Prevention and Control of Influenza: No Easy Task

Kristina Simeonsson, Zack Moore

Every influenza season presents different challenges: Novel viruses emerge, new groups of people are identified as being at high risk for complications, vaccine effectiveness varies, and resistance to antiviral agents develops. Health care providers must partner with public health professionals to prevent influenza and to reduce the morbidity and mortality associated with this illness.

Influenza is a common respiratory illness responsible for many outpatient visits, hospitalizations, and deaths every year. During the influenza seasons spanning the decade 1990–1999, the disease resulted in an average of 36,000 deaths and more than 200,000 hospitalizations each year in the United States [1, 2]. A review of data from the 31 influenza seasons during the period 1976–2007 yielded estimates of the number of annual influenza-associated deaths during that time, which ranged from 3,349 deaths in the 1986–1987 influenza season to 48,614 deaths in the 2003–2004 season [3]. The vast majority of deaths occur in elderly individuals; however, rates of hospitalization for infants and young children are similar to those for elderly patients. A 2007 study by Molinari and colleagues estimated that the direct health care costs related to seasonal influenza total $10.4 billion annually; when indirect costs from missed days at work and premature death were included, using projected statistical life values, the total annual economic burden was estimated to be $87.1 billion (in 2003 dollars) [4].

Symptoms of influenza include sudden onset of fever, myalgias, and cough. Illness typically lasts 5 days; however, respiratory symptoms and malaise can persist for 2–3 weeks. Children may manifest gastrointestinal symptoms such as vomiting and diarrhea, and infants can present with a sepsis-like syndrome. Worsening of underlying chronic conditions is responsible for most of the severe complications and mortality associated with influenza. Secondary bacterial infections (eg, pneumonia) can occur in all age groups; in these cases, there is often a brief period of improvement followed by rapid deterioration.

Influenza is usually spread from person to person by inhalation of respiratory droplets produced by coughing and sneezing. Children are the major reservoir of influenza in community outbreaks, as they shed influenza virus longer and in larger quantities than do adults. Influenza activity in the United States usually peaks in January or February; however, some influenza seasons have peaked as late as May or as early as December. Because influenza circulates year-round, a diagnosis of influenza can be made at any time during the year, particularly in individuals who have traveled outside of the United States.

Two types of influenza virus are responsible for the vast majority of human disease: types A and B. Type A influenza viruses are further divided into subtypes based on 2 surface proteins: hemagglutinin and neuraminidase. More than one strain of influenza virus can circulate during each season, although a single strain usually predominates. From 1977 through 2008, circulating viruses included 1 of 2 strains of influenza B, and 2 subtypes of influenza A (H3N2 and H1N1). In 2009, a novel H1N1 virus emerged and resulted in a pandemic. Since then, the 2009 H1N1 virus has co-circulated with H3N2 and type B strains.

Surveillance

Influenza surveillance serves several functions, one of which is early detection of novel strains that have pandemic potential. The value of state and national influenza surveillance systems was demonstrated by the early detection of the pandemic H1N1 strain in California in 2009 and more recently by the detection of continued outbreaks of influenza A H3N2 variant (H3N2v) found to be associated with swine contact [5]. The continued occurrence of illness due to H5N1 and the recent emergence of H7N9 highlight the need for continued vigilance for novel viruses in the United States.

Accurate and timely surveillance data help clinicians by providing information about the timing and intensity of seasonal influenza activity in a given area, as well as yielding data on antiviral resistance, vaccine effectiveness, and predominant circulating strains. In North Carolina, influenza surveillance is coordinated by the Epidemiology Section of the Division of Public Health. This surveillance relies

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Mandatory Influenza Vaccination Program Proves Successful in Its First Year

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Vidant Health is a health care system comprising many physician practices, 9 hospitals, and an academic medical center affiliated with the Brody School of Medicine at East Carolina University. The system is headquartered in Greenville, North Carolina, and its network spreads throughout the 29 counties of Eastern North Carolina. Vidant Medical Center, a teaching hospital with 909 beds, serves as a health care resource throughout the region and delivers comprehensive tertiary care, education, and research. In 2012 Vidant Health joined a growing number of hospitals and health systems around the country in implementing a mandatory influenza vaccination program for its employees and physicians.

Every influenza season increases patients' risk of infection and possible complications, especially for vulnerable patients in a tertiary care setting. Exposure to influenza among Vidant Health's employees also threatens the operation of its clinics and hospitals and has the potential to reduce access to care. The leaders and employees of Vidant Health believe that the needs of the patient come first, and staff members accept their responsibility to model healthy behaviors. Thus, David Herman, chief executive officer of Vidant Health, proposed a mandatory vaccination program in the interest of patient safety, saying, "Patients trust that when they come to us for care, their health will improve and they will not be put at risk because we did not do everything possible to prevent harm" (written communication to employees, October 2012).

In previous years, Vidant Health had less than 75% compliance with influenza vaccination among its health care workers, despite efforts to promote vaccination. One reason for reduced participation was fear on the part of some staff members that vaccination would result in a more serious illness, such as Guillain-Barré syndrome. In addition, Vidant Health faced 2 other obstacles to making vaccination mandatory: the difficulty of confirming that an employee had received the vaccine, and concern that requiring vaccination would negatively affect the satisfaction of employees or affiliated physicians.

The decision to move forward with mandatory vaccination came after months of deliberation. Once the clinical governance committee of the health system achieved consensus, the decision became policy. Vidant Health followed the leadership of executive staff members and the physicians' medical executive committee to ensure that evidence of vaccination was provided by all medical, clinical, and administrative staff members; volunteers; students; and vendors. Individuals with certain medical conditions or religious beliefs, as defined in the policy, were exempt from the mandatory vaccination. Compliance became a condition of employment for all staff as well as a condition of medical privileges for physicians.

Vaccination was centrally coordinated and provided free of charge. Vaccination clinics were offered over a 3-month period to accommodate varying work shifts and to make vaccination available to employees and physicians who were working off site. A comprehensive communication strategy was used to educate individuals about the risk that influenza poses to patients, especially high-risk or immunocompromised patients, and the impact of illness on the workforce and the community.

Physicians and staff members were receptive to the mandatory vaccination initiative and quickly became ambassadors for its implementation. Influenza vaccination compliance ultimately reached 99.9%, demonstrating the commitment of Vidant Health's physicians and employees to patient safety. Despite concerns about a negative reaction or employee turnover among Vidant Health's teams, compliance with the policy was nearly universal. All physicians complied with the policy, as did all but 1 of more than 12,000 employees. Also, only 1 acute hospitalized influenza case was detected in the health system during the first year of mandatory vaccination (although we cannot prove any association with the vaccination program).

The leaders of Vidant Health are certain that the decision to require influenza vaccination served the purpose of protecting patients. The initiative has also had a positive impact on the culture of patient safety, resulting in a more engaged health care team that is working to put patients' needs first. NCMJ

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on contributions from many partners, including physician practices, local health departments, student health centers, hospitals, and the national Centers for Disease Control and Prevention (CDC).

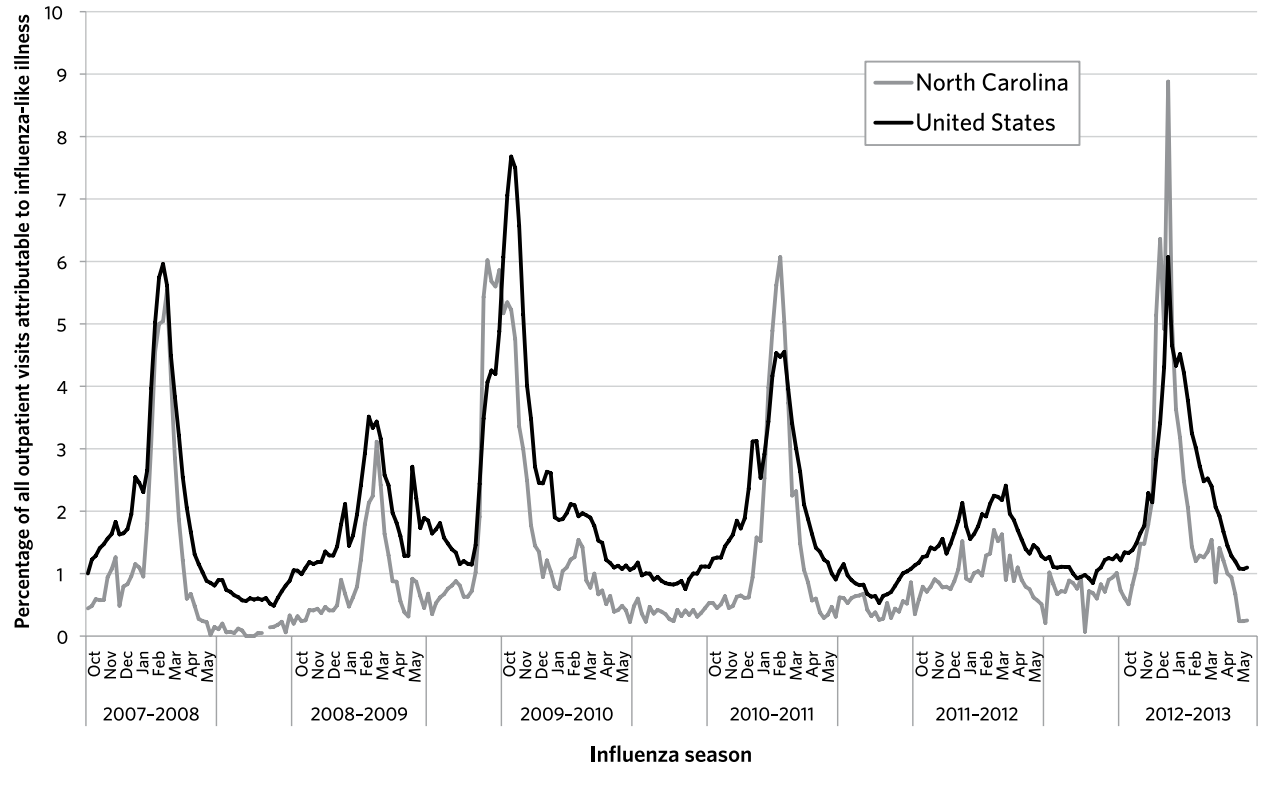
Unlike most communicable diseases that are under public health surveillance, influenza is not tracked by reporting of individual cases. Aside from the logistical challenges of such an undertaking, case-based reporting from physicians or laboratories would not be accurate because most persons who are infected with influenza never seek medical attention. Instead, influenza surveillance is conducted using a combination of data sources. These include monitoring of "influenza-like illness" (ILI), virologic surveillance, and reporting of influenza-associated deaths.

In North Carolina, ILI is primarily monitored through 2 systems: the North Carolina Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT) and the Influenza-Like Illness Surveillance Network (ILINet). NC DETECT is an electronic surveillance system that collects data twice daily from all emergency departments (EDs) in the state that are open 24 hours a day and 7 days a week; surveillance of data from NC DETECT allows for near real-time monitoring of ED visits for ILI and other syndromes. ILINet is a CDC-operated system coordinated by state health departments. Approximately 80 volunteer providers from across the state report weekly on the total number of patient visits and the number of visits for ILI (defined as a temperature of at least 100°F along with cough or sore throat), subdivided by age group. These data are used to monitor trends by comparing the current data with national and region-specific baselines. As shown in Figure 1, the timing and intensity of influenza activity varies from year to year. During the 2012–2013 influenza season, the peak occurred in late December, 2 months before the usual peak, and the proportion of all outpatient visits attributable to ILI reached the highest level since ILINet was introduced in North Carolina.

In addition to reporting data, ILINet providers collect nasopharyngeal swabs from selected patients and submit them to the North Carolina State Laboratory of Public Health. These specimens help public health officials to determine what proportion of ILI is caused by influenza, whether the current year's vaccine is a good match for circulating influenza strains, and whether resistance to antiviral medications is changing. Moreover, these specimens allow for timely recognition of new influenza strains that could have the potential to cause an influenza pandemic.

The third major component of influenza surveillance in North Carolina is tracking of influenza-associated deaths. The North Carolina Administrative Code requires physicians to report all influenza-associated deaths to their local public health departments within 24 hours. For reporting purposes,

FIGURE 1.
Percentage of All Outpatient Visits Attributable to Influenza-Like Illness, as Reported by Providers in the Influenza-Like Illness Surveillance Network (ILINet), 2007–2013



Pharmacists:
Medication Experts Who Help Prevent Disease

Ouita Davis Gatton

Vaccines help prevent disease and have significantly decreased morbidity and mortality due to influenza, pneumonia, and other bacteria and viruses. But vaccines are only beneficial if people are actually vaccinated. Influenza and pneumococcal disease are still among the leading preventable diseases in the United States, in part because vaccination rates for both diseases are well below the goals set in recent years. These low rates have led to an increase in preventable deaths, illnesses, and health care costs each year [1]. There are many reasons why someone may not be vaccinated, one of which is lack of access to vaccines. One strategy for addressing this need is to allow vaccination by pharmacists.

Pharmacists have been involved in immunization in some form since the middle of the 19th century, first serving to distribute vaccine and to educate physicians and the public. Small groups of pharmacists have also been involved in administering vaccines, but only recently has such involvement become coordinated within the profession [2].

States that allow pharmacists to administer a particular vaccine have higher vaccination rates for that vaccine than do states that do not allow vaccination by pharmacists [1-3]. Washington was the first state in which pharmacists made an organized effort to administer immunizations; their state association began training pharmacists in vaccine administration in 1994 [2]. Most initial efforts focused on having pharmacists administer influenza vaccine. It took nearly 17 years, but eventually pharmacists were granted the authority to immunize patients against influenza in all 50 states, the District of Columbia, and Puerto Rico; this was thanks to the determination and successful collaboration of pharmacists, state associations of pharmacists, state legislatures, supportive physicians, and other health care providers [4]. During the 2010–2011 influenza season, the Centers for Disease Control and Prevention (CDC) reported that pharmacists administered almost 20% of all adult influenza vaccinations [3]. Currently, more than 150,000 pharmacists are trained to provide immunizations in the United States, including more than 6,100 pharmacists in North Carolina [3].

Pharmacy-based immunization is not about removing patients from their medical home or denying patients access to physicians. Rather, it is about assisting in the prevention of disease by increasing the availability of vaccines to those who need them. The pharmacist is frequently the most accessible member of the health care team, as pharmacies often keep longer hours than do most physicians' offices and health care clinics [1, 4], and pharmacies are often located in areas where preventive care is needed but not readily accessible. Additionally, if pharmacists are legally able to vaccinate, they can screen patients who need vaccines—especially influenza and pneumococcal vaccines—and then immediately follow up on this screening to ensure that patients receive the vaccine without delay [4].

Laws governing pharmacy immunization practices vary from state to state. Until very recently, North Carolina had one of the most restrictive immunization practice mandates for pharmacists. Achieving change in pharmacists' immunizing authority has occurred slowly and has not been without misunderstanding and confusion on the part of physician groups [1]. Pharmacists have administered vaccines in North Carolina since 2003 and are governed by rules adopted by the Boards of Pharmacy, Nursing, and Medicine. The state's pharmacists must receive special

an influenza-associated death is defined as a death resulting from a clinically compatible illness that is confirmed to be influenza by an appropriate laboratory or rapid diagnostic test with no period of complete recovery between illness and death. Although the number of reported deaths is certainly an underestimate of all influenza-associated deaths, these reports allow for monitoring of trends within and across influenza seasons and provide important information about the groups that are at highest risk of death from influenza. For example, findings from reports of influenza-associated deaths helped identify the high risk of death from influenza among children with neurodevelopmental disorders and, during the H1N1 pandemic, the high risk of death among pregnant women. Data from this and all other influenza surveillance systems are posted weekly from October through May at www.flu.nc.gov.

Diagnosis

Definitive diagnosis of influenza infection is made by isolation of the virus from nasal or nasopharyngeal secretions. Confirming the presence of influenza virus by culture can take up to 7–10 days and therefore is not very useful in the clinical management of patients. Newer modalities to test for influenza are becoming more widely available—in particular, reverse transcriptase–polymerase chain reaction (RT-PCR) testing. Immunofluorescence assays are also available in many hospitals and can provide results within 2–4 hours.

For faster results, clinicians can use rapid influenza diagnostic tests (RIDTs); several of the commercially available RIDTs can provide results within 30 minutes. RIDTs are often used in outpatient settings when deciding whether to begin

vaccine training that is approved by the Board of Pharmacy. They must also follow a written protocol that is prepared, signed, and dated by both the pharmacist and a physician; they must hold current, provider-level certification in cardiopulmonary resuscitation (CPR); and they must maintain appropriate documentation as dictated by the Board of Pharmacy. Currently, pharmacists in North Carolina may administer influenza vaccine by written protocol to persons 14 years of age and older, and they may administer pneumococcal and zoster vaccines to those 18 years of age and older after contacting the patient's primary care provider. The H1N1 influenza public health crisis in 2009 prompted North Carolina to lower the minimum age for administration of influenza vaccine by pharmacists from 18 years to 14 years [5].

Adverse reactions to vaccines administered in a pharmacy are rare [1]. Pharmacists are trained to appropriately screen patients for allergies and other risks prior to administration of the vaccine. They are additionally mandated to explain the risks of the vaccine and any potential adverse reactions that could occur. If an adverse reaction does occur, pharmacists are trained in appropriate emergency protocols, including use of epinephrine and administration of CPR. Pharmacists must report any documented reaction to the patient's physician and to the Vaccine Adverse Event Reporting System. Appropriate Occupational Safety and Health Administration guidelines also apply to vaccination by pharmacists [5]. Current leaders in the pharmacy and medical communities are working on streamlining pharmacy best-practice models to make immunization protocols and documentation more uniform, despite the variation in state rules.

In July 2013, the North Carolina General Assembly passed House Bill 832, "An Act to Protect the Public's Health by Increasing Access to Immunizations and Vaccines through the Expanded Role of Immunizing Pharmacists" [6]. The legislation, which goes into effect on October 1, 2013, allows immunizing pharmacists who meet certain requirements to administer any CDC-recommended vaccination to any person at least 18 years of age who has a prescription. The new law also allows pharmacists to administer 6 vaccines under standing order or protocol. This will substantially increase pharmacy-based immunization practice in North Carolina, affording patients in the state increased access to vaccines and preventive care. The new law will provide North Carolina pharmacists with additional means by which to help decrease the number of deaths due to vaccine-preventable diseases. NCM

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treatment with antiviral medications. RIDTs differ in terms of the types of influenza they can detect and in their ability to distinguish between types of influenza. Results from RIDTs should be interpreted with caution, as these tests have a lower sensitivity (40%–70%) than that of viral culture; thus false-negative results are more likely with RIDTs. If confirmation of influenza is necessary, a negative RIDT should be confirmed with culture or RT-PCR testing.

The likelihood of obtaining a false-negative result with a RIDT can be minimized by obtaining an adequate specimen and by testing patients within the first few days of their illness. Given the inherent limitations of influenza diagnostic tests, treatment decisions are often based on clinical and epidemiologic information. If treatment is clinically indicated, it should not be delayed while awaiting laboratory confirmation, nor should it be withheld based on a negative RIDT result. False-positive results with RIDTs can also occur, especially when influenza activity in the community is low. If the RIDT is positive when the level of influenza activity in the community is low, confirmatory testing with viral culture or RT-PCR is recommended.

Management

Antiviral treatment for patients with severe infections has been associated with a decreased length of uncomplicated influenza illness and with reductions in deaths and other severe outcomes [6-9]. Prompt treatment can reduce the risk of severe illness or death among persons who are

at increased risk for influenza (Table 1). Only 2 classes of antiviral agents are currently licensed in the United States: adamantanes and neuraminidase inhibitors. The adamantanes, amantidine and rimantidine, are not effective against currently circulating strains of influenza. However, the neuraminidase inhibitors, oseltamivir and zanamivir, are effective against currently circulating strains of both influenza A and influenza B (Table 2) [12].

The CDC's Advisory Committee on Immunization Practice (ACIP) recommends that treatment with oseltamivir or zanamivir be initiated as early as possible for any patient with confirmed or suspected influenza who has severe, complicated, or progressive illness; for any patient who is hospitalized; or for any patient who is at higher risk for influenza complications [12]. Antiviral treatment also can be considered for previously healthy, symptomatic outpatients with confirmed or suspected influenza if treatment can be initiated within 48 hours of the onset of illness [12]. Antiviral treatment might also be effective in preventing serious outcomes in more severe cases even when treatment is started more than 48 hours after the onset of illness [8]. Patients who are hospitalized with influenza should be started on antiviral medications even if more than 48 hours have passed since the onset of symptoms.

Despite the clear clinical benefits of antiviral medications for treatment of influenza, use of these agents can lead to the development of antiviral resistance. Several different point mutations have been identified that confer low-level or high-level antiviral resistance. Most notably, the H275Y mutation in the H1N1 neuraminidase led to widespread resistance among H1N1 viruses circulating prior to the 2009 pandemic, and this mutation continues to occur in a smaller proportion of pandemic H1N1 viruses [13, 14]. Several clusters of antiviral-resistant influenza A and influenza B have been identified in North Carolina, sometimes in association with broad or prolonged use of antiviral medications [15-17].

Antiviral medications can be used to prevent influenza infection; however, they are not a substitute for vaccination. The benefits of antiviral chemoprophylaxis must be weighed against the risk of developing resistance. Antiviral chemoprophylaxis is particularly important in controlling the spread of influenza among high-risk patients in institutional settings, such as nursing homes, and for high-risk individuals for whom influenza vaccine is not indicated [18].

TABLE 1.
Antiviral Treatment and Influenza Vaccination Recommendations

Persons for whom antiviral *treatment* is recommended	Persons for whom influenza *vaccination* is recommended when vaccine supplies are limited
Hospitalized patients Patients with severe, complicated, or progressive illness	
Persons with the following types of chronic conditions:	Persons with the following types of chronic conditions:
Pulmonary (eg, asthma, COPD)	Pulmonary (eg, asthma, COPD)
Cardiovascular (except hypertension alone)	Cardiovascular (except hypertension alone)
Renal	Renal
Hepatic	Hepatic
Hematologic (eg, sickle cell disease)	Hematologic (eg, sickle cell disease)
Metabolic (eg, diabetes mellitus)	Metabolic (eg, diabetes mellitus)
Neurologic or neurodevelopmental (eg, epilepsy, cerebral palsy, stroke)	Neurologic or neurodevelopmental (eg, epilepsy, cerebral palsy, stroke)
Persons who are immunosuppressed, from HIV infection or from use of medications such as high-dose steroids or chemotherapy	Persons who are immunosuppressed, from HIV infection or from use of medications such as high-dose steroids or chemotherapy
Women who are pregnant or up to 2 weeks postpartum	Women who are pregnant or will be pregnant during the influenza season
Persons younger than 19 years of age who are receiving long-term aspirin therapy	Persons younger than 19 years of age who are receiving long-term aspirin therapy
American Indians	American Indians
Alaska Natives	Alaska Natives
Persons who are morbidly obese (body mass index ≥ 40 kg/m^2)	Persons who are morbidly obese (body mass index ≥ 40 kg/m^2)
Residents of nursing homes or other chronic care facilities	Residents of nursing homes or other chronic care facilities
Children younger than 2 years	Children aged 6 months to 4 years
Adults aged 65 years or older	Adults aged 50 years or older
	Health care personnel
	Household contacts and caregivers of children younger than 5 years or adults older than 50 years, with particular emphasis on contacts of infants younger than 6 months
	Household contacts and caregivers of persons with medical conditions that put them at high risk for severe complications

Note. COPD, chronic obstructive pulmonary disease.
Source: This table is adapted from Centers for Disease Control and Prevention [10] and Centers for Disease Control and Prevention [11].

TABLE 2.
Current Recommendations for Treatment and Prophylaxis of Influenza Using Antiviral Medications

Antiviral medication	Type of use	Age of patient	Dosing
Oseltamivir	Treatment[a]	Infants aged 2 weeks to 1 year	3 mg/kg twice daily
		Children older than 1 year	
		< 15 kg	30 mg twice daily
		15–23 kg	45 mg twice daily
		23–40 kg	60 mg twice daily
		> 40 kg	75 mg twice daily
		Adults	75 mg twice daily
	Prophylaxis[b]	Infants aged 3 months to 1 year[c]	3 mg/kg once daily
		Children older than 1 year	
		< 15 kg	30 mg once daily
		15–23 kg	45 mg once daily
		23–40 kg	60 mg once daily
		> 40 kg	75 mg once daily
		Adults	75 mg once daily
Zanamivir[d]	Treatment	Children 7 years and older	10 mg (2 inhalations) twice daily
		Adults	10 mg (2 inhalations) twice daily
	Prophylaxis	Children 5 years and older	10 mg (2 inhalations) once daily
		Adults	10 mg (2 inhalations) once daily

Source: This table is adapted from Centers for Disease Control and Prevention [10].
[a]Recommended duration of treatment with oseltamivir is 5 days; a longer course of treatment can be considered for patients who remain severely ill after 5 days. Treatment should ideally begin within 48 hours of symptom onset.
[b]Recommended duration of prophylaxis with oseltamivir is 7 days after last exposure. Duration of prophylaxis is longer for patients in long-term care facilities.
[c]Oseltamivir has not been approved by the US Food and Drug Administration for chemoprophylaxis in infants; however, oseltamivir was approved under Emergency Use Authorization for prophylaxis in infants aged 3 months to 1 year during the 2009 H1N1 pandemic.
[d]Zanamivir is not recommended for use in people with underlying respiratory disease.

Prevention

Vaccination is the best way to prevent influenza infection. In a 2013 study, Kostova and colleagues estimated that during the 6-year period 2005–2011, the number of cases of influenza averted each year by vaccination ranged from 1.1 million to 5 million, and the number of averted hospitalizations ranged from 7,700 to 40,400 [19]. Annual influenza vaccine is now recommended by the ACIP for everyone 6 months of age or older. During times of influenza vaccine shortage, the ACIP may tailor its recommendations to prioritize the vaccination of individuals in certain target groups (Table 1). The ACIP also recommends that health care workers and household contacts of high-risk individuals receive influenza vaccine, because they can spread influenza to high-risk people if they become infected. Similarly, vaccinating pregnant women is recommended because vaccination of the mother confers protection on the infant, thus reducing the infant's risk of laboratory-confirmed influenza virus infection and his or her risk of hospitalization for ILI during the first 6 months of life [20].

Vaccine effectiveness varies from year to year. A person's age, his or her immune status, and the strain of influenza can influence vaccine effectiveness. Adults aged 65 years or older mount less of an immune response to influenza vaccine than do younger adults and children. In the most recent influenza season, vaccination reduced the risk for medical visits resulting from influenza A (H3N2) by 44% in the population as a whole (95% confidence interval [CI], 35% to 52%); among those 65 years of age or older, however, vaccination reduced this risk by only 19% (95% CI, –36% to 52%) [21].

A wide variety of influenza vaccine formulations are available for the 2013–2014 influenza season. Quadrivalent vaccines that cover 4 strains of influenza—influenza A (H1N1), influenza A (H3N2), and 2 influenza B viruses—are available in both the inactivated (intramuscular) form and the live-attenuated (intranasal) form. In addition to the traditional egg-based trivalent inactivated vaccines, there will also be an inactivated trivalent vaccine that is made in cell culture—including influenza A (H1N1), influenza A (H3N2), and 1 strain of influenza B—and an inactivated trivalent vaccine made with recombinant technology; this is the first time non–egg-based vaccines are being offered. High-dose vaccine for persons 65 years of age or older will also still be available, as will the intradermal form of the inactivated vaccine. When more than one type or brand of influenza vaccine is appropriate and available for an individual, no preferential recommendation exists for the use of one product over another.

Even though the ACIP recommends influenza vaccine for all persons aged 6 months or older, there is still room for improvement in vaccination rates, both across the board

and in specific target groups. Vaccination of health care providers (HCPs) deserves special attention. The Healthy People 2020 goal for vaccination of HCPs is 90%. Despite long-standing recommendations that HCPs should receive influenza vaccine, vaccination rates are still well below this goal; during the 2010–2011 influenza season, only 63.5% of HCPs were vaccinated against influenza [22].

HCPs' reasons for refusing influenza vaccine are similar to those offered by the general population. A recent survey of 1,931 HCPs found that almost one-third did not think influenza vaccine worked, 27% were concerned about side effects, 23% did not think they needed to be vaccinated, and 18% were concerned they would get sick from the vaccine [22]. To remove some of the barriers to receiving influenza vaccine, health care institutions need to offer vaccine on site, free of charge, and on multiple days at various times. Education of HCPs needs to emphasize that receipt of influenza vaccine not only protects the HCP against influenza but also promotes patient safety.

The most effective way to improve vaccination rates among HCPs is for health care employers to require influenza vaccination. In a survey during the 2010–2011 influenza season, vaccination rates were 98% among HCPs whose employer required vaccination, compared with only 58% among those whose employers did not require vaccination [22]. Mandatory vaccination policies are supported by a variety of national organizations, including the Infectious Diseases Society of America, the American College of Physicians, and the Society for Healthcare Epidemiology of America. A majority of North Carolina hospitals now have policies that make annual influenza vaccination a condition of employment for HCPs; 20% of hospitals have a mask requirement for HCPs who decline vaccination (Stephanie Strickland, e-mail communication). [Editor's note: See the sidebar by Floyd on page 426 (in this issue) for details about the mandatory vaccination program implemented by Vidant Health.] The number of North Carolina hospitals with an influenza vaccination requirement is likely to increase. In January 2013, the Centers for Medicare & Medicaid Services began requiring hospitals to report their rate of influenza vaccination among HCPs as part of the Acute Care Hospital Inpatient Prospective Payment System. Thus hospitals now have a financial incentive to increase vaccine coverage among their employees.

Influenza is a common respiratory illness that is associated with significant morbidity and mortality. HCPs play a major role in the prevention of influenza and its complications, and they need to use available surveillance to recognize when influenza is circulating in their communities. Physicians also need to follow current recommendations on the appropriate use of antiviral medications, and they must report all influenza-associated deaths to the health department. Finally, HCPs need to encourage influenza vaccination in all patients, and they should set an example for their patients by being vaccinated themselves. NCMJ

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