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POLICY STATEMENT

Prevention of Influenza: Recommendations for Influenza Immunization of Children, 2008–2009

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Infectious Diseases

ABSTRACT

The purpose of this statement is to update current recommendations for routine use of influenza vaccine in children and adolescents, which originally were published in a comprehensive format in *Pediatrics* in April 2008.
Pediatrics 2008;122:000

www.pediatrics.org/cgi/doi/10.1542/peds.2008-2449

doi:10.1542/peds.2008-2449

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Key Words
influenza, immunization, live-attenuated influenza vaccine, trivalent inactivated influenza vaccine, vaccine, children, pediatrics

Abbreviations
AAP—American Academy of Pediatrics
TIV—trivalent inactivated influenza vaccine
LAIV—live-attenuated influenza vaccine
CDC—Centers for Disease Control and Prevention

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INTRODUCTION

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

- All children, both healthy and with high-risk conditions, aged 6 months through 18 years
- Household contacts and out-of-home care providers of:
  - Children with high-risk conditions
  - Healthy children younger than 5 years of age
- Health care professionals
- Pregnant women

KEY POINTS RELEVANT FOR THE 2008–2009 INFLUENZA SEASON

1. The recommended age range of children for annual influenza immunization has been expanded to include all children 6 months through 18 years of age, which means vaccinating:
   - All children at higher risk for influenza complications (eg, those with chronic medical conditions or immunosuppression)
   - All healthy children 6 through 59 months of age
   - All children 5 through 18 years of age, if feasible, in the 2008–2009 influenza season, but it should be routine no later than the 2009–2010 season

This expansion targets all school-aged children, the population that bears the greatest disease burden and is at significantly higher risk of needing influenza-related medical care compared with healthy adults. In addition, reducing influenza transmission among school-aged children will, in turn, reduce transmission of influenza to household contacts and community members.

2. Household members and out-of-home care providers of all children at high risk and adolescents and of all healthy children younger than 5 years also should receive influenza vaccine each year. Immunization of the close contacts of children at high risk is intended to reduce the risk of exposure to influenza for these young children, who are at serious risk of influenza infection, hospitalization, and complications. The risk of influenza-associated hospitalization 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. Children 24 through 59 months of age experience increased morbidity as a result of influenza illness, with increased rates of outpatient visits and antibiotic use. Infants younger than 6 months are too young to be immunized. Influenza vaccine has not been approved for use in infants younger than 6 months.

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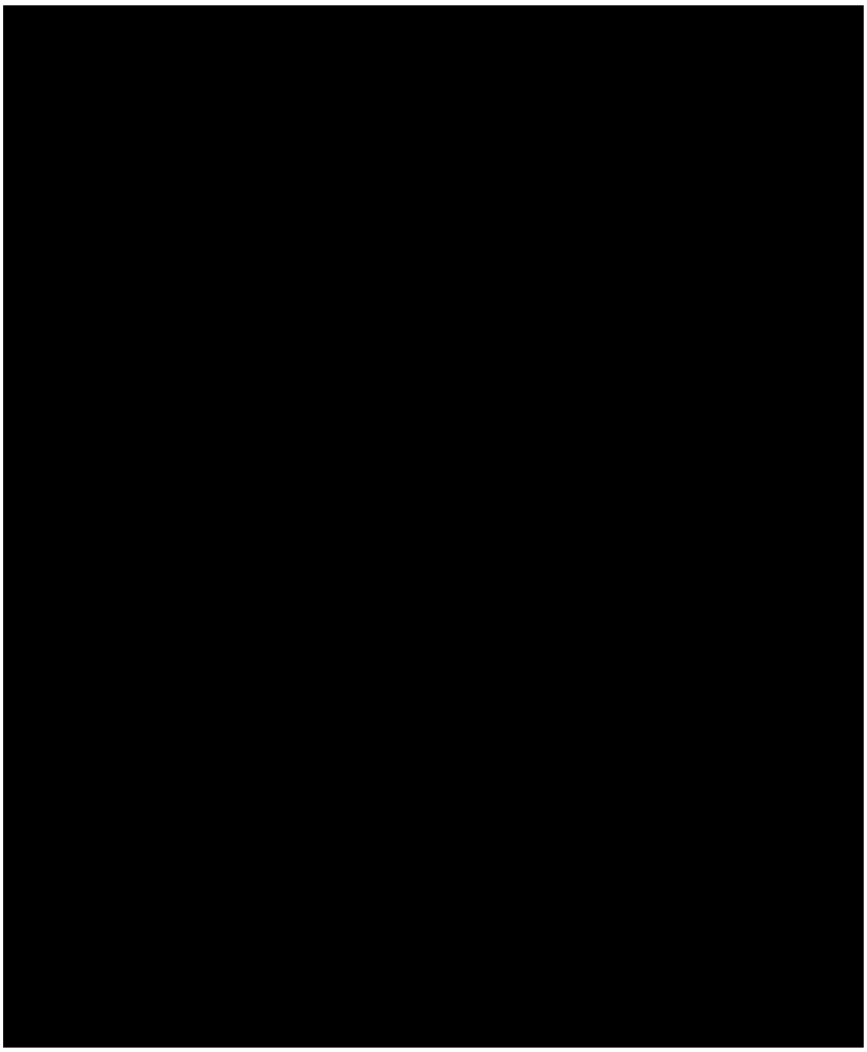

FIGURE 1

Influenza algorithm for determining recommended 2008–2009 influenza immunization actions for children (www.preventchildhoodinfluenza.org/resource/algorithm.swf).

[a] Contraindications: refer to page 5 of this statement. [b] If children aged <9 years of age received their first influenza vaccination last year and received only 1 dose, it is recommended that 2 doses be administered in the current season. This recommendation applies for this season only. No data are available for other influenza vaccine-administration scenarios.

Source: adapted with permission from American Academy of Pediatrics, Committee on Infectious Diseases. Prevention of influenza: recommendations for influenza immunization of children, 2007–2008. *Pediatrics*. 2008;121(4). Available at: www.pediatrics.org/cgi/content/full/121/4/e1016; and Centers for Disease Control and Prevention. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practice (ACIP), 2008. *MMWR Recomm Rep*. 2008; 57(RR-07):1–60

3. All children 6 months through 18 years of age, especially those at high risk of complications from influenza, should be identified, and their parents should be informed, when possible, that annual influenza immunization is due.
4. On the basis of global surveillance of circulating influenza strains, all 3 strains in the 2008–2009 influenza vaccines are different from last year's strains.
5. The number of influenza vaccine dose(s) to be administered is age dependent (Fig 1):
   - Children 9 years and older who have not received the influenza vaccine previously need only 1 dose in their first season of immunization.
   - In contrast, any child younger than 9 years receiving an influenza vaccine for the first time should receive a second dose at least 4 weeks after the first.
   - Children younger than 9 years who received only 1 dose of influenza vaccine in the first season they were vaccinated should receive 2 doses of influenza vaccine the following season. This recommendation

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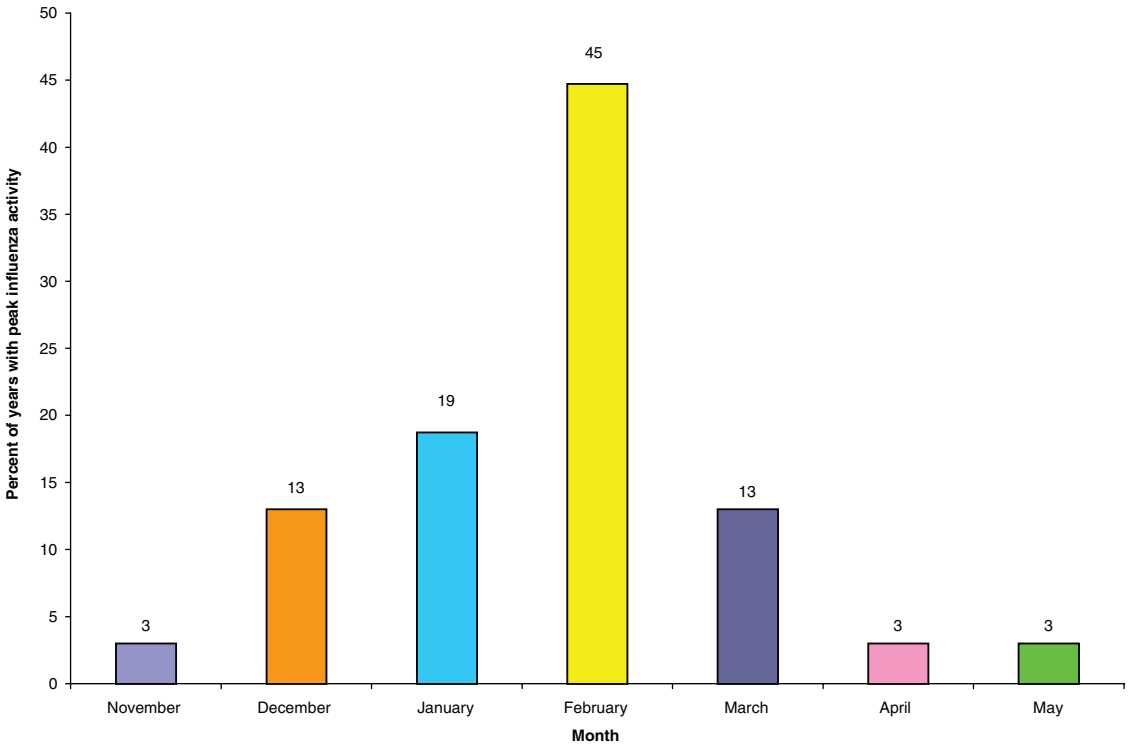

FIGURE 2
Month of peak influenza activity from 1976 to 2007. Note that the peak week of influenza activity was defined as the week with the greatest percentage of positive respiratory specimens for influenza. The number of peak weeks in each month was then summed, and a percentage was calculated.
Source: United States–World Health Organization Collaborating Laboratory (CDC, unpublished data, 1976–2007).

applies only to the influenza season that follows the first year that a child younger than 9 years receives influenza vaccine.

6. The antiviral medications recommended for chemoprophylaxis or treatment (ie, oseltamivir or zanamivir) have not changed for the 2008–2009 influenza season. Health care professionals should not prescribe amantadine or rimantadine for influenza treatment or chemoprophylaxis because of widespread resistance to these antiviral medications that continues to exist among some circulating influenza A virus strains. Amantadine and rimantadine are not effective against influenza B strains. Although oseltamivir resistance has been reported, it is still very limited; therefore, current antiviral treatment recommendations have not changed.
7. Influenza vaccine should be offered to all children as soon as vaccine is available. Immunization efforts should continue throughout the entire influenza season, even after influenza activity has been documented in a community. Influenza season often extends well into March and beyond (Fig 2), and there may be more than 1 peak of activity in the same season. Thus, immunization through May 1 can still protect recipients during that particular season and also provide ample opportunity to administer a second dose of vaccine to children who require 2 doses in that season.
8. Health care professionals, influenza campaign organizers, and public health agencies should cooperate to develop plans for expanding outreach and infrastructure to achieve the target immunization of all children 6 months through 18 years of age, beginning no later than the 2009–2010 influenza season. Concerted effort among the aforementioned groups, plus vaccine manufacturers, distributors, and payers, also is necessary to appropriately prioritize administration of influenza vaccine whenever vaccine supplies are delayed or limited.

INFLUENZA VACCINES

Tables 1 and 2 summarize information on the 2 types of influenza vaccine used to immunize both children and adults: trivalent inactivated influenza vaccine (TIV) and live-attenuated influenza vaccine (LAIV). Both vaccines contain the same 2 strains of influenza A subtypes (ie, H1N1 and H3N2) and 1 strain of influenza B, which are anticipated to circulate during the upcoming influenza season. The 2008–2009 vaccine virus strains are an A/Brisbane/59/2007 (H1N1)–like virus, an A/Brisbane/10/2007 (H3N2)–like virus, and a B/Florida/4/2006–like virus strain.

TIV is an inactivated vaccine that contains killed viruses 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 symptoms associated with TIV administration are soreness at the injection site and fever.

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TABLE 1 **LAIV Compared With TIV**

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

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

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

[c] LAIV coadministration has been evaluated systematically only among children aged 12 to 15 months with measles, mumps, and rubella vaccine. TIV coadministration has been evaluated systematically only among adults with pneumococcal polysaccharide vaccine.

Sources: American Academy of Pediatrics, Committee on Infectious Diseases. Prevention of influenza: recommendations for influenza immunization of children, 2007–2008. *Pediatrics*. 2008;121(4). Available at: www.pediatrics.org/cgi/content/full/121/4/e1016; and Fiore AE, Shay DK, Broder K, et al. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep*. 2008;57(RR-7):1–60.

TABLE 2 **Approved Influenza Vaccinations for Different Age Groups: United States, 2008–2009 Influenza Season**

Vaccine	Trade Name	Manufacturer	Dose, mL	Presentation	Thimerosal Mercury Content, μg of Hg/0.5-mL dose	Age Group
Inactivated		Sanofi Pasteur (Swiftwater, PA)	0.25	Prefilled syringe	0.00	6–35 mo
TIV	Fluzone		0.50	Prefilled syringe	0.00	≥36 mo
			0.50	Vial	0.00	≥36 mo
			5.00	Multidose vial	25.00	≥6 mo
TIV	Fluvirin	Novartis (formerly Chiron) (Emeryville, CA)	0.50	Prefilled syringe	<1.00	≥4 y
			5.00	Multidose vial	24.50	≥4 y
TIV	Fluarix	GlaxoSmithKline (King of Prussia, PA)	0.50	Prefilled syringe	<1.25	≥18 y
TIV	FluLuval	GlaxoSmithKline	5.00	Multidose vial	25.00	≥18 y
TIV	Afluria	CSL Biotherapies (King of Prussia, PA)	0.50	Prefilled syringe	0.00	≥18 y
			5.00	Multidose vial containing 10 doses	24.50	
Live-attenuated						
LAIV	FluMist	MedImmune (Gaithersburg, MD)	0.20	Sprayer	0.00	2–49 y

Source: American Academy of Pediatrics, Committee on Infectious Diseases. Prevention of influenza: recommendations for influenza immunization of children, 2007–2008. *Pediatrics*. 2008;121(4). Available at: www.pediatrics.org/cgi/content/full/121/4/e1016

Fever usually occurs within 24 hours after immunization and affects approximately 10% to 35% of children younger than 2 years; the frequency of fever after TIV injection is much lower in older children and adults. Mild systemic symptoms such as nausea, lethargy, headache, muscle aches, and chills also can occur with TIV injection.

LAIV is a live-attenuated influenza vaccine that is administered intranasally and is licensed by the US Food and Drug Administration for people 2 through 49 years of age. However, safety and effectiveness have not been demonstrated for people with chronic medical conditions that confer higher risk of influenza complications. LAIV has the potential to produce mild signs or symptoms related to attenuated influenza virus infection, including fever. LAIV should not be delivered if the amount of nasal congestion is anticipated to impede delivery of the vaccine to the nasopharyngeal mucosa, until the congestion-inducing illness is resolved.

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

Although the efficacy of TIV and LAIV vary depending on recipient age, dosage, and antigenic similarity between circulating and vaccine strains, both vaccines are cost-effective strategies for preventing influenza among children and their families when circulating and

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

Concerns about the minute amounts of thimerosal in vaccines continue to be raised. There is no evidence that the incidence of autism spectrum disorders is higher among children who receive thimerosal-containing vaccines than among children who do not receive vaccines containing thimerosal. The benefits of protecting children against the known risks of influenza far outweigh the hypothetical risks associated with the minute amounts of thimerosal in some currently available forms of influenza vaccine, including the use of TIV in children at high risk with underlying central nervous system disorders. Certain types of TIV can be obtained thimerosal free, including single-dose Fluzone (Sanofi Pasteur) and Fluvirin (Novartis), but the latter vaccine is not licensed for children younger than 4 years. LAIV does not contain thimerosal.

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 that is currently licensed in the United States must be shipped and stored at 2 to 8°C. LAIV doses are 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 information on how concurrent administration of LAIV with other vaccines affects the safety or efficacy of either LAIV or the simultaneously administered vaccine has not been well studied, it is generally recommended that any inactivated or live vaccines can be administered simultaneously with LAIV. After administration of a live vaccine, at least 4 weeks should pass before another live vaccine is administered. Other live vaccines can be given on the same day as LAIV.

CURRENT RECOMMENDATIONS

Influenza immunization is recommended for all children 6 months through 18 years of age. Healthy children aged 2 through 18 years can receive either TIV or LAIV. Immunization efforts should continue to focus on (Fig 1):

- Use of TIV (not LAIV) for all children and adolescents with underlying medical conditions, 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 requiring 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 for aspiration, such as cognitive dysfunction, spinal cord injuries, seizure disorders, or other neuromuscular disorders
- Household contacts and out-of-home care providers of children younger than 5 years and at-risk children of all ages. Healthy contacts 2 through 49 years of age can receive either TIV or LAIV.
- Any female who will be pregnant during influenza season (TIV only).
- Health care professionals.

In addition, immunization with either TIV or LAIV is recommended for the following people to prevent transmission of influenza to those at risk, unless contraindicated:

- Healthy contacts and caregivers of other children or adults at high risk of complications from influenza infection
- Close contacts of immunosuppressed people
- Health care professionals or volunteers

CONTRAINDICATIONS AND PRECAUTIONS

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

Children Who Should Not Be Vaccinated With TIV

- Those younger than 6 months
- Those who have a moderate-to-severe febrile illness
- Those who have a history of hypersensitivity, including anaphylaxis, to eggs, to any previous influenza vaccine dose, or to any of its components
- Those who have a past history of Guillain-Barré syndrome

Children Who Should Not Be Vaccinated With LAIV

- Those younger than 2 years
- Those who have a moderate-to-severe febrile illness
- Those who have received other live vaccines within the last 4 weeks, although other live vaccines can be given on the same day as LAIV

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- Those with asthma, reactive airways disease, 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
- Those who have a past history of Guillain-Barré syndrome
- Adolescents who are pregnant
- Those who have a history of hypersensitivity, including anaphylaxis, to eggs, to any previous influenza vaccine dose, or to any of its components
- Those with any condition that can compromise respiratory function or handling of secretions or can increase the risk for aspiration, such as cognitive dysfunction, spinal cord injuries, seizure disorders, or other neuromuscular disorders

PRECAUTIONS

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

When offering LAIV to children younger than 5 years, a clinician should screen young children who might be at higher risk of asthma by asking parents/guardians of 2-, 3-, and 4-year-olds (24- to 59-month-olds) the question, "In the past 12 months, has a health care professional ever told you that your child had wheezing?" If parents answer "yes" to this question, LAIV is not recommended for those children. TIV would be recommended for the child for whom LAIV is not given because of wheezing.

In addition, TIV is the influenza vaccine of choice for anyone in close contact with a person who is severely compromised (ie, in a protected environment). The preference of TIV over LAIV for these people is because of the theoretical risk of infection in an immunocompromised contact of an LAIV-immunized child. As a precautionary measure, recently vaccinated people should restrict contact with severely immunocompromised (ie, in a protected environment) patients for 7 days after LAIV immunization, although there have been no reports of LAIV transmission from a vaccinated person to an immunocompromised person. The strains of influenza in LAIV are susceptible to oseltamivir and zanamivir, although no data exist on treatment of symptomatic LAIV infections in immunocompromised hosts.

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

FUTURE NEEDS

Although expansion of the recommended age cohort of children for annual immunization can be seen as progress toward universal immunization, the resulting increases in demand for vaccine and overall costs of coverage introduce a series of public health challenges that must be faced in upcoming months.

The CDC has estimated that under this new policy, 30 million more children will be recommended for immunization. Although all 3 strains of the 2008–2009 vaccines are different from last season's strains, manufacturers anticipate being able to provide adequate supplies of vaccine.

Efforts should be dedicated to building 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 seeking influenza immunization. Because of the increased demand for immunization during each influenza season, the AAP and the CDC have suggested providing the vaccine (1) at any visit to the medical home during influenza season when it is not contraindicated, (2) at specially arranged "shot-only" sessions and/or (3) cooperating with community clinics and schools. If alternate venues are used, a system of patient record transfer is necessary to ensure maintenance of accurate immunization records.

Cost-effectiveness and logistic feasibility of vaccinating such a large segment of the population are legitimate concerns. As plans for immunization are made, particular attention must be paid to vaccine supply, distribution, implementation, and financing. Also, large population-based studies are being planned for the 2008–2009 influenza season to determine the cost-effectiveness of universal expansion to this childhood age group. Potential benefits among recipients, their contacts, and the community of more widespread childhood immunization include fewer influenza cases, fewer outpatient visits and hospitalizations for influenza infection, and a decrease in the use of antibiotics, absenteeism from school, and parent work time lost.

Continued evaluation of the safety, immunogenicity, and effectiveness of LAIV for young children is important. Development of a safe, immunogenic vaccine for infants younger than 6 months would also be valuable. Lastly, efforts are being explored to improve the vaccine-development process to allow for a shorter interval between identification of vaccine strains to be included each year and vaccine production.

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Richard L. Gorman, MD
National Institutes of Health
R. Douglas Pratt, MD
Food and Drug Administration
Benjamin Schwartz, MD
National Vaccine Program Office
Jeffrey R. Starke, MD
American Thoracic Society

CONTRIBUTORS

J. Dennis O'Dell, MD
Medical home Expert
Stuart T. Weinberg, MD
Partnership for Policy Implementation (PI)

CONSULTANTS

Edgar O. Ledbetter, MD
H. Cody Meissner, MD

EX OFFICIO

Larry K. Pickering, MD
Red Book Editor
Carol J. Baker, MD
Red Book Associate Editor
Sara S. Long, MD
Red Book Associate Editor

STAFF

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IMPORTANT RESOURCES

American Academy of Pediatrics, Committee on Infectious Diseases. Prevention of influenza: recommendations for influenza immunization of children, 2007–2008. *Pediatrics.* 2008;121(4). Available at: www.pediatrics.org/cgi/content/full/121/4/e1016

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Fiore AE, Shay DK, Broder K, et al. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep*. 2008;57(RR-7):1–60

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This AAP policy statement was prepared in parallel with CDC recommendations and reports. Much of this statement is based on literature reviews, analyses of unpublished data, and deliberations of CDC staff in collaboration with the Advisory Committee on Immunization Practices Influenza Working Group, with liaison from the AAP.

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ERRATA

American Academy of Pediatrics, J Stirling, Jr and the Committee on Child Abuse and Neglect and Section on Adoption and Foster Care American Academy of Child and Adolescent Psychiatry, L Amaya-Jackson, National Center for Child Traumatic Stress, Understanding the Behavioral and Emotional Consequences of Child Abuse. PEDIATRICS 2008;122(3):667–673

Two errors occurred in the American Academy of Pediatrics clinical report "Understanding the Behavioral and Emotional Consequences of Child Abuse" (doi:10.1542/peds.2008-1885). Lisa Nalven, MD, MA, was inadvertently omitted from the roster of the Section on Adoption and Foster Care Executive Committee, and the name of David A. Harmon, MD, was misspelled. We regret the errors.

doi:10.1542/peds.2008-3077

SL Cutrona, S Woolhandler, KE Lasser, DH Bor, DU Himmelstein, WH Shrank, NS LeLeiko. Free Drug Samples in the United States: Characteristics of Pediatric Recipients and Safety Concerns. PEDIATRICS 2008;122(4):736–742

Errors occurred in the article by Cutrona et al, titled "Free Drug Samples in the United States: Characteristics of Pediatric Recipients and Safety Concerns" published in the October 2008 issue of *Pediatrics* (doi:10.1542/peds.2007-2928). On page 736 in the Abstract under the heading 'Results' in paragraph 1, on lines 9–10, the authors wrote: "The 15 most frequently distributed pediatric free samples in 2004 included 2 schedule II controlled medications, Strattera (atomoxetine) and Adderall (amphetamine/dextroamphetamine), . ." This should have read "The 15 most frequently distributed pediatric free samples in 2004 included 1 schedule II controlled medication, Adderall (amphetamine/dextroamphetamine), . ."

On page 741 in the Results section under the heading 'Safety Concerns' in paragraph 1, on lines 9–11, the authors wrote: "In addition, 2 of the top 15 sample medications were schedule II controlled substances." This should have read "In addition, 1 of the top 15 sample medications was a schedule II controlled substance." Also on page 741 in the Discussion section, paragraph 6, lines 1–3, the authors wrote: "Our finding that 2 of the top 15 sample medications were schedule II controlled substances raises other safety concerns." This should have read "Our finding that 1 of the top 15 sample medications was a schedule II controlled substance raises other safety concerns."

doi:10.1542/peds.2008-3307

Committee on Infectious Diseases. Prevention of Influenza: Recommendations for Influenza Immunization of Children, 2008–2009. PEDIATRICS 2008;122(5):1135–1141

Several errors occurred in the AAP clinical report "Prevention of Rickets and Vitamin D Deficiency in Infants, Children, and Adolescents" (doi:10.1542/peds.2008-2449). In Table 2, the last row of the left column should read: Multivitamin preparations: polyvitamins (A, D, and C vitamin preparations)[c]. In addition, Arthur J. Eidelman, MD, Policy Committee Chairperson, should have been included on the roster for the Section on Breastfeeding Executive Committee. We regret the errors.

doi:10.1542/peds.2008-3365

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/content/early/2008/09/08/peds.2008-2449.citation

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DOI: 10.1542/peds.2008-2449

Updated Information & Services	including high resolution figures, can be found at: /content/early/2008/09/08/peds.2008-2449.citation
Supplementary Material	Supplementary material can be found at: /content/suppl/2009/07/27/peds.2008-2449.DC1.html
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