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December 2015

During an animal disease emergency, efforts to contain and control the spread of disease will be essential. Responders need to have a basic understanding of how diseases can move from animal to animal, as well as location to location; these are called routes of transmission. This Just-In-Time training presentation will overview these routes of disease transmission as well as provide some specific preventive measures that can be used to break the transmission cycle.

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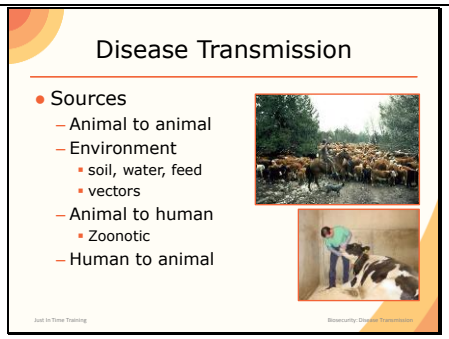

Animals can be exposed to diseases from a variety of sources. Most occur between animals, but transfer can also occur from the environment, such as soil, water, or feed. Some diseases can also be transferred between animals and people. Diseases of animals transferred to people are referred to as zoonotic diseases, while diseases of humans transferred to animals are referred to as reverse zoonoses. Zoonotic diseases of concern for responders during animal health emergencies are addressed further in the *Health and Safety: Zoonoses Risks and Prevention* Just-In-Time training presentation.

[Photos: (Top) Cattleman herding cattle through a ravine; (Bottom) oral examination of a dairy cow, Source: Danelle Bickett-Weddle, Iowa State University]

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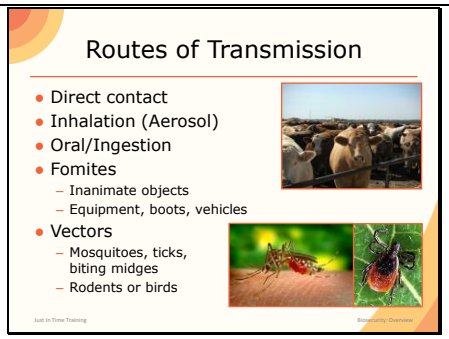

Regardless of the source, animal diseases, much like human diseases, are then spread (or transmitted) through a variety of ways. These can vary with the disease of concern.
Animal diseases can be spread by 5 main routes of transmission: direct contact; inhalation of aerosols; ingestion; indirect transfer by fomites, such as equipment, footwear or vehicles; or vector transmission.

[Photos (Top): Feedlot cattle in close contact, Renee Dewell, Iowa State University; (Bottom) mosquito and tick, Centers for Disease Control and Prevention Public Health Image Library]

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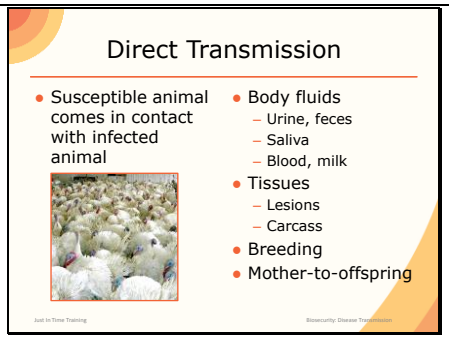

Direct contact is one of the main methods of disease spread between animals. It occurs when a susceptible animal comes in direct contact with an infected animal, its body fluids or tissues. Depending on the microorganism, it may be transferred directly by blood, saliva, urine, or feces. It may also be spread through contact with infected animal lesions or tissues. Entry into the susceptible animal generally occurs through contact with the mucous membranes, such as the eyes, nose, or mouth but can also enter through open wounds or breaks in the skin. So, possible exposures can occur from nose-to-nose contact, biting or rubbing against each other. Some diseases of animals can also be spread during breeding as well as from mother-to-offspring, during gestation or through milk when nursing.

[Photo: A flock of turkeys, USDA]

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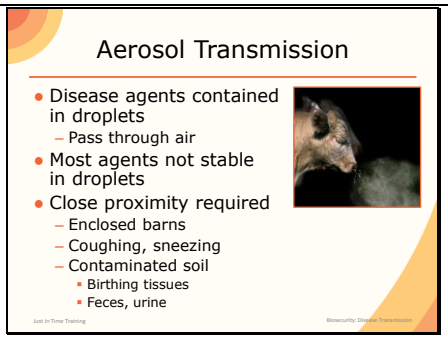

Aerosol transmission is another means of disease spread. This involves the transfer of disease agents in droplets spread through the air, which are then inhaled by another animal. Most microorganisms are not able to survive for extended periods of time within the aerosol droplets, and as a result, close proximity of infected and susceptible animals is required for disease transmission. Aerosol transmission can also occur when infected droplets from urine, feces, or birthing material get stirred up from contaminated soil or dust and inhaled.

[Photo: Depiction of aerosol spread from a cow, Clint May, CFSPH, Iowa State University]

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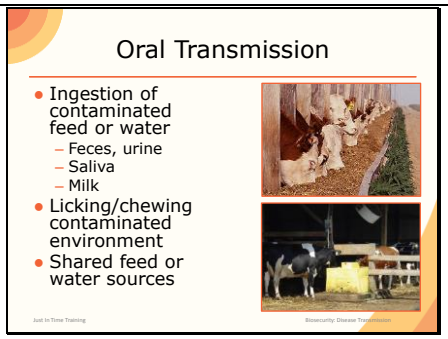

Oral transmission of disease causing organisms involves ingestion through the consumption of contaminated feed or water, or by licking/chewing on contaminated environmental objects. Feed and water contaminated with feces, urine or saliva are frequently the cause of oral transmission of disease agents. Fecal-oral transmission of diseases is a common means of infection in animals (and people). Shared feed and water sources can contribute to the spread of the disease.

[Photos: (top): Cattle eating at a feedbunk, Danelle Bickett-Weddle, CFSPH, Iowa State University; (bottom) cattle sharing a water tank, Danelle Bickett-Weddle, CFSPH, Iowa State University]

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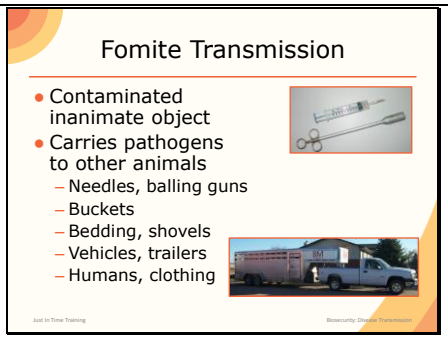

Indirect transmission may occur by fomites. These are inanimate objects, such as equipment, clothing, footwear or vehicles, that can transfer microorganisms from an infected animal to another animal or person. Examples of fomites that may be present during a response include needles, balling guns (used to dispense medication to cattle), feed or water buckets, bedding and shovels. Even items such as clothing or vehicles may become contaminated and serve to spread pathogens.

[Photos: (top) Syringe and balling gun. Danelle Bickett-Weddle, CFSPH, Iowa State University; (bottom): pickup and trailer, Bryan Buss, CFSPH, Iowa State University]

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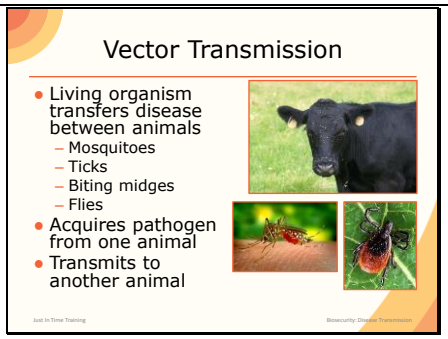

Lastly, some diseases are spread by vectors – living organisms – able to transfer microorganisms from an infected animal to another. Mosquitoes, ticks, biting midges and flies are common disease carrying vectors, but sometimes rodents or birds can serve as disease vectors.

[Photos: (top): Calf with numerous face flies, USDA; (bottom): mosquito (left) and tick (right), CDC Public Health Image Library]

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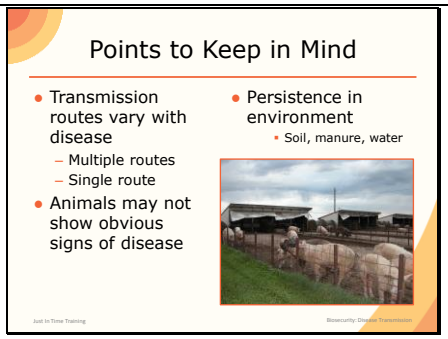

It is important to remember that transmission varies with the disease of concern. Multiple routes of transmission may be possible for some diseases, while others may be limited to a single means of transfer. Equally important is knowing that transmission may occur without animals exhibiting obvious signs of disease. That is why awareness of the various routes of transmission becomes so essential when implementing a strategy to minimize disease spread during a response. Finally, remain aware that many disease agents can survive for extended periods of time in the environment or on objects; therefore, environmental contamination should not be ignored.

[Photo: Outdoor swine shed and pen, VDPAM, Iowa State University]

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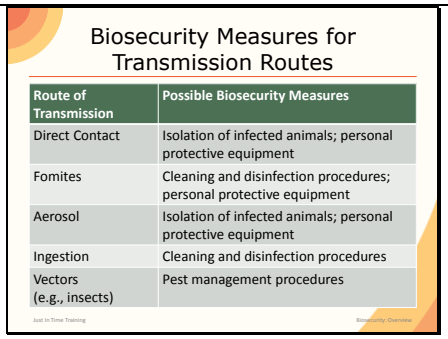

This table shows some of the possible biosecurity measures that may be used to limit transmission of pathogenic agents based on their routes of transmission. For pathogens spread by direct contact and aerosols, the isolation of infected animals and use of personal protective equipment, such as gloves, can limit and prevent transmission by this route. For pathogens spread by fomites, such as equipment or vehicles, or ingestion, cleaning and disinfection measures can be effective in reducing contamination. Control of vector-borne diseases will involve the use of pest management procedures to limit transmission. Let's talk about these biosecurity measures a bit more.

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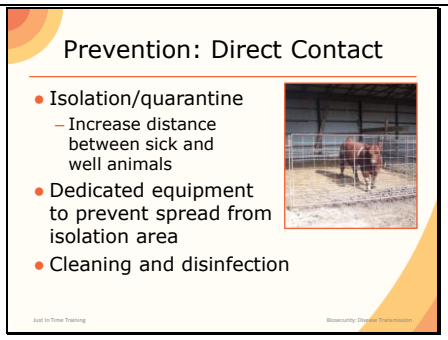

One of the first steps in preventing further spread of disease is minimizing contact between susceptible and infected animals. This is often accomplished by isolating the infected animal. In the case of animal disease emergencies, often more than one animal is involved; therefore the entire farm may be quarantined, in efforts to prevent the further spread of the disease. When working with animals in isolated or quarantined areas, dedicated equipment should be used to prevent pathogen spread outside of the area. Proper cleaning and disinfection procedures are also important for preventing the spread of pathogens by fomites, such as equipment, vehicles, or footwear. Keep the animal housing environment as clean and dry as possible to minimize risk of environmental exposure.

[Photos: (top) Bull in an isolation pen, Bryan Buss, CFSPH, Iowa State University; (bottom) cleaning and disinfecting boots, Sandy Amass, Purdue University]

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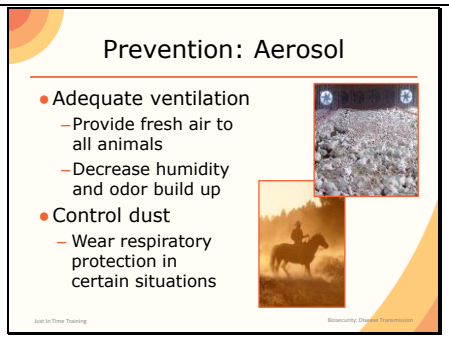

To minimize aerosol transmission, maximize ventilation so that fresh air is provided to all animals and humidity and odors do not build up. Control the amount of dust generated in animal housing areas. This can damage the protective cells in the respiratory tract, as well as result in exposure to contaminated particles that can cause disease. Responders should wear respiratory protection, especially when there is a zoonotic disease concern.

[Photos: (top) Ventilation fans in a poultry facility, USDA; (bottom) stirred up dust, The Animal Photo Archive]

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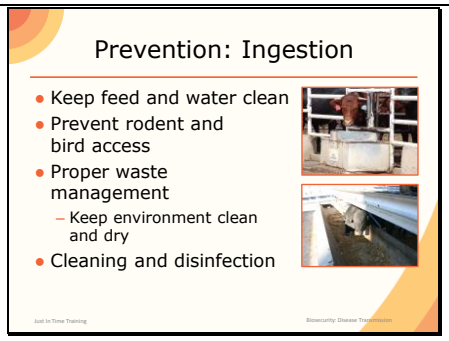

Keeping feed and water clean by minimizing fecal and urine contamination is extremely important. Prevent rodent and bird access to feed and water to prevent contamination by these vectors. Proper waste management procedures can help to keep the environment clean and dry. Cleaning and disinfection procedures for feed bunks or waterer can help minimize transmission between animals.

[Photos: (top) Feedlot cow at a waterer, Renee Dewell, CFSPH, Iowa State University; (bottom) cows at a feedbunk, Mykel Weding, CFSPH Iowa State University]

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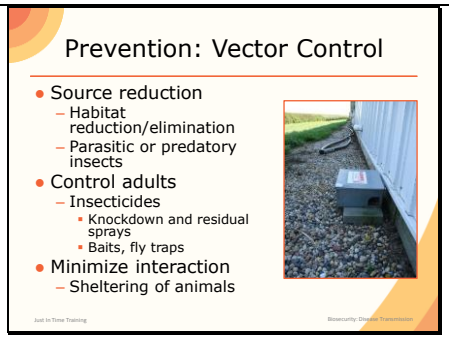

Vector control begins with an understanding of the insect's life cycle. Insect life stages vary and so do the specific, effective control measures. For instance, the egg laying grounds for flies are different than that of mosquitoes and midges, and one approach will not necessarily work for all. Source reduction consists of eliminating potential insect breeding areas and larval habitats. Generally this involves removing standing water sources, such as tree holes or old tires or agitating any water sources, such as stock tanks or water troughs. Some insects require manure or organic material for development, so cleaning animal feeding areas, yards and barns can minimize these vectors. Sometimes, parasitic or predatory insects may be used to control the larval stages of other insects. Controlling adult insects, often involves the use of insecticides, either as a knockdown or residual treatment. These methods are often less effective compared to habitat reduction methods. Baits and fly traps may aid efforts, but should not be used as the sole method of control. Sheltering animals indoors, can minimize the opportunities for insects to interact with animals. Additional information on vector control can be found in the corresponding Just-In-Time training presentation.

[Photo: A rodent bait trap, Danelle Bickett-Weddle, CFSPH, Iowa State University]

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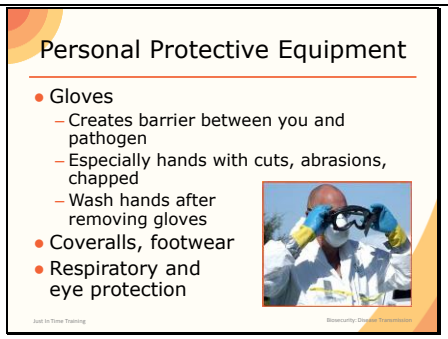

The use of personal protective equipment, such as gloves, coveralls, and boots, can help reduce exposure and transfer of pathogens. Gloves should be worn when working with sick animals and those that you are unaware of their health status (remember that infected animals do not always appear sick). This is especially important if hands have cuts, abrasions or are severely chapped because areas of broken skin provide an entrance for disease agents. Wearing gloves does not replace good hand washing habits – wash hands in warm water and soap after removing gloves. Coveralls will help keep your clothes clean and cover your arms to minimize disease exposure when handling tissues or animals. Protective footwear (e.g., rubber boots) will protect your shoes from contamination and minimize spread to other areas of the farm. Wear masks in certain situations to prevent inhaling contaminated particles. Additional information on PPE can be found in the corresponding Just-In-Time training presentation.

[Photos: Responder in PPE, Travis Engelhaupt, CFSPH, Iowa State University]

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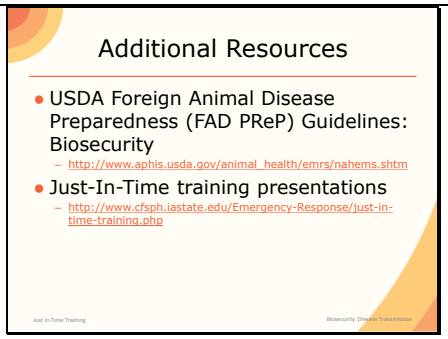

For more information on biosecurity issues during an animal health emergency response, consult the USDA FAD PReP Biosecurity Guidelines. Additional training presentations, including a biosecurity overview, personal protective equipment, cleaning and disinfection, and wildlife and vector control, can be found on the Just-in-Time training website.

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Information provided in this presentation was developed by the Center for Food Security and Public Health at Iowa State University College of Veterinary Medicine, through funding from the Multi-State Partnership for Security in Agriculture.