Influenza: Impact, Prevention, and Control

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1. **REVIEW THE OBJECTIVES**

   The objectives provide an overview of the entire course and identify what information will be focused on. Objectives are stated in terms of what you, the learner, will know or be able to do upon successful completion of the course. They let you know what you should expect to learn by taking a particular course and can help focus your study.

2. **STUDY EACH SECTION IN ORDER**

   Keep your learning "programmed" by reviewing the materials in order. This will help you understand the sections that follow.

3. **COMPLETE THE COURSE EXAM**

   After studying the course, click on the "Course Exam" option located on the course navigation toolbar. Answer each question by clicking on the button corresponding to the correct answer. All questions must be answered before the test can be graded; there is only one correct answer per question. You may refer back to the course material by minimizing the course exam window.

4. **GRADE THE TEST**

   Next, click on "Submit Test." You will know immediately whether you passed or failed. If you do not successfully complete the exam on the first attempt, you may take the exam again. If you do not pass the exam on your second attempt, you will need to purchase the course again.

5. **FILL OUT THE EVALUATION FORM**

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About the Author

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Introduction

Influenza dominated the news in the winter of 2003-2004, when 10 western US states reported high rates of influenza activity in October and November. As the 2003-2004 influenza epidemic spread eastward, it eventually claimed the lives of over 100 children and an unknown number of adults (Centers for Disease Control [CDC], 2004b). In many parts of the country, nervous citizens stood on long lines to receive the flu shot until vaccine shortages developed, and young, healthy people could no longer obtain immunizations.

Once again, a new influenza virus, known as swine influenza A H1N1, or the swine flu, is dominating the news in the spring of 2009. The CDC and the World Health Organization (WHO) have been closely monitoring the situation and have been providing updates on what is being called a Phase 5 pandemic (see Figure 1). The United States Government officially declared a public health emergency.

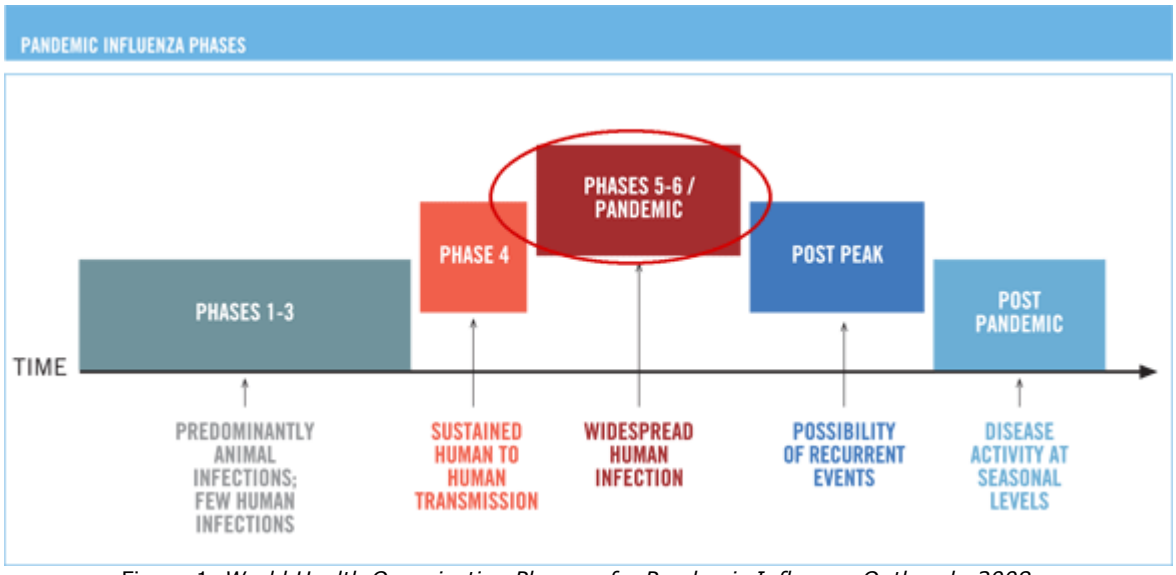

Figure 1. *World Health Organization Phases of a Pandemic Influenza Outbreak, 2008*. Downloaded April 30, 2009 from http://www.who.int/csr/disease/avian_influenza/phase/en/index.html.

For updates on what the Centers for Disease Control and Prevention (CDC, 2009) are recommending for healthcare professionals and the public, please go to http://www.cdc.gov/swineflu.

For specific information related to swine flu cases in New York state please visit http://www.nysna.org/practice/alerts/swine_flu.htm.

Influenza routinely kills an estimated 36,000 Americans every year (CDC, 2003a). "Pneumonia and influenza" ranks as the seventh overall leading cause of death in the US. Over at least the past four centuries, influenza has caused epidemics somewhere every one to three years. In the twentieth century, it was responsible for three major pandemics: the Spanish flu of 1918-1919; the Asian flu of 1957; and the Hong Kong flu of 1968. The Asian and Hong Kong flu are estimated to have killed 76,000 and 60,000 Americans, respectively (Simonsen, Schonberger, Stroup, Arden, & Cox, 1996). In the worst pandemic of all time, the Spanish flu epidemic, which was driven in part by troop movements across continents, 20 to 40 million people died worldwide, and half a million (or more) perished in the US. The course of World War I was affected; soldiers on both sides died in droves (Crosby, 1989).

Thus, influenza has had an enormous impact on human endeavors. But it is not only during pandemics that flu wields its power. During interpandemic years, influenza is responsible for

premature death, morbidity due to pulmonary and neurological complications, absenteeism in the work force and school population, and a financial burden to the healthcare delivery system.

The flu has received attention from scientists, healthcare providers, public health workers, and pharmaceutical companies, as well as from the World Health Organization and the CDC (both of which publish pages of recommendations annually). Despite four effective medications for treatment and prophylaxis; and safe, efficacious vaccines, influenza is still not under control anywhere in the world.

To bring influenza under control, three pathways must be followed: maintaining surveillance of human and epidemiologically significant animal populations; improving immunization rates; and expediting treatment. By taking this course, the learner will gain the knowledge required to understand why bringing influenza under control is so vital, and learn some ways to achieve that goal. The purpose of this course is to provide the information nurses need to become part of the global effort to prevent and control influenza cases and epidemics.

Objectives

Upon completion of this course, the learner will be able to:

- Identify the microbiological aspects of influenza
- Describe the mode of transmission
- Review signs/symptoms
- Recall complications
- Review treatment options
- Review strategies to prepare for a pandemic event

Definitions

Epidemic: Outbreak of influenza that involves a limited area such as one community, state, or country.

Pandemic: Epidemics that reach globally into all parts of the world.

Hemagglutinin and *Neuraminidase*: spike-like antigens that are found on the envelope of the influenza virus and are used as markers of subtypes.

Microbiology

Influenza viruses are classified into three related viral genera: influenza A, B, and C; they are members of the Orthomyxoviridae family. Human influenza A (but not B or C) is further divided into three subtypes (H1N1, H3N2, H5N2) that are designated, according to type/place of first isolation/assigned number/year of isolation/subtype for example as "A/Panama/200/99(H3N2)".

The subtypes differ in several important ways, but it is notably two kinds of surface antigens, the hemagglutinins, (HA—the "H" in the subtype designation) and the neuraminidases (NA—the "N" in the designation), that define them. Like all viruses, the influenza viruses can replicate only inside a host cell. HA and NA have complementary and vital roles to play in the replication process, making them ideal as a target for either a vaccine or an antiviral medication.

A remarkable and significant feature of influenza is its ability to create novel subtypes as the virus mutates readily through two mechanisms. *Antigenic drift* involves minor, or "point" mutations during replication and appears fairly frequently. *Antigenic shift*, on the other hand, occurs infrequently, and creates a much greater variability in the genetic makeup of the virus. When different viral subtypes, say an avian subtype and a human subtype, "meet" in a porcine or other host cell, they can undergo a sharing of genomes during replication. This sharing, or viral reassortment, produces a new subtype to which humans lack immunity, and therefore has the potential to cause pandemics when conditions are ripe. The end result of genetic variability, whether antigenic shift or drift, is a highly successful survival strategy for the virus.

Influenza B does not undergo genetic variation as frequently as A, and it causes fewer epidemics. Influenza C, largely a pediatric infection, is not a common cause of influenza or epidemics and will not be further discussed here.

Where Do Influenza Viruses Come From?

All human influenza A viruses originated in wild birds, particularly aquatic birds. The fifteen known avian virus subtypes inhabit the gastrointestinal tract of many bird species without causing illness in the birds (Webster, 1998). The birds contaminate water sources and soil by excreting large amounts of virus in their feces. Once the virus is in the environment, it can be transmitted by the fecal-oral route to domesticated animals. Poultry, swine, and horses are susceptible to the disease, not just viral carriage. The impact on the agricultural world is enormous; the avian virus has been responsible for countless epidemics among domesticated fowl, necessitating the destruction of millions of birds. Humans are rarely infected directly by avian influenza, though when they are, fatal cases ensue.

If human influenza viruses are avian in origin, (avian viruses rarely infect humans) then there is a missing link. An intermediary species, postulated to be swine, must therefore account for human infection (Webster, 1998). Experimental evidence has demonstrated the presence of receptors for both human and avian influenza viruses in pig trachea, supporting the description of the pig as "the mixing vessel" for human influenza (Ito, Kida, & Kawaoka, 1996). Interspecies spread of the viruses is further aided by 1) the natural migratory habits of wild birds, and 2) the co-mingling of bird species and populations at live bird markets.

An animal reservoir for influenza B has not been identified. Humans are the only source of influenza B that is known, though it has been found in sick marine mammals.

Epidemiology

Influenza attacks all ages and all populations. In a non-pandemic year, its peak coincides with the winter months in the northern and southern hemispheres, although cases in small numbers are found in the summer. In tropical areas, influenza is found year round. Incidence rates are usually highest in children while mortality rates are highest in people of 65 years of age or older. An epidemic curve of influenza for a community will demonstrate a peak in children a few days before the adult peak. Ten to twenty percent of Americans come down with the flu and 100,000 hospitalizations are attributed to it every year (NIAID, 2003). It is likely that there are single individuals who can be the sources of infections for many people, which would account for the abrupt onset of waves of flu. Influenza is not a reportable disease in most states. Surveillance is performed through a network of sentinel physicians, who report cases of "influenza-like illnesses" seen in their offices. Scientists also indirectly assess the impact of influenza by measuring excess mortality and excess hospitalization rates during the flu season. In all likelihood, influenza is undercounted.

Of note is the unexplained change in the epidemiology during pandemics when it is young adults who are the hardest hit by death (Crosby, 1989; Simonsen, Clarke, Schonberger, Arden, Cox, & Fukuda, 1998). Immunity in the older population probably has a role though this is hard to prove.

Transmission and Pathogenesis

The mode of transmission of the influenza viruses among humans is by the spread of virus-containing respiratory droplets that an infected person expels through sneezing, coughing, and talking. A susceptible person who is within three feet of the source is at risk for infection through inhalation, settling of particles on mucous membranes, or contact with contaminated fomites. The cells of the respiratory tract are the target host cells for the influenza virus. When virus reaches the lining of the respiratory tract, the process of tissue invasion begins when the virus penetrates epithelial cells, replicates intracellularly causing host cell death, and releases large amounts of new virus to perpetuate the cycle. Concomitantly, the host mounts a complex immune response consisting of systemic and local antibody production and cellular responses. The virus titers usually peak by the second day after infection. By the fourth to sixth day levels are reduced dramatically (Wolff & Snacken, 2003).

In adults, flu virus can be transmitted up to one day before clinical illness develops. By the fifth to seventh day, the person should no longer be infectious. Children shed virus for longer periods: up to six days before signs and symptoms and over ten days after. Immunocompromised people can shed virus for weeks or months.

The incubation period for influenza is 1-3 days.

Clinical Signs and Symptoms

Uncomplicated influenza is an acute, usually 3-5 day, respiratory illness affecting the larynx, trachea, and bronchi. Disease caused by A and B are clinically indistinguishable. The primary symptoms are fever, myalgia, dry cough, and malaise; sore throat, headache, and rhinitis also occur. Children may experience nausea, vomiting, and otitis media. Cough and malaise can linger as long as two weeks. The spectrum of illness runs from subclinical to incapacitating, depending on attributes of the host and the viral strain. Respiratory syndromes that circulate concurrently with the flu, such as disease caused by adenovirus, parainfluenza, and respiratory syncytial virus, mimic the signs and symptoms of influenza, making definitive diagnosis difficult without laboratory testing. One major difference between influenza and other viral diseases is that the latter do not cause epidemics.

Pneumonia is the most common serious complication of influenza, and people at the greatest risk are over age 65, under age 4, immunocompromised, and those with cardiac and pulmonary diseases. The etiology of pneumonia is generally bacteria colonizing the respiratory tract. In the recent pediatric deaths in the US, methicillin-resistant *Staphylococcus aureus, Streptococcus pneumoniae,* and *Neisseria meningitidis* were among the causes of the influenza-associated pneumonias (CDC, 2004b). Primary influenza pneumonia is a less common complication; it is a severe disease that can progress within days to death. These patients are also subject to bacterial super infections, an often deadly combination (Treanor, 2000).

Complications and serious health problems seen in flu are bronchitis, bronchiolitis, and croup in children. Sinus infections, otits media, Reye's syndrome, myocarditis, and pericarditis have also been observed. Encephalopathy and encephalitis occur occasionally and can result in permanent sequelae (Soldo et al., 2003).

Colds are often confused with the flu due to similar symptoms. They are however, different viruses and need to be treated in another way. Colds generally are milder than the flu and do not result in high fevers or serious health problems. Antibiotics are ineffective with the common cold and therefore should not be encouraged. Symptoms of a cold are more likely to consist of a stuffy or runny nose and can be treated with over the counter antihistamines and cough syrups suggested by health care advisors.

Diagnosis of Influenza

Diagnosis of flu is often made on clinical grounds alone. In the setting of known community transmission or exposure to the flu, laboratory testing may not be indicated. When it is, diagnosis is made by identification of viral antigens or by virus isolation in the lab. Eight rapid diagnostic tests are on the market, requiring varying degrees of expertise. Some are available for use in an office setting. Others require specific laboratory certification. Five other laboratory tests for influenza are available; they provide the more definitive diagnosis. Except for serology testing, respiratory specimens such as nasopharyngeal swabs, washings, and aspirates; and sputum are appropriate for these tests. Nasopharyngeal specimens should be collected in the first four days of illness, and collection should be done in a manner vigorous enough to pick up cells for examination. Swabs should be placed in a viral transport media and sent to the lab without delay.

Treatment Options

Four antiviral medications are licensed in the US for treatment and prophylaxis of influenza (see Table 1 for routine indications and doses). These antivirals reduce the length and severity of uncomplicated disease in about two thirds of people (Wolff & Snacken, 2003). The adamantanes, amantadine and rimantadine, available first in 1966 and 1993 respectively, are effective only against influenza A which somewhat limits their usefulness without lab diagnosis. Amantadine increases seizure activity in people with seizure disorder. Both adamantanes can cause mild, reversible central nervous system side effects. The other two drugs are the neuraminidase inhibitors, zanamivir and oseltamivir, both approved in 1999. They are active against influenza A and B because their viral target is a feature common to both viruses. Zanamivir inhalation can cause bronchospasm and therefore is not generally recommended for people with pulmonary conditions. Nausea and vomiting are the most commonly reported side effects with oseltamivir. The neuraminidase inhibitors are becoming the drugs of choice in influenza.

Limitations of these medications are: 1) none is approved for use in children under one year of age, 2) none has been shown to prevent serious complications associated with influenza, and 3) resistance to the adamantanes has been identified although the clinical significance is not fully understood.

Table 1. Guide to Treatment and Prophylaxis in Healthy Individuals

Amantadine (Symmetrel) Active against Influenza A	100 mg BID	1–9 yrs: usually 5 mg/kg/day not to exceed 150 mg/day ≥ 10 yrs: 100 mg BID*	P.O.	Children ≥ 1 yr: same dosing as for treatment. Adults: 100 mg BID
Rimantadine (Flumadine) Active against Influenza A	100 mg BID	Not FDA approved for treatment but is used by some experts at same dosing as amantadine	P.O.	Children ≥ 1 yr: same dosing as for treatment. Adults: 100 mg BID
Oseltamivir (Tamiflu) Active against Influenza A and B	75 mg BID	≥ 1 yr: dose varies by weight, from 30 mg/kg/day to 75 mg BID.	P.O.	Not approved for prophylaxis in children under 13 yrs. Adults: 75 mg BID
Zanamivir (Relenza) Active against Influenza A and B	10 mg BID	≥ 7 yrs: 10 mg BID x 5 days. Packaged in 5 mg foil blisters.	Inhalation via Diskhaler	Not approved for prophylaxis.

Note: There are four influenza antiviral drugs approved for use in the United States (oseltamivir, zanamivir, amantadine and rimantadine). The swine influenza A (H1N1) viruses that have been detected in humans in the United States and Mexico are resistant to amantadine and rimantadine so these drugs will not work against these swine influenza viruses. Laboratory testing on these swine influenza A (H1N1) viruses so far indicate that they are susceptible (sensitive) to oseltamivir and zanamivir (CDC, 2009).

Prevention of Influenza

The chain of infection for influenza offers ample opportunities to intervene and prevent infection, at least in theory. While the avian reservoir for influenza A cannot be eliminated, changes in farming and marketing practices to reduce opportunities for close contact among affected species would be highly beneficial. To reduce person-to-person transmission, commonsense measures should be employed, such as ill people staying home from work or school, and sneezing and coughing into tissues that are directly disposed of into a trash container. Hospitalized and nursing home patients should be isolated on droplet precautions. The rapid diagnostic tests (see below) can give assurance in a reasonable timeframe that the patients to be cohorted are infected with the same organism. Last but not least, hand hygiene should be stressed during the flu season in all settings—home, healthcare, work, and school. Easy-to-use alcohol hand sanitizers promote compliance with hand hygiene recommendations (CDC, 2002).

Targeting the susceptible host is ultimately the best hope for stopping transmission of the flu. If we cannot control the reservoir of influenza virus nor the actions of other people, then we must reduce the susceptibility of the population to influenza. This can be facilitated by providing flu vaccines as soon as the vaccine is available to those people at greatest risk for complications of the flu (New York State Department of Health, 2006).

Those at greatest risk for complications include:

- All children 6-59 months
- Adults aged > 50 years of age with an emphasis on those > 65 yrs
- Persons aged 2-64 years with underlying chronic medical conditions
- Persons > 2 yrs of age with conditions that can cause breathing problems
- All women who may become pregnant within flu season
- Residents of nursing homes and long-term care facilities
- Children aged 6 months to 18 years on chronic aspirin therapy
- All health care workers
- Out of home caregivers and household contacts of persons in the high risk groups

Who should not be vaccinated?

- People with severe allergy to chicken eggs
- People who have had a severe reaction to an influenza vaccination in the past
- People who developed Guillain-Barre syndrome within six weeks of getting an influenza vaccine previously
- Children less than 6 months of age
- People sick with a fever. People with mild illness can usually get the vaccine

Inactivated Flu Vaccine

Spurred by memories of the devastation of troops during World War I, the first flu vaccine was tested on American soldiers during 1943. It protected over 70% of vaccines (Keitel & Couch, 2002). The influenza A virus had been identified in 1933, followed in a few years by the isolation of B (Treanor, 2000). The discovery that the viruses could be grown in hens' eggs was critical for the study and development of the vaccine. The vaccines used today have evolved over the last 60 years from a product made with formaldehyde to a safer one.

The World Health Organization convenes a group of experts twice a year (in February for the Northern Hemisphere) to decide which subtypes should be covered for the upcoming influenza season. The decision is based on the results of a global surveillance network begun in 1947 that includes 110 centers in 80 countries, and identifies predominant circulating viruses all over the world. The injectable, inactivated, trivalent vaccine is made from the purified hemagglutinins of three chosen strains: 2 A subtypes and 1 B virus. The system is not perfect. In the 2003-04 flu vaccine, the formulation did not include the virus strain (A/Fujian/411/2002[H3N2]-like viruses) that turned out to cause about 75% of the cases (CDC, 2003a). It did include a closely related strain, and some experts suggested that cross protection would offer some degree of protection. However, an initial study done among healthcare workers at a Colorado children's hospital comparing vaccinated to unvaccinated staff did not show that the vaccine conferred protection against development of the flu (CDC, 2004a). The study had design limitations and the findings are considered preliminary. By contrast, during a year of a good match between the vaccine and circulating strains, overall 86% of healthy people obtained protection from the vaccine (CDC, 2004a; Wolff & Snacken, 2003).

Vaccination should begin in October in the northern latitudes. It is recommended annually for the following populations (CDC, 2003b):

- Persons over 50 years, but especially ≥ 65
- Persons with underlying medical problems, particularly pulmonary and cardiac disease
- Nursing home and chronic care facility residents
- People with immunosuppression (including drug induced), diabetes mellitus, renal dysfunction, and hemoglobinopathies such as sickle cell disease
- Pregnant women in the 2nd or 3rd trimester
- Children receiving long-term aspirin therapy

The targeting of people as young as 50 years is a means of capturing the many people who develop chronic conditions in the sixth decade of life. The cohort over 65 has the highest morbidity and mortality rates due to increased rates of cardiopulmonary, renal, and metabolic diseases. Pregnant women are at increased risk for severe influenza due to changes in the immune system. While there is no known risk in the 1st trimester, out of caution, pregnant women should wait until the 2nd trimester before vaccinating. People without competent immune systems can and should be vaccinated. Children on aspirin therapy who become ill from the flu are at risk for the development of Reye's Syndrome.

Healthcare workers with direct patient care assignments are also targeted for vaccination. Of particular concern is the front line staff that sees patients before isolation can be instituted. People working in ambulatory practices, emergency departments, and ambulance workers should be vaccinated unless contraindicated. Outbreaks in nursing homes are common even in vaccinated residents; the elderly do not always mount a protective immune response. Annual drives to immunize the staff of acute care hospitals, long term care facilities, and ambulatory practices should begin as soon as vaccine is available.

The latest guidelines on the indications for the flu vaccine strongly recommend vaccination of children ages 6-23 months as this cohort is at increased risk for hospitalization due to complications of the flu (CDC, 2003b; American Academy of Pediatrics, 2003). Two injections a month apart are needed for optimum coverage in most children under 9 years of age. Children

younger than 12 years should receive the “split virus” vaccine (also known as the subvirion or purified surface-antigen vaccine). No vaccine is approved for use in the under 6 months of age group. The best prevention for infants entails vaccination of their close contacts, including caregivers.

Contraindications to receiving the inactivated flu vaccine are few. This is a safe vaccine. People with allergy to eggs should not take the vaccine due to the possibility of egg protein left over from the manufacturing process. Also, most experts recommend postponing vaccination until a febrile illness is over.

The vaccine requires about two weeks before an individual has developed maximum protection. Side effects are generally limited to local tenderness at the injection site and minor body aches a few hours after vaccination. Systemic reactions are seen sometimes in first time vaccinees. These consist of flu-like symptoms for a day or two. It is not well understood what causes these reactions. The killed virus in the vaccine cannot cause the flu. A respiratory illness that develops after vaccination either was the flu already incubating or another viral syndrome.

Live, Attenuated Vaccine

After decades of research, an intranasally delivered, live, attenuated influenza vaccine (LAIV) became available in 2003 for use in healthy individuals from 5 to 49 years. The LAIV is composed of the same three strains of virus as the inactivated vaccine. It delivers modified virus in a mist via a device to the nostrils, where the virus then replicates and induces the production of strain-specific antibodies. Its efficacy is 92% in preventing influenza and it seems to work even when it is not well matched to circulating strains. The current product (Flumist) is a relatively expensive one; costs range from $50 to $100 though the manufacturer offers a $25 rebate through its website. In addition, the vaccine must be kept at very low temperatures, which affects its availability.

Since the LAIV is approved for healthy individuals only, there are few contraindications. As for the inactivated vaccine, the LAIV is contraindicated in egg allergy. Also, nasal congestion probably interferes physically with delivery, but the vaccine can otherwise be given during mild disease. The LAIV is not recommended for use by healthcare workers or other people who have contact with immunosuppressed individuals. As the virus is live (though modified), there is a small theoretical risk of transmission of influenza infection to those individuals. The likelihood is small for several reasons besides the fact that the virus is modified, it has also been "cold adapted" to the lower temperatures in the nose, and cannot survive in the warmer, lower parts of the body.

Side effects of the LAIV are generally limited to rhinitis. Headache, vomiting, muscle aches, fever, and cough have been observed.

Infection Control in the Healthcare Setting

Identification and isolation of the patient are the most important steps in preventing transmission of influenza in the healthcare setting. Suspect and diagnosed patients should immediately be placed on droplet isolation. Droplet isolation requires a single room (unless cohorting of likewise diagnosed patients is necessary), the wearing of a mask by staff and visitors upon entering the room, and appropriate hand hygiene. Also important are the cleaning of environmental surfaces by a disinfectant that is active against viruses and the disinfection of shared patient care equipment.

Every healthcare setting should begin efforts in October to vaccinate employees. Vaccination rates among healthcare workers are notoriously low for various reasons (Salgado, Farr, Hall, & Hayden, 2002). Workers fear becoming ill from the flu shot; others are needle phobic; some claim that they never become sick from the flu so do not need the shot; and others do not have time to go to Occupational Health Services (OHS). If hospital administration supports a vaccine drive and provides resources for it, an intensive campaign can raise vaccination rates. Workers need to have easy access to the vaccine and strategies should be combined to promote vaccinations. Extending OHS hours to accommodate 24 hours/7 days a week staff is a necessity. Tables can be set up at shift change in the entryways of a building with staff ready to give vaccinations; this is a tactic that has been successful. Taking the vaccine to units and departments is the most effective method of immunizing the staff. In some hospitals, a nurse takes on the role of the unit's vaccinator; anecdotally this has been very successful.

Outbreaks in the Healthcare Setting

Influenza causes outbreaks in long term care facilities and in hospitals. Affected hospital units include neonatal intensive care, solid organ transplant, pediatrics, medical, and oncology. Outbreaks are a threat even in a highly vaccinated population, especially if the vaccine does not closely correlate with predominant circulating subtype or the population has not built adequate immunity. When nosocomial transmission of disease is identified, an organization must move decisively to contain it. Ill patients should be moved to a designated part of a unit and confined to their rooms on droplet isolation except for necessary procedures. Rapid diagnostic testing should be performed to verify diagnosis and to identify the strain. Contacts (e.g., previous roommates and staff) should be considered for prophylaxis with the appropriate antiviral medication. The number of people entering the room should be restricted to the minimum. The nursing staff should be cohorted so that one group of nurses cares for the influenza patients and the other does not. Unvaccinated staff should be vaccinated. Consideration should be given to closing a unit to admissions if transmission cannot be halted, though in this day and age, this should be avoidable. In the presence of a widespread community outbreak, visitors should be restricted.

Pandemic Considerations

Easier access and availability to diverse forms of transportation can be a factor in world wide pandemics. Not only is there an increase in mobility of people which leads to additional exposure and risk of spreading illness, but there is also a potential for animals to interact with other animals outside normal living areas as well. Put the two together and this creates an increase in human to animal interaction with increased opportunities for viral-gene recombination and transmission. Once a virus adapts to human subjects it brings us back to the concept of easier access and availability to world wide travel and a threat of rapid spread of new viruses.

This, in fact, was the concern in 2003 with the A (H5N1) also known as avian influenza. Most of the people who fell ill from A (H5N1) had direct exposure to infected poultry (Davey, 2007). Time will tell if or when this virus will mutate and become a pandemic threat.

Recent Events

Evaluating recent medical events brought many countries into preparing for the next pandemic through disaster planning. The 2003 outbreak of severe acute respiratory syndrome, otherwise known or referred to as SARS, took the world wide public health community by surprise. The virulence and rapid transcontinental transmission was unexpected and contributed to great economic losses.

The World Health Organization (WHO) estimates the global cost of SARS to be $30 billion. This includes medical impact for outreach programs, education, quarantines, and patient screening, along with retailers and the tourist industries. The economic impact of pandemics could be greater if one includes the closing of factories, manufacturers, trade, and tourism. Add to those figures the costs of premature deaths of income-earners, lost work days of sick employees, higher hospitalization, and treatment costs (WHO, 2005). What may not have been included would be the losses suffered from unnecessary closures due to irrational panic. One report stated widespread avoidance of Chinese restaurants and Chinatowns across the United States (Ben-Ami, 2003).

As a reminder, to keep up-to-date with the changing CDC updates regarding the H1N1 flu, be sure to visit http://www.cdc.gov/swineflu.

National Strategy

Countries are wise to have a national pandemic control plan and action in which they can respond rapidly and effectively when needed. Each government should be able to respond promptly in ways to communicate to the public and educate what the flu is as well as what it isn't. This also includes providing prevention programs and mechanisms.

Examining past histories of disasters such as the 1918 pandemic, major hurricanes, tsunamis, earth quakes, as well as the 2003 SARS outbreak can help teach us how to prepare and plan for future strains on the healthcare system. President Bush divulged the National Strategy for Pandemic Influenza on November 1, 2005. The twelve page document outlines both government and private sector responsibilities in the three areas of: preparedness and communications, surveillance and detection, and response and containment (The White House, 2005). Included in the document is the charge to the federal cabinet on plans to maintain operations, protect employees, and to support federal efforts during a pandemic. The action plan includes performance measures that require federal agencies to work together with state agencies and private groups, businesses, and organizations. Disaster preparedness drills have taken place in many communities to test the effectiveness of their plans. The development of vaccines and stockpiles have been created for antiviral medications and personal protective equipment. The various measures would be applied in the event of a pandemic episode according to the severity of the outbreak. Other planning efforts would include closures of schools and businesses, cancellation of public gatherings and quarantine measures. Check lists were also developed to help businesses develop their own plan. This can be found at www.pandemicflu.gov.

Individual planning for communities

Just like the old Boy Scouts' motto: *it is always better to be prepared*. Businesses may have limited supplies, limited hours, or may even close. You may be unable to leave the house if you or a family member falls ill. Public services may also be interrupted due to limited staff or operation hours. With this being said, a list of the following should be considered in any disaster emergency planning and outages:

- Keep immunizations (including flu shots) up-to-date and have the records available.
- Keep about a two week supply of non-perishable food and water on hand.
- Occasionally check prescription medications for a continuous supply at home.

- Keep on hand over-the-counter medications such as pain relievers, stomach remedies, cough and cold medicines, fluids with electrolytes, and vitamins.
- Have readily available: your family medical history and allergy list.

It is also important to use good hand washing techniques to prevent infection. Be sure to use good hygiene behavior such as coughing and sneezing into a tissue or the elbow of your sleeve instead of your hand. Teach the importance of washing hands immediately after blowing one's nose. Stay away from those who exhibit symptoms of illness and by all means stay home if you become ill.

Items to have on hand for an extended stay at home:

Examples of Food and Non-Perishables	Examples of Medical, Health, and Emergency Supplies
Ready-to-eat canned meats, fish, fruits, vegetables, beans, and soups	Prescribed medical supplies such as glucose and blood-pressure monitoring equipment
Protein or fruit bars	Soap and water, or alcohol-based (60-95%) hand wash
Dry cereal or granola	Medicines for fever, such as acetaminophen or ibuprofen
Peanut butter or nuts	Thermometer
Dried fruit	Anti-diarrheal medication
Crackers	Vitamins
Canned juices	Fluids with electrolytes
Bottled water	Cleansing agent/soap
Canned or jarred baby food and formula	Flashlight
Pet food	Batteries
Other non-perishable items	Portable radio
	Manual can opener
	Garbage bags
	Tissues, toilet paper, disposable diapers
Source: Pandemicflu.gov (http://www.pandemicflu.gov/plan/individual/checklist.html)	

Conclusion

Seasonal flu, avian flu, swine flu, and pandemic flu are not the same. Understanding their differences can help us educate the public as to what it is versus what it isn't, thereby helping to prevent mass hysteria, confusion, and unnecessary closures leading to financial losses. Conquering infectious disease is a battle fought hard and long. New viral diseases have emerged in the past 25 years with astounding regularity. And despite all the scientific knowledge that has been gained about the flu virus in 70 years, influenza continues to plague humankind. We cannot safely say that no more pandemics will happen. Will we be ready to act should one start? The United States has developed and announced a national strategy in the event a pandemic event occurs. However, the commitment to stop epidemics and pandemics is a considerable one for the world to make but there is little choice. It will take a global network of cooperation, but it takes each one of us to commit to the fight on our local level.

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Influenza: Impact, Prevention, and Control
Course Exam

After studying the downloaded course and completing the course exam, you need to enter your answers online. **Answers cannot be graded from this downloadable version of the course.** To enter your answers online, go to e-leaRN's Web site, www.elearnonline.net and click on the Login/My Account button. As a returning student, login using the username and password you created, click on the "Go to Course" link, and proceed to the course exam.

1. To bring influenza under control, three pathways must be followed. They include all the following EXCEPT:

    A. Surveillance of human and epidemiologically significant animal populations
    B. Improvement of immunization rates
    C. Effective treatments
    D. Prophylactic destruction of avian populations

2. Antigenic shift is one form of mutation of the influenza virus. Which of the following is true of antigenic shift?

    A. It is a "minor" mutation that occurs frequently during viral replication.
    B. Mutation does not occur frequently and is generally not a problem during replication of the influenza virus.
    C. It occurs when viral subtypes "meet" in a host cell and share genomes during replication, creating a new subtype to which humans lack immunity.
    D. Hemagglutinins from porcine hosts create antibodies against influenza virus.

3. The mode of transmission of the influenza virus among humans is

    A. Blood and body fluids, most frequently through percutaneous needlestick injury.
    B. Respiratory droplets containing virus which are spread through sneezing, coughing and talking.
    C. Skin to skin contact.
    D. All of the above.

4. The incubation period for influenza is:

    A. 1-3 days
    B. 3-5 days
    C. 5-7 days
    D. None of the above

5. The following are true regarding the symptoms of influenza **EXCEPT**:

    A. Primary symptoms are fever, myalgia, dry cough, malaise, sore throat, headache and rhinitis.
    B. Children may experience nausea, vomiting and otitis media.
    C. Cough and malaise may last as long as two weeks.
    D. Primary symptoms last on average 7 to 14 days.

6. Pneumonia is the most common serious complication from influenza. All of the following are true about the complication of pneumonia **EXCEPT**:

    A. It most often affects persons under age 4 and over age 65.
    B. It almost always progresses to primary influenza pneumonia, resulting in rapid death in most cases.
    C. It also often impacts persons who are immunocompromised and those with cardiac or pulmonary disease.
    D. It is most often caused by bacteria colonizing the respiratory tract.

7. Treatment for influenza includes the Amantanes, which are the only class of antiviral medications that has been proven to be effective against Influenza A and B.

    A. True.
    B. False.

8. The World Health Organization (WHO), based on the results of a global surveillance network, identifies predominant circulating viruses and develops an injectable, inactivated, trivalent vaccine from the chosen strains. The following is true of this system:

    A. It is not a perfect system; in some years the formulation of the vaccine does not include the virus strain responsible for the majority of influenza cases, such as occurred in the 2003-2004 flu vaccine.
    B. It is not a perfect system because the surveillance network includes only a handful of countries and centers throughout the world, therefore large segments of the world population, and therefore their respective influenza strains, are not represented.
    C. It is not a perfect system, as it was begun just 10 years ago and most global efforts at health surveillance need time to become effective.
    D. It is a perfect system.

9. The Centers for Disease Control and Prevention (CDC) recommend that vaccination should begin in October in the northern latitudes; and annual vaccination for the following populations are recommended:
    - Persons over 50 years, but especially ≥ 65
    - Persons with underlying medical problems, particularly pulmonary and cardiac disease
    - Nursing home and chronic care facility residents
    - People with immunosuppression (including drug induced), diabetes mellitus, renal dysfunction, and hemoglobinopathies such as sickle cell disease
    - Pregnant women in the 2nd or 3rd trimester
    - Children receiving long-term aspirin therapy

    A. True.
    B. False.

10. Live, attenuated influenza vaccine (LAIV) became available in 2003. The following is true about this vaccine **EXCEPT**:

    A. It is indicated for use in healthy individuals from 5 to 49 years.
    B. It is composed of the same 3 strains of virus as the inactivated vaccine; it delivers modified virus in a mist via a device to the nostrils, where the virus then replicates and induces the production of strain-specific antibodies.
    C. Its efficacy is 92% in preventing influenza and it seems to work even when it is not well matched to circulating strains.
    D. It is an inexpensive vaccine that must be stored at high temperatures.