MCEIRS
PANDEMIC H1N1 2009
INFLUENZA TRAINING

Individual Study Guide
Version: January 18, 2011

pH1N1 2009 Influenza Virus Among Humans: Surveillance

Minnesota Center of Excellence for Influenza Research and Surveillance
pH1N1 2009 Influenza Virus Among Humans: Surveillance

Introduction

Lesson 1: Overview of Public Health Surveillance

Lesson 2: Influenza Surveillance in the United States

Lesson 3: Global Influenza Surveillance Network

Lesson 4: Influenza Surveillance in Resource-Limited Countries

Glossary

Resources
INTRODUCTION

pH1N1 2009 Influenza Virus Among Humans: Surveillance

This module will familiarize you with the ways in which disease patterns are tracked and will enhance your understanding of approaches to influenza surveillance among humans. The general purposes, methods, and performance characteristics of public health surveillance systems and specific examples of surveillance for seasonal and pH1N1 2009 influenza will also be covered.
LESSON 1: OVERVIEW OF PUBLIC HEALTH SURVEILLANCE

In this lesson, we will cover:

- Definition, Purpose, and Uses of Surveillance
- Methods of Operation
- Attributes of Disease Surveillance Systems
- Limitations and Challenges

DEFINITION, PURPOSE, AND USES OF SURVEILLANCE

Disease surveillance is the cornerstone of public health.

Disease surveillance is the ongoing systematic collection, analysis, interpretation, and dissemination of health data.

These data are used to effectively investigate, control, and prevent disease in the population.

Disease surveillance may be carried out in a number of different ways.

Matching the public health informational needs to appropriate and timely surveillance data sources is critical to the development of useful surveillance systems.

The overall purpose for conducting public health surveillance is to learn the ongoing pattern of disease occurrence and the potential for disease in a population in order to effectively investigate, control, and prevent disease in that population. "Populations" may be defined in many different ways - by geography, age group, occupation, potential for exposure, etc.

Dissemination is an essential component of public health surveillance. Surveillance data can only guide public health actions if they are communicated to public health decision-makers.
Public health surveillance data may be collected for a variety of uses, which may vary over time as circumstances evolve:

- Monitor trends in the occurrence of a disease, including the detection of epidemics and pandemics.
- Guide the planning, implementation, and evaluation of programs to prevent and control disease, injury, or adverse exposure.
- Evaluate disease control strategies.
- Understand the natural history of a disease, including the identification of populations at high risk for disease or complications from the disease.
- Prioritize the allocation of health resources.
- Monitor changes in infectious agents.
- Evaluate public policy.
- Generate hypotheses and stimulate epidemiologic and related scientific research.

**METHODS OF OPERATION**

Depending on the intended uses, possible data sources, and availability of human and material resources, different approaches may be taken to carry out public health surveillance.

Examples of possible data sources for public health surveillance include:

- Primary data sets: reports from healthcare clinics and providers; reports from diagnostic and clinical laboratories.
- Existing (secondary) data sets: vital records, hospital discharge data, health interview surveys.

Surveillance systems based on disease reporting by healthcare clinics, providers, and the laboratories supporting them may be "passive", "active", or a combination of the two.

Whether passive or active, disease reporting for public health surveillance in many countries is often a legal requirement based on a published list of notifiable diseases.

Passive surveillance: Healthcare clinics, providers, and/or laboratories report notifiable diseases on a case-by-case basis to a health department.

Active surveillance: Routine outreach by health department staff to potential disease reporters is used to increase the completeness and/or timeliness of disease reporting.
Information on diseases can be obtained in many ways. Each approach has characteristics that must be balanced against the purpose of the system. For example:

- Detailed information about circulating influenza strains requires a laboratory-based system.
- Time is critical for potentially virulent and transmissible infectious agents. Rapid provider-based disease reporting systems are most appropriate for conditions that require urgent preventive actions.

**ATTRIBUTES OF DISEASE SURVEILLANCE SYSTEMS**

Surveillance systems are described and evaluated in terms of a set of attributes.

Simplicity refers to the system’s structure and ease of operation. Surveillance systems should be as simple as possible while still meeting their objectives.

Flexibility reflects the ability of the system to adapt to changing needs such as the addition of new data-collection elements.

Acceptability reflects the willingness of individuals and organizations to participate in the system (e.g., health department staff, physicians, or laboratory personnel who are asked to report cases).

Timeliness of the system typically refers to how quickly after initial diagnosis cases are reported to the health department. Timeliness can also refer to the overall time between onset of infection, time of diagnosis, time of case report, and time of data dissemination to guide public health action.

Completeness is reflected by the proportion of all cases of disease in a population that are detected by the surveillance system. Completeness is affected by the likelihood that:

- Persons with disease seek medical care
- The condition is correctly diagnosed (skill of healthcare provider, accuracy of diagnostic tests)
- The case is reported to the system once it has been diagnosed

A representative system accurately describes the occurrence of disease over time and its distribution in the population by place and person. This attribute is important because most systems do not detect every single case of disease.
LIMITATIONS AND CHALLENGES

The overall effectiveness of a surveillance system is reflected by how well the system meets its objectives. Weaknesses in one or more of the listed attributes can compromise usefulness.

It is important to understand the strengths and limitations of the system in order to appropriately interpret and apply the resulting data.

Sometimes even experts do not agree on the appropriate interpretation of data.

Public health officials face the ongoing challenge of communicating surveillance data in an understandable and accurate way to a variety of lay and professional audiences. Misunderstandings can sometimes have undesirable effects on health and/or social behaviors.
LESSON 2: INFLUENZA SURVEILLANCE IN THE UNITED STATES

In this lesson, we will cover:

- Routine Influenza Surveillance
- Changes in Response to pH1N1 2009 Influenza

ROUTINE INFLUENZA SURVEILLANCE

There are often multiple purposes for conducting public health surveillance for a particular disease. In the US, the purposes of influenza surveillance are to:

- Detect novel strains of influenza virus with pandemic potential
- Identify unusual patterns of influenza in the community that require targeted interventions
- Guide influenza treatment recommendations based on the occurrence and patterns of antiviral drug resistance
- Help identify which influenza strains should be included in vaccines

Multipurpose surveillance often requires multiple approaches to establish a useful system. In the United States, the CDC maintains five separate components as part of its national influenza surveillance system.

CDC uses a multifaceted approach to conduct influenza surveillance in the US. The systems described in the tabs on this page are typically maintained throughout the Northern Hemisphere influenza season (October through mid-May); data are summarized and reported in a weekly publication, "FluView."

Characteristics of circulating influenza viruses (e.g., subtype, antiviral resistance, and antigenic profile) are monitored through laboratory-based virologic surveillance. More than 150 laboratories from across the US contribute isolates and data; 80 of these are WHO Coordinating Centers.

Human infection with a novel influenza virus that is different from viruses already circulating became a nationally notifiable condition in 2007. States are requested to report cases of novel influenza A infection within 24 hours of confirmation.

CDC monitors patient visits to healthcare providers for influenza-like illness (ILI) through the US Outpatient Influenza-like Illness Surveillance Network. Outside of flu season or a
pH1N1 2009 Influenza Virus Among Humans: Surveillance

When the pH1N1 2009 virus was first identified in April 2009, CDC implemented a separate system from those previously described to track individual cases, hospitalizations, and deaths associated with the novel virus across all states. See Figure 1.

Because of large numbers, on July 24, 2009, CDC discontinued reporting of individual cases of pH1N1 2009, but continued to track hospitalizations and deaths.

Beginning August 30, 2009, CDC modified the case definition for influenza-associated hospitalizations and deaths by asking states to report either laboratory-confirmed hospitalizations and deaths or syndromic cases (i.e., cases of presumed influenza.
and/or pneumonia based on disease codes in hospital or death records each week).

The new system increased the representativeness of the hospitalization and mortality surveillance data and thereby provides a more complete picture of the burden of serious flu illness and deaths in the US.
LESSON 3: GLOBAL INFLUENZA SURVEILLANCE NETWORK

In this lesson, we will cover:

• Global Influenza Surveillance Network

WHO coordinates the Global Influenza Surveillance Network. See Figure 2. One of the key aims of this network is to monitor the evolution of influenza viruses in order to inform twice yearly recommendations on the content of the influenza vaccine for the subsequent influenza season - once for the Northern Hemisphere and once for the Southern Hemisphere.

Frequent updates to the influenza vaccine are necessary owing to the substantial genetic variability of influenza viruses.

The WHO Global Influenza Surveillance Network is composed of National Influenza Centers (NICs), WHO Collaborating Centers (WHO CCs), and the WHO. Representative samples from patients with ILI presenting at NICs are submitted to WHO CCs for antigenic and genetic analyses. The WHO analyzes and disseminates the information via routine and special reports or communications. See Figure 3.
Currently, 131 institutions from 102 countries are recognized by WHO as NICs. In a typical (non-pandemic) year these institutions collect about 175,000 patient samples and submit around 2,000 viruses to the WHO CCs for antigenic and genetic analyses. Between April 19 and October 1, 2009, 195,000 specimens tested positive for influenza; the predominant strain was 2009 H1N1.

Global coverage is not complete, but large scale trends can be monitored. Tropical and resource-limited countries are underrepresented.

**INDICATORS**

The WHO Global Influenza Surveillance Network has supported the worldwide public health response to the 2009 H1N1 influenza pandemic by monitoring the spread, evolution, and drug susceptibility of the pandemic virus and sharing this information to inform public health response decisions, such as the use of antiviral drugs and the development of vaccines.

The WHO Global Influenza Surveillance Network utilizes a number of indicators:

**Strain Distribution** - By August 1, 2009, the pH1N1 2009 influenza virus strain represented 58% of all influenza isolates submitted to the WHO Global Influenza Network since the start of the pandemic in April 2009.

**Antigenic Similarity** - Only a few amino acid substitutions in the HA have been detected in pH1N1 2009 viruses analyzed through 2009 and none appear to confer an antigenic alteration (i.e., antibodies bind with similar affinity to pH1N1 2009 viruses analyzed to date).

**Drug Susceptibility** - In general, the pH1N1 2009 viruses are resistant to M2 inhibitors (amantadine and rimantadine) but sensitive to neuraminidase inhibitors (oseltamivir and zanamivir). Some oseltamivir-resistant isolates have been and continue to be reported.

![Figure 3: Global NIC Distribution](image_url)
DISSEMINATION

The WHO Global Surveillance Network disseminates collected information through routine and special reports, as well as conference calls with its partners. The primary communication mechanisms WHO used to disseminate pH1N1 2009 surveillance information include:

- Teleconference calls with network partners to periodically exchange and review laboratory response and virologic findings.
- Featured articles in the WHO "Weekly Epidemiological Record."
- Online pH1N1 2009 Influenza Situation Updates - Beginning in April 2009, WHO began providing, via a dedicated area on its Web site, situation updates that included current surveillance information.
LESSON 4: INFLUENZA SURVEILLANCE IN RESOURCE-LIMITED COUNTRIES

In this lesson, we will cover:

- Influenza Surveillance in Resource-Limited Countries

Quality influenza surveillance systems enable countries to better understand influenza epidemiology, including disease incidence and severity, and help them implement appropriate prevention strategies for their populations.

Influenza surveillance in developing countries is often inadequate because of competing public health priorities and limited human and material resources. Sometimes partnering with other countries can bolster disease surveillance capacity.

A surveillance system like that of the US is not feasible in resource-limited countries. Innovative low-cost and effective approaches are necessary.

One publication recommends an approach centered on a three-fold strategy of collecting data on severe acute respiratory infection, ILI, and laboratory-confirmed influenza which can be implemented in limited-resource settings.

EXAMPLE: SOUTH AFRICA

Changes to Address pH1N1 2009 Influenza Surveillance

South Africa is an example of a country that has implemented such a system and participates in the WHO Global Surveillance Network.

Routine Influenza Surveillance

South Africa’s influenza surveillance program is centrally-administered by the National Institute for Communicable Disease (NICD). The program was initiated in 1984 with 10 sentinel centers including primary healthcare clinics, general practitioners, a mine hospital, and pediatric outpatient departments. Its objectives are to monitor influenza activity in the community and determine the circulating strains. During 2005 and 2006 the number of participating centers substantially increased to 65 centers.
Throat swabs are submitted from these centers throughout the year from patients with respiratory infections of recent onset (i.e., within 48-72 hours), and without obvious bacterial cause, and transported to NICD in viral transport medium for isolation of virus.

Results of these analyses (shown in Figure 4) are used to generate summary reports of influenza activity in the country.

Methods for case finding, surveillance systems, laboratory testing, and diagnostic strategies in South Africa evolved with the influenza pandemic.

Following the first reports of transmission in the Northern Hemisphere, South Africa developed local case definitions and a procedure for active case-finding of possible imported cases, which were in place by the end of April 2009.

- Suspected cases reported a recent onset of ILI and a history of travel to an area reporting a confirmed community-wide outbreak, or close contact with a suspected or confirmed case, within the 7 days prior to onset of symptoms.
- Nasal and throat swabs were collected from all individuals who met the interim definition for a suspected case.

Once local transmission became established, laboratory testing and diagnosis of all ILI cases became unsustainable and unnecessary. The recommendation of WHO was followed to cease universal laboratory testing of all suspected cases after the first 100 cases were diagnosed in resource-limited areas. This criterion was met in July 2009.

After July, South African clinicians were requested to collect specimens only from patients with moderate to severe illness or unusual situations.

In response to the heavy demands on laboratory resources, an effort began in July 2009 to decentralize laboratory testing from NICD to include a network of private and public health diagnostic laboratories throughout the country.
Surveillance data from South Africa suggest a pattern of illness and occurrence of severe and fatal cases similar to other countries, although the predominant underlying medical conditions also include HIV and tuberculosis.

**Figure 4: pH1N1 2009 Influenza Surveillance - South Africa**
pH1N1 2009 INFLUENZA VIRUS AMONG HUMANS: SURVEILLANCE

KNOWLEDGE CHECK

In the module you have just completed, you learned about influenza surveillance in humans. Now, check your knowledge and receive your certificate of completion.

1) What are potential uses of public health surveillance data?
   a. Monitor changes in infectious agents
   b. Screen potential employees
   c. Evaluate disease control strategies
   d. Prioritize the allocation of health resources
   e. Identify persons eligible for health insurance
   f. Provide corporations with propriety advantage
   g. A, C & D
   h. B, E & F

2) Which of the following statements is correct?
   a. Passive surveillance means that healthcare clinics, providers, and/or laboratories report notifiable diseases on a case-by-case basis to a health department.
   b. Whether passive or active, disease reporting for public health surveillance in many countries is often a legal requirement based on a published list of notifiable diseases
   c. Active surveillance involves routine outreach by health department staff to potential disease reporters to increase the completeness and/or timeliness of disease reporting
   d. All of the above

3) Match each attribute of disease surveillance systems with its corresponding definition.

   a. Acceptability
   b. Timeliness
   c. Completeness
   d. Representativeness

   __ Reflects the willingness of individuals and organizations to participate in the system.
   __ Typically refers to how quickly after initial diagnosis cases are reported to the health department.
   __ Reflected by the proportion of all cases of disease in a population that are detected by the surveillance system.
   __ System accurately describes the occurrence of disease over time and its distribution in the population by place and person.
4) Which of the following are limitations of pH1N1 2009 influenza surveillance systems?

   a. Due to significant stigma, pandemic influenza is commonly underreported.
   b. The geographic coverage of human influenza surveillance is incomplete.
   c. Not all persons with pH1N1 2009 influenza seek medical care.
   d. When the number of individual cases became overwhelming to report, surveillance systems for pH1N1 2009 influenza were streamlined to monitor trends in severe disease, but only broad patterns of mild to moderate disease.
   e. Widespread vaccination programs increase the false positive rate of influenza diagnostic tests.
   f. Influenza surveillance data are often used to discriminate against disenfranchised populations.
   g. A, E & F
   h. B, C & D
   i. All of the above

5) South Africa publishes its surveillance data in a weekly publication called, "FluView".

   a. True
   b. False

6) Because influenza is easy to diagnose, a multifaceted approach to disease surveillance is not necessary.

   a. True
   b. False

7) Which of the following are components of the influenza surveillance system in the US?

   a. Laboratory-based virologic surveillance
   b. Mortality surveillance via reporting from vital statistics offices
   c. Throat swabs in emergency room departments
   d. Estimates of geographic spread from state and local health officials
   e. Estimates of geographic spread from political pundits
   f. A, B & D
   g. E & F
   h. All of the above

8) Due to large numbers, on July 24, 2009, CDC discontinued tracking pH1N1 2009 influenza.

   a. True
   b. False
9) Which of the following statements is/are true about the Global Influenza Surveillance Network?

a. Global coverage is not complete, but large scale trends can be monitored.
b. 275 institutions in 150 countries are currently recognized by the WHO as National Influenza Centers (NICs).
c. Tropical and resource-limited countries are underrepresented.
d. All of the above
e. A & C

10) Influenza surveillance in developing countries is often inadequate because of:

a. Competing public health priorities
b. Limited human resources
c. Limited material resources
d. All of the above
e. Both B & C
pH1N1 2009 INFLUENZA VIRUS AMONG HUMANS: SURVEILLANCE

KNOWLEDGE CHECK ANSWERS

1) A, C, D
2) D. All of the above
3) C, B, D, A
4) B, C, D
5) B. False
6) B. False
7) A, B, D
8) B. False
9) E. A & C
10) D. All of the above
GLOSSARY

Active Surveillance - Disease surveillance approach in which routine outreach by health department staff to potential disease reporters is used to increase the completeness and/or timeliness of disease reporting.

Acute Respiratory Distress Syndrome - See ARDS.

Adamantanes - M2 inhibitors; a class of antiviral drugs used to treat influenza. This class includes amantadine and rimantadine. pH1N1 2009 influenza viruses are naturally resistant to all drugs in this class.

Adaptive Immunity - Specific immunity; The form of immunity that produces protection against infection that is highly specific and long lasting. The adaptive immune system takes time to mobilize following the first exposure to a specific antigen, but subsequent exposures produce a rapid adaptive immune response. Adaptive immunity includes humoral and cell-mediated immunity.

Amantadine - An antiviral drug used to treat influenza and belongs to the drug class called "adamantanes." pH1N1 2009 influenza viruses are naturally resistant to amantadanes.

Antibody - A type of glycoprotein molecule produced during a humoral (adaptive) immune response that binds antigens, often with a high degree of specificity and strength.

Antigen - A molecular substance foreign to the body that binds with antibodies or T-cell receptors. Antigens that produce a specific immune response can also be called "immunogens." The adaptive immune system may recognize multiple antigens in a single virus.

Antigenic Profile - The unique collection of antigens associated with a specific microorganism (e.g., a particular viral strain).

Antiviral - Drug that is used to prevent or cure a disease caused by a virus, by interfering with the ability of the virus to multiply in number or spread from cell to cell.

ARDS - Acute Respiratory Distress Syndrome; an emergency caused by failure of the lungs to work.

Cell-Mediated Immunity - A type of adaptive immune response mediated by T cells of the immune system.

Chemoprophylaxis - The use of chemicals (drugs) to prevent infection or disease.

Communicable - See Contagious.
**Contagious** - Communicable; A contagious or communicable disease is one that is spread from one person or animal to another by direct or indirect contact. Direct contact includes touching any discharge from the body that contains the infectious agent. Indirect contact might include contact through something else, such as toys or eating utensils.

**Cytotoxic (Killer) T Cell** - A major effector cell in a cell-mediated (adaptive) immune response.

**Epidemic** - The occurrence in humans of an illness or health-related event in a community, region, or country in numbers clearly in excess of normal expectancy.

**Epithelium** - The outer covering of the organs of the body.

**Fomite** - Any inanimate object or substance capable of carrying infectious organisms (such as bacteria or viruses) and hence transferring them from one individual to another.

**Hemagglutinin (HA)** - An important surface structure protein of the influenza virus that is an essential gene for the spread of the virus throughout the respiratory tract. This protein enables the virus to attach itself to a cell in the respiratory system and penetrate it. It is used to name influenza A subtypes and is referred to as the "H" in the influenza virus subtype (e.g., H5N1). To date, 16 different influenza A hemagglutinin antigens have been identified.

**Host** - An organism on or in which a parasitic organism (e.g., virus, bacteria) lives.

**Humoral Immunity** - A type of adaptive immune response mediated by the production of antibodies.

**ILI** - Influenza-like illness.

**Immunocompetent** - Refers to a state of the immune system in which normal immune responses are produced following exposure to an antigen.

**Immunocompromised** - Refers to an abnormal state of the immune system in which immunity is too low and resistance to infection is decreased. May be a result of a disease process (e.g., human immunodeficiency virus [HIV] infection, leukemia) or treatment (e.g., chemotherapy for cancer).

**Immunosuppression** - See Immunocompromised.

**Incubation Period** - The time between exposure to a disease-causing organism and the onset of symptoms.

**Infectious** - Capable of causing infection.

**Infectious Period** - The time during which a person or animal infected with a
disease-causing agent is capable of transmitting the agent to another.

**Infectivity** - A pathogen’s ability to spread rapidly from one person or animal to another.

**Innate Immunity** - Nonspecific immunity; Protection against infection that relies on cells and mechanisms that exist before infection, are capable of a rapid response to infectious agents, and react in essentially the same way to repeated infections.

**Interferon** - A class of cellular signaling proteins produced as part of an innate immune response. When produced by virally-infected cells they inhibit viral replication in these and adjacent cells.

**M2 Inhibitors** - See Adamantanes.

**Morbidity** - Disease; morbidity rate is the incidence or prevalence of disease in a specific population during a specified interval of time or a specific point in time.

**Mortality** - Death; mortality rate is a measure of the number of deaths in a population during a specified interval of time.

**Multifocal Infiltrates** - For purposes of this module, refers to multiple areas within the lung where fluid has entered.

**Neuraminidase (NA)** - An important surface structure protein of the influenza virus that is an essential enzyme for the spread of the virus throughout the respiratory tract. This protein enables the virus to escape the host cell and infect new cells. It is used to name influenza A subtypes and is referred to as the "N" in the influenza virus subtype (e.g., H5N1). To date, 9 different influenza A neuraminidase antigens have been identified.

**Neuraminidase Inhibitors** - A class of antiviral drugs commonly used to treat or prevent influenza. This class includes oseltamivir and zanamivir.

**Nonspecific Immunity** - See Innate Immunity.

**Oseltamivir** - An antiviral drug commonly used to treat or prevent influenza and belongs to the drug class called "neuraminidase inhibitors."

**Outbreak** - The occurrence of a disease or health-event in a specific geographic area or population in excess of normal expectancy; cases are usually related in time and space.

**Pandemic** - A worldwide outbreak of a disease in humans in numbers clearly in excess of normal. A global influenza pandemic may occur if two conditions are met:

- A new subtype of influenza A virus emerges for which there is little or no immunity in the human population.
The virus can spread easily from person to person in a sustained manner.

**Passive Surveillance** - Disease surveillance approach in which healthcare clinics, providers, and/or laboratories report notifiable diseases on a case-by-case basis to a health department.

**Panzootic** - A worldwide outbreak of a disease in animals in numbers clearly in excess of normal.

**Pathogenesis** - The mechanisms by which an agent causes disease.

**Pathogenic** - Causing disease or capable of doing so.

**Reservoir** - A person or animal that serves as a host to a pathogenic agent, generally without visible symptoms of the disease or injury.

**Pathogen** - A disease-causing agent (e.g., virus, bacteria, fungus).

**Rimantadine** - An antiviral drug used to treat influenza and belongs to the drug class called "adamantanes." pH1N1 2009 influenza viruses are naturally resistant to adamantanes.

**Seasonal Flu ("Common Flu", "Winter Flu")** - Influenza caused by one of the common influenza subtypes known to be circulating in the human population; seasonal influenza peaks in the winter months in the Northern and Southern Hemispheres and tends to be year-round in tropical regions.

**Specific Immunity** - See Adaptive Immunity.

**Strain** - Influenza virus subtypes are further characterized into strains. New strains of influenza viruses replace older strains through the process of antigenic drift (i.e., small mutations in the genetic material of the virus).

**Swine Flu** - A respiratory disease in pigs caused by influenza A virus. Influenza outbreaks in swine herds are common; the illness is relatively mild, and most animals recover. Domestic birds can be a source of influenza A in swine, and transmission from humans to swine and from swine to humans has occurred.

**Virulence** - A pathogen's ability to invade host tissues and cause severe disease.

**Virulent** - Highly lethal; causing severe illness or death.

**Virus** - Any of various simple submicroscopic parasites of plants, animals, and bacteria that often cause disease and that consist essentially of a core of RNA or DNA surrounded by a protein coat. Unable to replicate without a host cell, viruses are typically not considered living organisms.
**Vital Records** - Records of life events kept under governmental authority, including birth certificates, marriage licenses, and death certificates.

**Zanamivir** - An antiviral drug used to treat or prevent influenza and belongs to the drug class called "neuraminidase inhibitors."

**Zoonoses** - Diseases that transfer from animals to humans.
RESOURCES


AVMA. 2009 H1N1 Flu Virus Outbreak. February 8, 2010

CDC. 2009 H1N1 early outbreak and disease characteristics. H1N1 flu (swine flu): general information. October 27, 2009
[Web page: http://www.cdc.gov/h1n1flu/surveillanceqa.htm]

CDC. 2009 H1N1 flu ("swine flu") and you. Questions and answers. February 10, 2010
[Web page: http://www.cdc.gov/h1n1flu/qa.htm]

CDC. CDC recommendations for the amount of time persons with influenza-like illness should be away from others. H1N1 flu clinical and public health guidance. October 23, 2009
[Web page: http://www.cdc.gov/h1n1flu/guidance/exclusion.htm]

[Web page: http://www.cdc.gov/flu/weekly/weeklyarchives2009-2010/weekly44.htm]

CDC. Interim guidance for state and local health departments for reporting influenza-associated hospitalizations and deaths from 2009-2010 season. H1N1 flu clinical and public health guidance. September 8, 2009
[Web page: http://www.cdc.gov/H1N1flu/hospitalreporting.htm]

CDC. Interim guidance on infection control measures for 2009 H1N1 influenza in healthcare settings, including protection of healthcare personnel. H1N1 flu clinical and public health guidance. October 14, 2009
[Web page: http://www.cdc.gov/h1n1flu/guidelines_infection_control.htm]

CDC. Monitoring influenza activity, including 2009 H1N1. Questions and answers. September 11, 2009  
[Web page: http://www.cdc.gov/h1n1flu/reportingqa.htm]

CDC. Overview of influenza surveillance in the United States. March 20, 2010  


WHO. Pandemic (H1N1) 2009 (Virological Surveillance Data)-update 74. Weekly Update. November 13, 2009  
[Web page:  


WHO. Statement by WHO Director-General, Dr. Margaret Chan. April 27, 2009  
[Web page:  
WHO. Statement by WHO Director-General, Dr. Margaret Chan. April 29, 2009

WHO. Swine flu illness in the United States and Mexico. Pandemic (H1N1) 2009 - update 2. April 26, 2009

WHO. Pandemic influenza A (H1N1) 2009 virus vaccine: conclusions and recommendations from the October 2009 meeting of the immunization Strategic Advisory Group of Experts. Meeting reports. December 4, 2009

All glossary definitions are found at one or more of the following sources (or are adapted from those sources):

Abbas AK, Lichtman AH. Cellular and Molecular Immunology, 5th ed. 2003
Philadelphia, PA: Saunders

Flu.gov. Glossary
