EDUCATIONAL COMMENTARY – INFLUENZA A AND B

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Learning Outcomes

Upon completion of this exercise, the participant will be able to:

- Discuss the epidemiology of influenza outbreaks.
- Explain why viral culture is important in managing influenza outbreaks.

Influenza killed an estimated 20 million people worldwide during the pandemic of 1918-1919. Today, nearly 85 years later, influenza remains a significant threat to public health. Each year, during “mild” outbreaks, 10% - 20% of United States residents get influenza. The Centers for Disease Control (CDC) estimates that flu now causes approximately 36,000 deaths per year in the United States alone, a figure that is nearly double previous estimates. In more severe outbreaks, the estimated death toll rises to as many as 50,000 - 70,000. Researchers attribute this increase to an aging population and increased virulence of currently circulating strains of the virus.

People become ill with influenza as soon as 1 - 4 days after exposure to the virus. Classic symptoms include rapid onset of extreme tiredness, headache, muscle aches, cough, sore throat, nasal congestion, and fever. Although most people recover after 1 - 3 weeks, some suffer complications such as pneumonia, bronchitis, sinus and ear infections, and worsening of chronic conditions (e.g. asthma and congestive heart failure). Those at high risk for complications from flu include people over age 65, people of any age with chronic medical conditions, and very young children.

Influenza Viruses

Influenza is caused by influenza virus types A and B, which are members of the family Orthomyxoviridae. (A third virus, influenza type C, does not cause epidemic human disease.) The viruses are characterized by a segmented, single-stranded RNA genome and a helical capsid with envelope. Both influenza A and B are transmitted by contact with respiratory secretions.

Influenza A viruses are subtyped on the basis of the surface antigens hemagglutinin (H), which binds to host cells, and neuraminidase (N), which cleaves budding viruses from infected cells. Human disease is caused by viruses with hemagglutinin subtypes H1, H2, H3, and H5; and neuraminidase subtypes N1 and N2. Unlike influenza A viruses, influenza B viruses are not subtyped.

Influenza viruses mutate continuously. These mutations may be minor (antigenic drift) or major (antigenic shift). Both influenza A and influenza B viruses undergo antigenic drift, which results in the frequent appearance of new antigenic variants. This is the cause of seasonal epidemics, and it is the reason influenza vaccines incorporate one or more new strains each year. (The vaccine typically contains two strains of influenza A and one strain of influenza B.)

Antigenic shifts occur with influenza type A but not influenza type B. These mutations are more likely to cause pandemics, as happened three times in the past century. Influenza A (H1N1) first appeared in 1918-1919 and caused the “swine flu” pandemic. In 1957-1958 the virus shifted to H2N2 (the “Asian flu” pandemic). It shifted a third time to H3N2 (the “Hong Kong flu” pandemic) in 1968-1969. In 1998, an outbreak of influenza A (H5N1) (“avian flu”) appeared in Hong Kong, but this subtype did not cause a widespread outbreak because it did not transmit efficiently from human-to-human.

Since 1977, the dominant influenza A subtypes have been H1N1 and H3N2. Recently, a new subtype, influenza A (H1N2), has been reported in many countries--including the United States. However, the H and N antigens on the new subtype are very similar.
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to those on the currently circulating H1N1 and H3N2 viruses, so many people already have immunity to the new virus, and the current vaccine will protect against it. Consequently, it is not expected to cause increased rates of disease.

Laboratory Diagnosis of Influenza

A person who becomes ill with classic flu symptoms when influenza is known to be epidemic in the community very likely has influenza. However, flu-like symptoms can also be caused by other pathogens, notably *Mycoplasma pneumoniae*, adenovirus, respiratory syncytial virus, rhinovirus, parainfluenza viruses, and *Legionella* species. For individual patients, physicians often need to definitively determine the cause of symptoms in order to make appropriate treatment decisions, such as whether to prescribe an antiviral drug or an antibiotic. Also, during an outbreak of respiratory illness, testing for influenza can help determine if this is the cause.

Testing for influenza can be done either in the physician’s office or in the hospital or reference laboratory. Rapid antigen tests that can be performed in the physician’s office yield results in less than 30 minutes, but most of these tests have a sensitivity of approximately 70% or greater and a specificity of about 90%. This means that as many as 30% of specimens that contain the influenza virus may falsely test negative, and as many as 10% of specimens that do not contain the virus may falsely test positive. Also, some rapid tests do not distinguish between influenza A and B; and some will detect only type A or type B but not both.

In the hospital or reference laboratory, influenza can be detected by viral culture, direct fluorescent antibody (DFA), reverse transcriptase polymerase chain reaction (RT-PCR), enzyme immunoassay (EIA), and serology. All procedures except serology are performed on nasopharyngeal swabs, washes, or aspirates taken early in the course of the illness. Because influenza viruses are fragile, these specimens should never be frozen.

Of the available procedures for diagnosing influenza, only viral culture can determine the subtype and strain. This is important information because it helps public health officials determine which strains to include in the next year’s vaccine and it alerts them to the emergence of new subtypes and strains. Viral culture can also help identify other infectious agents when influenza is not the cause of illness.

Controlling Influenza Outbreaks

At present, the best option for controlling outbreaks and reducing the impact of influenza is annual vaccination of people in high-risk populations. These include persons over 65 years of age, residents of nursing homes and other chronic-care facilities, adults and children who have chronic medical conditions, children and adolescents on long-term aspirin therapy, and women who will be in the second or third trimester of pregnancy during flu season. Public health officials also recommend vaccination for health care workers and others who care for high-risk individuals.

As an adjunct to vaccination, antiviral drugs can help prevent and treat influenza. Currently, four drugs are available: amantadine, rimantadine, zanamivir, and oseltamivir. Treatment with any of these, if started within the first two days of symptoms, can shorten the duration of illness by about one day.

Suggested Reading


