Excellence in Exhibition: Preventing Disease in Animals and People

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Course Introduction

Welcome to Excellence in Exhibition: Preventing Disease in Animals and People! Animal agriculture is an important part of 4-H and FFA. Being a part of these organizations helps you gain knowledge about animals and develop responsibility, good sportsmanship, and confidence. However, there are many diseases that can be spread between people and animals, and knowing about these diseases is especially important because of the close contact that you have with your show animals. This course was created to teach you how to keep yourself and your animals safe and healthy so that you can continue to enjoy showing and teaching others about animal agriculture.

Lesson 1: Introduction to Influenza, Zoonoses, and Disease Risks

Lesson 1 focuses on influenza and other zoonoses and why it is important to learn about them. The diseases you will learn about can be spread between people and animals, especially when you are in close contact with your animals. This lesson will teach you about what diseases could affect you and your animals. Knowing these diseases will help you be on the lookout for any signs of illness in your animals or yourself. Keeping both yourself and your animals healthy will make showing animals a more enjoyable experience.

Learning Objectives

1. Define zoonoses.

2. Describe the importance of influenza and other zoonoses.

3. Recognize common zoonotic diseases that might affect people and animals at fairs or exhibitions.

4. Identify risk factors for zoonotic disease infection.

What are zoonoses?

Zoonoses (zoh-*uh*-**noh**-sis), or zoonotic diseases, are diseases that can be spread among animals and between animals and people.

Endemic Disease

A disease* regularly found among a particular population or in a certain area, including both zoonotic and non-zoonotic diseases.

*Disease: When the body is damaged as the result of an infection and clinical signs and symptoms occur.

Examples of Endemic Diseases

Avian Influenza: Avian influenza, sometimes called “bird flu,” is caused by infection* with influenza A viruses. Influenza viruses are endemic in some wild waterfowl populations, such as ducks and geese. Wild waterfowl often are asymptomatic** but can act as reservoirs for the virus. Reservoirs are animals that continuously have the disease-causing agent (but may not show signs) and can spread it to others. Infected waterfowl can serve as a source of the virus for domestic poultry, like chickens and turkeys, if they are in the same areas.

*Infection: When agents such as bacteria or viruses enter the body.

**Asymptomatic: Do not show signs of illness.

Rabies: Rabies virus is endemic in the United States and most of the world. In the United States, wildlife species such as raccoons, skunks, and bats are the primary reservoirs of the rabies virus. Rabies can infect all mammals, including humans. Rabies is spread by the bite of an infected animal whose saliva contains the virus. Clinical signs* in both people and animals include

behavior changes, leg paralysis, drooling, and difficulty swallowing. Rabies has a very high mortality rate.** In these animals, almost 100% of cases result in death. A rabies vaccination is available for people and some types of animals.

*Clinical signs: Changes in an animal or person that may happen when that have a certain disease.

**Mortality rate: Death rate.

Emerging Disease

A new disease that has appeared in a population for the first time, or that had previously existed but is rapidly increasing in incidence* or geographic range (also known as re-emerging). 75% of emerging pathogens** in humans are zoonotic.

*Incidence: The number of new cases.

**Pathogens: Disease-causing agents, such as viruses, bacteria, fungi, parasites, or prions.

Examples of Emerging Diseases

Emerging Zoonotic Diseases: 60% of existing human infectious diseases are zoonotic. At least 75% of emerging infectious diseases of humans (including Ebola, HIV, and influenza) have an animal origin. 5 new human diseases appear every year. Three are of animal origins. 80% of agents with potential bioterrorist use are zoonotic pathogens.

West Nile Virus: West Nile appeared in the United States for the first time in 1999. There were 62 human cases with 7 deaths. Exotic birds, crows, and horses were also infected. Birds are the primary reservoirs for West Nile virus. It is spread by the bite of infected mosquitoes. After feeding on infected birds, the mosquitoes can spread the virus to humans, horses, and other animals. People and horses are considered dead-end hosts.* Since its emergence in the U.S., the virus has become established here and continues to cause outbreaks in human and horse populations. West Nile is now endemic in North America.

*Dead-end hosts: Hosts that cannot spread the virus to others.

Avian Influenza H5N1: H5N1 avian influenza virus re-emerged in Southeast Asia in 2003 after not being seen since 1997. H5N1 is classified as a highly pathogenic avian influenza (HPAI) virus, meaning that it causes more severe disease in chickens than a low pathogenic avian influenza (LPAI) virus. Over 100 million birds died or were culled* and destroyed as a result of H5N1. As of early 2017, over 800 cases of H5N1 influenza were reported in people. About 50% of the human cases resulted in death.

*Culled: Remove from the flock or herd.

Recent Emerging Diseases Timeline

1981 – HIV/AIDS, United States
1982 – *E. coli* 0157:H7 and Lyme Disease
1983 – Cat Scratch Disease

1986 – Bovine Spongiform Encephalopathy, United Kingdom
1989 – Ebola-Reston Virus
1993 – Hantavirus, United States
1994 – Hendra Virus, Australia
1996 – Variant Creutzfeldt-Jakob Disease, United Kingdom
1997 – Avian Influenza (H5N1), Hong Kong
1998 – Nipah Virus, Malaysia
1999 – West Nile Virus, United States
2002 – SARS, China
2003 – Monkeypox, United States
2004 – Avian Influenza (H5N1, Asia and Eurasia
2005 – Avian Influenza (H5N1), Europe and Asia
2009 – Pandemic Influenza A H1N1
2011 – Influenza A of Swine Variant Virus (H3N2v), United States
2012 – MERS, Arabian Peninsula
2013 – Avian Influenza (H7N9), China; Porcine Epidemic Diarrhea virus, United States
2014 – Ebola virus, West Africa
2015 – Avian Influenza (H5N2 and H5N8), United State All of these disease are zoonotic except for HIV/AIDS, Ebola-Reston Virus, Porcine Epidemic Diarrhea virus, and the 2015 Avian Influenza (H5N2 and H5N8).

Why worry about zoonoses?

Public Health: Some zoonoses can cause widespread and severe disease in people. One example is influenza. Influenza viruses can infect many animal species, including dogs, cats, horses, pet birds, poultry, and pigs. Influenza can spread quickly through a population.

Some influenza viruses are zoonotic. Zoonotic influenza that can infect animals and people during exhibitions is caused by an Influenza A virus. The zoonotic viruses of most concern are influenza viruses of avian and swine origin.

Some people are at a higher risk for developing serious complications of influenza, including death. High risk groups include:

- Children less than 5 years of age
- Pregnant women
- People 65 years or older
- People with weakened immune systems
- People with certain medical conditions like asthma, diabetes, or heart disease

People who are in close contact with animals or who live in crowded areas are more likely to be infected with influenza A viruses.

Influenza A viruses are classified into groups, also known as subtypes, based on two surface proteins. One is called H (hemagglutinin) and the other is N (neuraminidase). These subtypes are

used for naming viruses like H1N1. Different subtypes vary in their zoonotic risk and ability to cause disease.

Influenza A viruses can undergo rapid genetic* changes which then allow them to infect new species. When two different influenza viruses infect a single animal at the same time, the viruses can swap genetic information and create a new strain. This is called reassortment. The new virus will have some gene segments from each of the parent viruses.

*Genetic: Relating to genes, the basic units by which traits are passed from parents to offspring.

1918 Spanish Influenza H1N1 Pandemic*: About one third of the world's population was infected with the H1N1 virus during this outbreak. About 50 million people died from influenza. The exact origin of the 1918 H1N1 virus is not known but it is thought that it was an avian-like virus that infected and adapted to humans.

*Pandemic: Disease outbreak that occurs over a wide area and affects a large number of people.

1957-1958 Asian H2N2 Pandemic: The H2N2 virus responsible for this pandemic had gene segments of both avian and human origin. Almost 70,000 people in the United States and over 1 million people worldwide.

1968-1969 Hong Kong H3N2 Pandemic: The H3N2 influenza was also of both avian and human origin. This virus killed about 1 million people worldwide.

2009 H1N1 Pandemic: The 2009 H1N1 influenza virus was originally called swine flu. It is now known that the H1N1 virus contained gene segments from influenza viruses of swine, birds, and humans. People in more than 200 countries were infected by H1N1 and more than 18,000 deaths. This virus is now considered a human virus that circulates seasonally. It is included in the annual flu vaccine.

Animal Health: Animals with zoonotic diseases may appear healthy on the outside. They might have decreased weight gain, poor performance, or decreased production (milk or eggs). Some animals will look like "poor doers." Some zoonoses can even cause severe disease in animals. Preventive measures such as vaccinations and insect and other parasite control can help keep your animals healthy. These measures can also help limit the spread of disease from animals to humans. **Animals suspected of having a disease should not be taken to any animal exhibition, such as a show or fair, and should be seen by a veterinarian.**

Food Safety: Sometimes the food we eat can make us sick. Many zoonoses, such as *Salmonella*, *Campylobacter*, *Listeria*, and *E. coli*, are foodborne pathogens, meaning that the pathogen could be in or on the food that we eat. According to the CDC (Centers for Disease Control and Prevention), 1 in 6 Americans will get sick from a foodborne illness each year.

Contamination by foodborne pathogens can occur anywhere along the food production chain, such as, production, processing, distribution, retail or restaurant, home or restaurant preparation or preparation, to home consumers or restaurant consumers.

Milk is an example of a food that can be contaminated by bacteria on the farm. There are several pathogens that can be present in raw milk, even if it comes from healthy animals. Illness can be prevented by pasteurizing milk. The pasteurization process uses heat to destroy bacteria, making the milk safe to drink.

If a sick animal enters the food supply, meat can become contaminated at the processing plant. USDA employees inspect animals for signs of disease at the plant to prevent any ill animals from entering the food supply. Many foodborne illnesses are the result of improper food handling at home or in restaurants. Unclean hands, undercooked foods, and improper storage temperature can lead to foodborne illness.

Personal Health: Animals infected with zoonotic pathogens may become ill, but many will not appear sick. Even if animals appear healthy, they can still spread pathogens to people. People who are in close contact with animals, such as pet owners and livestock producers, can be at an increased risk for zoonotic infections. Children less than 5 years of age, pregnant women, people older than 65 years, people with weakened immune systems, and people with certain medical conditions are at an increased risk of developing serious complications of some diseases if they are infected. Zoonoses cause about 2.5 billion cases of human illness and 2.7 million human deaths worldwide each year.

The next sections give examples of common zoonoses that could infect you and your animal. More information on prevention of these diseases is provided in Lessons 2 and 3. If you suspect that your animal has a zoonotic disease, you should contact your veterinarian.

Avian Influenza

Cause: Influenza A virus

Also known as: Bird flu

Classification is based on genetic characteristics of the virus and the severity of disease in chickens

- Highly pathogenic avian influenza (HPAI)
- Low pathogenic avian influenza (LPAI)

Some strains of avian influenza are considered reportable or notifiable.*

*Reportable (notifiable) disease: Must be reported to local, state, or federal health officials when diagnosed. Diseases can be reportable in people, animals, or both.

Species Commonly Affected:

- Pet birds
- Mammals
- Poultry
- Wild waterfowl (can be carriers of the virus but they usually don’t appear sick)

Clinical signs in domestic birds:

- Depression
- Ruffled feathers
- Lack of appetite
- Watery diarrhea
- Swollen combs** and wattles***
- Decreased egg production
- Paralysis
- Sudden death

**Comb: The fleshy growth on top of the head of chickens and turkeys.

***Wattle: The fold of skin hanging from the neck or throat of chickens and turkeys.

Clinical signs and symptoms in people:

- Fever
- Aches
- Pink-eye
- Flu-like symptoms such as cough, sore throat, runny nose, headache, and tiredness
- More severe disease is possible

Not all strains of avian influenza are zoonotic. The people with the highest risk of getting zoonotic avian influenza are those who come in close contact with sick birds. Person-to-person transmission is possible but rare.

Influenza A Virus of Swine Origin (IAV-S)

Cause: Influenza A virus

Also known as: IAV-S and sometimes called swine flu

Species Commonly Affected:

- Turkeys
- Pigs,
- Mink
- Ferrets

Clinical signs in animals

- Depression
- Fever
- Tiredness
- lack of appetite
- weight loss
- coughing
- sneezing

- nasal discharge
- labored breathing

Clinical signs and symptoms in people:

- Flu-like symptoms such as fever, cough, sore throat, runny nose, muscle aches, headache, and tiredness

Influenza viruses normally found in pigs are called “variant” viruses when they infect people. Most human cases of IAV-S have involved people in close contact with infected pigs. Person-to-person transmission is possible but not common.

Campylobacteriosis

Cause: *Campylobacter jejuni* bacteria

Cases of campylobacteriosis in people may be reportable in some states. Any cases of reportable diseases should be reported to your Public Health Department. If you live in Iowa, call the Iowa Department of Public Health (IDPH) at 1-800-362-2736. If you live in another state, contact your local or state department of public health for a list of reportable diseases.

Species Commonly Affected:

- Pigs
- Poultry
- Cattle
- Dogs
- Cats
- Sheep

Clinical signs in animals:

- Diarrhea
- Secreased appetite
- Vomiting
- Fever

Clinical signs and symptoms in people:

- Diarrhea
- Fever
- Vomiting
- stomach pain
- headache
- muscle pains

People can get campylobacteriosis from eating raw or undercooked meats or raw eggs or from drinking raw, unpasteurized milk. They can also get it from eating or drinking water contaminated with feces. It can also be spread through direct contact with infected animals.

Salmonellosis

Cause: *Salmonella* bacteria

Cases of salmonellosis in people may be reportable in some states. Any cases of reportable diseases should be reported to your Public Health Department. If you live in Iowa, call IDPH at 1-800-362-2736. If you live in another state, contact your local or state department of public health for a list of reportable diseases. .

Species Commonly Affected:

- Reptiles and amphibians
- Poultry
- small non-traditional pets
- Pigs
- Cattle
- Horses
- Dogs and cats

Clinical signs in animals:

- Diarrhea
- Fever
- Dehydration
- Hunched position because of stomach pain

People can get *Salmonella* through direct contact with feces from infected animals. They can also get it from eating improperly cooked food. Raw poultry, raw or undercooked eggs, and raw milk are common sources. Clinical signs and symptoms in people include diarrhea, fever, and cramping.

E. coli

Cause: *Escherichia coli* bacteria

Cases of certain strains of *E. coli* in people may be reportable in some states. Any cases of reportable diseases should be reported to your Public Health Department. If you live in Iowa, call IDPH at 1-800-3692-2736. If you live in another state, contact your local or state department of public health for a list of reportable diseases.

Species Commonly Affected:

- Sheep and goats
- Cattle

- Pigs
- Poultry
- Dogs

Animals are carriers of the bacteria but might not look sick. Animals that do become ill from *E. coli* usually have diarrhea. In young pigs, *E. coli* can cause edema* disease. Pigs with edema disease will have swelling of the forehead, difficulty breathing, and a decreased appetite.

*Edema: Swelling caused by a build-up of fluid.

People can get *E. coli* from direct contact with feces from infected animals or from eating food that contains the bacteria. Raw or undercooked ground beef is a common source. Clinical signs and symptoms in people include stomach pain, cramping, and watery or bloody diarrhea. Hemolytic Uremic Syndrome is a kidney disease that sometimes follows an infection with *E. coli* O157:H7. It is a life-threatening condition that most often affects children.

Cryptosporidiosis

Cause: *Cryptosporidium parvum* parasites.

Cases of cryptosporidiosis in people may be reportable in some states. Any cases of reportable diseases should be reported to your Public Health Department. If you live in Iowa, call IDPH at 1-800-362-2736. If you live in another state, contact your local or state department of public health for a list of reportable diseases.

All mammals can be in affected, but it is more common in young animals.

Clinical signs in animals:

- Diarrhea
- poor appetite
- Weight loss

Clinical signs and symptoms in people:

- Watery diarrhea
- Stomach cramps
- Poor appetite

People most often get cryptosporidiosis from eating food or drinking water that contains the parasite, or by contact with objects that have been contaminated by feces. This commonly happens during recreational water activities.

Ringworm

Cause: Many species of fungi

Also known as: Dermatophytosis, club lamb fungus

Species Commonly Affected:

- Dogs
- Goats
- Cats
- Cattle
- Sheep
- Horses
- Pigs

Clinical signs in animals:

- Hair loss
- Scaling
- Crusts (a hard outer covering of the skin)
- Redness

Clinical signs and symptoms in people:

- Itchy skin
- Ring-shaped rash
- Red, scaly, cracked skin
- Hair loss

Ringworm in people is sometimes called a “tinea” infection.

Contagious ecthyma

Cause: Contagious ecthyma virus

Also known as: Orf, Scabby Mouth, Sore Mouth, or Contagious Pustular Dermatitis

Species Commonly Affected:

- Goats
- Sheep
- Alpacas
- Camels

Clinical signs in animals:

- Small raised bumps, sores, and blisters found on the lips, nose, ears, and eyelids

Clinical signs in people:

- One or more small, firm, red to blue bumps, sores, or blisters that last 3 to 6 weeks

Q fever

Cause: *Coxiella burnetii* bacteria

Q fever is a reportable disease. Any human cases of reportable diseases should be reported to your Public Health Department. If you live in Iowa, call IDPH at 1-800-326-2736. If you live in another state, contact your local or state department of public health for a list of reportable diseases.

Species Commonly Affected:

- Sheep
- Cattle
- Goats

Clinical signs in animals:

- Spontaneous abortion (miscarriage)
- Infertility (not able to have offspring)
- Small offspring
- Weak offspring

Clinical signs and symptoms in people:

- Fever
- Chills
- Night sweats
- Headache
- Weakness
- Chest pains
- Premature birth or miscarriage in pregnant women

People usually get Q fever by breathing dust that contains the bacteria or by direct contact with infected animals. This commonly happens while helping animals give birth.

Lesson 2: Zoonotic Disease Transmission

This lesson will teach you about ways diseases can spread between animals and people. There are many factors that determine whether or not you will become ill. For example, simply touching an animal that is infected with a zoonotic disease does not mean you will become infected. However, understanding the ways disease can spread will help you know the best practices to stay healthy.

Learning Objectives

1) Explain the five routes of disease transmission.

2) Give an example of a zoonotic disease that can be transmitted by each route.

3) Describe how influenza viruses are transmitted among animals and to humans.

4) Explain ways to prevent each route of transmission.

Five Routes of Disease Transmission

1) Direct Contact

2) Indirect Contact

3) Aerosol/Droplet

4) Ingestion/Oral

5) Vectors

Direct Contact

Spread of pathogens through contact with an infected animal, its tissues,* or its fluids (Such as urine, feces, saliva, or blood) by way of open wounds, mucous membranes,** or scraped skin.

*Tissues: A group of cells that are close together and have the same function.

**Mucous membranes: Lining of the digestive, respiratory, or urinary tracts.

Diseases spread by direct contact include Avian Influenza, Influenza A of swine, Q fever, Salmonellosis, *E. coli*, Contagious ecthyma, Campylobacteriosis, Cryptosporidiosis, and Ringworm.

Direct Contact Example

Influenza A of Swine

Jason spends a lot of time with his pigs. He even sleeps in the pen with his four pigs during the fair. One of the pigs is infected with Influenza A virus. By the end of the fair, Jason and two other pigs are also infected with influenza.

Ways to Prevent Direct Contact Transmission

- Wash your hands after having contact with animals or being in animal areas even if you did not touch the animals
- Wear gloves when working with sick animals
- Isolate* sick animals

*Isolate: Separate from others

Indirect Contact

Spread of pathogens through coming into contact with areas where animals live and roam, or objects or surfaces contaminated by an infected animal. Fomites are objects or surfaces that may become contaminated with pathogens. Examples of fomites include boots, cages, needles, bedding, clothing, vehicles, and restraint devices.

Diseases spread by indirect contact include Avian Influenza, Influenza A of swine, Contagious ecthyma, and Ringworm.

Indirect Contact Example

Ringworm

John and Annie are grooming their horses, Tulsa and Buttons. John thoughtfully lends his brush to Annie, but he doesn't realize Tulsa has ringworm. Annie and Buttons both get ringworm from touching Tulsa's brush.

Ways to Prevent Indirect Contact Transmission

- Avoid sharing equipment, or clean and disinfect equipment when sharing is necessary
- Clean and disinfect any equipment used with sick animals or animals with skin lesions
- Dispose of or wash boots and clothing after animal contact
- Wash your hands after having contact with animals or being in animal areas even if you did not touch the animals

Aerosol/Droplet

Droplets containing pathogens travel through the air and are inhaled by another animal or person.

Diseases that are spread by aerosol/droplet include Avian Influenza, Influenza A of swine, and Q fever.

Aerosol/Droplet Example

Avian Influenza

A turkey with avian influenza is sneezing. Nearby turkeys and people inhale the droplets in the air and become infected as well.

Ways to Prevent Aerosol/Droplet Transmission

- Increase distance between sick animals and healthy animals and people

- Wear respiratory protection when working with sick animals
- Provide fresh air to animals and people
- Decrease humidity and odor build up in barns
- Stay away from animal barns if you are sick

Ingestion/Oral

Ingestion of disease-causing agents from contaminated food or water or by licking or chewing contaminated objects in the environment.

Diseases spread by ingestion include Q fever, Salmonellosis, *E. coli*, Campylobacteriosis, and Cryptosporidiosis.

Ingestion Example

Cryptosporidiosis

A calf sheds *Cryptosporidium parvum* in its feces. This FFA member becomes infected after cleaning her calf's pen and not washing her hands before drinking.

Ways to Prevent Oral Transmission

- Wash your hands
    - After contact with animals or being in an animal area even if you did not touch an animal
    - After cleaning pens or having contact with manure
    - Before preparing or handling food
    - After using the bathroom
- Cook meat to the appropriate temperature
- Store food at the proper temperature

Vectors

Transfer of a pathogen from an infected animal to another animal or a human by the bite of an arthropod.*

*Arthropod: Invertebrate animals including mosquitoes, ticks, and flies.

Q fever is a disease spread by vectors.

Vector Example

West Nile Virus

A bird (the reservoir host carrying West Nile virus) is bitten by a mosquito. While feeding on a person, the mosquito transfers the virus to the human.

Ways to Prevent Vector-borne Transmission

- Use insect control products

- Prevent standing water
- Work with your veterinarian to check and treat your animals for parasites
- Check for ticks on people and pets

Epidemiologic Triangle

The epidemiologic* triangle is used to study infectious diseases and how they spread. For an animal or human to be infected with a specific pathogen, all three corners of the triangle (agent, host, and environment) must favor the spread of disease.

*Epidemiology: The study of the cases, distribution, and control of diseases in populations.

Agent: The agent is the cause of disease. Disease-causing agents can be viruses, bacteria, fungi, parasites, or prions.

Host: The host is the animal or human that is exposed to and carries the agent. Hosts may or may not show signs of illness.

Environment: The environment is the surroundings and conditions outside of the host that cause or allow the agent to be transmitted.

Lesson 3: Zoonotic Disease Prevention and Biosecurity

You've now learned about the different ways that diseases can be spread. Lesson 3 will teach you about ways to prevent disease spread on your farm and at exhibitions. Working with and showing your animals is a fun and rewarding experience. By practicing the prevention measures you will learn about in this lesson, you can make sure that both you and your animals stay healthy.

Learning Objectives

1) Define biosecurity.

2) Explain the importance of biosecurity in zoonotic disease control.

3) Review ways zoonotic diseases might be spread to you, your family, and your animals on the farm and at exhibitions.

4) Describe measures to prevent zoonotic disease spread to you, your family, and your animals on farms and at exhibitions.

Biosecurity Basics

What is biosecurity?

Biosecurity is a series of practices designed to prevent the introduction and spread of pathogens. Good biosecurity can help keep you and your animals healthy.

There are two components to biosecurity:

1) Keeping disease from entering an area

2) Preventing disease from spreading to other locations

Ways Pathogens Can Enter a Farm

- Equipment and bedding
- Feed and water
- People
- Farm animals and products
- Rodents, birds, insects, and other wild animals
- Vehicles and trailers

Biosecurity on the Farm

Farm Entrance and Perimeter

- Limit access to the farm
    - Minimize visitors and traffic
    - Have only one gated entrance to the animal areas
    - Lock gates to prevent unwanted entry

- Maintain fences to keep your animals in and other animals out
- Limit contact between your animals and outside animals including:
    - Neighbors' livestock
    - Rodents, wildlife, and other animals
    - Birds
    - Dogs, cats, and other pets that are free to roam
- Post signs at the farm entrance to inform visitors of biosecurity procedures to follow

People and Vehicles

- Keep a record of visitors who enter and leave
- Require that all people wash hands before and after animal contact and after leaving animal areas even if they did not touch animals
- Require that employees who have contact with outside livestock use the same biosecurity measures as visitors
- Be able to recognize and report diseases
- Take steps to prevent disease spread between your neighbors' farm and yours
    - Do not share equipment or vehicles between farms
    - If equipment must be shared, all manure and bedding should be removed. Then the equipment should be cleaned, rinsed, disinfected, and then rinsed again before using it with your animals
- Prevent off-farm vehicles from driving where animals are kept
- Make sure visitors avoid livestock areas and do not have contact with animals

Personal Protective Equipment (PPE)

- Wear gloves when working with animals
- Wear clean boots or disposable boot covers in animal areas
    - Have a boot bath or trash at entrances and exits
    - Clean the boot bath regularly
- Wear clean protective outer clothing when working with animals

Farm Animals

- ID animals individually
- Maintain health records and records of animal movement
- Inspect animals for signs of illness at least daily
- Review vaccination and preventive care with your veterinarian yearly
- Visit sick animals last when working with groups of animals
- Clean equipment and boots and change clothing between groups of different health statuses
- Quarantine* all new or reintroduced animals to prevent exposing your herd or flock to different pathogens
- Isolate sick animals immediately to minimize disease exposure of others in the herd or flock and use separate facilities and equipment to handle these animals

- Remove dead animals quickly and dispose of carcasses in a safe manner that prevents wildlife and rodent attraction

*Quarantine: Put an animal in a separate area to prevent the spread of disease, even if the new animal appears healthy

Wildlife and Other Animals

- Prevent contact with free roaming animals
- Control wildlife access to the farm
- Minimize bird contact and nesting on your farm
- Have a rodent control program
- Secure all feed storage areas and clean up spilled feed to minimize access by pests

Cleaning and Disinfection

Step 1: Cleaning

- Remove all organic material (e.g., manure, dirt, feed, debris)
- Wash
- Rinse
- Allow to dry

Step 2: Disinfection

- Follow the label instructions on the disinfectant
- Apply the disinfectant for the proper contact time
- Rinse

Human Health on Farms

People who live or work on farms with animals are at risk of infection with zoonotic diseases. Many of the biosecurity practices listed earlier not only protect animal health but also prevent the spread of zoonoses to people. There are other measures that can be taken to prevent disease spread to people as well.

Hierarchy of Controls

The NIOSH (National Institute for Occupational Safety and Health) Hierarchy of Controls is a system that can be used to reduce or eliminate exposures to hazards. Actions at the top of the hierarchy are the most effective methods. Actions at the bottom are the least effective.

Elimination

Physically remove the hazard. When zoonoses are the hazard, eliminated is not usually an option.

Substitution

Replace the hazard. Substitution may not be an option for zoonoses.

Engineering Controls

Isolate people from the hazard.

Examples:

- Put animals showing signs of illness in isolation where they will have limited contact with other animals and people
- Restrict the number of people that have contact with sick animals

Administrative Controls

Change the way people work.

Examples:

- Do not eat or drink in areas where there are animals
- Wash your hands after animal contact
- Cover any open wounds when working with animals

PPE

Protect the worker with Personal Protective Equipment.

Examples:

- Wear gloves, protective outerwear, and respiratory protection if you must have contact with a sick animal
- Wear gloves when handling feces, urine, or body fluids such as blood and nasal discharge

Biosecurity at Exhibitions

It is important to work with your veterinarian before taking an animal to any exhibition. Your animals should receive preventive care before being around people or other animals. This includes vaccinations and parasite control.

Only bring healthy animals to public settings. If your animal becomes sick, remove them from areas of human contact and notify the fair veterinarian. Especially of concern are animals with diarrhea or respiratory illness.

About 200 human disease outbreaks involving animals in public settings were reported to the CDC during 1996–2002.

Animal exhibition personnel should inform visitors that certain groups of people are at an increased risk of severe complications from zoonotic infections:

- Children less than 5 years of age
- Pregnant women
- People older than 65 years

- People with weakened immune systems
- People with certain medical conditions

Exhibition facilities should have specific **non-animal areas**, **transition areas**, and **animal areas**.

Non-animal areas are areas where visitors have no contact with animals. Exhibition organizers can allow food and beverages in these areas. They should make hand washing stations should be available and accessible to all visitors.

Transition areas are located between animal and non-animal areas. In these areas, signs should tell visitors that they are about to enter an animal area, and that things like food, strollers, and toys are not allowed in the animal area. Signs should notify visitors of the risks associated with animal contact. Signs should also tell visitors to wash their hands when leaving the animal area. Handwashing signs in multiple languages should be displayed near handwashing stations in the transition area. They should show the correct hand washing procedure.

Animal areas are those where people may have animal contact. Promptly remove manure and soiled bedding from these areas. Do not let visitors have direct contact with manure or dirty surfaces. Cover feed and store in sealed containers. Do not allow visitors to bring strollers, toys, etc. into an animal area. Avoid eating, drinking, and sleeping in these areas. After the animals leave, clean and disinfect animal areas.

Keeping Animals Healthy at an Exhibition

- Avoid mixing of animals from different farms
- Do not share equipment
- Do not let visitors touch animals
- Remove manure and clean pens often
- Observe animals regularly for signs of illness
- Isolate sick animals from healthy animals
- Quarantine animals for 7 days after returning home from an exhibition and watch for illness
- Clean and disinfect any equipment, clothing, shoes, and vehicles that were at the fair

Review of Zoonotic Disease Prevention Strategies: WASH

W: Wash

Hand washing is one of the most effective ways to prevent disease

- Use warm water and soap for a minimum of twenty seconds (sing the happy birthday song twice)
- Use hand sanitizer when hands are not visibly dirty
- Wash your hands before making food and eating

- Wash your hands after having contact with animals and cleaning up animal waste or enclosures

A: Avoid

- Avoid wildlife
    - Wild animals can be reservoirs for a variety of diseases
- Avoid disease-transmitting vectors (e.g., mosquitoes, fleas, ticks)
    - Insect vectors can be carriers for a variety of zoonotic diseases
    - Avoid vector areas (e.g., wooded areas for ticks) or activity times (e.g., dawn and dusk for mosquitoes)

S: Safety

- Use personal protection
    - Wear gloves when handling feces
    - Wear gloves and respiratory protection when in contact with sick animals
    - Control insects in barns
- Use proper food preparation procedures
    - Wash hands before preparing or handling food
    - Do not eat raw or undercooked meat or eggs or consume raw or unpasteurized dairy products
    - Cook foods thoroughly to an appropriate temperature
    - Promptly refrigerate unused foods

H: Health

Maintain good health for you and your animals

- Inspect animals regularly for signs of illness
- Seek veterinary care for sick animals
- Keep vaccinations current
- Check and treat animals for parasites

Lesson 4: Highly Pathogenic Avian Influenza (HPAI) Outbreak Case Study

Lesson 4 focuses on avian influenza, which is a zoonotic disease of birds. Avian influenza virus can cause serious disease in both poultry and people. Not all strains of avian influenza can be spread to people, but it is important to be aware of the risks and to do your best to prevent the spread of the virus. Taking precautions when working with your birds will help keep you and your animals healthy.

Learning Objectives

1) Describe avian influenza and how it is transmitted among animals and between animals and people.

2) Explain the impact that an HPAI outbreak has on animal agriculture.

3) Identify potential public health impacts of a highly pathogenic avian influenza outbreak.

4) Identify those persons most at risk for being infected with avian influenza A viruses and those with the highest risk of complications.

5) Explain how and why animal exhibitions might be impacted by HPAI.

Avian Influenza Review

Background

Avian influenza viruses can infect wild birds, pet birds, poultry, and mammals. Avian influenza viruses are classified as highly pathogenic avian influenza (HPAI) or low pathogenic avian influenza (LPAI) viruses. Their classification is based on severity of disease in chickens and genetic characteristics of the virus. HPAI viruses cause more severe disease in poultry than LPAI viruses.

Clinical Signs

Wild waterfowl that are infected usually do not show signs of disease.

Clinical signs in domestic birds are:

- Depression
- Reduced feed and water intake
- Coughing
- Sneezing
- Decreased egg production
- Diarrhea
- Sudden death

Treatment

There is no specific treatment for avian influenza in birds. Because of the seriousness of the disease, birds with HPAI viruses are usually depopulated.*

*Depopulation: Large numbers of animals are destroyed quickly and efficiently.

Spread among birds

Spread of avian influenza viruses among wild waterfowl is largely through ingestion. Birds will eat the feces of infected birds that contain the virus and then become infected themselves. This can also occur in domestic poultry. Because of the closeness of birds in commercial poultry facilities, droplets are another common route of spread. Fomites can spread avian influenza as well.

Spread to humans

Not all avian influenza viruses are zoonotic. Zoonotic avian influenza viruses are usually transmitted to people when they are in close contact with infected birds or tissues. Poultry that have had avian influenza will not enter the food supply. People cannot get avian influenza from eating properly cooked poultry or poultry products. Human infection with avian influenza viruses is rare.

Case Study

Now we will review a case study. The HPAI outbreak that began during the spring of 2015 was the largest U.S. animal disease outbreak to date. The outbreak occurred in the upper Midwest in laying hens, turkeys, and pullets. In total, 211 commercial flocks and 21 backyard flocks were affected. About 50 million chickens and turkeys were infected with or exposed to the virus and depopulated. Over $900 million was spent on response efforts.

This case study will help you learn about the impact of a disease outbreak and how to prevent future outbreaks. It's important to remember that the 2015 HPAI outbreak was the largest U.S. animal disease outbreak to date. Not all avian influenza outbreaks will have such far-reaching consequences and impacts on agriculture.

You are visiting a turkey farm in Minnesota. The farm manager tells you that in the past week there has been an increase in the number of bird deaths. Most of the birds died suddenly without showing any signs of illness. The manager has also noticed that more turkeys seem tired and are not eating as much. These turkeys might have avian influenza. Avian influenza can be transmitted between birds by direct contact with infected birds, feces, or fluids from infected birds; indirect contact, such as by fomites contaminated with the virus; aerosol/droplet transmission; and ingestion of feces containing the virus.

Remember that some strains of avian influenza are reportable. If you suspect your birds have avian influenza, contact your veterinarian immediately. This disease must be reported to state and federal animal health officials.

A lab determined that the turkeys are infected with a strain of highly pathogenic avian influenza (HPAI) virus. This strain of HPAI is new to poultry in the United States. Possible ways that this new virus could have spread to poultry in the United States include it was created by the combination of two different influenza viruses, it was spread to poultry from wild birds, and it was brought here by poultry from another country.

H5N8 HPAI emerged in January 2014 in Asia. It affected millions of chickens and ducks, mainly in Japan and South Korea. In November 2014, the virus was found in commercial poultry and a wild duck in Germany. In December 2014, the virus was isolated from commercial poultry in the Netherlands, the United Kingdom, and Italy. Migrating wild birds probably carried the virus to Alaska. At some point a bird was infected with both the H5N8 HPAI virus and a North American LPAI virus at the same time. Those two viruses mixed together and made two new viruses. These viruses infected wild birds, backyard poultry, and commercial poultry in British Columbia, Washington, Oregon, Idaho, and California in late 2014 and early 2015. In March 2015, H5N2 (an HPAI subtype of one of the new viruses) was found in a backyard flock in Kansas, two commercial turkey farms in Missouri, and a commercial turkey farm in Arkansas. All of those flocks were depopulated and no other outbreaks occurred in those states. Also in March, the HPAI virus infected a commercial turkey flock in Minnesota. The virus became highly adapted to commercial poultry and quickly spread to many turkey farms in Minnesota. In April 2015, the first case of the HPAI virus in a commercial egg-laying facility occurred in northwest Iowa. The last case of the 2015 HPAI outbreak in Minnesota was detected on June 6, 2015. The last case of the 2-15 HPAI outbreak in Iowa was detected on June 16, 2015.

The turkey farm you visited is only one of many turkey and chicken flocks in the Midwest that has been infected with HPAI. Your veterinarian should contact state and federal health officials, who may decide to depopulate the flock. There is no specific treatment for avian influenza and HPIA is very severe, meaning that the state and federal officials will likely depopulate infected flocks.

Number of birds infected with HPAI in Minnesota in 2015

Over 4 million chickens from 5 different flocks in Minnesota were infected with HPAI and depopulated. Over 4.75 million turkeys from 104 different flocks in Minnesota were infected with HPAI and depopulated.

Number of birds infected with HPAI in Iowa in 2015

Over 31 million chickens from 37 different flocks in Iowa were infected with HPAI and depopulated. Over 1 million turkeys from 35 different flocks in Iowa were infected with HPAI and depopulated.

Even if animal diseases aren’t zoonotic, outbreaks have a huge impact on people. Many groups of people, including poultry exhibitors, fair organizers, poultry farm workers, processing plants, feed mills, retail stores, and consumers were affected by the HPAI outbreak in poultry.

Agricultural Impact

The United States lost about 3% of its annual turkey production and 10% of its laying hen population because of HPAI.

Prior to the outbreak, Iowa had 59.5 million laying hens, produced 16.5 billion eggs annually, and had 11 million turkeys. The outbreak resulted in a loss of 25 million laying hens and 1.1 million turkeys. In Iowa alone the economic impact was estimated to be $1.2 billion.

The economic loss in the entire United States was estimated to be over $3 billion.

There are more than 20,000 jobs in Iowa and 12,000 jobs in Minnesota associated with the egg industry.

Poultry workers were laid off because of the stop of production for depopulation, cleaning, and disinfection of facilities.

Other businesses (such as processing plants, feed mills, trucking companies, food production companies, and retail stores) were also affected.

In addition, many countries limited importation* of U.S. poultry and poultry products, including eggs.

*Importation: Bringing of goods into the country

Exhibition Impact

Several states banned poultry exhibitions during the HPAI outbreak in 2015 to reduce the spread of the disease. Iowa and Minnesota, along with many other states, placed bans on all live bird exhibitions. Some states banned waterfowl, out-of-state waterfowl, or out-of-state birds from exhibitions.

Instead of having live birds, some exhibitions provided activities to educate the public on the poultry industry. Many 4-H and FFA shows provided alternative projects, such as competing in showmanship classes with bird models or stuffed animals, for those who had been planning on showing poultry.

In the scenario, you have had contact with the turkeys on the farm in Minnesota. You should be concerned about becoming infected with HPAI since some strains of HPAI are zoonotic.

You want to visit another poultry flock but are worried about infecting them. You find out that this particular strain of HPAI that is infecting turkeys is not zoonotic. It is safe for you to be around other birds, but you should follow all biosecurity protocols, including wearing PPE. You also may need to spend a few days away from other poultry before visiting a new flock.

Public Health Impact

During the 2015 HPAI outbreak there were no human infections with the outbreak strains of the virus reported. However, some avian influenza viruses do have zoonotic and pandemic potential. The two most common zoonotic avian influenza viruses are the Asian H5N1 HPAI virus and the H7N9 LPAI virus that has caused disease in China and other countries.

People that have close contact with infected birds or tissues are at the highest risk of infection with avian influenza viruses. Some people are at a higher risk of developing severe complications from infections with avian influenza than others, including:

- Children less than 5 years of age
- Pregnant women

- People older than 65 years
- People with weakened immune systems
- People with certain medical conditions

Clinical signs of avian influenza in people include:

- Flu-like symptoms such as cough, sore throat, runny nose, headache, and tiredness
- Fever
- Aches
- Pink-eye

Avian influenza viruses are able to cause severe disease as well. Many of the past influenza pandemics have been a result of avian-origin influenza viruses.

Practices that will help prevent the spread of disease include avoid sharing equipment between farms, avoid traveling directly between poultry farms, and avoid sharing vehicles between farms. New birds can be brought onto the farm but they should be quarantined before they are mixed with the birds already there.

Avian Influenza Prevention for Poultry Owners

- Isolate birds from visitors and other birds
- Keep clothing, boots, equipment, cages, and vehicles clean
- Avoid sharing equipment with your neighbors
- Be able to recognize signs of disease in birds
- Report any unusual signs of disease or unexpected deaths in your birds to your veterinarian

Lesson 5: Influenza A Virus of Swine Origin (H3N2v) Outbreak Case Study

Lesson 5 will help you to learn more about Influenza A viruses of swine (IAV-S). IAV-S has caused disease in pigs and people at fairs in the past. However, taking simple precautions will help to keep both you and your pigs healthy so that you can continue to enjoy working with and showing your animals.

Learning Objectives

1) Describe influenza A viruses of swine and how they can be transmitted among animals and to humans.

2) Explain measures to protect swine from infection with influenza viruses.

3) Identify the public health impacts of the H3N2v virus outbreak.

4) Identify those persons most at risk for being infected with swine influenza A viruses and those with the highest risk of complications.

5) Explain the measures humans can take to protect themselves from influenza A viruses of swine when on farms or attending animal exhibitions.

Influenza A Virus of Swine Review

Background

Influenza A of swine origin (IAV-S) can infect pigs, turkeys, ferrets, mink, and people. IAV-S is sometimes called “swine flu.” H1N1, H1N2, and H3N2 are some of the zoonotic subtypes of IAV-S.

Variant viruses

Influenza viruses normally found in pigs are called “variant” viruses when they are found in people. Adding the letter “v” to the end of the virus subtype shows that it is a variant virus. One example of a variant virus is the H3N2v influenza virus. H3N2v was first detected in people in 2011.

Clinical signs

Clinical signs in pigs:

- Fever
- Tiredness
- Lack of appetite
- Weight loss
- Coughing
- Sneezing
- Nasal discharge
- Difficulty breathing

Clinical signs in people:

- Flu-like symptoms (such as fever, cough, sore throat, runny nose, muscle aches, headache, and tiredness).

Spread among pigs

The influenza virus is transmitted between pigs by droplets and contact with nasal discharge, either directly or indirectly.

Influenza can be spread from people to pigs. This happens more commonly than pigs spreading the disease to people.

Spread to humans

The influenza virus is thought to be spread to people when an infected pig coughs or sneezes and the droplets with influenza virus are spread through the air. If the droplets land on a person's nose or mouth, or are inhaled, the person can become infected. It is also possible that a person can get the virus from touching an object with the virus on it and then touching their nose or mouth.

Case Study

Now you will review a case study of an Influenza A of swine origin outbreak. This case study will help you learn about the impact of a disease outbreak and how to protect yourself and your animals.

You want to show pigs at the country fair. One of your pigs has a fever, nasal discharge, and is coughing. You should not bring that pig to the fair because a sick pig could infect other pigs or humans.

Three of your fellow exhibitors got sick a few days into the fair. They are all complaining of having a fever, coughing, being tired, and having red eyes. A doctor determines that all three of them have influenza.

The 4-H member could have gotten influenza from the pigs and other humans, as these are both potential sources of the influenza virus.

Since the three sick exhibitors all had contact with pigs, the fair veterinarian has decided to test all the pigs at the fair for influenza A virus of swine by swabbing each pig's nose.

Here are the results: 53% of the pigs at the fair tested positive for IAV-S. They are all infected with H3N2. The strain infecting the pigs was almost identical to the strain infecting people.

H3N2v Cases 2011–2017

H3N2v was first detected in people in 2011. In 2012, it was responsible for over 300 human cases, almost all of which were associated with fair attendance and contact with swine.

There were 12 total cases in 2011, 309 total cases in 2012, 19 total cases in 2013, 3 total cases in both 2014 and 2015, 18 total cases in 2016, and 62 total cases in 2017.

H3N2v Cases in 2012

Of the 309 cases of H3N2v in 2012, 5.2% of infected people were hospitalized. Of the sixteen people hospitalized, one died. 69% of people hospitalized were in one of the 'high risk' categories for influenza complications.

The median* age of infected people was seven years and the median age of hospitalized people was five years.

*Median—The middle number in a given sequence of numbers.

93% of infected people said they attended an agricultural fair. 95% of infected people said they had contact with pigs. Almost 67% of infected people said they had contact with pigs for multiple days.

Zoonotic diseases are more likely to be spread in a large gathering where many people and animals mix, such as at a fair.

Large numbers of people, large numbers of animals from different locations in close contact, people having contact with animals, and potentially contaminated environment, are all things about the environment that favors the spread of disease.

Risks for Infection with H3N2v

- Close contact with infected pigs
- Repeated exposure to pigs
- Large numbers of pigs in one area
- Large numbers of people in contact with pigs
- Potentially contaminated environment

All of your friends are now worried that they might get sick too. Any people who are in close contact with swine are at risk of being infected with H3N2v.

You practiced great biosecurity, and you and your pigs made it through the country fair without getting sick! The state fair is coming up, and you really want to show your pigs there. Due to the recent cases of H3N2v, upcoming swine exhibitions organizers could decide to not have pigs at the fair or they could take extra precautions to make sure that all pigs at the fair are healthy.

Exhibition Impact—Indiana, 2012

After several pigs and exhibitors tested positive for H3N2v following county fairs in 2012, the Indiana State Fair took precautions to prevent the spread of the virus.

Veterinarians and fair officials checked all pigs' temperatures before they came onto the fairgrounds. Normal pigs have a temperature of 101.5–103.5ºF. Veterinarians allowed only pigs

with a temperature less than 105ºF onto the grounds, and observed pigs throughout the entire fair. After finding 6 pigs ill, all pigs were sent home early.

Since then, exhibitions have increased prevention measures to minimize the risk of influenza transmission while still allowing swine to be present.

Exhibition Impact—Ohio, 2017

On July 12, 2017, a pig at an Ohio county fair tested positive for H3N2 influenza. The next day, more pigs began to show signs of influenza. The Ohio Department of Agriculture (ODA) placed a quarantine on the hog barn. ODA allowed only exhibitors and their parents into the barn to care for their animals. Because so many pigs were getting sick so quickly, the state veterinarian made the show terminal. Exhibitors were still able to show their healthy animals, but to protect other hog farms and people, all pigs at the fair, regardless of their intended purpose, were sent directly to slaughter and not allowed to return home.

A few ways fairs could minimize the risk of disease include require that pigs have an influenza vaccination before coming to the fair, immediately isolate and sick pigs from the healthy pigs, clean and disinfect the facilities between shows, and limit the amount of time pigs spend at the fairgrounds.

Some fairs are working more closely with veterinarians to monitor animals for signs of illness and to discuss vaccinating pigs for IAV-S before coming to the fair. Many exhibitions are focusing on making both the public and exhibitors more aware of the risks of disease spread. Exhibitions are encouraged to have rules in place regarding sick pigs and to have isolation areas available if animals do become sick.

Any long term swine exhibits (e.g., petting zoo or birthing demonstration) should be kept away from competition swine to prevent contact. If an exhibition has both breeding and terminal swine shows, the breeding show should be first or there should be a break between shows to clean and disinfect facilities. Pigs should only spend 72 hours at the exhibition to limit the spread of the virus between pigs.

People were worried about H3N2v because it is an influenza virus that has the ability to quickly change and possible spread person-to-person.

Public Health Impact

So far, most infections with H3N2v have been mild and similar to seasonal flu infections. As with the seasonal flu, serious illness is possible, especially in people with a high risk of flu-related complications. This H3N2v virus contains a gene from the 2009 H1N1 pandemic virus. This gene may allow the virus to infect humans more easily than swine influenza viruses typically can.

The people most likely to be infected with an influenza A virus of swine are those who are in close contact with infected pigs. Person-to-person transmission of IAV-S has been limited to date. However, because of the ability of influenza viruses to quickly change, it is possible that the virus could change to allow for more efficient person-to-person transmission.

Now that you know all about how H3N2v can impact exhibitions and public health, the next section will show you ways to help prevent the spread of influenza A of swine to keep you and your pigs healthy!

Prevention Measures to Protect Swine

Pigs do not commonly have influenza virus when they arrive at fairs. Movement and corralling of swine enhance disease spread between pigs. Therefore, most prevention measures focus on limiting pig-to-pig transmission while at the exhibition.

- Do not bring sick animals to an exhibition
- Avoid taking swine to multiple exhibitions
- Avoid mixing of animals from different farms
- Limit the amount of time your animals spend at an exhibition to 72 hours or less
- Avoid sharing equipment with other exhibitors
- Observe swine regularly for signs of illness
- Contact your veterinarian if your pig becomes sick
- Quarantine animals for at least 7 days before allowing contact with other animals after a show
- Clean and disinfect equipment, clothing, shoes, and vehicles that were at the exhibition before using them on your farm
- Avoid contact with pigs if you have flu-like symptoms to prevent spreading the illness to pigs

Prevention Measures to Protect People

- Avoid eating and drinking in animal areas
- Wash your hands often, especially before and after pig exposure
- Avoid sleeping in animal areas
- Avoid putting anything in your mouth while in swine barns
- Leave toys, pacifiers, cups, strollers, etc. outside of the animal areas
- Avoid pigs and swine areas if you are at a high risk of flu complications (children less than 5 years of age, pregnant women, people older than 65 years, people with weakened immune systems, and people with certain medical conditions)
- Avoid contact with pigs that look or act sick
- Take protective measures, such as wearing PPE, if you must come in contact with pigs that are known or suspected to be sick

Lesson 6: One Health Agencies and Careers

One Health is an approach that recognizes that human, animal, and environmental health are connected. The goal of One Health is to encourage the collaborative efforts of multiple disciplines locally, regionally, nationally, and globally to achieve the best health for people, animals, and our environment.

This lesson will introduce you to many agencies and careers that put One Health into practice. It also combines the information you've learned in the other lessons and shows how that knowledge can be used in a One Health approach to a zoonotic disease outbreak.

Learning Objectives

1) Identify agencies that promote animal and public health.

2) Recognize careers that are available in animal and public health.

3) Describe the education and responsibilities that different animal and public health jobs require.

Agencies Promoting Animal and Public Health

There are many different agencies that work to promote both animal and public health. These agencies can operate at the local, state, national level or global level. Agencies within each of these categories have the ability to impact populations at all levels. We will describe some of the common agencies that employ public health workers. However, people in the public health field can work in many different places, not just the ones listed here.

Local Agencies

Local Health Department

- Gives immunizations (vaccinations)
- Investigates reportable disease cases and outbreaks
- Provides food safety education
- Provides food service establishment (such as restaurant) inspections
- Offers nutrition programs

State Agencies and Personnel

State Health Department

- Conducts disease surveillance (keeping track of diseases throughout the state)
- Investigates outbreaks
- Prepares for and responds to public health emergencies

State Veterinarian

- Protects livestock, the livestock industry, and consumers by enforcing rules and regulations on elimination and control of certain animal diseases

- Licenses and inspects pet food plants and rendering plants* to ensure the safety of the finished products

*Rendering plants: Plants that process animal by-products into different materials

State Public Health Veterinarian

- Works on zoonotic disease control and prevention
- Coordinates vector control for disease spread by mosquitoes, ticks, and other insects
- Provides recommendations regarding rabies exposures
- Works in epidemiology including disease surveillance and outbreak investigation

National Agencies

Centers for Disease Control and Prevention (CDC)

- Monitors, detects, and investigates health problems
- Conducts research to improve disease prevention
- Recommends disease prevention strategies
- Develops and promotes public health policies
- Promotes healthy behaviors
- Protects Americans from pandemics and other public health threats

U.S. Food and Drug Administration (FDA)

- Ensures that food (except meat and poultry, which is regulated by the United States Department of Agriculture) is safe, wholesome, clean, and properly labeled
- Ensures that human and veterinary drugs and vaccines are safe, effective, and properly labeled
- Makes sure food for animals is safe, clean, and properly labeled

United States Department of Agriculture (USDA)

- Expands markets for agricultural products and supports economic development in other countries
- Develops new markets for agricultural products and activities
- Enhances food safety from farm to table
- Ensures that meat and poultry is safe, wholesome, and clean

Careers in Animal and Public Health

Epidemiologist

Epidemiologists investigate disease outbreaks. They are often called “disease detectives.” They work to find people with the illness, determine the cause, and make recommendations for preventing and controlling disease.

Epidemiologists are often employed by local and state health departments, CDC, FDA, and USDA. Depending on where they work, epidemiologists might need to obtain a master's degree, usually a Master of Public Health.

Public Health Laboratory Scientist

People who work in public health laboratories perform screening tests,* diagnostic tests,** and surveillance tests.*** They can aid in investigating disease outbreaks and research infectious diseases.

Laboratory scientists often work for government agencies. They usually have a bachelor's degree in a science-related field and sometimes a master's degree in public health.

*Screening Tests: Tests performed on a large number of people to identify those who have or are likely to develop a disease

**Diagnostic Tests: Tests performed to aid in the detection of disease

***Surveillance Tests: Tests performed to monitor the occurrence of a disease in a population

Nurse

Nurses work with other healthcare providers to monitor health conditions, administer medicine, and provide care for patients. One specialty type of nurse is a public health nurse.

Public health nurses work to improve the health of the community. They help to identify health issues such as improper diets, sexually transmitted diseases, and substance abuse, within a community and come up with ways to address these issues. Public health nurses are employed by local health departments, businesses, and schools. Depending on where they work, public health nurses may need either an associate's degree or bachelor's degree in nursing.

Physician

Physicians are responsible for the health of people. Some of their duties include diagnosing illness, prescribing medications, and developing treatment plans. Some specialized physicians will also perform surgery.

To be a physician, you need to have a Doctor of Medicine (M.D.) or a Doctor of Osteopathic Medicine (D.O.) degree. Most physicians also have bachelor's degrees.

Veterinarian

Veterinarians are responsible for the health of animals and public health. They perform many duties including giving vaccinations, diagnosing and treating illnesses and injuries, and doing surgery. Veterinarians can also conduct research, work in food safety, or in public health.

Veterinarians need a Doctor of Veterinary Medicine degree (DVM or VMD). Most veterinarians also have a bachelor's degree.

Public Health Veterinarian

A public health veterinarian is a veterinarian who focuses on the interaction between animal and human health. They can work in many different fields, including food safety, disaster preparedness efforts, zoonoses prevention, epidemiology, drug and vaccine safety, and occupational health.

Public health veterinarians are employed by local and state health departments, USDA, CDC, FDA, the National Park Service, private companies, industry groups such as the National Pork Board, and many other agencies and organizations. Public health veterinarians need a Doctor of Veterinary Medicine degree and a Master of Public Health degree.

Roles in a Zoonotic Disease Outbreak

Although all of these careers have a wide variety of responsibilities, we will now talk about the role that each might play in a zoonotic disease outbreak situation. The next several slides provide an example of a One Health approach to a disease outbreak. However, during a disease outbreak, many people will step into other roles and provide assistance wherever needed. Animal health and human health skills are often linked and can be used in a variety of settings.

Zoonotic Disease Outbreak Scenario

A poultry veterinarian visits a laying hen facility in northwest Iowa. The farm manager is complaining that several of his birds died suddenly in the past couple of days. T The veterinarian is worried the chickens have avian influenza. Since she knows that this is a potentially zoonotic disease, the vet discusses the risks for human infection with the farm manager. When she learns that three of the farm employees are out sick with flu-like symptoms, she encourages them to visit their physician. The vet reports the disease to human and animal health officials. The veterinarian sends samples from the chickens to a laboratory. Laboratory scientists decide the chickens died from a zoonotic strain of avian influenza.

As advised by the veterinarian, the sick farm employees go to their physician. The physician sends samples out to a laboratory and finds out that the employees are infected with the same strain of avian influenza as the chickens. The physician instructs the farm employees on the best treatment to help them get healthy again. She also warns them about the risks of zoonotic disease transmission. The physician communicates her findings with the state public health veterinarian and other health officials.

Avian influenza has now been detected on multiple laying hen farms in Iowa. All of the birds on infected premises need to be depopulated. The public health veterinarian provides recommendations for animal disease responders who will help with the depopulation and cleaning and disinfection of the facilities. State and federal public health veterinarians also try to determine the cause of the outbreak. In addition, they work to develop a plan to control and prevent any further illness.

Animal and human laboratory scientists receive samples from the veterinarian and the physician. They determine that both the chickens and farm employees are infected with the same strain of avian influenza. As avian influenza continues to spread, the laboratory scientists work with

others to determine the case of the outbreak. They also try to find the best treatment for those infected with the disease.

A public health nurse in northwest Iowa receives the disease reports of avian influenza. She interviews other patients who have flu-like symptoms and collects samples to send to the laboratory. The nurse also provides information to her patients on avian influenza to educate them on the risks and best measures to prevent getting the disease.

An epidemiologist works with all the other health officials to determine the cause of the disease and how it is spreading. The epidemiologist identifies cases by using a case definition he creates. A case definition is a set of standard criteria for deciding whether an individual should be classified as having the disease. The epidemiologist describes the outbreak in terms of time, place, and person. This information is used to help develop a plan to control and prevent additional illness.

Solve The Outbreak Scenario Game

There is an illness going around your hometown and it's up to you to figure out what disease is causing everyone to be sick. You can visit with people who work in animal and public health to gather clues.

Physician's Office

Zoonoses are disease that are spread among animals and between animals and people.

I have had five patients visit me this week complaining of very similar symptoms. All of the patients had diarrhea. Four of them had stomach pains and two had a fever.

Epidemiologist's Office

Aerosol/droplet transmission is defined as "droplets containing pathogens travel through the air and are inhaled by another animal or human."

I have interviewed all of the sick patients and found out that they have several things in common. All patients are under ten years of age, attend the same school, and are in the same class. The class has a pet turtle that the students help take care of. The patients also all visited a petting zoo with their families recently. At the petting zoo, all of the children interacted with a dairy cow, goats, and a pony.

Veterinarian's Office

Children less than 5 years of age, pregnant women, people 65 years and older, and people with weakened immune systems are at an increased risk of developing complications from illness when visiting an animal exhibition.

I work closely with the petting zoo in town. None of their animals have shown any signs of illness. One of the patients has a dog at home. Another owns a cat. I am the vet for both of these pets. The dog and cat were healthy at their last appointments and their owners haven't noticed any signs of sickness since then.

Laboratory Scientist's Office

Epidemiologists are often called "disease detectives."

I received samples from the animals that the children came in contact with. I also had samples from the sick children. The children were infected with a bacteria that was also found in the samples of the dairy cow at the petting zoo and the dog of one of the children. This is a bacteria that usually doesn't cause illness in animals but that animals can spread to humans.

Public Health Veterinarian's Office

During the 2012 H3N2v influenza outbreak, young children were most commonly infected. The median age of people infected with H3N2v was 7 years.

I know that animals can spread diseases even if they aren't showing any clinical signs, so I collected samples from all of the animals that the children had contact with and sent them to the lab. I also interviewed the sick children and their parents. The parents don't think that their children washed their hands while at the petting zoo and think it's possible that they could have come in contact with manure.

Nurse's Office

Avian influenza is most commonly spread to people through close contact with infected birds.

I received disease reports from the physician who treated the children and wanted to educate my clients on the outbreak and how to prevent future illness. My recommendations included washing hands before and after animal contact, washing hands before eating, and avoiding contact with manure.

Case File—Solve the Case

Remember that to solve the case you will need to know what disease the people have, the animal that spread the disease, and the location where people were infected. Are you ready?

Disease—*E. coli*

Animal—Cow

Location—Petting zoo

The people were infected with *E. coli*, which they got from the dairy cow at the petting zoo.

Additional Resources

Animal and Plant Health Inspection Service website. Biosecurity for birds. Available at: https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/avian-influenza-disease/birdbiosecurity. Accessed Jul 15, 2016.

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