Avian Influenza: The Next Pandemic, Implications for Nurses

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How to Take This Course

Please take a look at the steps below; these will help you to progress through the course material, complete the course examination and receive your certificate of completion.

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**

   Upon passing the course exam you will be prompted to complete a course evaluation. You will have access to the certificate of completion **after you complete the evaluation**. At this point, you should print the certificate and keep it for your records.

Introduction

In an unnamed city, a well-known world leader is fighting his biggest battle; the battle is for his life. As he lies perilously close to death, doctors and nurses work frantically to try to save him. They cast worried glances at each other over tight fitting respirators. It appears they might loose the battle; meanwhile, inside the hospital, around the city, and over the globe others are dying in enumerable masses by the minute.

No, that is not a paragraph from the latest best selling medical thriller, but a possible real case scenario. The head of the World Health Organization predicted the next pandemic at a meeting in late November 2004. The culprit: avian influenza. Health leaders throughout the world have been using words such as avian flu, pandemics, economic collapse, vast numbers dying in an extensive outbreak of a disease very few of us know about (WHO, 2005; CNN, December 13, 2004).

"One of the most powerful allies of human disease is human ignorance," writes David Dickson in *a Science and Development Network* article. In this continuing education course, ignorance regarding avian influenza will be attacked and nurses will be empowered with the knowledge to fight it.

Human infection of the avian influenza A virus is rare, but more than 100 confirmed cases have been reported since 1997 (CDC, 2005). Spread of avian flu was thought to occur from infected birds; however, in January 2005, the *New England Journal of Medicine* reported the first documented probable human-to-human transmission of the disease. From January, 2004 to early February, 2005, 55 people were infected with avian influenza; 42 have died (WHO, 2005a).

The purpose of this course is to introduce nurses to this new emerging infectious disease, avian influenza, and examine control and treatment options to prevent a pandemic.

Objectives

Upon completion, the learner will be able to:

- Describe avian influenza and the threat of human infection.
- Identify signs and symptoms of avian influenza virus.
- Discuss treatment and prevention measures for avian influenza.
- Describe infection control measures to limit the spread of avian influenza.

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What Is Avian Influenza?

Avian influenza is a member of the orthomyxoviridae family of viruses. The root word "myxa" comes from Greek origins, meaning mucus. The avian influenza virus is composed of single-stranded RNA material (DHHS, 2004). An influenza virus structure is somewhat like a double walled sphere. Inside the sphere, are eight segments (RNA) that look like springs. On the surface of the sphere are tiny protein projections called hemaglutinin (HA) and neuraminidase (NA). These projections resemble straight pins, the heads of the NA particles face outward and the heads of the HA particles face inward. The HA particles assist in the binding of the virus to other cells (such as respiratory tract cells) which allows for exchange of genetic material. Once this exchange occurs, eight new RNA particles are formed and encased in a new envelope. The new virus cell is released, and the process is replicated again and again (Tulane University, 1999).

Avian flu, a type of influenza that birds carry, was first documented in Italy around 1878 and was then called "fowl plague". It is found in chickens, geese, turkeys, quail, falcons, herons, and most avian species. Imported pet birds can also carry and spread the disease. Ducks can remain asymptomatic but still carry the disease, excreting large amounts of the virus in their droppings (CDC, 2004). Excessive amounts of virus have been found in the waterways where ducks congregate (DHHS, 2004a). This can be significant in the transmission of the disease, since ducks live in the waterways from which other animals drink.

Historically, coughing, sneezing, diarrhea, and decreased egg production are symptoms of infection in birds. Sick birds may sit or stand with heads touching the ground in a semi-comatose state. Others may drink vast amounts of water. Some birds may show no symptoms at all other than sudden unexplained death. Hemorrhages throughout the body are a complication of advanced illness.

A flock of birds can become rapidly infected with avian influenza, with a 90-100 percent mortality rate among infected birds (OIE World Organization for Animal Health, 2003). Viral shedding occurs in saliva, respiratory secretions, and feces of fowl. The virus is usually transmitted by direct contact with the secretions, droplet spray, or feces of infected birds. The virus travels from flock to flock through contaminated feed, vehicles, and equipment, or through the migratory patterns of birds as movement between flocks and farms occurs (WHO, 2004).

The virus may survive up to several weeks outside its host, depending on environmental conditions. The avian influenza virus is killed by exposure to temperatures over 70° Celsius for 30 minutes. With 80° Celsius contact, the virus is killed in 1 minute. Not affected by freezing temperatures, the virus prefers cool moist environments (OSHA, 2004).

Background

There are three types of influenza viruses: influenza A, influenza B, and influenza C. Birds are only affected by influenza A viruses, and all the known subtypes of influenza A viruses infect birds. Normally only humans are infected with influenza B, and while it can cause epidemics, it has not caused pandemics. Influenza B is not classified into subtypes. Influenza type C viruses only cause mild illness and do not cause pandemics or epidemics (CDC, 2004a).

Influenza A viruses are classified into subtypes. The subtypes consist of 15 different hemagglutinin (HA) proteins and 9 different neuraminidase (Na) proteins. These proteins are found on the surface of the influenza A virus. There are three prominent subtypes of avian influenza A: H5, H7, and H9. Each of these subtypes can partner with any one of nine neuraminidase surface proteins to produce different strains H5N4, H5N6, etc. (CDC, 2004a).

Low pathogenic and high pathogenic forms of H5 and H7 influenza viruses exist. The highly pathogenic forms of avian Influenza are 90 percent fatal to poultry that become infected. H5N1 is the highly pathogenic subtype that scientists believe will cause the next pandemic, and they are watching it closely (CDC, 2004a).

Prior to 1997 the H5N1 subtype began circulating in poultry and early infections were mild. However, in 1997 it mutated into a highly pathogenic form that could kill a bird within 48 hours of contracting the disease. After this initial surfacing of the H5N1 subtype in 1997 it remained relatively dormant until in 2003 it became very visible and very destructive (WHO, 2005).

What is a Pandemic?

A pandemic is defined as a global disease outbreak for which there is little or no immunity in the human populations and spreads easily person-to-person worldwide (www.PandemicFlu.gov, 2005). Viruses are constantly evolving through genetic mutation, and are taking on new and different structures and compositions. When viruses mutate to the point that human immunity no longer exists, pandemics occur. This happens about every 20-30 years or so. This concept explains why people continue to catch the common cold. The common cold is a virus and it continues to evolve and mutate over time. The body recognizes it as a new threat each time it appears.

Pandemics can be divided into distinct stages. Each phase has its own unique characteristics (CDC, 2005a):

Interpandemic period

Phase 1: No new influenza virus subtypes have been detected in humans. An influenza virus subtype that has caused human infection may be present in animals. If present in animals, the risk of human infection or disease is considered to be low.

Phase 2: No new influenza virus subtypes have been detected in humans. However, a circulating animal influenza virus subtype poses a substantial risk of human disease.

Pandemic alert period

Phase 3: Human infection(s) with a new subtype but no human-to-human spread, or at most rare instances of spread to a close contact.

Phase 4: Small cluster(s) with limited human-to-human transmission but spread is highly localized, suggesting that the virus is not well adapted to humans.

Phase 5: Larger cluster(s) but human-to-human spread still localized, suggesting that the virus is becoming increasingly better adapted to humans but may not yet be fully transmissible (substantial pandemic risk).

Pandemic period

Phase 6: Pandemic: increased and sustained transmission in general population.

As of November 2005, the World Health Organization has identified that the world is presently in Phase 3 (WHO, 2005b).

Pandemics of the 20th Century

The three influenza pandemics of the 20th century were the Spanish flu pandemic in 1918-1919 which killed 50 million people worldwide; the Asian flu in 1957 in which 2 million people died worldwide; and in 1968, the Hong Kong flu which killed 1 million worldwide (WHO, 2005).

The Spanish flu pandemic of 1918 is considered the yardstick for all other pandemics. During this scourge, 20 to 35 percent of the world population fell ill (WHO, 2005). Death came very quickly, sometimes within hours with this flu outbreak. The disease spread rapidly through the military camps ravaging the military forces. Those that did not die quickly of suffocation succumbed later of pneumonia. Death rates for this pandemic were highest among young healthy adults.

Asian flu was first identified in the Far East in 1957. Unlike the devastating pandemic of 1918, officials quickly identified the virus and began vaccination. Unlike the Spanish flu, Asian flu claimed larger numbers of elderly individuals. The death count globally was estimated to be 2 million (WHO, 2005).

Hong Kong flu was detected in Hong Kong in early 1968. By September, the first cases were appearing in the United States. By December, the virus was widespread. This was the mildest of the pandemics of the 20th century only claiming 33,800 lives in the US (WHO, 2005), although 1 million people died worldwide (CNN, 2004).

Scientists fear that the avian flu may already have mutated into a virus that can be spread by human-to-human contact, particularly if humans catch the avian flu concurrently with another type of flu. In that case, the two strains could mix, and create a virus that is easier to transmit from person to person, in a process called viral reassortment (DHHS, 2004).

Scientists are estimating that 25 to 30 percent of the world population will fall ill in a pandemic (CNN, 2004). Even more troubling are the figures of the vast numbers of people that could die; avian flu carries a 70 percent mortality rate (Lauras, 2005; Revill, 2004). Using the current world population of 6,412,130,000 people, these estimates would mean that at least 1,603,032,000 people would fall ill with avian flu. If 70 percent of those numbers die, we stand to loose 1,122,122,000 people – over twice the number of deaths from the Spanish flu pandemic of 1918 – 1919. When one ponders those numbers, it becomes easy to see what a catastrophic disaster of global proportions human avian influenza could become.

The world impact of an avian flu pandemic could be astounding. A pandemic could seriously impair the healthcare systems, with shortages of personnel as staff fall ill. Commercial travel would grind to a halt as air traffic controllers and airline pilots become sick. The movement of essential supplies and medicine could be severely impaired as transportation workers sicken. The absence of staff in world financial markets would affect the global economy. A pandemic would wreck havoc on our military and police forces. To address these very issues the President has developed a national strategy for a pandemic influenza (White House, 2005).

Strong evidence of the first probable human-to-human transmission of the avian flu virus already existed from a case reported in Thailand in September 2004 (CDC, 2004b). Human infections of H5N1 first appeared in 1997 in Hong Kong, 18 people were hospitalized with six deaths occurring. Transmission was mainly through contact with infected poultry but it was possible that rare person-to-person infection occurred.

In 2003, two cases of avian influenza occurred in a family that traveled from Hong Kong to China, one died and the other recovered. A third family member died from a respiratory illness in China, but was never tested for avian flu (CDC, 2004c). Human H5N1 infection has been identified in Cambodia, China, Indonesia, Malaysia, Thailand and Viet Nam. As of November 2005, (WHO, 2005c), a total of 133 cases have been identified in these countries, 68 of which died.

To date there have been no cases of avian or human H5N1 reported in the United States.

Surveillance

Surveillance is the combined effort of multiple world organizations such as the World Health Organization, the Centers for Disease Control and Prevention, the Department of Health and Human Services, local health departments and medical communities world wide. WHO is the coordinator for this worldwide surveillance system. There are 110 National Influenza Centers across the globe conducting continuous monitoring of influenza outbreaks. The WHO has laboratories in 83 countries for the testing of influenza samples.

There are three primary objectives for surveillance of influenza:

1. To determine where, when and which types of virus are circulating.
2. To determine the intensity and impact of influenza outbreaks.
3. To detect novel viruses that could cause pandemics.

Surveillance information is needed to direct vaccination and treatment efforts, containment efforts and to drive pandemic planning and preparedness. Priority groups for antiviral and vaccination administration can be defined from surveillance. Efforts are currently underway to strengthen surveillance resources is Asia, the epicenter for the avian influenza virus.

In the United States on a weekly basis, laboratories report to the CDC the total number of specimens received by the laboratory for respiratory testing. At least one laboratory is present in each state for the receipt, testing and reporting of suspect specimens (DHHS, 2004b).

In early 2006, the Food and Drug Administration (FDA) approved a new laboratory test to diagnose H5 strains of influenza in patients suspected to be infected with the virus. The test provides preliminary results within four hours once testing in the laboratory begins. Previous testing technology would require at least two to three days to render results (DHHS, 2006).

Hosts

Chickens, herons, ducks, pigs, falcons, cats, and humans have been infected with avian flu.

Wild waterfowl are the natural reservoir for all influenza A viruses, but have historically been of the low-pathogenic subtype. However, this may be changing, as two mountain hawk eagles smuggled on a plane from Thailand were found to be infected with the highly pathogenic H5N1 subtype of avian influenza (WHO, 2005).

Domestic ducks can carry the virus without getting sick from the disease and have been a significant source of concern regarding the spread of the H5N1 subtype. These ducks can excrete large amounts of virus without any signs of illness, thereby infecting other fowl or humans. The transmission of the H5N1 virus from seemingly healthy ducks is a complication in the tracing of the disease since some infected humans had not been exposed to sick birds (WHO, 2005).

Animal viruses do not normally affect humans until viral reassortment occurs and the flu jumps the species barrier. Avian influenza is already exhibiting this behavior. In 2004, the H5N1 subtype caused a large and deadly outbreak among tigers in Thailand. The tigers were thought to be infected by eating chicken carcasses (WHO, 2005).

Symptoms

The incubation period of avian flu is 3 to 7 days. Viral shedding in humans may begin as early as the day before symptoms are present and lasts 5-7 days. Some individuals may remain contagious for 3 weeks (CDC, 2005c). Persons with high fevers may shed greater amounts of the virus. Avian flu may be carried and spread by a host without causing symptoms of illness. Symptoms alone cannot diagnose avian flu. A nasopharyngeal swab is required for human testing for the illness. Laboratory testing must be conducted to differentiate the H5N1 subtype, since so many subtypes of Influenza A exist (CDC, 2004e).

Symptoms of illness that include fever, fatigue, diarrhea, cough, sore throat, pink eye (a distinct feature, though not always present), and muscle aches. Additional life-threatening complications can include pneumonia, acute respiratory distress, and viral pneumonia (CDC, 2005b).

Treatment

The best treatment is containment of the infection. Antibiotics are ineffective against viruses and are only used to treat secondary bacterial infections. General supportive measures and antivirals are the current standards of care.

The most important role of the nurse in treatment is education of the patient and public about the spread of the illness. Nurses will be responsible for the enforcement of infection control policies in healthcare facilities as well, and so will bear responsibility in the outcome of epidemics and pandemics. Nurses will also have a unique opportunity to educate poultry workers and containment personnel during flu vaccination clinics.

Most cases of avian influenza (H5N1) have been traced to direct contact with infected poultry and have occurred in Asia. Nurses and other healthcare providers should closely question anyone with flu symptoms about recent travel habits and contact with poultry. Upon returning from an infected area and for the following ten days, the traveler should watch for fever plus a cough, sore throat, or trouble breathing. If the traveler decides to visit a health care provider, s/he should be prepared to share the following: 1) symptoms, 2) where traveled, and 3) if there was direct contact with poultry or close contact with a severely ill person (CDC, 2005c).

Four different influenza antiviral drugs (amantadine, rimantadine, oseltamivir, and zanamivir) are approved by the U.S. Food and Drug Administration (FDA) for the treatment of influenza; three are approved for prophylaxis. Sometimes influenza strains can become resistant to these drugs, and therefore the drugs may not always be effective. Monitoring of avian influenza A viruses for resistance to influenza antiviral medications is ongoing (CDC, 2005d).

The vaccination saga grows more complex when one considers that the majority of flu vaccine is grown in chicken eggs. As the avian flu virus spreads, the supply of uncontaminated poultry products will diminish. The eggs used to make flu vaccine must be embryonated and the avian flu virus kills egg embryos. Additionally, vaccine production is 6-9 months and pandemics can last up to 2 years. So, what alternatives are there? The world leaders and government officials are working with vaccine manufactures on ways to decrease production time for vaccines. One option is growing vaccines in tissue samples instead of eggs, but these tissue-cultured vaccines must go through the same production process as egg-based vaccines so production time remains an issue. The majority of vaccines used are from inactive viruses instead of live ones so the vaccine itself would not transmit avian influenza. Currently no vaccine is available to protect humans against the H5N1 virus that is being seen in Asia. However, vaccine development efforts are under way. Research studies to test a vaccine to protect humans against H5N1 virus began in April 2005, (CDC, 2005d).

Guidelines for Healthcare Workers

Emphasis is placed on limiting contact and droplet spread. Nurses should emphasize that hand washing is again an important defense. Handwashing between patients and after contact with contaminated surfaces is essential. Nurses should use gown and gloves for ALL patient contact. In addition, eye protection should be worn when within three feet of the patient. Dedicated or disposable equipment should be used on all patients. The CDC currently advocates placing influenza patients in airborne isolation rooms or using portable HEPA filters (CDC, 2005e).

Standard Precautions

- Pay careful attention to hand hygiene before and after all patient contact or contact with items potentially contaminated with respiratory secretions.

Contact Precautions

- Use gloves and gown for all patient contact.
- Use dedicated equipment such as stethoscopes, disposable blood pressure cuffs, disposable thermometers, etc.

Eye protection (i.e., goggles or face shields)

- Wear when within 3 feet of the patient.

Airborne Precautions

- Place the patient in an airborne isolation room (AIR). Such rooms should have monitored negative air pressure in relation to corridor, with 6 to 12 air changes per hour (ACH), and exhaust air directly outside or have recirculated air filtered by a high efficiency particulate air (HEPA) filter. If an AIR is unavailable, contact the health-care facility engineer to assist or use portable HEPA filters (see Environmental Infection Control Guidelines) to augment the number of ACH.

- Use a fit-tested respirator, at least as protective as a National Institute of Occupational Safety and Health (NIOSH)-approved N-95 filtering facepiece (i.e., disposable) respirator, when entering the room.

For additional information regarding these and other health-care isolation precautions, see the Guidelines for Isolation Precautions in Hospitals. These precautions should be continued for 14 days after onset of symptoms or until either an alternative diagnosis is established or diagnostic test results indicate that the patient is not infected with influenza A virus. Patients managed as outpatients or hospitalized patients discharged before 14 days with suspected avian influenza should be isolated in the home setting on the basis of principles outlined for the home isolation of SARS patients.

Food Safety Issues

On present evidence, the vast majority of human cases have acquired their infection following direct contact with infected live or dead poultry. The World Health Organization is aware of recent concerns that the virus could also spread to humans through contact with contaminated poultry products. To date, no epidemiological data suggest that the disease can be transmitted to humans through properly cooked food (even if contaminated with the virus prior to cooking). However, in a few instances, cases have been linked to consumption of dishes made of raw contaminated poultry blood, (CDC, 2005f).

Conclusion

Avian influenza has been labeled as the next worldwide pandemic threat. Avian influenza is more lethal than the Severe Acute Respiratory Syndrome (SARS) virus. The SARS virus killed over 8,000 people in an eight-month period. However, this is not the time to panic; education and a levelheaded approach are the best defenses. Facing the reality of the threat and following infection control guidelines may avert the disaster. Common sense methods of avoiding large crowds and areas where the avian flu virus exists are additional measures to enhance viral containment.

Nurses are an important ally in the defense of the world against this viral threat. Nurses have the all-important power to stamp out ignorance through education and avert widespread panic. But first, we must open our eyes and educate ourselves.

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Avian Influenza: The Next Pandemic Implications for Nurses
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. Symptoms of Avian influenza in birds are

   A. Rapid breathing, sneezing, and limping
   B. Wheezing, decreased appetite, and seizures
   C. Coughing, sneezing, decreased egg production
   D. Inactivity, bleeding, and loosing feathers

2. A pandemic is defined as an epidemic over a wide geographical area.

   A. True
   B. False

3. The process by which two viruses mix and create a virus that is easily transmitted from human to human is called

   A. Viral shedding
   B. Viral rearrangement
   C. Mutation
   D. Viral reassortment

4. Avian flu carries a 25% mortality rate.
   A. True
   B. False

5. What are the three subtypes of the influenza virus?

   A. D,F,E
   B. A,B,C,
   C. A,B,D
   D. G,D,C

6. The influenza A subtype called Avian influenza is

   A. H5N4
   B. H5N1
   C. H5N6
   D. H7N2

7. The incubation period of Avian influenza is

   A. 14 days
   B. 7 to 10 days
   C. 5 days
   D. 3 to 7 days

8. Symptoms of Avian influenza infection in humans include

    A. pink eye, fever, cough
    B. sneezing, runny nose, swollen eyes
    C. rash, joint pain, headache
    D. loss of appetite, diarrhea, nausea

9. The best treatment for avian flu is

    A. Containment
    B. The flu vaccine
    C. Rest
    D. Antibiotics

10. The nurse should follow contact and droplet precautions when caring for Avian influenza patients.

    A. True
    B. False

11. Droplet spray is known to cover a _____foot area

    A. 2
    B. 13
    C. 3
    D. 23

12. Raw poultry products do not transmit the Avian influenza virus.

    A. True
    B. False

13. Avian influenza is more lethal than SARS.

    A. True
    B. False