions to chicken or egg proteins, to any previous influenza vaccine dose, or to any of the vaccine components.
- 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; the decision not to immunize should be thoughtfully balanced against the potential morbidity and mortality associated with influenza for that individual.

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 a history of known anaphylactic reactions to chicken or egg proteins, to any previous in-
fluenza vaccine dose, or to any of the vaccine components.

- Those who are known to have experienced GBS within 6 weeks after a previous influenza vaccination. Whether influenza vaccination specifically might increase the risk of recurrence of GBS is unknown; the decision not to immunize should be thoughtfully balanced against the potential morbidity and mortality associated with influenza for that individual.

- 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 or other chronic disorders of the pulmonary or cardiovascular systems.

- Those with underlying medical conditions including metabolic disease, diabetes mellitus, renal dysfunction, and hemoglobinopathies.

- Those who have known or suspected immunodeficiency disease or who are receiving immunosuppressive therapies.

- Those who are receiving aspirin or other salicylates.

- Any female who is pregnant or considering pregnancy.

- Those 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.

**PRECAUTIONS**

LAIV is not recommended for children with 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 previous 12 months should *not* receive LAIV.

When offering LAIV to children younger than 5 years, a clinician should screen them 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 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 a history of wheezing.

In addition, TIV is the vaccine of choice for anyone in close contact with a subset of severely immunocompromised people (ie, individuals in a protected environment). TIV is preferred over LAIV for contacts of severely immunocompromised people because of the theoretical risk of infection in an immunocompromised contact of an LAIV-immunized person. Available data indicate a very low risk of transmission of the virus in both children and adults vaccinated with LAIV. Health care workers immunized with LAIV may continue to work in most units of a hospital, including the neonatal intensive care unit and general oncology wards, using standard infection-control techniques. 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. 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.

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 2009–2010 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). During the 2009–2010 season, minimal activity of seasonal A/H1N1, A/H3N2, and B influenza strains was documented. In contrast, the novel 2009 pandemic influenza A (H1N1) virus far surpassed the other strains as the most prevalent subtype in circulation.

**USE OF ANTIVIRAL MEDICATIONS**

If local or national influenza surveillance data indicate a predominance of a particular influenza strain with known antiviral susceptibility profile, then empiric treatment can be directed toward that strain. For example, during the 2009–2010 season, more than 98% of influenza viruses tested were the pandemic strain influenza A (H1N1) virus and were susceptible to oseltamivir or zanamivir but resistant to amantadine and rimantadine (Table 1).

- Oseltamivir is available in capsule and oral-suspension formulations. The manufactured liquid formulation has a concentration of 12 mg/mL. If the commercially manufactured oral suspension is not available, the capsule may be opened and the contents mixed with
Use Authorization (EUA) recommendations for use of oseltamivir in children of commercial suspension), 6–11 months

3. Current weight-based dosing recommendations are not intended for premature infants. Premature infants may remain appropriate for use when indicated.

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Continuous monitoring of the epidemiology, change in severity, and resistance patterns of influenza strains may lead to new guidance.

Treatement should be considered for:
- any child hospitalized with presumed influenza;
- influenza infection of any severity in children at high risk, regardless of influenza-immunization status; and
- 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 provider.

Earlier treatment provides more optimal clinical responses, although treatment after 48 hours of symptoms in the child with moderate-to-severe disease or with progressive disease may still provide some benefit. Dosages for antiviral agents for both treatment and chemoprophylaxis in children, including emergency-use dosing recommendations for oseltamivir in infants, can be found in Table 4 and on the CDC Web site (www.cdc.gov/h1n1flu/recommendations.htm).

Clinical judgment 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 pandemic H1N1 strain, and should not be used to rule out influenza.

People with suspected influenza who present with an uncomplicated febrile illness typically do not require treatment unless they are at higher risk of influenza complications, especially in situations with limited antiviral medication availability. Should there be a shortage of antiviral medications, local public health authorities might provide additional guidance about diagnostic testing and prioritizing treatment.

Recommendations for chemoprophylaxis when there is a seasonal influenza outbreak in a community remain unchanged:
- children at high risk for whom influenza vaccine is contraindicated;
- children at high risk during the 2 weeks after influenza immunization;

1. Oseltamivir is manufactured by Roche Pharmaceuticals and 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 12 mg/mL. If the commercially manufactured oral suspension is not available, the capsules may be opened and the contents mixed with a sweetened liquid to mask the bitter taste or a suspension can be compounded by retail pharmacies (final concentration 15 mg/mL). In patients with renal insufficiency the dose should be adjusted based on creatinine clearance. For treatment of patients with creatinine clearance 10-30 mL/min: 75 mg once daily for 5 days. For chemoprophylaxis of patients with creatinine clearance 10-30 mL/min: 30 mg once daily or 75 mg once every other day for 10 days after the exposure. Cases are investigated to assess the spread of resistant strains into the community. Of note, since September 1, 2009, 65 cases of 2009 Influenza A (H1N1) have been confirmed as oseltamivir resistant.

2. Weight-based dosing is preferred, however, if weight is not known, dosing by age for treatment (give two doses per day) or prophylaxis (give one dose per day) of influenza in full-term infants younger than 1 year of age may be necessary: 0–3 months (treatment only) = 12 mg/mL (1 mL of 12 mg/mL commercial suspension); 3–5 months = 20 mg/mL (1.6 mL of 12 mg/mL commercial suspension); 6–11 months = 25 mg/mL (2 mL of 12 mg/mL commercial suspension). Although the Emergency Use Authorization (EUA) recommendations for use of oseltamivir in children < 1 y expired on June 23, 2010, this drug remains appropriate for use when indicated.

3. Current weight-based dosing recommendations are not intended for premature infants. Premature infants may have slower clearance of oseltamivir due to immature renal function, and doses recommended for full-term infants may lead to very high drug concentrations in this age group. Very limited data from a cohort of premature infants receiving an average dose of 1.7 mg/kg twice daily demonstrated drug concentrations higher than those observed with the recommended treatment dose in term infants (0.5 mg/kg twice daily). Observed drug concentrations were highly variable among premature infants. These data are insufficient to recommend a specific dose of oseltamivir for premature infants.

4. Zanamivir is manufactured by GlaxoSmithKline and 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 persons with chronic respiratory diseases such as asthma or chronic obstructive pulmonary disease that increase the risk of bronchospasm.


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### TABLE 4

**Recommended Dosage and Schedule of Influenza Antiviral Medications for Treatment and Chemoprophylaxis for the 2010–2011 Influenza Season: United States**

<table>
<thead>
<tr>
<th>Medication</th>
<th>Treatment (5 days)</th>
<th>Chemoprophylaxis (10 days)</th>
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</thead>
</table>
| **Oseltamivir**
  | Adults | | |
  | Children ≥12 months | 75 mg twice daily | 75 mg once daily |
  | ≤10 kg (<33 lb) | 30 mg twice daily | 30 mg once daily |
  | >10 kg to 23 kg (>33 lb to 51 lb) | 45 mg twice daily | 45 mg once daily |
  | >23 kg to 40 kg (>51 lb to 88 lb) | 60 mg twice daily | 60 mg once daily |
  | >40 kg (>88 lb) | 75 mg twice daily | 75 mg once daily |
| **Children 3 months to <12 months**
  | 3 mg/kg/dose twice daily | 3 mg/kg/dose once per day |
| **Children 0 to <3 months**
  | 3 mg/kg/dose twice daily | Not recommended unless situation judged critical due to limited data on use in this age group |
| **Zanamivir**
  | Adults | 10 mg (two 5-mg inhalations) twice daily | 10 mg (two 5-mg inhalations) once daily |
  | Children (≥7 years or older for treatment, ≥5 years for chemoprophylaxis) | 10 mg (two 5-mg inhalations) twice daily | 10 mg (two 5-mg inhalations) once daily |

1. Provided by UNIV OF CALIF - SAN DIEGO on September 29, 2010 www.pediatrics.org Downloaded from.
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 pediatric residents at high risk (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 for family members and close contacts of an infected individual; and
- 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 trivalent seasonal influenza vaccine strains, based on 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, and change in epidemiology or severity of influenza.

Chemoprophylaxis should not be considered a substitute for immunization. Antiviral medications currently licensed are important adjuncts to influenza immunization for control and prevention of influenza disease (Table 1). In addition, recommendations for chemoprophylaxis against 2009 pandemic influenza A (H1N1) virus are important to consider (lack of data makes it difficult to approximate natural immunity acquired during the 2009–2010 season). Only 30% of children 6 months through 18 years of age were immunized with 2009 H1N1 monovalent vaccine this past season, and 21% to 42% of children may have been infected with the virus. Thus, many children potentially remain susceptible, and chemoprophylaxis should be considered. For recommendations about treatment and chemoprophylaxis against influenza, see Table 4. Updates will be available at www.cdc.gov/h1n1flu/recommendations.htm and www.aapredbook.org/flu.

VACCINE IMPLEMENTATION

These updated recommendations for the prevention and control of influenza in children will have considerable operational and fiscal impact 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.

FUTURE NEEDS

Although the recommendation for expansion to annual universal immunization for all people 6 months of age and older is now in effect, the resulting increases in demand for vaccine and overall costs of coverage pose public health challenges. Manufacturers anticipate being able to provide adequate supplies of vaccine.

Efforts should be made to create adequate outreach and infrastructure 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 (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 clinics, schools, and child care centers to provide influenza vaccine. If alternate venues are used, a system of patient record transfer is beneficial to ensuring maintenance of accurate immunization records. Immunization-information systems should be used whenever available.

Cost-effectiveness and logistic feasibility of vaccinating everyone continue to be legitimate 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.

Continued evaluation of the safety, immunogenicity, and effectiveness of influenza vaccine for children younger than 2 years is important. Development of a safe, immunogenic vaccine for infants younger than 6 months is essential. Consideration of how best to administer influenza vaccine to parents of patients in pediatricians’ offices continues to be investigated. Making annual influenza immunization mandatory for all HCP to increase their immunization rates continues to be explored. Finally, efforts are underway to improve the vaccine-development process to allow for a shorter interval between identification of vaccine strains and vaccine production. This idea was put to the test most recently with the 2009 pandemic influenza A (H1N1) virus outbreak.
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ADDITIONAL RESOURCES

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Number of 2010-2011 Seasonal Influenza Vaccine Doses Recommended For Children

- **Infants under 6 months of age**: No influenza vaccine
- **Children 6 months through 8 years of age**: Follow algorithm below
- **Children 9 years of age and older**: One (1) dose

**Algorithm**

1. Did the child receive any 2009 H1N1 monovalent vaccine?  
   - **NO/NOT SURE**: Administer two (2)* doses this season
   - **YES**: Proceed to next question
2. Has the child ever received seasonal influenza vaccine?  
   - **NO/NOT SURE**: Administer two (2)* doses this season
   - **YES**: Proceed to next question
3. Was last year the child’s first to receive seasonal influenza vaccine?  
   - **NO**: Administer one (1) dose this season
   - **YES**: Proceed to next question
4. Did the child receive two (2) doses of seasonal influenza vaccine last year?  
   - **NO**: Administer two (2)* doses this season
   - **YES**: Administer one (1) dose this season

* Interval between two (2) doses is 4 weeks

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Childhood Influenza Immunization Coalition
The Power of One Strong Voice
Policy Statement
Recommendations for Prevention and Control of Influenza in Children, 2010-2011
COMMITTEE ON INFECTIOUS DISEASES
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