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Prevention and Control of Influenza

Recommendations of the Advisory Committee on Immunization Practices (ACIP) - 2005

Introduction

Epidemics of influenza typically occur during the winter months in temperate regions and have been responsible for an average of 36,000 deaths/year in the United States (1990-1999). Rates of serious illness and death are highest among persons aged greater than 65 years, children less than two years of age and persons of any age with medical conditions that place them at increased risk for complications from influenza. As a result of the predictability of the problem, the potential severe impact on the health of a wide range of people, and the numerous strategies available to combat influenza, each year the Virginia Epidemiology Bulletin (VEB) reviews the updated recommendations from the Advisory Committee on Immunization Practices (ACIP). This article summarizes the 2005 recommendations by the ACIP for the use of influenza vaccine (inactivated and live attenuated) and the use of antiviral agents for treatment and prophylaxis of influenza for the 2005-2006 influenza season [MMWR: July 29, 2005 / 54(RR08);1-40]. The full report and updated information on influenza can be accessed at www.cdc.gov/flu.

Background

Influenza A and B are the two main types of influenza viruses that cause epidemic human disease. A person's immunity to the surface antigens reduces the likelihood of infection and severity of disease if infection occurs. However, waning immunity over time and the development of antigenic variants through antigenic drift mean that seasonal epidemics occur.

Influenza virus spreads from person to person mainly in droplets produced through the coughing and sneezing of infected persons. However, spread can occur by the hands touching droplets from an infected person and then touching the nose or mouth before hand washing. The incubation period for influenza is 1-4 days, with an average of two days. Adults typically are infectious from the day before symptoms begin through approximately five days after illness onset. Young children can shed virus for several days before their illness onset, and can be infectious for ≥10 days. Severely immunocompromised persons can shed influenza viruses for weeks or months.

Clinical Signs and Symptoms of Influenza

Uncomplicated influenza illness is characterized by the **abrupt** onset of constitutional and respiratory signs and symptoms (e.g., fever, myalgia, headache, malaise, nonproductive cough, sore throat, and rhinitis). Among children, otitis media, nausea, and vomiting are commonly reported with influenza illness. Young children with influenza infection can also have initial symptoms mimicking bacterial sepsis with high fevers, and approximately 20% of children hospitalized with influenza can have febrile seizures.

Influenza illness typically resolves after 3-7 days for the majority of persons, although cough and malaise can persist for greater than two weeks. However, influenza can exacerbate underlying medical conditions (e.g., pulmonary or cardiac disease), lead to primary influenza viral pneumonia or secondary bacterial pneumonia, or occur as part of a coinfection with other viral or bacterial pathogens. Influenza infection has also been associated with encephalopathy, transverse myelitis, Reye syndrome, myositis, myocarditis, and pericarditis.

The risks for complications, hospitalizations, and deaths from influenza are higher among persons aged ≥65 years, young children, and persons of any age with certain underlying health conditions than among healthy older children and younger adults. Hospitalization rates among children aged less than one year are comparable to rates reported among persons aged ≥65 years of age.

Older adults account for ≥90% of deaths attributed to pneumonia and influenza. Deaths from influenza are uncommon among children—153 laboratory-confirmed influenza-related pediatric deaths were reported in the U.S. during the 2003-04 influenza season. Overall, models suggest that during the 1990s annual influenza-related deaths occurred at a rate of 0.4 deaths per 100,000 among children aged less than five years, compared with 98.3 per 100,000 among adults aged ≥65 years.

Role of Laboratory Diagnosis

Appropriate treatment of patients with respiratory illness depends on accurate and timely diagnosis. Early diagnosis of influenza can reduce the inappropriate use of antibiotics and provide the option of using antiviral therapy. The accuracy of clinical diagnosis of influenza on the basis of symptoms alone is limited since symptoms from illness caused by other pathogens can overlap considerably with influenza.

Diagnostic tests available for influenza include viral culture, serology, rapid antigen testing, polymerase chain reaction (PCR) and immunofluorescence. Sensitivity and specificity of any test for influenza might vary by the laboratory that performs the test, the type of test used, and the type of specimen tested. Among respiratory specimens for viral isolation or rapid detection, **nasopharyngeal specimens** are typically more effective than throat swab specimens.

Despite the availability of rapid diagnostic tests, collecting clinical specimens for viral culture is critical, because only culture isolates can provide specific information regarding circulating influenza subtypes and strains. This information is needed to compare current circulating influenza strains with vaccine strains, to guide decisions regarding influenza treatment and chemoprophylaxis, and to formulate vaccine for the coming year. Virus isolates are also needed to monitor for the emergence of antiviral resistance and the emergence of novel influenza A subtypes that might pose a pandemic threat. Finally, since the specificity and the sensitivity of rapid tests are lower than for viral culture, healthcare workers should consider confirming negative tests with viral culture or other means if influenza is strongly suspected.

Options for Controlling Influenza

Vaccinating persons at high risk for complications and their contacts each year before seasonal increases in influenza virus circulation is the most effective means of reducing the effect of influenza. Inactivated (i.e., killed virus) influenza vaccine and live, attenuated influenza vaccine (LAIV) are available for use in the United States (Table 1). Antiviral drugs used for chemoprophylaxis or treatment of influenza are a key adjunct to vaccine. However, antiviral medications are not a substitute for vaccination.

2005-06 Influenza Vaccine

Table 1. Live, attenuated influenza vaccine (LAIV) compared with inactivated influenza vaccine

Factor	LAIV	Inactivated influenza vaccine
Route of administration	Intranasal spray	Intramuscular injection
Type of vaccine	Live virus	Killed virus
Number of included virus strains	3 (2 influenza A, 1 influenza B)	Same as LAIV
Vaccine virus strains updated	Annually	Same as LAIV
Frequency of administration	Annually	Same as LAIV
Approved age and risk groups*	Healthy persons aged 5-49 years	Persons aged ≥6 months
Can be administered to family members or close contacts of immunosuppressed persons not requiring a protected environment	Yes	Yes
Can be administered to family members or close contacts of immunosuppressed persons requiring a protected environment (e.g., hematopoietic stem cell transplant recipient)	Inactivated influenza vaccine preferred	Yes
Can be administered to family members or close contacts of persons at high risk but not severely immunosuppressed	Yes	Yes
Can be administered simultaneously with other vaccines	Yes†	Yes§
If not administered simultaneously, can be administered within 4 weeks of another live vaccine	Prudent to space 4 weeks apart	Yes
If not administered simultaneously, can be administered within 4 weeks of an inactivated vaccine	Yes	Yes

*Populations at high risk from complications of influenza infection include persons aged ≥65 years; residents of nursing homes and other chronic-care facilities that house persons with chronic medical conditions; adults and children with chronic disorders of the pulmonary or cardiovascular systems; adults and children with chronic metabolic diseases (including diabetes mellitus), renal dysfunction, hemoglobinopathies, or immunosuppression; children and adolescents receiving long-term aspirin therapy (at risk for developing Reye syndrome after wild-type influenza infection); pregnant women; and children aged 6-23 months.
†No data are available regarding effect on safety or efficacy.
§Inactivated influenza vaccine coadministration has been evaluated systematically only among adults with pneumococcal polysaccharide vaccine.

Composition

The inactivated influenza vaccine contains killed viruses and is administered intramuscularly by injection. Sanofi Pasteur, Inc. (formerly Aventis Pasteur, Inc.) produces FluZone,® an inactivated influenza vaccine for persons aged ≥6 months. Chiron produces Fluvirin,™ an inactivated influenza vaccine. Pending approval by the Federal Drug Administration (FDA), the vaccine would be licensed for use in persons aged ≥4 years. GlaxoSmithKline, Inc. produces Fluarix,™ an inactivated influenza vaccine for persons aged ≥18 years.

MedImmune produces FluMist,™ a live attenuated virus vaccine that is intranasally administered and approved for use only among healthy persons aged 5-49 years.

Both the inactivated and LAIV prepared for the 2005-06 season will include:

- A/California/7/2004 (H3N2)-like or equivalent antigens;
- A/New Caledonia/20/99 (H1N1)-like antigens; and,

- B/Shanghai/361/2002-like or equivalent antigens.

Because circulating influenza A (H1N2) viruses are a re-assortment of influenza A (H1N1) and (H3N2) viruses, antibody directed against influenza A (H1N1) and influenza (H3N2) vaccine strains provides protection against circulating influenza A (H1N2) viruses.

For the inactivated vaccine, the vaccine viruses are made noninfectious (i.e., inactivated or killed). Since influenza viruses for both the inactivated and live attenuated vaccines are initially grown in embryonated hens' eggs, both types of vaccines might contain limited amounts of residual egg protein. In addition, manufacturers might use different compounds to inactivate influenza viruses and add antimicrobials to prevent bacterial contamination. For example, FluZone in multidose vials contains thimerosal as a preservative. Thimerosal-free FluZone is packaged as 0.25-mL unit dose syringes for use among persons aged 6-35 months and thimerosal-free FluZone is packaged as 0.5 mL unit dose syringes for use among persons aged ≥3 years. Fluvirin in a preservative-free formulation (contains trace amounts of thimerosal) is packaged as 0.5-mL single-dose syringes. LAIV does not contain thimerosal. Package inserts should be consulted for additional information as needed.

Efficacy and Effectiveness

The effectiveness of influenza vaccine depends primarily on the age and immunocompetence of the vaccine recipient and the degree of similarity between the viruses in the vaccine and those in circulation. The majority of vaccinated children and young adults develop high postvaccination hemagglutination inhibition antibody titers. These antibody titers are protective against illness caused by strains similar to those in the vaccine.

Children. Children aged ≥6 months can develop protective levels of antibody after influenza vaccination. One study of children aged 1-15 years found that inactivated influenza vaccine was 77%-91% effective against influenza respiratory illness. A study of healthy children initially aged 15-71 months found that LAIV was 92% effective in preventing culture-confirmed influenza during the two-season study. LAIV also reduced febrile otitis media by 27%.

Adults Aged <65 Years. When the vaccine and circulating viruses are antigenically similar, influenza vaccine prevents influenza illness among approximately 70%-90% of healthy adults aged <65 years. Vaccination of healthy adults has resulted in decreased work absenteeism and decreased use of healthcare resources when the vaccine and circulating viruses are well-matched. In another study, healthy adults aged 18-41 years experimentally challenged by viruses compared LAIV and inactivated vaccine and found the overall efficacy in preventing laboratory-documented influenza to be 85% and 71%, respectively (difference not statistically significant).

Adults Aged >65 Years. Older persons and persons with certain chronic diseases might develop lower postvaccination antibody titers than healthy young adults and thus can remain susceptible to influenza-related upper respiratory tract infection. One study of noninstitutionalized persons aged ≥60 years reported a vaccine efficacy of 58% against influenza respiratory illness, but indicated that efficacy might be lower among those aged ≥70 years. The vaccine can be effective in preventing secondary complications and reducing the risk for influenza-related hospitalization and death among adults ≥65 years with and without high-risk medical conditions (e.g., heart disease and diabetes). Among elderly persons not living in nursing homes or similar chronic-care facilities, influenza vaccine is 30%-70% effective in preventing hospitalization for pneumonia and influenza. Among older persons who do reside in nursing homes the vaccine can be 50%-60% effective in preventing hospitalization or pneumonia and 80% effective in preventing death, although the effectiveness in preventing influenza illness often ranges from 30%-40%.

Supply

Influenza vaccine distribution delays or vaccine supply shortages have occurred in the United States in three of the last five influenza seasons. Influenza vaccine delivery delays or shortages exist in part because of the inherent critical time constraints in manufacturing the vaccine given the annual updating of the influenza vaccine strains. Although the total vaccine supply for the 2005-06 influenza season is not yet known, four manufacturers are now expected to provide influenza vaccine to the U.S. population during the 2005-06 influenza season (Table 2). The timing of vaccine distribution for the 2005-06 influenza season remains unknown. Steps being taken to accommodate delays or vaccine shortages include identification and implementation of ways to expand the influenza vaccine supply and the improvement of targeted delivery of vaccine to groups at high risk when delays or shortages are expected.

Given the uncertainties in the number of doses that will be available and the distribution, ACIP and the Centers for Disease Control and Prevention (CDC) have established priority groups, ranked in three tiers, on the basis of influenza-associated mortality and hospitalization rates (Table 3). ACIP and CDC recommend that the priority groups corresponding to tiers 1A-1C in Table 3 receive inactivated influenza vaccine until October 24, 2005. Beginning October 24, 2005, all persons will be eligible for vaccination with inactivated influenza vaccine.

The tiered prioritization is not recommended for LAIV administration. LAIV may be administered at any time for vaccination of nonpregnant healthy persons aged 5-49 years, including most healthcare personnel, other persons in close contact with groups at high risk for influenza-related complications, and others desiring protection against influenza.

Recommendations for Influenza Vaccinations

LAIV is approved for use only among healthy persons aged 5-49 years.

Inactivated influenza vaccine is approved for persons aged ≥6 months, including those at increased risk for complications from influenza including:

- persons aged ≥65 years;
- residents of nursing homes and other chronic-care facilities that house persons of any age who have chronic medical conditions;
- adults and children who have chronic disorders of the pulmonary or cardiovascular systems, including asthma (note: hypertension is not considered a high-risk condition);

- adults and children who have required regular medical follow-up or hospitalization during the preceding year because of chronic metabolic disease (including diabetes mellitus), renal dysfunction, hemoglobinopathies, or immunosuppression [e.g., due to medications, human immunodeficiency virus (HIV)];
- adults and children who have any condition (e.g., cognitive dysfunction, spinal cord injuries, seizure disorders, or other neuromuscular disorders) that can compromise respiratory function or the handling of respiratory secretions or that can increase the risk for aspiration;
- children and adolescents (aged 6 months-18 years) on long-term aspirin therapy and, therefore, who might be at risk for experiencing Reye syndrome after influenza infection;
- women who will be pregnant during the influenza season; and
- children aged 6-23 months.

In 2004, approximately 88 million persons in the United States were included in one or more of these target groups.

Table 2. Influenza vaccine manufacturers and projected supplies for the 2005-06 influenza season

Manufacturer	Vaccine	Formulation	Contains thimerosal preservative	Age indication	No. of projected doses
Sanofi Pasteur, Inc.	Fluzone® trivalent inactivated influenza vaccine (TIV)	Multidose vial	Yes	≥6 mos	60 million*
		Single-dose prefilled 0.5 mL syringe or vial	No	≥36 mos	
		Single-dose prefilled 0.25 mL syringe	No	6-35 mos	
Chiron Corporation	Fluviron™ TIV	Multidose vial	Yes	≥4 yrs	18-26 million†
		Single-dose prefilled 0.5 mL syringe	No§	≥4 yrs	
GlaxoSmithKline, Inc.	Fluarix™ TIV	Single-dose prefilled 0.5 mL syringe	No§	≥18 yrs	8 million
Medimmune Vaccines, Inc.	FluMist™ live, attenuated influenza vaccine (LAIV)	Single-dose nasal sprayer	No	Healthy, nonpregnant persons aged 5-49 yrs	3 million

**Approximately 6-8 million of the 60 million doses are projected to be distributed in single-dose prefilled syringes or vials.*
†Chiron projects that the majority of its vaccine doses will be distributed by the end of October 2005; the exact timing of distribution was uncertain as of August 30, 2005. A minimal number of doses of Chiron thimerosal-free formulation might be available in late season.
§These preparations contain traces of thimerosal from the production process.

Information Regarding Vaccination of Specific Populations

Persons Aged 50-64 Years

Vaccination is recommended for persons aged 50-64 years because approximately 34% of people in this group have one or more high-risk medical conditions. Influenza vaccine has been recommended for this entire age group because age-based strategies are more successful in increasing vaccine coverage than patient-selection strategies based on medical conditions. Persons aged 50-64 years without high-risk conditions also receive benefit from vaccination in the form of decreased rates of influenza illness, decreased work absenteeism, and decreased need for medical visits and medication, including antibiotics.

Persons Who Can Transmit Influenza to Those at High Risk

Decreasing transmission of influenza from caregivers and household contacts to persons at high risk might reduce influenza-related deaths among persons at high risk.

Therefore, the following groups should be vaccinated:

- physicians, nurses, and other personnel in both hospital and outpatient-care settings, including medical emergency response workers (e.g., paramedics and emergency medical technicians);
- employees of nursing homes and chronic-care facilities who have contact with patients or residents;
- employees of assisted living and other residences for persons in groups at high risk;
- persons who provide home care to persons in groups at high risk; and,
- household contacts (including children) of persons in groups at high risk.

Because children aged 0-23 months are at increased risk for influenza-related hospitalization, vaccination is recommended for their household contacts and out-of-home caregivers. Since the current inactivated influenza vaccine is not approved for use among children aged less than six months, vaccinating their household contacts and out-of-home caregivers might decrease influenza infection among these children. Beginning in March 2003, the group of children eligible for influenza vaccine coverage under the Vaccines for Children (VFC) program was expanded to include all VFC-eligible children aged 2-18 years who are household contacts of children aged 0-23 months.

Healthy persons aged 5-49 years in these groups who are not contacts of severely immunosuppressed persons can receive either LAIV or inactivated influenza vaccine. All other persons in these groups should receive inactivated influenza vaccine.

Pregnant Women

Women who will be pregnant during the influenza season should be vaccinated. Vaccination can occur in any trimester. No adverse fetal effects have been associated with influenza vaccine and estimates suggest that 1-2 hospitalizations can be prevented for every 1,000 pregnant women vaccinated against influenza.

Persons Infected with HIV

The risk for influenza-related death has been estimated at 9.4-14.6/10,000 persons with acquired immunodeficiency syndrome (AIDS) compared with 0.09-0.10/10,000 among all persons aged 25-54 years and 6.4-7.0/10,000 among persons aged ≥65 years. Therefore, vaccination will benefit HIV-infected persons, including HIV-infected pregnant women.

Breastfeeding Mothers

Influenza vaccine does not affect the safety of mothers who are breastfeeding or their infants. Breastfeeding does not adversely affect the immune response and is not a contraindication for vaccination.

Travelers

The risk for exposure to influenza during travel depends on the time of year and destination. Persons at high risk for complications of influenza who were not vaccinated with influenza vaccine during the preceding fall or winter should consider receiving influenza vaccine before travel if they plan to travel to the tropics, travel with organized tourist groups at any time of year, or travel to the Southern Hemisphere during April-September. No information is available regarding the benefits of revaccinating persons before summer travel who were already vaccinated in the preceding fall. Persons aged ≥50 years and others at high risk should consult with their healthcare workers before embarking on travel during the summer to discuss the advisability of carrying antiviral medications for either prophylaxis or treatment of influenza.

General Population

In addition to the groups for which annual influenza vaccination is recommended, healthcare workers should administer influenza vaccine to any person who wishes to reduce the likelihood of becoming ill with influenza (the inactivated vaccine can be administered to children ≥6 months), depending on vaccine availability. Persons who provide essential community services should be considered for vaccination to minimize disruption of essential activities during influenza outbreaks. Students or other persons in institutional settings (e.g., those who reside in dormitories) should be encouraged to receive vaccine.

Inactivated Influenza Vaccine

Dosage and Route

Dosage recommendations for inactivated influenza vaccine vary according to age group (Table 4). Among previously **unvaccinated** children aged less than nine years, two doses administered ≥1 month apart are recommended to achieve a satisfactory antibody responses. If possible, the second dose should be administered before December. In a child aged less than nine years who received vaccine for the first time but who did not receive a second dose of vaccine within the same season, only one dose of vaccine should be administered in subsequent seasons. Among adults, studies have indicated limited or no improvement in antibody response when a second dose is administered during the same season. However, even when the current influenza vaccine contains one or more antigens administered in previous years, annual vaccination with the current vaccine is necessary because immunity declines during the year after vaccination.

The intramuscular route is recommended for inactivated influenza vaccine. Adults and older children should be vaccinated in the deltoid muscle. Infants and young children should be vaccinated in the anterolateral aspect of the thigh.

Persons Who Should Not Be Vaccinated with Inactivated Influenza Vaccine

Inactivated influenza vaccine should not be administered to persons with a known anaphylactic hypersensitivity to eggs or to other components of the influenza vaccine without first consulting a physician. Prophylactic use of antiviral agents is an option for preventing influenza among such persons. Vaccination may also be an option after appropriate allergy evaluation and desensitization. Persons with acute febrile illness usually should not be vaccinated until their symptoms have abated. However, minor illnesses with or without fever do not contraindicate use of influenza vaccine, particularly among children with mild upper respiratory tract infection or allergic rhinitis.

Side Effects and Adverse Reactions

When educating patients regarding potential side effects, healthcare workers should emphasize:
1) inactivated influenza vaccine contains noninfectious killed viruses **and cannot cause influenza**; and,
2) coincidental respiratory disease unrelated to influenza vaccination can occur after vaccination.

The most frequent side effect of vaccination is soreness at the vaccination site that lasts less than two days. These local reactions typically are mild. Fever, malaise, myalgia, and other systemic symptoms can occur after vaccination with inactivated vaccine and most often affect persons who have had no prior exposure to the influenza virus antigens in the vaccine (e.g., young children). These reactions begin 6-12 hours after vaccination

Table 3. Priority groups for vaccination with inactivated influenza vaccine

Tier		Priority group*
1	A	Persons aged ≥65 years with comorbid conditions
		Residents of long-term-care facilities
	B	Persons aged 2-64 years with comorbid conditions
		Persons aged ≥65 years without comorbid conditions
		Children aged 6-23 months
		Pregnant women
	C	Healthcare personnel
		Household contacts and out-of-home caregivers of children aged <6 months
2		Household contacts of children and adults at increased risk for influenza-related complications
		Healthy persons aged 50-64 years
3		Persons aged 2-49 years without high-risk conditions

*Certain persons might be included in more than one group.

Table 4. Inactivated influenza vaccine dosage, by age group, United States, 2005-06 season

Age group†	Dose	No. of doses	Route§
6-35 months	0.25 mL	1 or 2¶	Intramuscular
3-8 years	0.50 mL	1 or 2¶	Intramuscular
≥9 years	0.50 mL	1	Intramuscular

† Because of their decreased potential for causing febrile reactions, only split-virus vaccines should be used for children aged <13 years. Whole-virus vaccine is not available in the United States. Split-virus vaccine might be labeled as split, subvirion, *or* purified-surface-antigen *vaccine. Immunogenicity and side effects of split- and whole-virus vaccines are similar among adults when vaccines are administered at the recommended dosage.*
§For adults and older children, the recommended site of vaccination is the deltoid muscle. The preferred site for infants and young children is the anterolateral aspect of the thigh.
¶Two doses administered at least 1 month apart are recommended for children aged <9 years who are receiving influenza vaccine for the first time.

and can persist for 1-2 days. Among older persons and healthy young adults, influenza vaccine is not associated with higher rates of systemic symptoms compared with placebo injections. No increase in asthma exacerbations has been reported for either children or adults.

Immediate, presumably allergic, reactions (e.g., hives, angioedema, allergic asthma, and systemic anaphylaxis) rarely occur after influenza vaccination. These reactions probably result from hypersensitivity to certain vaccine components (e.g., residual egg protein). Protocols exist for safely administering influenza vaccine to persons with egg allergies.

Substantial evidence exists that multiple infectious illnesses, such as *Campylobacter jejuni* and upper respiratory tract infections, are associated with Guillain-Barré Syndrome (GBS). Investigations to date indicate no substantial increase in GBS associated with influenza vaccines other than the swine influenza vaccine in 1976. However, persons with a history of GBS do have a greater likelihood of subsequently experiencing GBS than persons without such a history. Thus, the likelihood of coincidentally experiencing GBS after influenza vaccination is expected to be greater among persons with a history of GBS than among persons with no history of this syndrome. Whether influenza vaccination specifically might increase the risk for recurrence of GBS is unknown; therefore, avoiding vaccinating persons who are not at high risk for severe influenza complications and who are known to have experienced GBS within six weeks after a previous influenza vaccination is prudent. Influenza antiviral chemoprophylaxis for these persons is a consideration. Although data are limited, for the majority of persons who have a history of GBS and who are at high risk for severe complications from influenza, the established benefits of influenza vaccination justify annual vaccination.

Healthcare professionals should promptly report all clinically significant adverse events after influenza vaccination of children to the Food and Drug Administration (FDA)/CDC Vaccine Adverse Event Reporting System (VAERS), even if the healthcare provider is not certain that the vaccine caused the event.

Live, Attenuated Influenza Vaccine

LAIV is an option for the vaccination of healthy persons aged 5-49 years, including persons in close contact with groups at high risk. The LAIV virus is:

- attenuated, producing mild or no signs or symptoms related to influenza virus infection;
- temperature-sensitive, limiting the replication of the vaccine viruses at 38°C-39°C (restricting LAIV viruses from replicating efficiently in human lower airways); and,
- cold-adapted, enabling efficient replication at 25°C, a temperature that is permissive for replication of LAIV viruses in the mucosa of the nasopharynx.

Available data indicate that both children and adults vaccinated with LAIV can shed vaccine viruses for ≥2 days after vaccination, although in lower titers than typically occurs with shedding of wild-type influenza viruses. Shedding should not be equated with person-to-person transmission of vaccine viruses, although, in rare instances, vaccine viruses that are shed can be transmitted to nonvaccinated persons.

LAIV Dosage and Administration

LAIV is intended for intranasal administration only and should not be administered by the intramuscular, intradermal, or intravenous route. LAIV is supplied in a pre-filled single-use sprayer containing 0.5 mL of vaccine. The vaccine can be administered by holding an individual sprayer in the palm of the hand until thawed, with subsequent immediate use. Alternatively, the vaccine can be thawed in a refrigerator and stored at 2°C-8°C for up to 60 hours before use. Vaccine should not be refrozen after thawing. Approximately 0.25 mL (i.e., half of the total sprayer contents) is sprayed into the first nostril while the recipient is in the upright position. An attached dose-divider clip is removed from the sprayer to administer the second half of the dose into the other nostril. If the vaccine recipient sneezes after administration, the dose should not be repeated.

LAIV should be administered annually according to the following schedule (Note: One dose equals 0.5 mL divided equally between each nostril):

- Children aged 5-8 years previously unvaccinated at any time with either LAIV or inactivated influenza vaccine should receive two doses of LAIV separated by 6-10 weeks.
- Children aged 5-8 years previously vaccinated at any time with either LAIV or inactivated influenza vaccine should receive one dose of LAIV. They do not require a second dose.
- Persons aged 9-49 years should receive one dose of LAIV.

LAIV can be administered to persons with minor acute illnesses (e.g., diarrhea or mild upper respiratory tract infection with or without fever). However, if nasal congestion is present that might impede delivery of the vaccine to the nasopharyngeal mucosa, deferral of administration should be considered until resolution of the illness.

Following the ACIP general recommendations when immunizing with two or more vaccines is prudent: inactivated vaccine can be administered either simultaneously or at any time before or after LAIV. Two live vaccines not administered on the same

day should be administered ≥4 weeks apart when possible.

Persons Who Should Not Be Vaccinated with LAIV

The following populations should not be vaccinated with LAIV:

- Persons aged less than five years or those aged greater than 49 years;
- Persons with asthma, reactive airways disease, cystic fibrosis, chronic obstructive pulmonary disease or other chronic disorders of the pulmonary or cardiovascular systems;
- Persons with other underlying medical conditions, including such metabolic diseases as diabetes, renal dysfunction, and hemoglobinopathies;
- Persons with known or suspected immunodeficiency diseases or who are receiving immunosuppressive therapies;
- Household members, healthcare workers, and others who have close contact with severely immunosuppressed persons (e.g., patients with hematopoietic stem cell transplants);
- Children or adolescents receiving aspirin or other salicylates (because of the association of Reye syndrome with wild-type influenza infection);
- Persons with a history of GBS;
- Pregnant women; or,
- Persons with a history of hypersensitivity, including anaphylaxis, to any of the components of LAIV or to eggs.

Protection from influenza using inactivated influenza vaccine may be an option for some persons in these groups.

Use of inactivated influenza vaccine is preferred for vaccinating household members, healthcare workers, and others who have close contact with severely immunosuppressed persons (e.g., patients with hematopoietic stem cell transplants) as a result of the theoretical risk that a live, attenuated vaccine virus could be transmitted to the severely immunosuppressed person and cause disease. No preference exists between inactivated influenza vaccine or LAIV use by healthcare workers or other healthy persons aged 5-49 years who have close contact with persons with lesser degrees of immunosuppression (e.g., persons with diabetes, persons with asthma taking corticosteroids, or persons infected with human immunodeficiency virus) or other groups at high risk from influenza. If a person receives LAIV, that person should refrain from contact with severely immunosuppressed patients for seven days after vaccine receipt.

Personnel Who May Administer LAIV

Low-level introduction of vaccine viruses into the environment is likely unavoidable when administering LAIV. The risk of acquiring vaccine viruses from the environment is unknown but likely limited. As a result, severely immunosuppressed persons should not administer LAIV. Other persons with underlying medical conditions placing them at high risk for influenza complications (e.g., pregnant women, persons with asthma, and persons aged ≥50 years) may administer LAIV.

LAIV and Use of Influenza Antiviral Medications

The effect on safety and efficacy of LAIV coadministration with influenza antiviral medications has not been studied. However, because influenza antivirals reduce replication of influenza viruses, LAIV should not be administered until 48 hours after cessation of influenza antiviral therapy, and influenza antiviral medications should not be administered for two weeks after receipt of LAIV.

LAIV Storage

LAIV must be stored at -15°C or colder. LAIV may be stored in a frost-free freezer (an optional manufacturer-supplied freezer box may be used for additional vaccine protection).

Side Effects and Adverse Reactions

The incidence of adverse events possibly complicating influenza (e.g., pneumonia, bronchitis, bronchiolitis, or central nervous system events) has not been found to be statistically different among LAIV and placebo recipients aged 5-49 years.

Among children, signs and symptoms reported more often among vaccine recipients than placebo recipients included runny nose or nasal congestion, headache, fever, vomiting, abdominal pain, and myalgias. Symptoms were associated more often with the first dose and were self-limited.

Among adults, runny nose or nasal congestion, headache, cough, chills, tiredness/weakness and sore throat have been reported more often among vaccine recipients than placebo recipients.

In studies, serious adverse events among healthy children aged 5-17 years or healthy adults aged 18-49 years occurred at a rate of less than 1%. Healthcare workers should promptly report all clinically significant adverse events after LAIV administration to VAERS, as recommended for inactivated influenza vaccine.

Timing of Annual Influenza Vaccination

In the United States, seasonal influenza activity can begin to increase as early as October or November, although influenza activity has not reached peak levels in the majority of recent seasons until late December-early March. Therefore, the optimal time to vaccinate is usually during October-November, but vaccine administered after November is likely to be beneficial.

After November, many persons who should or want to receive influenza vaccine remain unvaccinated. To improve vaccine coverage, influenza vaccine should continue to be offered in December and throughout the influenza season as long as vaccine supplies are available.

Strategies for Implementing Vaccination Recommendations in Healthcare Settings

Successful vaccination programs combine publicity and education for healthcare workers and other potential vaccine recipients, a plan for identifying persons at high risk, use of reminder/recall systems, and efforts to remove administrative and financial barriers that prevent persons from receiving the vaccine. **When possible, the use of standing orders programs is recommended for long-term-care facilities, hospitals, and home health agencies to ensure the administration of recommended vaccinations for adults.**

Assisted living housing, retirement communities, and recreation centers should

offer unvaccinated residents and attendees vaccination on-site before the influenza season. Staff education should emphasize the need for influenza vaccine.

Beginning in October each year, healthcare facilities should offer influenza vaccinations to all personnel, including night and weekend staff. Particular emphasis should be placed on providing vaccinations to persons who care for members of groups at high risk. Efforts should be made to educate healthcare personnel regarding the benefits of vaccination and the potential health consequences of influenza illness for themselves and their patients. All healthcare personnel should be provided convenient access to influenza vaccine at the work site, free of charge, as part of employee health programs.

Recommendations for Using Antiviral Agents for Influenza

The primary methods of controlling the spread of influenza consist of immunization and good respiratory etiquette. However, influenza antiviral medications can play an important role in the management of influenza both as chemoprophylaxis to prevent illness and as treatment of influenza infection.

Influenza Antiviral Agents

Currently, four influenza antiviral agents are licensed and available in the United States: amantadine, rimantadine, zanamivir, and oseltamivir (Table 5).

Amantadine and rimantadine are chemically related drugs known as adamantanes (or M2 inhibitors)—this class has activity **only** against **influenza A viruses**. Amantadine is approved for the treatment and chemoprophylaxis of influenza A virus infections among adults and children aged ≥1 year. Rimantadine is approved for treatment and chemoprophylaxis of influenza A infection among adults and chemoprophylaxis among children aged ≥1 year (although some specialists consider it appropriate for treatment of influenza A among children).

Zanamivir and oseltamivir belong to the class of drugs known as neuraminidase inhibitors—they have activity against **both influenza A and B viruses**. Zanamivir is approved for treating persons aged ≥7 years with uncomplicated influenza infections. Oseltamivir is approved for the treatment of persons with uncomplicated influenza infections aged ≥1 year, and is also approved for chemoprophylaxis of influenza among persons aged ≥13 years.

When considering use of influenza antiviral medications (i.e., choice of antiviral drug, dosage, and duration of therapy), clinicians must consider the patient's age, weight, and renal function; presence of other medical conditions; indications for use (i.e., prophylaxis or therapy); and the potential for interaction with other medications.

An overview of these medications is presented below. However, package inserts should be consulted for additional information as needed.

Treatment

When administered within two days of illness onset to otherwise healthy adults, amantadine and rimantadine can reduce the duration of uncomplicated influenza A illness, and zanamivir and oseltamivir can reduce the duration of uncomplicated influenza A and B illness, by approximately one day.

Data are limited regarding the effectiveness of these agents in preventing serious influenza-related complications or their effectiveness for the treatment of influenza among persons at high risk for serious complications of influenza. One study assessing oseltamivir treatment primarily among adults reported a reduction in complications requiring antibiotic therapy compared with placebo. Even fewer studies of the efficacy of influenza antivirals have been conducted among pediatric populations. However, one study documented a decreased incidence of otitis media among children taking oseltamivir.

To reduce the emergence of antiviral drug-resistant viruses, amantadine or rimantadine therapy for persons with influenza A illness should be discontinued as soon as clinically warranted, typically after 3-5 days of treatment or within 24-48 hours after the resolution of signs and symptoms. The recommended duration of treatment with either zanamivir or oseltamivir is five days.

Chemoprophylaxis

Influenza chemoprophylaxis is not generally a substitute for vaccination, although antivirals are critical adjuncts in the prevention and control of influenza. They may be used, for example, as a component of influenza outbreak-control programs to limit the spread of influenza within chronic care institutions.

Amantadine and rimantadine are indicated for chemoprophylaxis of influenza A infection (not influenza B), and are approximately 60%-90% effective in preventing illness. These antivirals may still permit subclinical infection and the development of protective antibody against circulating influenza viruses. These agents do not interfere with the antibody response to the inactivated vaccine.

Among the neuraminidase inhibitors, only oseltamivir has been approved for prophylaxis, but community studies of healthy adults indicate that both oseltamivir and zanamivir are similarly effective in preventing febrile, laboratory-confirmed influenza illness (efficacy: zanamivir, 84%; oseltamivir, 82%). Both agents have also been reported to prevent influenza illness among persons administered chemoprophylaxis after a household member was diagnosed with influenza. Experience with prophylactic use of these agents in institutional settings or among patients with chronic medical conditions is limited, but a six-week study of oseltamivir prophylaxis among nursing home residents reported a 92% reduction in influenza illness. Use of zanamivir has not been reported to impair the immunologic response to the inactivated influenza vaccine.

To be maximally effective as prophylaxis, antivirals must be taken each day for the duration of influenza activity in the community. However, to be most cost-effective, one study of amantadine or rimantadine reported that the drugs should be taken only during the period of peak influenza activity in a community.

Appropriate use of chemoprophylaxis:

- Persons at High Risk Who Are Vaccinated **After** Influenza Activity Has Begun. Persons at high risk for complications of influenza can still be vaccinated after an outbreak of influenza has begun in a community. However, the development of antibodies in adults after vaccination takes approximately two weeks. When influenza vaccine is administered while influenza viruses are

Table 5. Recommended daily dosage of influenza antiviral medications for treatment and prophylaxis

	Age group (yrs)				
Antiviral agent	**1-6[#]**	**7-9**	**10-12**	**13-64**	**≥65**
Amantadine*					
Treatment, influenza A	5 mg/kg body weight/day up to 150 mg per day in 2 divided doses†	5 mg/kg body weight/day up to 150 mg per day in 2 divided doses†	100 mg twice daily§	100 mg twice daily§	≤100 mg/day
Prophylaxis, influenza A	5 mg/kg body weight/day up to 150 mg per day in 2 divided doses†	5 mg/kg body weight/day up to 150 mg per day in 2 divided doses†	100 mg twice daily§	100 mg twice daily§	≤100 mg/day
Rimantadine¶					
Treatment,** influenza A	NA††	NA	NA	100 mg twice daily§§	100 mg/day
Prophylaxis, influenza A	5 mg/kg body weight/day up to 150 mg per day in 2 divided doses†	5 mg/kg body weight/day up to 150 mg per day in 2 divided doses†	100 mg twice daily§	100 mg twice daily§	100 mg/day¶¶
Zanamivir*†††**					
Treatment, influenza A and B	NA	10 mg twice daily	10 mg twice daily	10 mg twice daily	10 mg twice daily
Oseltamivir					
Treatment,§§§ influenza A and B	Dose varies by child's weight¶¶¶	Dose varies by child's weight¶¶¶	Dose varies by child's weight¶¶¶	75 mg twice daily	75 mg twice daily
Prophylaxis, influenza A and B	NA	NA	NA	75 mg/day	75 mg/day

NOTE: Amantadine manufacturers include Endo Pharmaceuticals (Symmetrel®, tablet and syrup); Geneva Pharms Tech and Rosemont (Amantadine HCL, capsule); USL Pharma (Amantadine HCL, capsule and tablet); and Alpharma, Copley Pharmaceutical, HiTech Pharma, Mikart, Morton Grove, Carolina Medical, and Pharmaceutical Associates (Amantadine HCL, syrup). Rimantadine is manufactured by Forest Laboratories (Flumadine®, tablet and syrup) and Corepharma, Impax Labs (Rimantadine HCL, tablet), and Amide Pharmaceuticals (Rimantadine ACL, tablet). Zanamivir is manufactured by GlaxoSmithKline (Relenza®, inhaled powder). Oseltamivir is manufactured by Hoffman-LaRoche, Inc. (Tamiflu®, tablet). This information is based on data published by the Food and Drug Administration (FDA), which is available at http://www.fda.gov.

#None of the current influenza antiviral medications are approved for use in children <1 year of age.

** The drug package insert should be consulted for dosage recommendations for administering amantadine to persons with creatinine clearance ≤50 mL/min/1.73m^2.*

† 5 mg/kg body weight of amantadine or rimantadine syrup = 1 tsp/22 lbs.

§ Children aged ≥10 years who weigh <40 kg should be administered amantadine or rimantadine at a dosage of 5 mg/kg body weight/day.

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

*** Only approved by FDA for treatment among adults.*

†† Not applicable.

§§ Rimantadine is approved by FDA for treatment among adults. However, certain specialists in the management of influenza consider rimantadine appropriate for treatment among children (see American Academy of Pediatrics. 2000 red book: report of the Committee on Infectious Diseases. 25th ed. Elk Grove Village, IL: American Academy of Pediatrics, 2000).

¶¶ Older nursing-home residents should be administered only 100 mg/day of rimantadine. A reduction in dosage to 100 mg/day should be considered for all persons aged ≥65 years, if they experience possible side effects when taking 200 mg/day.

**** Zanamivir is administered through inhalation by using a plastic device included in the medication package. The recommended dosage is one 5-mg blister inhalation twice daily (approximately 12 hours apart). Patients will benefit from instruction and demonstration of correct use of the device.*

††† Zanamivir is not approved for influenza prophylaxis.

§§§ A reduction in the dose of oseltamivir is recommended for persons with creatinine clearance <30 mL/min.

¶¶¶ The dose recommendation for children who weigh ≤15 kg is 30 mg twice a day. For children who weigh >15–23 kg, the dose is 45 mg twice a day. For children who weigh >23–40 kg, the dose is 60 mg twice a day. And, for children who weigh >40 kg, the dose is 75 mg twice a day.

circulating, chemoprophylaxis should be considered for persons at high risk during the time from vaccination until immunity has developed. Children aged less than nine years who receive influenza vaccine for the first time require six weeks of prophylaxis (i.e., prophylaxis for four weeks after the first dose of vaccine and an additional two weeks of prophylaxis after the second dose).

- Persons Who Provide Care to Those at High Risk. To reduce the spread of virus to persons at high risk during community or institutional outbreaks, chemoprophylaxis during peak influenza activity can be considered for **unvaccinated** persons who have frequent contact with persons at high risk. This may include employees of hospitals, clinics, and chronic-care facilities, household members, visiting nurses, and volunteer workers. If an outbreak is caused by a variant strain of influenza that might not be controlled by the vaccine, chemoprophylaxis should be considered for all such persons, regardless of their vaccination status.
- Persons Who Have Immune Deficiencies. Chemoprophylaxis can be considered for persons at high risk who are expected to have an inadequate antibody response to influenza vaccine. This category includes persons infected with HIV, chiefly those with advanced HIV disease. Such patients should be monitored closely if chemoprophylaxis is administered.
- Other Persons. Chemoprophylaxis throughout the influenza season or during peak influenza activity might be appropriate for persons at high risk who should not be vaccinated. In general, chemoprophylaxis could be used by any person who wishes to avoid influenza illness, but healthcare providers and patients should make this decision on an individual basis.
- As an Adjunct in the Control of Outbreaks in Institutions. Using antiviral drugs for the treatment and prophylaxis of influenza is a key component of influenza outbreak control in institutions (or other closed or semi-closed settings) in addition to other outbreak-control measures such as droplet precautions, cohorting, vaccinations, and restricting staff movement between wards. When confirmed or suspected outbreaks of influenza occur in institutions that house persons at high risk, chemoprophylaxis should be started as early as possible to reduce the spread of the virus. In these situations, having pre-approved orders from physicians or plans to obtain orders for antiviral medications on short notice can expedite administration of antiviral medications.

When outbreaks occur in institutions, chemoprophylaxis should be administered to all residents, regardless of whether they received influenza vaccinations during the previous fall, and should continue for a minimum of two weeks. If surveillance indicates that new cases continue to occur, chemoprophylaxis should be continued until approximately one week after the end of the outbreak. The dosage for each resident should be determined individually. Chemoprophylaxis also can be offered to unvaccinated staff who provide care to persons at high risk. Prophylaxis should be considered for all employees, regardless of their vaccination status, if the outbreak is caused by a variant strain of influenza that is not well-matched by the vaccine.

To limit the potential transmission of drug-resistant virus during outbreaks in institutions, whether in chronic or acute-care settings or other closed settings, measures should be taken to reduce contact as much as possible between persons taking antiviral drugs for treatment and other persons, including those taking chemoprophylaxis.

Dosage

Dosage recommendations may vary by age group, weight, and medical conditions (e.g., impaired renal function, or liver disease) (Table 5). Note: none of the current influenza antiviral medications are approved for use in children less than one year of age.

Route

Amantadine, rimantadine, and oseltamivir are administered orally. Amantadine and rimantadine are available in tablet or syrup form, and oseltamivir is available in capsule or oral suspension form. Zanamivir is available as a dry powder that is self-administered via oral inhalation by using a plastic device included in the package with the medication. Patients benefit from instruction and demonstration of correct use of this device.

Side Effects and Adverse Reactions

Amantadine and Rimantadine

Both amantadine and rimantadine can cause CNS side effects (e.g., nervousness, anxiety, insomnia, difficulty concentrating, and lightheadedness), although rimantadine at a dosage of 200 mg/day causes fewer symptoms compared to the same dosage of amantadine. Gastrointestinal side effects (e.g., nausea and anorexia) occur among approximately 1%-3% of persons taking either drug.

Side effects associated with amantadine and rimantadine are usually mild and cease soon after discontinuing the drug. Side effects can diminish or disappear after the first week, despite continued drug ingestion. However, serious side effects have been observed (e.g., marked behavioral changes, delirium, hallucinations, agitation, and seizures). These more severe side effects have been associated with high plasma drug concentrations and have been observed most often among persons who have renal insufficiency, seizure disorders, or certain psychiatric disorders and among older persons who have been taking amantadine as prophylaxis at a dosage of 200 mg/day. Clinical observations and studies have indicated that lowering the dosage of amantadine among these persons reduces the incidence and severity of such side effects. Amantadine has anticholinergic effects and might cause mydriasis – therefore, it should not be used among patients with untreated angle closure glaucoma. Because rimantadine has been marketed for a shorter period than amantadine, its safety among certain patient populations (e.g., chronically ill and older persons) has been evaluated less frequently.

Zanamivir

Because of the risk for serious adverse events and because the efficacy has not been demonstrated among this population, zanamivir is not recommended for treatment for patients with underlying airway disease. If healthcare providers decide to prescribe zanamivir to patients with underlying chronic respiratory disease after carefully considering potential risks and benefits, the drug should be used with caution under conditions of appropriate monitoring and supportive care, including the availability of short-acting bronchodilators. Allergic reactions, including oropharyngeal or facial edema, have also been reported.

In clinical treatment studies of persons with uncomplicated influenza, the frequencies of adverse events were similar for persons receiving inhaled zanamivir and those receiving placebo (i.e., inhaled lactose vehicle alone). The most common adverse events reported by both groups were diarrhea; nausea; sinusitis; nasal signs and symptoms; bronchitis; cough; headache; dizziness; and ear, nose, and throat infections. Each of these symptoms was reported by less than 5% of persons in the clinical treatment studies combined.

Oseltamivir

Nausea and vomiting were reported more frequently among adults receiving oseltamivir for treatment. Among children treated with oseltamivir, 14.3% had vomiting, compared with 8.5% of placebo recipients. Similar types and rates of adverse events were reported in studies of oseltamivir prophylaxis. Nausea and vomiting might be less severe if oseltamivir is taken with food.

Use During Pregnancy

No clinical studies have been conducted regarding the safety or efficacy of amantadine, rimantadine, zanamivir, or oseltamivir for pregnant women. However, both amantadine and rimantadine have been demonstrated in animal studies to be teratogenic and embryotoxic when administered at high doses. Because of the unknown effects of influenza antiviral drugs on pregnant women and their fetuses, these four drugs should be used during pregnancy only if the potential benefit justifies the potential risk to the embryo or fetus.

Drug Interactions

Careful observation is advised when amantadine is administered concurrently with drugs that affect the CNS, including CNS stimulants. Concomitant administration of antihistamines or anticholinergic drugs can increase the incidence of adverse CNS reactions. No clinically substantial interactions between rimantadine and other drugs have been identified.

Clinical data are limited regarding drug interactions with zanamivir. However, no known drug interactions have been reported, and no clinically critical drug interactions have been predicted on the basis of *in vitro* data and data from studies using rats.

Limited clinical data are available regarding drug interactions with oseltamivir. Because oseltamivir and its metabolite oseltamivir carboxylate are excreted in the urine by glomerular filtration and tubular secretion via the anionic pathway, a potential exists for interaction with other agents (e.g., probenecid) excreted by this pathway.

Antiviral Drug-Resistant Strains of Influenza

Amantadine-resistant viruses are cross-resistant to rimantadine and vice versa. Drug-resistant viruses can appear in approximately one-third of patients when either amantadine or rimantadine is used for therapy. During the course of amantadine or rimantadine therapy, resistant influenza strains can replace susceptible strains within 2-3 days of starting therapy. Epidemic strains of influenza A resistant to amantadine and rimantadine have rarely been detected. Amantadine- and rimantadine-resistant viruses are not more virulent or transmissible than susceptible viruses.

Development of viral resistance to zanamivir and oseltamivir during treatment has been identified but does not appear to be frequent.

Conclusions

Although influenza vaccination levels increased substantially during the 1990s, estimated national adult vaccine coverage for the 2001-02 season was 66% for adults aged ≥65 years and 34% for adults aged 50-64 years. Vaccination levels are low among children at increased risk for influenza complications. Annual vaccination is also recommended for healthcare workers to protect patients, but coverage averages only 38% among healthcare workers. Therefore, there are many opportunities for every healthcare provider in Virginia to work towards improving vaccination levels and the health of the population.

The appropriate use of antiviral agents in the treatment and prophylaxis of influenza can reduce influenza morbidity and mortality, especially in select populations. In particular, antivirals may significantly benefit people at risk for complications from influenza but who cannot take the vaccine, or in the prevention or control of an outbreak. However, the expense of these medications, as well as the risk of side effects, the risk of developing more wide-spread viral resistance, and the likely limited availability of such drugs during major outbreaks, makes judicious use important and reinforces the importance of primary prevention (through vaccination and respiratory etiquette).

Sources of Information Regarding Influenza and Its Surveillance

State and local health departments should be consulted concerning the availability of influenza vaccine, access to vaccination programs, information related to state or local influenza activity, and for reporting influenza outbreaks and receiving advice concerning outbreak control. Additional information about the status of influenza in Virginia is available on the VDH website (www.vdh.virginia.gov/epi/newhome.asp).

References

CDC. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 2005;54(No. RR-8).

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CDC. Update: Influenza Vaccine Supply and Recommendations for Prioritization During the 2005-06 Influenza Season. MMWR 2005; 54(34):850.

Cases of Selected Notifiable Diseases Reported in Virginia*

Disease	Total Cases Reported, July 2005: State	Regions: NW	N	SW	C	E	Total Cases Reported Statewide, January - July: This Year	Last Year	5 Yr Avg
AIDS	38	4	15	1	13	5	340	427	435
Campylobacteriosis	87	22	19	15	16	15	309	336	331
E. coli O157:H7	3	1	0	0	2	0	17	16	23
Giardiasis	52	6	13	15	7	11	291	229	196
Gonorrhea	701	37	53	98	236	277	4,759	5,160	5,562
Hepatitis, Viral									
A	7	0	2	1	0	4	52	50	63
B, acute	12	1	4	2	1	4	99	120	104
C, acute	0	0	0	0	0	0	9	11	4
HIV Infection	58	5	14	1	20	18	436	516	494
Lead in Children†	52	5	3	10	18	16	281	384	376
Legionellosis	9	1	3	1	0	4	25	22	22
Lyme Disease	35	11	18	1	2	3	85	56	58
Measles	0	0	0	0	0	0	0	0	<1
Meningococcal Infection	3	0	1	1	0	1	20	10	24
Mumps	0	0	0	0	0	0	0	5	3
Pertussis	113	73	10	7	3	20	238	101	60
Rabies in Animals	40	11	3	15	6	5	284	293	313
Rocky Mountain Spotted Fever	17	4	2	3	5	3	27	11	10
Rubella	0	0	0	0	0	0	0	0	0
Salmonellosis	156	40	32	26	32	26	528	544	557
Shigellosis	14	4	6	2	2	0	61	80	245
Syphilis, Early§	33	3	6	0	6	18	161	121	129
Tuberculosis	35	2	25	1	3	4	172	126	143

Localities Reporting Animal Rabies This Month: Albemarle 1 bat, 1 raccoon; Arlington 1 bat; Bedford 1 skunk; Campbell 1 raccoon; Carroll 1 skunk; Chesapeake 1 fox; Clarke 1 raccoon; Culpeper 1 bat, 1 raccoon; Essex 1 raccoon; Fairfax 1 raccoon, 1skunk; Fauquier 1 dog; Goochland 1 raccoon; Grayson 1 skunk; Halifax 1 skunk; Hanover 1 raccoon; Henrico 1 bat; King George 1 raccoon; Lunenburg 1 raccoon; Mathews 2 foxes; Montgomery 1 raccoon; Patrick 1 fox, 1 raccoon; Pittsylvania 1 fox; Pulaski 1 dog; Rockingham 1 skunk; Smyth 1 raccoon; Stafford 1 groundhog, 2 raccoons; Sussex 1 raccoon; Tazewell 1 fox, 1 raccoon; Washington 1 cat; Westmoreland 1 raccoon; Wythe 1 cat, 1 raccoon.

Toxic Substance-related Illnesses: Adult Lead Exposure 4; Asbestosis 2; Mercury Exposure 1; Pneumoconiosis 7; Silicosis 1.

*Data for 2005 are provisional. †Elevated blood lead levels ≥10µg/dL. §Includes primary, secondary, and early latent.

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