Content is drafted in outline form. All content will be incorporated into an interactive, online format with visual aids, photos, or other media to improve the learning experience.

Module 1: Introduction to Influenza, Zoonoses, and Disease Risks (20–25 min)

- Learning Objectives
    - Define zoonoses.
    - Describe the importance of influenza and other zoonoses.
    - Recognize common zoonotic diseases that might affect people and animals at fairs or exhibitions.
    - Identify risk factors for zoonotic disease infection.

- What are zoonoses or zoonotic diseases?
    - Zoonoses are diseases of animals that can be spread to humans.
    - Examples of zoonoses by species

	Cats	Cattle	Dogs	Goats	Horses	Poultry	Sheep	Swine
Campylobacteriosis	✓	✓	✓			✓	✓	✓
Contagious ecthyma				✓			✓	
Cryptosporidiosis	✓	✓	✓	✓	✓		✓	✓
E. coli		✓	✓			✓	✓	✓
Influenza	✓		✓		✓	✓		✓
Q fever	✓	✓	✓	✓	✓		✓	✓
Rabies	✓	✓	✓	✓	✓		✓	✓
Ringworm	✓	✓	✓	✓	✓	✓	✓	✓
Salmonellosis	✓	✓	✓	✓	✓	✓	✓	✓

    - Endemic vs. emerging
        - Definition of endemic: A disease regularly found among a particular population or in a certain area, including both zoonotic and non-zoonotic diseases
            - Example: 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 virus. Reservoirs are animals that continuously have the disease (but may not be showing it) and can spread it to others. Rabies can infect all mammals, including humans. Rabies is spread by the bite of an infected animal whose saliva (spit) contains the virus. Signs include behavior changes, leg paralysis, drooling, and difficulty swallowing. Rabies has a very high death rate, also called a mortality rate. Almost 100% of cases result in death.
            - Example: Avian influenza
                - Avian influenza sometimes called “bird flu”, is caused by influenza viruses. Influenza viruses are endemic in wild bird populations. The wild birds are asymptomatic (meaning that they do not show signs of illness) but act as reservoirs for the disease. Wild birds can be a source of the virus for domestic poultry, like chickens and turkeys, if they are in close contact.

- Definition of emerging: A disease that has appeared in a population for the first time, or that had previously existed but is rapidly increasing in incidence (the number of new cases) or geographic range (area where the disease can be found)
    - 75% of emerging diseases in humans are zoonotic diseases
    - Example: Avian Influenza H5N1
        - H5N1 avian influenza virus re-emerged in Southeast Asia in 2004. H5N1 was considered to be a highly pathogenic avian influenza (HPAI) virus, meaning that it causes more severe disease in poultry than a low pathogenic avian influenza (LPAI) virus. Over 100 million birds died or were culled and destroyed as a result of H5N1. There were over 600 cases of H5N1 influenza in humans. About 50% of the human cases resulted in death.
    - Example: West Nile Virus
        - West Nile appeared in the United States for the first time in 1999. There were 62 human cases with 7 deaths. Zoo birds, crows, and horses were also infected. Birds are the primary reservoirs for West Nile Virus. It is spread by mosquitoes. After feeding on infected birds, the mosquitoes can spread the virus to humans, horses, and other animals. Humans and horses are considered dead-end hosts, meaning they cannot spread the virus to others. Since its emergence in the United States, the virus has become established here and continues to cause outbreaks in human and horse populations. West Nile is now endemic in North America.

- Why should we worry about zoonoses?
    - Influenza: Influenza viruses have the ability to cause very severe disease in humans and animals. The virus can also 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. Influenza A viruses are classified into subtypes based on two surface proteins, the HA (hemagglutinin) and the NA (neuraminidase). These subtypes are used for naming viruses, e.g., H1N1. Different subtypes vary in their zoonotic risk and ability to cause disease. Influenza viruses can infect many species including dogs, cats, horses, humans, pet birds, poultry, and swine. The viruses of most zoonotic concern are influenza viruses of avian and swine origin. Influenza A viruses can undergo rapid genetic changes which then allow them to infect new species. One way an influenza virus can change is through a process called reassortment. Reassortment occurs when two or more influenza viruses infect a single host and the viruses swap genetic information. The new virus will have some gene segments from each of the parent viruses.
        - Some people are at a higher risk for developing illness from influenza. High risk groups include:
            - Children under the age of 5 years
            - People over the age of 65 years
            - People with weakened immune systems
            - People with long term illnesses
            - Pregnant women
            - People who are in close contact with animals
            - People who live in crowded areas

- Animal health: Animals with zoonotic diseases may appear healthy on the outside, but have decreased weight gain, poor performance, or decreased production (milk or eggs). Some animals will have ill thrift and look like "poor doers." Some zoonoses can even cause severe disease in animals. Preventative measures such as vaccinations, parasite control, and insect control can help keep our animals healthy. These measures can also help minimize the spread of disease from animals to humans. **Animals suspected of having a zoonotic disease should not be taken to any animal exhibition, such as a show or fair.**
- Personal health: Animals with zoonotic diseases may become sick, 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 diseases. People with weakened immune systems, such as children, the elderly, and pregnant women, are also at an increased risk. It is estimated that zoonoses are responsible for 2.5 billion cases of human illness and 2.7 million human deaths worldwide per year. (Source: https://cgspace.cgiar.org/bitstream/handle/10568/21161/ZooMap_July2012_final.pdf)
- Public health: Some zoonoses can cause widespread and severe disease in the human population.
    - Example: Influenza pandemics (disease outbreaks that occur over a wide area and affect a large number of people) of avian origins
        - 1918-1919 Spanish Influenza H1N1 Pandemic: It is estimated that one third of the world's population was infected with 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.
        - 1957-1958 Asian H2N2 Pandemic: The H2N2 virus responsible for this influenza pandemic had gene segments of both avian and human origin. The pandemic resulted in the death of almost 70,000 people in the United States and over 1 million people worldwide.
        - 1968-1969 Hong Kong H3N2 Pandemic: The H3N2 influenza virus 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. H1N1 caused illness in over 200 countries and resulted in over 18,000 deaths. This virus is now considered a regular human virus that circulates seasonally.
- Food safety: Sometimes, food we eat can make us ill. 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 on the farm, at the slaughter plant or during processing, and in the home. 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 pasteurization of milk. The pasteurization process uses heat to destroy bacteria, making the milk safer to drink. Contamination can occur at the slaughter plant if an animal that is sick is slaughtered and enters the food supply. This is prevented by USDA employees that inspect the animals for signs of disease before slaughter. Many foodborne illnesses are the result of improper food handling at home or in restaurants. Contamination with

pathogens can result from not washing hands properly, not thoroughly cooking foods, and not storing foods at the proper temperature.

- Zoonoses affecting animals during exhibition and the public
    - Avian Influenza: Avian influenza is sometimes called bird flu. Some strains are considered reportable or notifiable diseases, meaning that they must be reported to local, state, or federal health officials when diagnosed. It infects wild birds, pet birds, poultry, and occasionally mammals. Avian influenza viruses are classified as highly pathogenic avian influenza (HPAI) or low pathogenic avian influenza (LPAI). The classification is based on genetic characteristics of the virus and severity of disease in domestic poultry such as turkeys and chickens. Avian influenza viruses usually do not cause disease in wild waterfowl such as ducks and geese. HPAI causes severe disease in domestic poultry and LPAI viruses cause milder disease in these species. HPAI viruses have been eliminated from domestic poultry in the United States. However, they could be reintroduced by poultry from other countries, wild birds, or pet birds. Most humans get avian influenza from close contact with infected birds. Person-to-person transmission is possible but very rare.
        - Clinical Signs in Domestic Poultry: Depression, ruffled feathers, lack of appetite, watery diarrhea, swollen combs and wattles, loss of egg production, paralysis, sudden death
        - Clinical Signs in Humans: Swelling and reddening of tissues around the eyes, fever, aches, flu-like symptoms (such as fever, cough, sore throat, runny nose, muscle aches, headache, and tiredness).
    - Influenza A of swine origin: Influenza A of swine origin (IAV-S) can infect pigs, turkeys, ferrets, mink, and humans. Most human cases of IAV-S have involved people in close contact with infected pigs. Person-to-person transmission is also possible but not common. Influenza viruses normally found in pigs are called “variant” viruses when they are found in people.
        - Some subtypes of IAV-S: H1N1, H1N2, H3N2
        - Clinical Signs in Pigs: Fever, tiredness, lack of appetite, weight loss, coughing, sneezing, runny nose, labored breathing
        - Clinical Signs in Humans: Flu-like symptoms such as fever, cough, sore throat, runny nose, muscle aches, headache, and tiredness.
    - Q fever: Q fever is caused by *Coxiella burnetii* bacteria. It is a reportable disease. Q fever can affect sheep, goats, cattle, and humans. Humans usually get Q fever by breathing dust that contains the bacteria or by direct contact with infected animals. This often happens while assisting with birthing of newborn animals.
        - Clinical Signs in Animals: Abortion (miscarriage), infertility (not being able to become pregnant), small or weak offspring
        - Clinical Signs in Humans: Fever, chills, night sweats, headache, weakness, chest pains
            - In pregnant women: Premature birth, miscarriage
    - Salmonellosis is caused by *Salmonella* bacteria. It can infect many animals including poultry, swine, reptiles, cattle, pigs, and horses. Humans can get *Salmonella* through direct contact with feces from infected animals. They can also get it from eating improperly cooked food. Raw poultry, eggs, and raw milk are common sources.
        - Clinical Signs in Animals: Often asymptomatic, diarrhea, stomach pain, fever, dehydration
        - Clinical Signs in Humans: Diarrhea, fever, cramping
    - *E. coli:* One very dangerous strain of *E. coli* is *Escherichia coli* O157:H7 bacteria. Animals are carriers of the bacteria but typically do not become ill. Animals that carry the

bacteria are cattle, sheep, pigs, dogs, and poultry. Humans can get *E. coli* from direct contact with feces of infected animals or from eating food that contains the bacteria. Raw or undercooked ground beef is a common source.

- Clinical Signs in Humans: Stomach pain, cramping, watery or bloody diarrhea
  - Hemolytic Uremic Syndrome (HUS) is a disease that sometimes follows a foodborne *E. coli* illness. It is a life-threatening condition that most often affects children. It causes acute kidney failure.

- Ringworm (Dermatophytosis): Ringworm is caused by many species of fungi. It can affect dogs, cats, cattle, sheep, goats, pigs, horses, birds, and humans. In human medicine it is sometimes called a 'tinea' infection.
  - Clinical Signs in Animals: Hair loss, scaling, crusts, redness
  - Clinical Signs in Humans: Itchiness, swelling, redness, scaling
- Contagious Ecthyma (Orf, Scabby Mouth, Sore Mouth, Contagious Pustular Dermatitis): Contagious ecthyma is caused by a virus. It affects sheep, goats, alpacas, and camels. Humans can also become infected.
  - Clinical Signs in Animals: Small raised bumps, sores, and blisters found on the lips, nose, ears, and eyelids
  - Clinical Signs in Humans: Usually a single, small, firm, red to blue skin sore that lasts 3 to 6 weeks
- Cryptosporidiosis: Cryptosporidiosis is caused by the parasite *Cryptosporidium parvum*. It can affect all mammals. It is more common in young animals. Humans most often get cryptosporidiosis by eating food or drinking water that contains the parasite, or by contact with objects that have been contaminated with feces.
  - Clinical Signs in Animals: Diarrhea, poor appetite, weight loss
  - Clinical Signs in Humans: Watery diarrhea, stomach cramps, poor appetite
- Campylobacteriosis: Campylobacteriosis is caused by *Campylobacter jejuni* bacteria. It affects cattle, sheep, poultry, dogs, cats, and pigs. Humans most commonly get campylobacteriosis from eating raw or undercooked meats or raw eggs or drinking raw, unpasteurized milk. They can also get it from eating food or drinking water contaminated with feces. It can be spread through direct contact with infected animals as well.
  - Clinical Signs in Animals: Diarrhea, decreased appetite, vomiting, fever
  - Clinical Signs in Humans: Diarrhea, fever, vomiting, stomach pain, headache, muscle pains

Module 1 Interactive Ideas:
-Interactive Timeline: Emerging Diseases
-Matching: Disease to species
-Matching: Transmission to humans (Salmonella to eating raw poultry, Swine influenza to a person touching a sick pig, etc.)
-Guess the disease based on a short case description – Bingo gamification with tablet/computer led by instructor
-Examples of zoonotic diseases by species: word clouds in the shape of the affected animal species, animated stacking bar graph or similar
-Interaction to show how virus reassortment occurs

Module 1 Supplemental Material:
-Disease Specific Handouts (Fast Facts)
-Worksheet to compare different diseases (chart format)
-PowerPoint slides

Module 2: Zoonotic Disease Transmission (10–15 minutes)

- Learning Objectives
  - Explain the five routes of disease transmission.
  - Give an example of a zoonotic disease that can be transmitted by each route.
  - Describe how influenza is transmitted among animals and to humans.
  - Explain ways to prevent each route of transmission.

- Five Routes of Disease Transmission
  - Direct contact: Spread of pathogens through contact with an infected animal, its tissues, or its fluids by way of open wounds, mucous membranes (such as the lining of the digestive, respiratory, or urinary tracts), or scraped skin
    - Diseases: Influenza, Q fever, *Salmonella*, *E. coli*, ringworm, contagious ecthyma, cryptosporidiosis, campylobacteriosis
    - Influenza A of Swine Example: A 4-Her sleeps in the pen with her four pigs during the fair. One of the pigs is infected with Influenza A. By the end of the fair, the 4-Her and two other pigs are also infected with influenza.
    - Ways to prevent direct contact transmission:
      - Isolate sick animals
      - Wear gloves when working with sick animals
      - Wash your hands after having contact with animals
  - Aerosol: Droplets containing pathogens travel through the air and are inhaled by another animal or human
    - Diseases: Influenza, Q fever
    - Avian Influenza Example: A turkey with avian influenza is sneezing. Nearby turkeys and humans inhale the droplets in the air and become infected as well.
    - Ways to prevent aerosol transmission:
      - Increase distance between sick animals and healthy animals and humans
      - Have respiratory protection when working with sick animals
      - Provide fresh air to animals and humans
      - Decrease humidity and odor build up in barns
  - Fomites: Spread of pathogens through contact with objects or surfaces contaminated by an infected animal
    - Examples of fomites: boots, cages, needles, bedding, clothing, vehicles, restraint devices
    - Diseases: Influenza, ringworm, contagious ecthyma
    - Ringworm Example: A horse has ringworm on its face. The halter rubs the area with ringworm and picks up the fungus. Then the horse's owner touches the halter and becomes infected with ringworm.
    - *Salmonella* example: A 4-H member takes care of a sick bottle calf and does not remove boots before entering the home. A small child crawls across the floor where the dirty boots had been and gets *Salmonella*.
    - Ways to prevent fomite transmission:
      - Clean and disinfect any equipment used with sick animals or animals with skin lesions
      - Dispose of or wash boots and clothing after animal contact
  - Ingestion (Oral): Ingestion of disease causing agents from contaminated food, water, or by licking or chewing contaminated objects in the environment
    - Diseases: Q fever, cryptosporidiosis, campylobacteriosis, *Salmonella*, *E. coli*
    - Cryptosporidiosis Example: *Cryptosporidium parvum* is shed in the feces of an infected calf. A person is infected after cleaning its pen and not washing their hands before eating.

        - Ways to prevent oral transmission:
            - Wash your hands after contact with animals
            - Wash your hands after cleaning pens or contact with manure
            - Wash your hands before preparing food
            - Cook meat thoroughly
            - Store food at the appropriate temperatures
    - Vectors: Transfer of a pathogen from an infected animal to another animal or a human by an insect
        - Diseases: Lyme disease, West Nile virus, Q fever
        - West Nile Example: A bird (the reservoir host) is bitten by a mosquito. While feeding on a human, the mosquito transfers the virus to the human.
        - Ways to prevent vector transmission:
            - Use insect control products
            - Check and treat animals for parasites

- Watch the Routes of Transmission Video: https://www.youtube.com/watch?v=ABk6agIE-bs

- Epidemiological Triangle: The epidemiological triangle is used to study infectious diseases and how they spread. For an animal or human to be infected with a specific disease, all three corners of the triangle (agent, host, and environment) must favor the spread of that disease.
    - Agent: The agent is the cause of disease. Disease-causing agents can be a virus, bacteria, fungi, or parasite.
    - Host: The host is the animal or human that is exposed to and carry the disease. 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 disease to be transmitted.

Module 2 Interactive Ideas:
-Matching Games—definition to route, picture to route, disease to route
-Disease Life Cycles: drag and drop correct word/picture into reservoir, vector, host, etc.
-Determine how disease was spread: provide a short description of a disease and have them decide how it was likely spread

Module 2 Supplemental Materials:
-Routes of Disease Transmission Handouts on CFSPH website
-Hands on disease transmission activity with GloGerm
-PowerPoint slides

Module 3: Zoonotic Disease Prevention/Biosecurity (15–20 minutes)

- Learning Objectives
    - Define biosecurity.
    - Explain the importance of biosecurity in zoonotic disease control.
    - Recognize the ways diseases might spread to you or your animals on the farm and at exhibitions.
    - Describe measures to prevent zoonotic disease spread to you and your animals on farms and at exhibitions.

- Biosecurity Basics

- Biosecurity is a series of practices designed to prevent the introduction and spread of diseases. There are two parts to biosecurity. The first is keeping disease from entering your area. The second is preventing disease already present from spreading to other locations. Good biosecurity can help keep you and your animals healthy.
- Ways that disease-causing organisms can enter a facility:
    - Vehicles and equipment
    - Bedding
    - Wildlife, Rodents, Birds, Vectors
    - Humans (employees, veterinarians, visitors)
    - Airborne
    - Feed, Water

- Biosecurity on the farm
    - Farm Entrance and Perimeter
        - Limit access to the farm.
            - Limit visitors and traffic on your farm.
            - Have only one gated entrance to the animal areas on your farm.
            - Lock gates to prevent unwanted human or animal entry.
        - Maintain fences to keep your animals in and others out.
        - Limit contact between your animals and outside animals.
            - Neighbors' livestock
            - Rodents and wildlife
            - Birds
            - Dogs and cats that are free to roam
        - Post signs at the farm entrance to inform visitors of procedures to follow on your farm.
    - People and Vehicles
        - Keep a record of visitors who enter and leave the farm.
        - Monitor and record traffic traveling on and off farm.
        - Require that all individuals wash hands with soap and warm water before and after animal contact.
        - Require that employees who have contact with livestock at other locations use the same biosecurity measures as visitors on your farm.
        - Educate yourself and teach others to recognize and report diseases.
        - Take steps to prevent disease spread from your neighbor's farm to 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 washed with warm water and soap, rinsed, disinfected, and rinsed again before using it with animals from your farm.
        - Prevent off-farm vehicles from driving in areas where animals travel.
        - Do not let visitors near livestock areas or handle animals.
    - Personal Protective Equipment (PPE)
        - Wear gloves when working with animals.
        - Wear clean boots in animal areas.
            - Have a boot bath or trash at entrances and exits.
        - Wear clean protective outer clothing when working with animals.
    - Animals
        - Individually ID every animal and keep health records on every animal.
        - Maintain accurate records of animal movement.

        - Review and update your vaccination and treatment plans with your veterinarian every year, or whenever a change in your management occurs.
        - Inspect animals at least daily for signs of illness.
        - Clean equipment, boots, and change clothing between animal groups with different health statuses, including those in different age groups or pregnancy statuses.
        - Quarantine all new or reintroduced animals to prevent exposing your herd to different pathogens.
        - Immediately isolate sick animals to minimize disease exposure of others in the herd.
        - Use separate facilities, equipment, and caretakers to handle the isolated animals and visit sick animals last when working with multiple groups of animals.
        - Remove dead animals as quickly as possible. Dispose of carcasses in a safe manner and in a way that prevents wildlife and rodent attraction. Do not allow rendering trucks to come near animal housing.
    - 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 limit access by pests.
    - Cleaning and Disinfection
        - Step 1: Cleaning
            - Remove all organic matter (e.g., manure, dirt, feed)
            - Wash and rinse
        - Step 2: Disinfection
            - Use an EPA-approved disinfectant
            - Be sure to use the proper concentration
            - Apply for the proper contact time
            - Rinse
    - Human Health: People who live or work on farms with animals are at risk of infection with zoonotic diseases. Many of the biosecurity practices listed not only protect animal health but also prevent the spread of zoonoses to humans. There are also other measures that can be taken to help prevent disease spread to humans. The NIOSH (National Institute for Occupational Safety and Health) Hierarchy of Controls is a system that can be used to reduce or eliminate exposure to hazards. Actions at the top of the hierarchy are the most effective methods. Actions at the bottom of the hierarchy are the least effective (include pyramid graphic).
        - Elimination: Physically remove the hazard
        - Substitution: Replace the hazard
        - Engineering Controls: Isolate people from the hazard
            - Animals showing signs of illness should be put in isolation where they will have limited contact with other animals and humans.
            - Restrict the number of people that have contact with sick animals.
        - Administrative Controls: Change the way people work
            - People should not eat or drink in areas where there are animals.
            - Require that people wash their hands after animal contact.
            - Cover any open wounds when working with animals.
        - PPE: Protect the worker with Personal Protective Equipment
            - People who must be in contact with sick animals should wear gloves, protective outerwear, and respiratory protection.

- People should wear gloves when handling feces, urine, or body fluids such as blood and nasal discharge.

- Biosecurity at the fair/exhibitions (Source: http://nasphv.org/Documents/AnimalContactCompendium2013.pdf and http://www.usaha.org/Portals/6/news/SwineExhibitions2015.pdf)
    - About 200 human disease outbreaks involving animals in public settings were reported to the CDC between 1996 and 2002.
    - It is very important to work with your veterinarian before any exhibition. All animals should receive appropriate preventative care before being brought to a public setting. This includes vaccinations and parasite control. Only healthy animals should be brought to public settings. Any sick animals need to be removed from areas of human contact. If an animal becomes sick at the fair, the fair veterinarian should be notified. The animals of primary concern are those with diarrhea or respiratory illness.
    - Inform visitors that the following groups of people are at an increased risk of illness:
        - Children under five years of age
        - People 65 years of age or older
        - Pregnant women
        - People with weakened immune systems
    - Facilities should have specific non-animal areas, animal areas, and transition areas.
        - Non-animal areas are areas where visitors have no contact with animals. Food and beverages can be allowed in these areas. Hand washing stations should be available. The hand washing stations should be accessible to all visitors.
        - Transition areas are those located between animal and non-animal areas. In these areas, signs should be posted telling visitors that they are about to enter an animal area, and that things like food, strollers, or toys are not allowed in the animal area. The signs should notify visitors of the risks associated with animal contact. They should also tell visitors to wash their hands when leaving the animal area. The signs should show the correct hand washing procedure. They should be made available in multiple languages if necessary. Hand washing stations should also be made available here.
        - Animal areas are those where people may have animal contact. Manure and soiled bedding should be promptly removed from these areas. The public should not have direct contact with manure or dirty surfaces. Feed should be covered and stored in sealed containers. There should be no strollers, toys, etc. brought into an animal area. Eating and drinking should not be allowed in this area. There should also be no sleeping in animal areas. After the animals leave, these areas need to be cleaned and disinfected.
    - Measures to keep animals healthy while at an exhibition:
        - Avoid co-mingling of animals from different farms.
        - Do not share equipment with other exhibitors.
        - Keep visitors from touching the animals.
        - Clean pens and manure frequently.
        - Observe animals regularly for signs of illness.
        - Isolate any sick animals from healthy animals.
        - Quarantine animals after returning home from a fair/exhibition. Watch for illness for 7 days. Clean and disinfect equipment, clothing, shoes, and vehicles that were at the fair.

- Summary of basic zoonotic disease prevention strategies: W.A.S.H.
    - W: Wash

        - Hand washing is one of the most effective ways to prevent disease.
        - Use warm water and soap for a minimum of 20 seconds.
        - Use hand sanitizer when hands are not visibly dirty.
        - Wash your hands before: Preparing food, eating
        - Wash your hands after: Having contact with animals, cleaning up animal waste or enclosures
    - A: Avoid
        - Avoid wildlife
            - Wildlife 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 or items in animal areas.
            - Wear gloves and respiratory protection when in contact with sick animals
            - Use insect control products in barns
        - Use proper food preparation procedures
            - Wash hands before preparing food.
            - Do not eat raw or undercooked meat or eggs or consume raw or unpasteurized dairy products.
            - Cook foods thoroughly to a temperature of at least 160°F.
            - 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.

Module 3 Interactive Ideas:
-Biosecurity scenarios on-farm and at the fair
-Cleaning and disinfection simulation
-Choosing good/bad biosecurity photos/descriptions
-Fomites- what about a “paper doll” farmer/4Her/etc. that has to get “dressed” and grab the appropriate non-fomite items to get into the truck or go through a door or something, picking the dirty boots and hat is wrong; clean clothes or applying soap to boots before taking them is right
-Make the W.A.S.H. list interactive

Module 3 Supplemental Materials:
-W.A.S.H. Handout (Modified to be more applicable to livestock/exhibitions)
-Farm Signs: Farm Visitor Policy, Animal Contact, etc.
-Hands on biosecurity activity
-Cleaning and Disinfection Protocol Handout
-Hand washing signs
-PowerPoint slides

Module 4: HPAI Outbreak, 2014–2016 (10 minutes)

- Material in this module will be delivered as an interactive case study.

- Learning Objectives
  - Describe avian influenza and how it is transmitted among animals and to humans.
  - Explain the impact that an HPAI outbreak has on animal agriculture.
  - Identify the potential public health impacts of an HPAI outbreak.
  - Identify those persons most at risk for avian influenza.
  - Explain how and why animal exhibitions might be impacted by HPAI.

- Avian influenza infects wild birds, pet birds, poultry, and occasionally mammals. Avian influenza viruses are classified as highly pathogenic avian influenza (HPAI) or low pathogenic avian influenza (LPAI). Their classification is based on severity of disease and genetic characteristics of the virus. HPAI viruses usually cause severe disease in domestic poultry and LPAI viruses cause milder disease.
  - Wild birds that are infected with avian influenza usually do not show signs of disease. Domestic birds infected with avian influenza may have the following clinical signs: depression, reduced feed and water intake, coughing, sneezing, decrease in egg production, diarrhea, and sudden death. There is no specific treatment for avian influenza. Due to the seriousness of the disease, birds with HPAI viruses are usually depopulated (large numbers of animals are destroyed quickly and efficiently).
  - Spread of avian influenza among wild bird populations is largely through ingestion. Birds will eat feces of infected birds that contain the virus and then become infected themselves. This can also occur in domestic poultry. Due to the closeness of birds in commercial poultry facilities, aerosol (through the air) is another common route of spread. Fomites (contaminated objects or surfaces) can spread avian influenza as well. Zoonotic avian influenza is usually transmitted to people when they are in close contact with infected birds or tissues.

- 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 laying hens, turkeys, and pullets were infected with or exposed to the virus and depopulated. Over $900 million was spent on response efforts.

- Outbreak Timeline
  - 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.
  - It is thought that this virus was carried to Alaska by migrating wild birds. At some point a bird was infected with both the H5N8 HPAI virus and a North American LPAI virus at the same time and reassortment, or swapping of the viruses' genetic material, occurred. The two new viruses that resulted were reported in wild birds, backyard poultry, and commercial poultry in British Columbia, Washington, Oregon, Idaho, and California in late 2014 and early 2015.

- In March 2015, one of these viruses, a HPAI subtype, was found in a backyard flock in Kansas, two commercial turkey farms in Missouri, and a commercial turkey farm in Arkansas. All flocks were depopulated and no other outbreaks occurred in those states.
- Also in March 2015, EA/AM H5N2 HPAI was detected in a commercial turkey flock in Minnesota. The virus became highly adapted to commercial poultry and quickly spread throughout many turkey farms in Minnesota.
- In April 2015, the first case in a commercial layer facility occurred in northwest Iowa.
- During 2015, 31 million poultry died or were depopulated in Iowa because of HPAI.
- The last case detected in Minnesota was on June 6, 2015. The last detection in Iowa was on June 16, 2015.

- Agriculture impact: The United States lost about 3% of their annual turkey production and 10% of their 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. It is estimated that the outbreak had an economic impact of $1.2 billion just in Iowa. The economic loss in the United States is estimated to be over $3 billion. Poultry workers were laid off (let go) due to 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. There are more than 20,000 jobs in Iowa and 12,000 jobs in Minnesota associated with the egg industry. In addition, many countries put partial or full restrictions on the importation (bringing of goods into their country) of U.S. poultry and poultry products including eggs. (Source: http://www.agriculture.senate.gov/hearings/highly-pathogenic-avian-influenza-the-impact-on-the-us-poultry-sector-and-protecting-us-poultry-flocks)

- Exhibition impact: As a result of the HPAI outbreak, several states banned poultry exhibitions. Iowa and Minnesota, along with many other states, placed bans on all live bird exhibitions during 2015. Some states banned waterfowl, out-of-state waterfowl, or out-of-state birds from exhibitions. These bans were put in place to reduce the spread of HPAI in poultry populations. Instead of having live birds, some exhibitions provided activities to educate the public on the poultry industry. Many 4-H shows provided alternative projects for those who had been planning on showing their poultry. Alternatives included hosting skill-a-thons, creating educational displays, and competing in showmanship classes with bird models.

- Public health impact: During the 2014-2016 HPAI outbreak, there were no human infections with the outbreak strains of HPAI viruses. However, avian influenza viruses do have zoonotic potential. The two most common zoonotic avian influenza viruses are the Asian H5N1 HPAI virus and the H7N9 LPAI virus that have caused disease in China. Humans are usually infected with avian influenza when they come in close contact with infected birds or their tissues. Some people are at a higher risk of getting avian influenza than others. Those at a higher risk include: people in close contact with birds, children under the age of 5, people 65 years of age or older, pregnant women, and people with long term health conditions. Signs in humans include flu-like symptoms, swelling and reddening of tissues around the eyes, fever, and aches. Avian influenza viruses are able to cause severe disease as well. Many of the past influenza pandemics (disease outbreaks that occur over a wide area and affect a large number of people) have been a result of avian-origin influenza viruses.
    - Avian influenza prevention (Source: https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/avian-influenza-disease/birdbiosecurity)
        - Isolate birds from visitors and other birds

- Prevent the spread of disease by keeping 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

Module 4 Supplemental Materials:
-Avian influenza Fast Facts Disease Summary
-PowerPoint slides

Module 5: Influenza A Virus of Swine Origin (H3N2v) Outbreak Associated with Animal Exhibitions (10 minutes)

- Material in this module will be delivered as an interactive case study.

- Learning Objectives
  - Describe influenza A viruses of swine and how they can be transmitted among animals and to humans.
  - Explain measures to protect swine from influenza.
  - Identify the public health impacts of the H3N2v virus outbreak.
  - Identify those persons most at risk for influenza A viruses of swine.
  - Explain the measures humans can take to protect themselves from influenza A viruses of swine when on farms or attending animal exhibitions.

- Influenza A of swine origin (IAV-S) can infect pigs, turkeys, ferrets, mink, and humans. IAV-S is sometimes called "swine flu." H1N1, H1N2, and H3N2 are some of the zoonotic subtypes of IAV-S. 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 humans in 2011.
  - In pigs, IAV-S can cause fever, tiredness, lack of appetite, weight loss, coughing, sneezing, nasal discharge, and difficulty breathing. In humans it causes flu-like symptoms, such as fever, cough, sore throat, runny nose, muscle aches, headache, and tiredness.
  - The influenza virus is transmitted between pigs by aerosol and contact with nasal discharge (from a runny nose), either directly or on fomites. The virus is thought to be spread to humans 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.
  - Influenza can be spread from humans to pigs as well. This happens more commonly than pigs spreading the disease to humans.

- During 2011 to 2015, there were 346 cases of H3N2v detected in the United States. 306 of the cases occurred in 2012. Sixteen of these cases resulted in hospitalization, and one resulted in death. The majority of these cases were associated with exposure to pigs at fairs, primarily in Indiana and Ohio. There has also been limited person-to-person spread of the virus but it is uncommon. The cases mainly occurred in children, many of whom were swine exhibitors. The majority (93%) of people infected reported having attended an agricultural fair and almost all (95%) had contact with swine. Almost two thirds of those infected had exposure to swine for

multiple days. The median age of those infected was 7 years. The median age for those hospitalized was 5 years. More than two-thirds (69%) of people hospitalized were at a high risk for influenza complications because of their age or underlying medical conditions. Those infected had signs such as fever, coughing, tiredness, and redness of the eyes. (Source: http://cid.oxfordjournals.org/content/57/12/1703.full.pdf+html)

- Risks for infection with H3N2v
    - Close contact with swine
    - Repeated exposure to swine
    - Large numbers of pigs in one area
    - Large numbers of people in contact with animals
    - Dirty environment

- Exhibition impact: After several pigs and 4-Hers tested positive for H3N2v following county fairs in 2012, the Indiana State Fair took precautions (preventative measures) to prevent the spread of disease. All pigs' temperatures were checked before they came onto the fairgrounds. Only pigs with a temperature of less than 105°F were allowed on the grounds. Pigs were also observed throughout the entire fair. After finding six pigs ill, all swine were sent home early. Since then, exhibitions have increased prevention measures to minimize the risk of disease while still allowing swine to be present. Some fairs are requiring that the pigs have been vaccinated for IAV-S. Others are working more closely with veterinarians to monitor animals for signs of illness. 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 should be kept away from competition swine to prevent contact. If an exhibition has both breeding and terminal swine shows, it is recommended that either the breeding show is done first or that there is a break between shows to allow for cleaning and disinfection. It is suggested that pigs only spend 72 hours at the exhibition to limit the spread of disease between pigs.

- 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 pigs. Person-to-person transmission of IAV-S is limited. 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.

- Prevention measures to protect swine: Research has shown that the pigs do not commonly have influenza virus when they arrive at fairs. It is thought that 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 co-mingling of animals from different farms.
    - Don't share equipment with other exhibitors.
    - Limit the amount of time your animals spend at an exhibition. Ideally swine should be on the grounds for no more than 72 hours.
    - Observe swine regularly for signs of illness.
    - Contact a veterinarian if your pig becomes sick.

    - Quarantine animals for at least 7 days before allowing contact with other animals after a show. Observe them daily for signs of illness.
    - Clean and disinfect equipment, clothing, shoes, and vehicles that were at the exhibition before using on your farm.

- Prevention measures to protect humans
    - Avoid pigs and swine areas if you are at a high risk of flu complications.
        - High risk groups include: Children under 5 years of age, people over 65 years of age, pregnant women, and people with long term health conditions.
    - Do not eat or drink in animal areas.
    - Do not sleep in animal areas.
    - Avoid putting anything in your mouth while in swine barns.
    - Leave toys, pacifiers, cups, strollers, etc. outside of the swine area.
    - Wash hands often, especially before and after pig exposure.
    - Minimize contact with pigs.
    - Avoid contact with pigs if you have flu-like symptoms to prevent spreading illness to the pigs.
    - Avoid contact with pigs that look or act sick.
    - Take protective measures, such as wearing personal protective equipment (PPE), if you must come in contact with pigs that are known or suspected to be sick.

Module 5 Supplemental Materials:
-PowerPoint slides
-Handout: Prevent the Spread of Flu between People and Pigs at Fairs (http://www.cdc.gov/flu/pdf/swineflu/prevent-spread-flu-pigs-at-fairs.pdf) or something similar
-Make signs to hang up in swine barns at the fair

Module 6: Veterinary Public Health Agencies and Careers (20 min)

- Lecture Objectives
    - Identify agencies that promote animal and public health.
    - Recognize careers that are available in animal and public health.
    - 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, or national levels. Agencies within each of these categories have the ability to impact populations at all levels. The below list describes 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 below.
    - Local
        - 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 and services
    - State
        - 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 feed and rendering (waste animal tissue processing) plants to ensure the safety of finished products
        - State Public Health Veterinarian
            - Works on zoonotic disease control and prevention
            - Coordinates vector control for diseases spread by mosquitoes, ticks, and other insects
            - Provides recommendations regarding rabies exposures
            - Works in epidemiology (the study of the causes, distribution, and control of diseases in populations)
    - National
        - Centers for Disease Control and Prevention (CDC)
            - Monitors, detects, and investigates health problems
            - Conducts research to improve disease prevention
            - Carries out prevention strategies
            - Develops and promotes public health policies
            - Promotes healthy behaviors
        - Food and Drug Administration (FDA)
            - Ensures that food is safe, wholesome, and clean (except meat and poultry)
            - Ensures that drugs are safe and properly labeled
        - United States Department of Agriculture (USDA)
            - Expands markets for agricultural products and support 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
            - Improves nutrition and health

- Careers
    - Epidemiologist: Epidemiologists investigate disease outbreaks and are often called “disease detectives”. They work to identify people with the illness, determine the cause, and develop a plan to prevent future outbreaks. They are often employed by local and state health departments, CDC, FDA, and USDA. Depending where they work, epidemiologists might need to obtain a master’s degree, usually a Master of Public Health.
        - Roles in a disease outbreak
            - Create a case description (standard set of criteria for deciding whether an individual should be classified as having the disease)
            - Identify cases
            - Interview patients
            - Describe the outbreak in terms of time, place, and person
            - Determine the cause and route of spread of the disease
            - Develop a plan to control and prevent additional illness

- 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 a community. They help to identify health issues within a community and create intervention strategies for health issues such as improper diet, sexually transmitted diseases, and substance abuse. Public health nurses are employed by local health departments, occupational health facilities, and businesses. Depending on where they work, public health nurses may also need either an associate's degree or bachelor's degree in nursing.
    - Roles in a disease outbreak
        - Receive disease reports and confirm the existence of an outbreak
        - Interview patients
        - Collect samples for laboratory analysis
        - Develop programs to educate the public on any risks
        - Give mass vaccinations, if necessary
- Public Health Laboratory Scientist: People who work in public health laboratories perform 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), and surveillance tests (tests performed to monitor the occurrence of a disease in a population). 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.
    - Roles in a disease outbreak
        - Perform laboratory analysis on samples
        - Determine the cause of disease
        - Determine what can be used to treat the disease
- Veterinarian: Veterinarians are responsible for the health of animals. They perform many duties including giving vaccinations, diagnosing and treating illnesses and injuries, and doing surgery. Veterinarians can also conduct research or work in food safety. Veterinarians need a Doctor of Veterinary Medicine degree.
    - Roles in a disease outbreak
        - Recognize and report disease outbreaks in animals
        - Assess the risk for potential zoonotic disease transmission
        - Advise potentially exposed people to seek medical attention
        - Share their findings with human health officials, such as physicians
- Physician: Physicians are responsible for the health of humans. Some of their duties include diagnosing illness, prescribing medications, and developing treatment plans. Some specialized physicians also perform surgery. Physicians need a bachelor's degree and a Doctor of Medicine degree.
    - Roles in a disease outbreak
        - Recognize and report disease outbreaks in humans
        - Warn their patients of the risks of zoonotic disease transmission
        - Communicate with other health officials
- 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 or organizations. Public health veterinarians need a Doctor of Veterinary Medicine degree and a Master of Public Health degree.

- Roles in a disease outbreak
    - Determine the cause of the outbreak
    - Provide recommendations for animal disease responders
    - Trace animal movement
    - Develop a plan to control and prevent further illness

During a disease outbreak, many people will step into other roles, and provide assistance wherever needed. Animal health and human health skills are often cross-cutting and can be used in a variety of settings.

Module 6 Interactive Ideas:
-Interviews with people in these careers
-After giving the general descriptions of each career, have a disease outbreak scene showing what people in each career would be doing

Module 6 Supplemental Materials:
-PowerPoint slides
-Career handouts