CIDRAP

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UNIVERSITY OF MINNESOTA

MCEIRS GENERAL INFLUENZA TRAINING

Individual Study Guide

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Biosecurity and Swine Influenza Virus

Minnesota Center of Excellence for Influenza Research and Surveillance

CONTENTS

INTRODUCTION

pH1N1 2009 Influenza Virus: Biosecurity and Swine Influenza Virus

Swine influenza is an important respiratory pathogen in pigs. In the swine industry, biosecurity measures are an important means of preventing and controlling economically important swine diseases including influenza. In this module, biosecurity measures to prevent the transmission of influenza and other diseases between swine, as well as specific measures to prevent the transmission of influenza between swine and other species including humans, are presented. Actions to take during a human influenza pandemic and in the event of an outbreak of pH1N1 2009 influenza in swine are also discussed.

LESSON 1: INFLUENZA IN SWINE

In this lesson, we will cover:

- Influenza A Virus
- Wild Birds as a Reservoir for Influenza Viruses
- Historic Perspective
- The pH1N1 2009 Influenza Virus
- The H3N2v Influenza Virus
- Clinical Illness in Swine

INFLUENZA A VIRUS

Influenza viruses belong to the Orthomyxoviridae family of segmented negative-sense RNA viruses. The genus influenza A consists of a single species: influenza A virus, which is the cause of type A influenza. (See Figure 1). Influenza B is also an important cause of influenza in humans, whereas influenza C is a relatively uncommon cause of human disease. Influenza D has recently been found in swine and cattle, but is not known at this time to cause disease in humans.

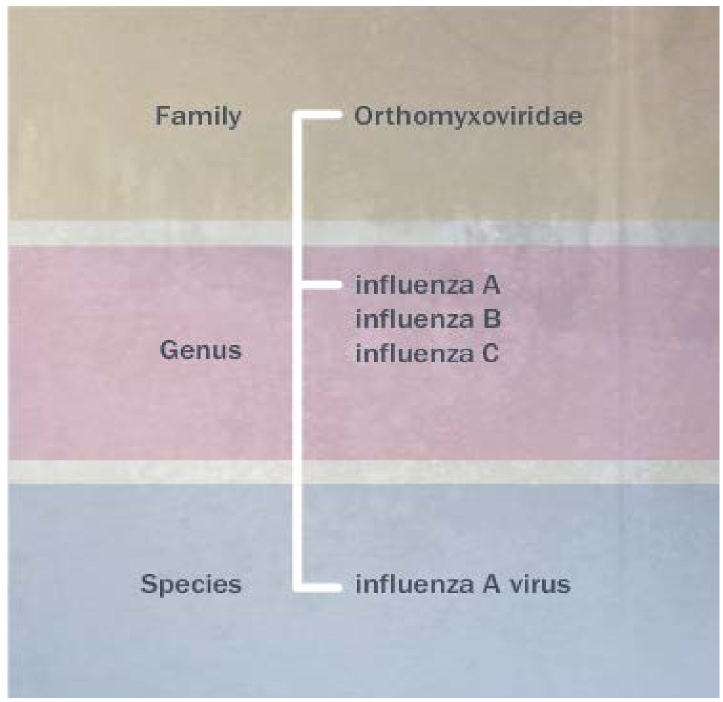

Figure 1: Classification of Influenza A Virus

Influenza A viruses cause illness in a variety of mammals and are the most common cause of influenza in humans. There are 18 different HA antigens (H1 to H18) and 11 different NA antigens (N1 to N11) for influenza A. These antigens give rise to the subtype designation. H1 to H16 and N1 to N9 are found in birds (mostly wild birds) and some of these subtypes have been found in mammals. H17N10 and H18N11 were discovered in bats in Guatemala in 2009 and in Peru in 2013, respectively. The NA genes in these influenza subtypes are highly divergent from other known influenza NAs and researchers propose that the attachment and activation of these viruses occur by a different mechanism than other influenza viruses. As of January 2017, these two subtypes appear to be unique to the bat population, but have been shown to infect and replicate in other mammalian cells (such as canine cell lines).

WILD BIRDS AS A RESERVOIR FOR INFLUENZA VIRUSES

Wild birds are considered to be the reservoir for influenza A viruses. All HA and NA subtypes of the influenza A virus (except for H17N10 and H18N11, which as of January 2017 had only been identified in bats) have been found in avian species especially waterfowl and shore birds. Aquatic birds may not show any clinical signs of infection, but the viruses replicate in the intestinal tract of the birds and are shed into the environment.

HISTORIC PERSPECTIVE

Influenza A was first recognized as a clinical illness in swine in 1918, which coincided with the 1918-19 influenza pandemic in humans.

H1N1 influenza A virus was first isolated from pigs in the United States in 1930. From 1930 through 1998, swine influenza in North America was primarily caused by viruses of the classical H1N1 lineage.

In 1998, H3N2 viruses with genes derived from human, swine, and avian influenza viruses (triple reassortant viruses) were identified as a cause of swine influenza in North America.

Pigs are susceptible to infection with influenza viruses of human, swine, and avian origin.

Because of this, pigs also can serve as hosts, in which influenza viruses from different species can undergo reassortment if a pig is infected with two or more different strains of influenza virus at the same time.

Since 1998, strains of triple reassortant H1N1, H3N2, and H1N2 have become endemic in swine in North America. Reassortant influenza viruses also have been found in pigs in Europe and Asia.

THE pH1N1 2009 INFLUENZA VIRUS

The pH1N1 2009 influenza virus that emerged in humans contains genes from a triple reassortant H1N1 swine influenza virus that has been present in North America, classical H1N1, and an H1N1 swine influenza virus that has been circulating in Europe and Asia.

There currently is no evidence that this virus had previously circulated in any swine population before it was identified in 2009 in humans, and swine have not been considered to be important to the spread of the disease. However, the risk of humans transmitting the virus to pigs (or other animals) is a concern.

To date, several countries around the world, including the United States, have reported outbreaks of the pH1N1 2009 influenza virus in swine herds. The virus is infectious to pigs and causes typical swine influenza symptoms. In these situations, it is likely that the virus was transmitted to pigs from infected humans.

THE H3N2v INFLUENZA VIRUS

In 2011, a swine influenza virus containing the M gene from the pH1N1 virus was detected in people and associated with exposure to pigs at agricultural fairs in the United States. In 2011 and 2012, over 320 cases of H3N2 variant virus (H3N2v) were identified in 13 states. In 2013-16, 43 cases of H3N2v were identified in 8 states. In December 2016, a case of H3N2v was reported from Canada. Other variant viruses have also been detected in the US since 2005 including H1N1v and H1N2v. Most cases had very close contact with swine, but human-to-human spread of the virus also has been recognized.

CLINICAL ILLNESS IN SWINE

Swine influenza (SIV) is an upper respiratory disease that causes outbreaks in herds. The incubation period is usually 1 to 3 days. Swine influenza is characterized by rapid onset and spread of disease through the herd. Clinical signs may include those listed in Figure 2.

The mortality rate is relatively low (1% - 3%) and most affected animals recover within 5 to 7 days after illness onset. Some pigs exhibit severe bronchopneumonia, which is the major cause of death. SIV can also be involved as an etiologic agent of porcine respiratory disease complex (PRDC).

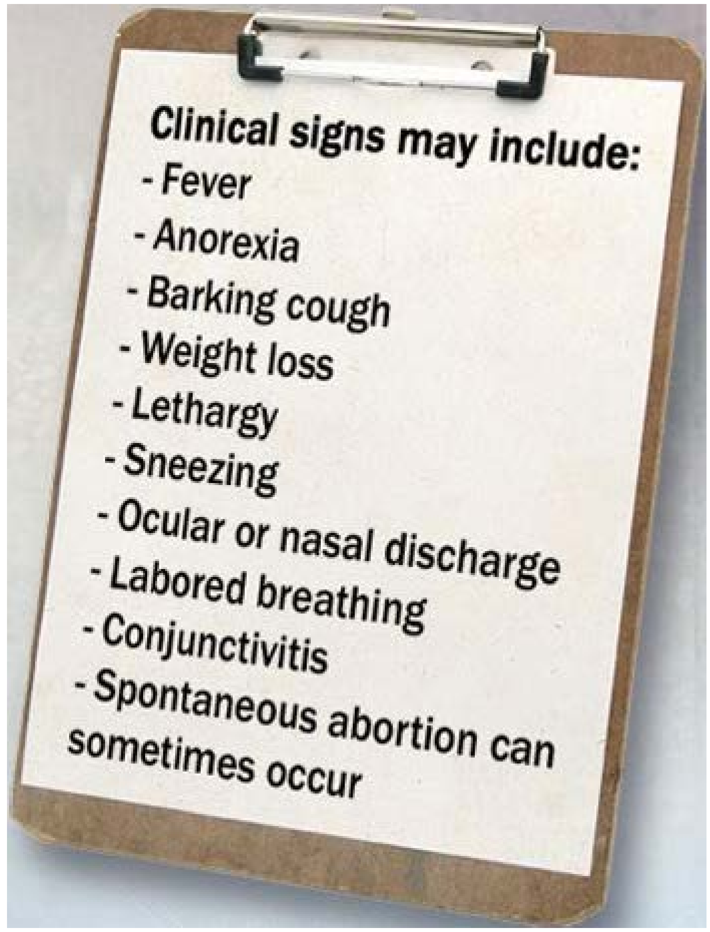

Figure 2: Clinical Signs of Swine Influenza

LESSON 2: TRANSMISSION OF INFLUENZA VIRUSES

In this lesson, we will cover:

- Environmental Persistence
- Modes of Transmission
- Historic Examples of Interspecies Transmission of Influenza Viruses Involving Swine
- Importance of Preventing Interspecies Transmission

ENVIRONMENTAL PERSISTENCE

Avian influenza (AI) viruses are shed in the feces and in the respiratory secretions of infected birds. AI viruses can survive in cool, moist environments for up to several months. The viruses generally survive on surfaces and fomites (such as equipment, vehicles, or footwear) for up to 6 days.

MODES OF TRANSMISSION

In mammals, influenza viruses are transmitted primarily by large droplet spread. Sneezing or coughing can disperse respiratory secretions (large droplets) contaminated with viral particles into the air, which are then inhaled by nearby people or animals. Large droplets also can contaminate surfaces, leading to fomite transmission.

Influenza viruses also can be transmitted by airborne spread (inhalation of small viral particles suspended in the air).

Modes of Transmission between Pigs

Influenza is transmitted between pigs through direct contact, contact with fomites, or through inhalation.

Pigs begin excreting the virus within 24 hours after infection, and may shed the virus for 7 to 10 days. A carrier state in an individual animal can exist for up to 3 months.

Interspecies Transmission of Influenza Viruses

Double and triple reassortant influenza viruses demonstrate interspecies transmission of influenza viruses between birds, pigs, and people.

Interspecies transmission also can occur between different bird species and between birds and other mammals. (See Figure 3).

An equine influenza virus has been shown to cause outbreaks of influenza among canines in the US.

Modes of Transmission between Birds and Pigs

AI viruses can be transmitted to swine from birds through direct contact with birds or through contamination of food, water sources, or fomites with bird feces. AI viruses have been found in water samples.

Modes of Transmission between People and Pigs

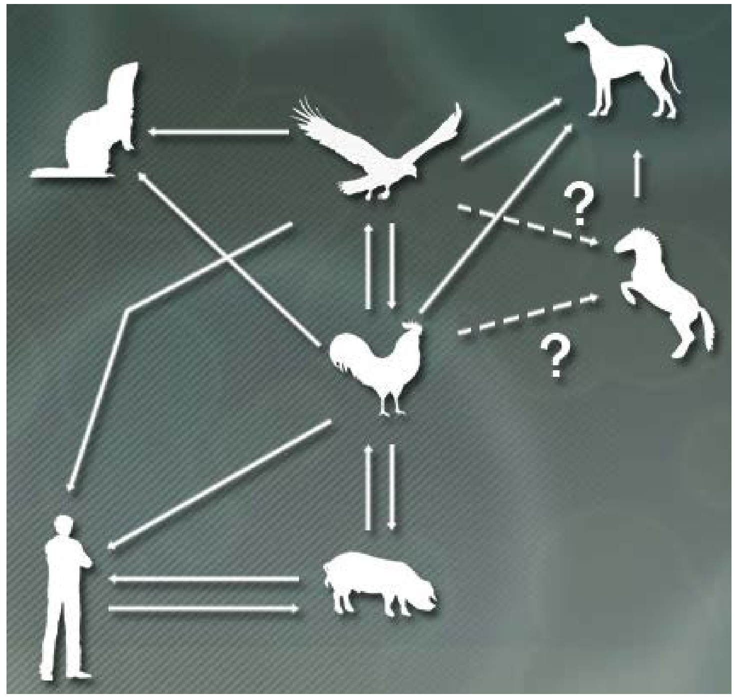

Figure 3: Interspecies Transmission

Influenza viruses are transmitted between people and pigs through droplet or airborne spread. Influenza viruses have not been shown to be shed in the feces of pigs, nor have they been shown to be present in other tissues such as blood or muscle. Influenza is not transmitted to people by eating pork.

HISTORIC EXAMPLES OF INTERSPECIES TRANSMISSION OF INFLUENZA VIRUSES INVOLVING SWINE

Pigs to People

Before 2011, transmission of swine influenza viruses to humans historically was an uncommon event; 50 cases were identified between 1958 and 2005. Thirteen cases were part of an outbreak at Fort Dix, New Jersey in 1976, where investigators did not find evidence of exposure to pigs. A majority of the remaining cases (~60%) reported potential exposure to pigs. In 37 of the cases, most infected people had exposure to pigs (swine workers, lived on a swine farm, etc.).

While illness with swine influenza is not common, one study in 2006 showed that persons exposed to pigs (swine workers, swine veterinarians, etc.) were more likely to have antibodies to swine influenza viruses than persons with no occupational exposure to pigs.

From 2011 to 2016, 364 cases of H3N2v swine influenza were identified in people, mostly in association with agricultural fairs.

People to Pigs

Serologic evidence of transmission of human influenza viruses to swine has been noted in the past.

Human H3N2 and H1N1 viruses have been isolated from swine.

The double and triple reassortant viruses that emerged in pigs in the US in 1998 contained genes of human influenza origin and demonstrate transmission between the two species.

Birds to Pigs

Viruses of avian origin have been found in pigs in Europe and Asia.

In 1999, a wholly avian influenza virus (H4N6) was found in pigs in Canada. In this case the farm used water from a nearby pond that was also used by migrating ducks.

Other avian viruses (H3N3, H1N1) have recently been found in pigs in North America. In addition, an avian-like H1N1 virus circulating in pigs in China has recently been shown to bind easily to human-type receptors and potentially could develop the ability to transmit between humans.

Pigs to Birds

Turkeys can become infected with swine influenza viruses. Both classical H1N1 and H3N2 influenza viruses of swine origin have been found in turkeys. Swine influenza viruses have also been found in ducks.

IMPORTANCE OF PREVENTING INTERSPECIES TRANSMISSION

Interspecies transmission of influenza viruses should be reduced for several reasons:

- Influenza viruses that are transmitted to people from other animals could adapt, or mutate, and become easily spread in the human population.
- Disease spread from humans to domestic agricultural species, or from wild bird species to domestic species, can cause serious damage to the agricultural industry.
- Interspecies transmission increases the risk of further reassortment of influenza viruses which could increase the risk for new pandemic strains to emerge.

LESSON 3: GENERAL BIOSECURITY METHODS FOR PREVENTING DISEASE TRANSMISSION

In this lesson, we will cover:

- Definition of Biosecurity
- Goals of Biosecurity in the Swine Industry
- Farm Location and Security
- Facility Design
- Visitors
- Vehicles
- Farm Personnel
- Animal Health
- Animal Management
- Sanitation
- Pest Management
- Record Keeping

DEFINITION OF BIOSECURITY

Biosecurity is defined as security from exposure to harmful biological elements.

General biosecurity practices and principles have been important in swine production for many years. Measures that reduce the risk of swine disease transmission between or within swine operations also can be important in reducing the transmission and spread of diseases between species.

In agricultural practice, biosecurity includes management practices designed to prevent disease agents that have a negative impact on production from infecting flocks or herds.

GOALS OF BIOSECURITY IN THE SWINE INDUSTRY

- To prevent the introduction of a disease from an outside source (usually another swine operation).
- To prevent the spread of disease within the facility. Younger animals are generally more susceptible to disease and newly introduced animals also can be a source of disease.
- To reduce the negative effects of diseases that already exist on the farm.
- To prevent the interspecies transmission of specific diseases, including influenza viruses. In addition to routine biosecurity practices, additional measures can be taken to prevent interspecies transmission of influenza viruses and the associated risks and should be considered when developing a biosecurity program.

FARM LOCATION AND SECURITY

The proximity of a swine operation to other swine farms is important. A distance of 2.5-3.0 kilometers between farms has been recommended.

Ideally, swine housing facilities should be set back well away from the road and passing traffic (100 meters is suggested).

The farm should be fenced and gated to limit access. Buildings should be locked.

A designated parking area for visitors and deliveries should be located at the entrance to the farm, away from housing facilities, and should be well marked.

FACILITY DESIGN

Housing facilities for different swine production phases should be separate. This can mean separate structures or separate rooms within the facility.

Ventilation systems should be designed to prevent cross contamination of separate housing areas. The use of air filtration systems can prevent the entrance of airborne pathogens from buildings on the farm and from nearby operations.

Building materials and any equipment should be easy to clean and disinfect.

Quarantine and isolation facilities should be separated from each other and from the general housing areas (distances of 130 - 150 meters are recommended).

Housing for other livestock species on the farm should be separate from swine.

Ideally, load out areas, deliveries, and rendering pickup should be located at the perimeter of the farm.

VISITORS

The number of visitors should be minimized and visitors should not enter animal areas unless necessary.

Visitors should park in designated areas away from animal facilities.

Signage should be posted to alert visitors not to enter housing areas and to check in with farm personnel upon arrival. The use of a log book to track visitors to the farm is ideal.

If possible, visitors should not have had contact with other swine for a minimum of 24 hours. If they have had contact with swine and must enter, they must shower and change clothes first.

Shower-in/shower-out facilities are ideal, but at a minimum, visitors should wash or disinfect hands and arms and wear dedicated, farm-specific clothing, and boots.

Visitors should be accompanied at all times by farm personnel and should follow the designated traffic patterns on the farm.

VEHICLES

All vehicles, including personal vehicles, coming onto the premises should be inspected and/or cleaned upon arrival. The undercarriage, wheels, and wheel wells should be cleaned and disinfected.

Only on-farm vehicles should be used for transport within the operation. Vehicles used to transport animals should be cleaned and disinfected after each use.

FARM PERSONNEL

Workers at the facility should shower in/shower out or wash well and wear clean dedicated clothing. Clean, dedicated, or disposable boots should be worn in each barn.

Ideally, farm personnel should not have contact with pigs outside of the operation, including pigs of their own. At a minimum, the farm should develop a policy for employees who may have contact with other pigs.

Personnel should be trained on biosecurity procedures and reminded of the farm's established practices as needed.

Workers should be trained to recognize diseases in animals and to report sick animals as soon as possible.

Traffic patterns for caring for the animals should be set up. The animals with the highest health status (i.e., nursery pigs) should be visited first. Animals in isolation or quarantine should be visited last, and at a minimum, separate dedicated clothing and boots should be worn in those facilities.

ANIMAL HEALTH

A herd health program including vaccination schedules should be developed with the herd veterinarian.

The health of the herd should be monitored on a regular basis and sick animals identified as soon as possible.

Sick animals should be isolated away from the main herd if possible. Separate equipment and staff should be used for isolated animals, or at a minimum, the animals should be visited last on the daily schedule.

Moribund animals should be humanely euthanized.

Dead animals should be removed from the housing area immediately. If an animal has died unexpectedly or for an unknown reason, a necropsy to determine cause of death is recommended.

Dead animals should be disposed of properly and away from the housing areas. Carcasses should be rendered, buried, incinerated, or composted on site, depending on local regulations.

ANIMAL MANAGEMENT

Animals in different production phases should be housed separately. Weaned pigs should be moved to a separate site, as should grower/finishers. Mixing pigs from different sources should be avoided.

An all-in/all-out management system is best. This is where one group of pigs (i.e., weaned pigs) is moved all at once through the various production phases and new animals are not added to the group. This also allows for cleaning of the housing area before a new group of pigs moves in.

When new animals are introduced to the farm they should be from a known source farm with known health status. This also applies to semen used for artificial insemination.

New animals should be quarantined. The quarantine facility should be separate from the main herd. Personnel should not return to the main herd after caring for quarantined animals without showering and changing clothing and boots.

A minimum quarantine period of 30 days is recommended. Animals may be tested for diseases of concern before entering the main herd.

Acclimation of the pigs during quarantine involves exposing the new arrivals to the pathogens present on the farm. This can be done by exposing the quarantined animals to culled pigs or manure from the main herd.

Pigs that have left the farm should not return. If they do return they should be quarantined and treated as new arrivals.

SANITATION

Proper cleaning procedures are important to disease control. Facilities and equipment should be power washed if possible to remove manure and other debris before disinfection.

There are many types of disinfectants that can be used on swine farms. Proper protective equipment should be worn when using disinfectants.

Adequate contact and drying time should be allowed in order for the disinfectant to work properly. This information can be found on the product label.

Footbaths can be used when entering housing facilities. Footbaths should be of adequate size and contain appropriate disinfectants. The presence of organic debris such as manure will reduce the effectiveness of the disinfectant. Footbaths should be changed at least daily or when they become contaminated with debris.

Any equipment or supplies coming onto the farm (that are not brand new) should be cleaned and disinfected before coming into contact with any pigs. Sharing equipment between farms should be avoided.

Swine carcasses, manure, and contaminated materials should be properly handled and disposed of to prevent contamination of the facilities.

PEST MANAGEMENT

Rodents can be a source of disease; therefore, rodent control systems should be in place in swine facilities. Proper feed storage, sealing potential entry routes, and maintaining the outside of buildings will help keep rodent populations down. Professional extermination may be needed. Since cats can also spread diseases to swine, cats are not recommended as rodent control.

Insects have been shown to carry some swine viruses. Screening windows and other openings in swine facilities can reduce insect populations. Removing standing water and other insect breeding areas on the farm, and using other control methods (such as fly strips) can be of added benefit.

Facilities should also be bird and bat proof if possible.

Other domestic animals or wildlife should not be able to access the housing areas.

RECORD KEEPING

Good record keeping may assist in determining the origin of or in tracking any disease that may have entered the facility.

Visitor logs should note all visitors, time and date of visit, and when the person last had contact with swine.

Records should be kept of all animal movements within and off of the farm.

Animal health records can also be an important tool in disease management.

LESSON 4: BIOSECURITY CONSIDERATIONS FOR SMALLHOLDER OR BACKYARD FARMS

In this lesson, we will cover:

- Adaptation of Biosecurity Principles
- Location
- Containment and Housing
- Animal Health and Management
- Sanitation and Pest Management

ADAPTATION OF BIOSECURITY PRINCIPLES

The general biosecurity principles described in Lesson 3 can be adapted to small holder or backyard swine farms. The use of dedicated clothing and boots, limiting visitors, ensuring that both workers and visitors have not had recent contact with other pigs, not allowing contaminated vehicles onto the farm, and development of on-farm traffic patterns can be accomplished in a similar manner on small farms. There may be some additional factors to be considered on small holder or backyard farms.

LOCATION

The risk of airborne exposure to disease agents from nearby swine farms may be increased if pigs are raised outdoors. The size and disease status of nearby swine farms should be considered. The prevailing winds and terrain between farms will also affect disease transmission. Insects and rodents can also travel between farms and spread disease. (Distances of 3 - 8 kilometers have been recommended, depending on risk factors.)

Other livestock species should be housed separately and at an adequate distance to prevent disease transmission. Separate clothing and separate or cleaned and disinfected boots, should be worn when caring for other species.

CONTAINMENT AND HOUSING

Free ranging pigs, especially pigs that are allowed to scavenge, are at higher risk for infectious diseases. Pigs should be contained in pigsties or pens for better biosecurity control.

Separate pens can be used for the different production phases.

Protection from the elements can reduce stress and disease levels. Housing should provide shade, wind and rain protection, and bedding for warmth depending on the environmental factors.

Housing materials should allow for adequate sanitation and management of manure. Concrete is easier to clean and disinfect than dirt or wood surfaces. Slatted floors will allow manure to drop through and be removed from below the pigs. Pens should allow for adequate dry areas for the pigs to lie down and rest.

ANIMAL HEALTH AND MANAGEMENT

Kitchen scraps or offal should not be fed to pigs unless properly cooked and treated. Recommended cooking times and temperatures should be followed. Feeding offal to pigs is not legal in some areas.

Even in small operations it is important to quarantine additions to the herd. A separate pen, away from the main herd, should be set up for quarantine animals. A distance of 500 meters from the general housing has been suggested for swine raised outdoors.

SANITATION AND PEST MANAGEMENT

Footbaths should be used at the entrance to housing areas.

Manure should be disposed of away from the premises. Manure is often used as crop or garden fertilizer but should not serve as a source of contamination of housing areas or water sources.

Dirt floors may not be able to be easily disinfected, but manure should be removed, dirt turned, and facilities should be cleaned between groups of animals or as needed.

Feed should be stored in rodent-proof containers.

In addition to insects and rodents, feral pigs and other wildlife can be sources of disease. Contact with wild animals should be limited to the extent possible.

LESSON 5: BIOSECURITY TO PREVENT INTERSPECIES TRANSMISSION – BIRDS TO PIGS

In this lesson, we will cover:

- Separation of Poultry and Pigs
- Preventing Exposure to Wild Birds
- Prevention of Feed and Water Contamination
- Prevention of Contamination of Facilities

SEPARATION OF POULTRY AND PIGS

Direct or indirect contact between domestic birds and pigs should be prevented.

If domestic poultry and pigs are raised on the same farm they should be kept in separate facilities.

Personnel should shower or wash hands well and change clothing and boots between facilities for pigs and birds.

PREVENTING EXPOSURE TO WILD BIRDS

Barns should be bird proofed and/or wild birds should be discouraged from nesting in swine facilities. Although aquatic birds are thought to be the main reservoir for avian influenza viruses, passerine birds (e.g., songbirds, sparrows, crows, jays, etc.) have been shown to be infected and may function as a "bridge species" to swine or other animals.

If pigs are raised or have access to the outdoors, the farm environment should not be attractive to birds, especially waterfowl.

PREVENTION OF FEED AND WATER CONTAMINATION

Feed should be covered to prevent contamination of the feed with bird droppings.

Untreated water from ponds or other open sources should not be used for cleaning or as drinking water for swine.

Waterfowl should be discouraged from utilizing lagoons as water sources.

PREVENTION OF CONTAMINATION OF FACILITIES

Boots may serve as fomites and carry material contaminated with bird feces from the environment into the barn; therefore, dedicated boots should be worn only inside the housing facilities.

If this is not possible, boots should be cleaned and disinfected using a footbath when entering facilities. Disposable boots can also be used.

Rodents or other pests may also be able to function as fomites. Effective control plans should be in place.

Workers who hunt or trap in a wild bird environment should not wear clothing or boots used for those activities in swine facilities and should shower before contact with pigs.

LESSON 6: BIOSECURITY TO PREVENT INTERSPECIES TRANSMISSION – PEOPLE TO PIGS

In this lesson, we will cover:

- Prevent Sick People from Going into Swine Facilities
- Personal Hygiene Practices for Workers
- Personal Protective Equipment
- Vaccination of Workers

PREVENT SICK PEOPLE FROM GOING INTO SWINE FACILITIES

Workers should be educated on the signs and symptoms of influenza and the importance of preventing transmission of the virus to pigs.

Personnel who have developed influenza-like symptoms should not be allowed into swine facilities. Sick leave policies should be available at all swine operations for the protection of the people as well as for protection of the pigs.

The general recommendation is for sick workers to remain home for 7 days or for 24 hours after the fever has subsided, whichever is longer. At a minimum, workers should stay home until 24 hours after the fever has resolved (in the absence of fever suppressing medications).

Visitors, including service personnel, who have influenza-like illnesses, should not be allowed onto the farm.

PERSONAL HYGIENE PRACTICES FOR WORKERS

Basic biosecurity practices including shower-in/shower-out practices and dedicated clothing will help to prevent the spread of infectious agents including influenza viruses.

Frequent handwashing is an important measure to reduce contamination of surfaces with influenza viruses. Alcohol-based hand sanitizers can also be used.

Workers should be encouraged to use a tissue when coughing or sneezing to reduce the spread of influenza viruses.

PERSONAL PROTECTIVE EQUIPMENT

The use of personal protective equipment (PPE) may prevent the transmission of virus from people to pigs.

In addition to protective clothing and boots, gloves may help to reduce the spread of infectious secretions.

Respirators may prevent airborne exposure and spread of influenza viruses. Disposable filtering face-piece respirators (such as N-95 or higher) are sometimes used to prevent exposure to other respiratory hazards present in swine barns and may help to reduce the transmission of viruses to pigs.

N95 or higher respirators need to be fitted by a specialist in order for the respirator to be effective. These respirators can be difficult to breathe in and a medical exam may be necessary before use. N95 respirators may not be able to be fitted to persons with facial hair or other limiting factors. In those situations another type of respirator (such as a powered air-purifying respirator) may be needed.

VACCINATION OF WORKERS

Farm personnel should be vaccinated for seasonal influenza. This will help to prevent people from spreading human viruses to the pigs.

Seasonal influenza vaccines are produced each year, tailored to the specific strains that are predicted to be circulating during the season. Human influenza vaccines may be in the form of a killed virus, given as a shot, or a live attenuated virus that is given intra-nasally. Seasonal vaccines typically contain an H3N2 influenza strain, an H1N1 strain, and an influenza B strain or two.

Other persons such as service personnel who are in contact with swine in the facility should be vaccinated.

Farm personnel should be vaccinated against pH1N1 2009 influenza or any other pandemic strain that arises.

Ensuring the flow of fresh air into the housing facilities will dilute any pathogens in the air. This will reduce the risk of swine being exposed to human influenza viruses.

LESSON 7: VACCINATION OF SWINE AGAINST INFLUENZA

In this lesson, we will cover:

- Vaccination of Swine Against Influenza

VACCINATION OF SWINE AGAINST INFLUENZA

Current commercial swine influenza vaccines typically contain inactivated isolates of H1N1 and H3N2 subtypes. While these vaccines can reduce clinical signs and post-mortem lesions, they do not necessarily prevent viral replication or shedding of the virus.

Because swine influenza viruses continue to change due to antigenic drift, commercial vaccines may not protect against circulating strains. In these cases, autogenous vaccines may be used. Specific influenza strains present on the farm are used to make a customized vaccine. These vaccines also may not prevent viral shedding.

Modified live vaccines, although not currently available, could produce more cross protection to circulating strains, but concerns exist about reassortment between the vaccine strains and field strains.

Other concerns with the effectiveness of current vaccination strategies include the development of maternal antibody which may not fully protect the young pigs and may interfere with the immune response to the vaccine.

Despite these limitations, vaccination of pigs for swine influenza is recommended. Vaccination may not protect swine from human strains of influenza but it may reduce viral shedding and further transmission and decrease the risk of co-infection with swine and human viruses.

Continued research and new vaccine technology, including the development of DNA or vectorborne recombinant vaccines, may increase the efficacy and cross protection of vaccination and reduce shedding of virus. This may reduce the risk of interspecies transmission and emergence of reassortant viruses in the future.

LESSON 8: BIOSECURITY DURING A HUMAN INFLUENZA PANDEMIC

In this lesson, we will cover:

- Enhanced Biosecurity Measures
- Enforcement of Sick Leave Policies
- Monitoring Pigs

ENHANCED BIOSECURITY MEASURES

During a human influenza pandemic, swine facilities should review their biosecurity plans and strengthen practices where possible in order to prevent transmission of the virus to pigs.

Increased employee awareness and enforcement of established biosecurity practices may be needed.

The number and types of visitors to the operation may need to be more severely restricted during an influenza pandemic. Visitors may need to be more closely screened to ensure they do not have influenza-like symptoms or been recently exposed to the pandemic virus.

ENFORCEMENT OF SICK LEAVE POLICIES

Employees who are sick should stay home. Sick leave policies should be strictly enforced during a human influenza pandemic.

Since people can shed influenza viruses for up to 24 hours before symptoms develop, policies should be in place regarding personnel who have been exposed to the virus (e.g., through a sick family member), but are not currently sick. Persons exposed to the virus may need to be reassigned to duties away from the animals or wear additional PPE to prevent exposure of the pigs.

The effectiveness of PPE use to prevent transmission to pigs is not known, so efforts to prevent contact between sick individuals and pigs should be stressed.

MONITORING PIGS

Pigs should be closely monitored for signs of influenza during a pandemic. Personnel should be trained to recognize the signs of influenza in pigs. Early recognition may help to prevent the spread of the virus in the herd.

Influenza can be diagnosed in pigs by testing for the presence of virus in nasal or oral-pharyngeal swabs from live pigs or lung tissue from pigs that have died. Exposure to or infection with influenza may also be diagnosed by serology.

Surveillance programs may be in place for determining the presence of human influenza pandemic strains in pig populations. These programs may serve to track the incidence and distribution of novel viruses in pigs, to inform response plans, and to provide samples for diagnostic and vaccine development.

LESSON 9: ACTION IN THE EVENT OF AN OUTBREAK OF pH1N1 2009 INFLUENZA IN SWINE

In this lesson, we will cover:

- Diagnosis
- Enhanced Biosecurity Measures
- Pig Movement

DIAGNOSIS

The pH1N1 2009 influenza virus has been found in swine facilities in several countries including the United States. Evidence suggests that the pigs were exposed to the virus by persons who were sick. This virus generally has caused disease similar to endemic swine influenza viruses and in some situations, pigs have not demonstrated clinical signs.

If pH1N1 2009 influenza is suspected in a swine herd, the local veterinarian should work with animal health officials to evaluate and diagnose the illness. Initial samples should be sent to the local diagnostic laboratory for screening for the virus.

In the US, diagnosis of pH1N1 2009 influenza is performed at the USDA National Veterinary Services Laboratory by initially testing samples using polymerase chain reaction (PCR), followed by confirmatory testing using virus isolation and genetic sequencing.

ENHANCED BIOSECURITY MEASURES

If pH1N1 2009 influenza is diagnosed in a herd, the pigs should be appropriately isolated and treated, as with any other swine influenza virus.

Enhanced biosecurity measures, if not already in place, should be implemented.

The use of a swine vaccine for pH1N1 2009 would be recommended if it were shown to reduce shedding, prevent disease in pigs, and reduce potential transmission to people.

PIG MOVEMENT

Pigs should not be moved until clinical signs have resolved. The local veterinarian, in consultation with animal health officials will determine when this has occurred.

Quarantine of the farm or culling of pigs is not recommended.

Once recovered, movement of pigs should not be restricted.

GLOSSARY

All in/All out management system - A strategy directed at the control of infectious disease, especially enzootic pneumonia of pigs and viral pneumonia of calves. The barn is emptied of all animals on a particular day, the accommodation is cleaned and disinfected and then refilled, all on the one day.

Antigenic Drift - One of two ways that influenza viruses can change (the other is antigenic shift, see below). Antigenic drift refers to small, gradual changes that occur through point mutations in the two genes that contain the genetic material to produce the main surface proteins, hemagglutinin and neuraminidase. These point mutations occur unpredictably and result in minor changes to these surface proteins. Antigenic drift produces new virus strains that may not be recognized by antibodies to earlier influenza strains. This process works as follows: a person infected with a particular influenza virus strain develops antibodies against that strain. As newer virus strains appear, the antibodies against the older strains might not recognize the "newer" virus, and infection with a new strain can occur. This is one of the main reasons why people can become infected with influenza viruses more than one time and why global surveillance is critical in order to monitor the evolution of human influenza virus strains for selection of which strains should be included in the annual production of influenza vaccine. In most years, one or two of the three virus strains in the influenza vaccine are updated to keep up with the changes in the circulating influenza viruses. For this reason, people who want to be immunized against influenza need to be vaccinated every year.

Antigenic Shift - Antigenic shift is one of two ways that influenza viruses can change (the other is antigenic drift, see above). Antigenic shift refers to an abrupt, major change to produce a novel influenza A virus subtype in humans (i.e., one that has not circulated previously among people). Antigenic shift can occur either through direct animal (poultry)-to-human transmission or through mixing of human influenza A and animal influenza A virus genes to create a new human influenza A subtype virus through a process called genetic reassortment. Antigenic shift results in a new human influenza A subtype.

Antigens -A substance that elicits a specific (as opposed to nonspecific) immunological response. Foreign antigens typically stimulate a response from the body's adaptive immune system resulting in the production of antibodies and effector T-cells; antigens that produce an immune response can also be called "immunogens."

Autogenous Vaccine - A vaccine prepared from cultures of material derived from a lesion of the animal to be vaccinated.

Biosecurity - Security from transmission of infectious diseases, parasites, and pests.

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.

Epizootic - The occurrence in animals of an illness or health-related event in a region or country in numbers clearly in excess of normal expectancy.

Fomite - Inanimate objects or materials on which disease producing agents may be conveyed.

Genetic Drift - See Antigenic Drift

Genetic Reassortment - The exchange of gene segments between viruses that have a segmented genome.

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).

Host - An organism on or in which a parasite lives.

Incubation period - The development of a disease by multiplication of an infectious agent within a host.

Isolation - The segregation of patients with a communicable disease.

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.

Mutation - Any alteration in a gene from its natural state. Specific mutations and evolution in influenza viruses cannot be predicted, making it difficult if not impossible to know if or when a virus such as H5N1 might acquire the properties needed to spread easily among humans.

Necropsy - Examination of a body after death.

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).

Offal - Refuse or garbage.

Outbreak - Presence of disease in numbers in excess of normal in a specific geographic area or population.

Pandemic - A worldwide outbreak of a disease in humans in numbers clearly in excess of normal. A global influenza pandemic may occur if the following 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.

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

Pathogenic - Causing disease or capable of doing so.

Personal Protective Equipment - Any devices or clothing worn by the worker to protect against hazards in the environment. Examples are respirators, gloves, and goggles.

Polymerase chain reaction (PCR) - The amplification of a specific DNA sequence.

Prevalence - The proportion of individuals (humans or animals) in a population having a disease or specific characteristic (such as a positive antibody test to a particular pathogen).

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

Quarantine - A period of time during which an animal that might have a disease is kept away from other animals so that the disease cannot spread.

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.

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. 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 the severity of disease produced.

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.

Virus Isolation - The gold standard test used to diagnose influenza virus infections. The virus is isolated in embryos inside chicken eggs. A series of tests follow to specifically identify H and N subtypes of the influenza virus.

Zoonoses - Diseases that transfer from animals to humans.

RESOURCES

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[Website: www.pandemicflu.gov/glossary/index.html]

United States Department of Agriculture. Avian Influenza (Bird Flu): Avian Influenza Glossary of Terms.
[Website:
http://www.usda.gov/wps/portal/usda/usdahome?contentidonly=true&contentid=influenza_glossary.xml]