Wildlife Diseases

Wildlife Diseases 1
Learning Objectives for Wildlife Diseases 2
Terms to Know 2
Zoonoses 2
Staying Safe on the Job. 3
Knowledge of Wildlife Diseases is Important 6
Agents of Disease Transmission 8
Methods of Disease Transmission 9
Common Zoonotic Diseases 14
Raccoon Roundworm 22
Histoplasmosis 27
Toxoplasmosis 32
Hantavirus: 36
Mange and Distemper 40
West Nile Virus 44
Lyme Disease 50
Dealing with Contaminated Materials and Dead animals 54

This material is copyrighted by the National Wildlife Control Training Program LLC.

Learning Objectives for Wildlife Diseases

1. Identify the most common zoonotic diseases, along with their causes and typical symptoms.
2. Describe practical ways to protect yourself on the job and reduce risk for customers.
3. Describe the groups (humans, pets, wildlife) most vulnerable to disease transmission.
4. Explain the purpose of personal protective equipment (PPE) and when it should be used.
5. Give examples of some disease agents.
6. List different routes of disease transmission.
7. Describe how to decontaminate and disinfect your gear and contaminated areas.

Terms to Know

Agent An organism or pathogen that causes disease.

Host An organism negatively affected by the disease.

Reservoir An organism that harbors or carries the disease but is not harmed by the disease.

Vector An organism that carries and transmits the disease agent to another organism.

Zoonotic Diseases originating from wildlife that can be transmitted to humans.

Zoonoses

Wildlife diseases are most often caused by bacteria, viruses, fungi, or parasites. Diseases that can be transmitted from wildlife to people are called zoonotic diseases, or zoonoses. Infection can

This material is copyrighted by the National Wildlife Control Training Program LLC.

happen in several ways. Common routes include bites and scratches from infected animals, contact with contaminated areas, and exposure through the eyes, nose, mouth, or an open wound.

You can also pick up diseases indirectly when you are bitten by a mosquito, tick, or flea that previously fed on an infected animal. Mosquitoes can spread West Nile virus, ticks can spread Lyme disease, and fleas can carry plague and typhus.

Some diseases are transmitted through the air, such as hantavirus and histoplasmosis. You may inhale them when dust is stirred up in a confined space. Infection can also occur when contaminated hands touch the mouth or when infected meat is not cooked properly. Young children are at particular risk because outdoor play areas, toys, and sandboxes may become contaminated with wildlife droppings or urine. Raccoon roundworm is one example of a disease spread this way, because its eggs may be present in contaminated soil.

Staying Safe on the Job.

How do you protect yourself and avoid bringing diseases or parasites home? Practice good personal hygiene, wear appropriate personal protective equipment (PPE) such as disposable gloves, eye protection, and particulate-filtering face masks, disinfect your equipment, keep rabies and tetanus vaccinations current, and use safe animal-handling techniques. Good hygiene and sanitation also reduce the chance of developing allergies to animals.

One of the most important ways to reduce your risk of zoonotic disease is to wash your hands thoroughly and often. Ordinary soap and water are effective. Always wash your hands before eating, drinking, or smoking.

Another good habit is to avoid touching your face, eyes, nose, or mouth while working. Be especially careful when eating, drinking,

This material is copyrighted by the National Wildlife Control Training Program LLC.

smoking, adjusting glasses, applying cosmetics, taking medication, or sneezing.

Regular hand washing can prevent most fecal-orally transmitted diseases.

Keep your gear clean as well. Many of the surfaces you handle may be contaminated with blood, feces, urine, saliva, or body tissues. If your hands or gloves are dirty, it is easy to spread contamination to doorknobs, vehicle doors, clipboards, phones, keyboards, faucet handles, and other surfaces. Wildlife work may also leave a significant mess at the job site. If you do not provide clean-up services, you should still be prepared to explain how customers can handle the area safely.

At the end of the day, clean and disinfect all equipment used on the job with a dilute bleach solution (10% chlorine bleach, or one part bleach to nine parts water) or with an appropriate household or commercial disinfectant. Wipe down your truck seat, steering wheel, and door handles as well. Some WCOs keep a spray bottle of disinfectant in the cab for quick use. Because bleach solutions

This material is copyrighted by the National Wildlife Control Training Program LLC.

lose strength over time, mix only small batches. Never mix bleach with ammonia, and do not use bleach directly on droppings that may contain ammonia, because the combination can produce a dangerous gas. In those cases, use an appropriate household or commercial disinfectant instead. Antibacterial wipes may be convenient, but they are not designed to kill parasites, fungi, or viruses.

The time you spend cleaning also supports your professionalism. Many customers see cleanliness as a sign of competence and attention to detail.

A few wildlife-related safety tips from the CDC that you may want to share with customers:

These CDC tips focus on disease prevention. As we mentioned earlier, you can take measures to prevent nuisance situations while leaving part of your landscape for wildlife. One of the many things to consider performing WDM is the risk of exposure to wildlife diseases.

8. Teach children never to handle unfamiliar animals, wild or domestic, even if they appear friendly. “Love your own, leave other animals alone.”

9. Enjoy wild animals from afar. Never adopt wild animals or bring them into your home. Do not handle, feed, or unintentionally attract wild animals to your home or yard.

10. Don’t try to nurse sick animals to health. Do not “rescue” baby birds or other baby animals. They usually don’t need it. Direct questions to a wildlife rehabilitator or state wildlife agency staff.

11. Before traveling abroad, consult with a health care provider, travel clinic, or your health department about the risk of exposure to rabies. They can advise you about whether pre-exposure rabies vaccinations are sensible, and how you should handle exposure in that country, should it arise.

This material is copyrighted by the National Wildlife Control Training Program LLC.

Knowledge of Wildlife Diseases is Important

Consider this section an introduction to health concerns that affect WCOs. For example, you will often be told to "wear a proper respirator." That is shorthand for protecting yourself from inhaling microscopic disease agents. You need to understand when and how to use a respirator and other personal protective equipment (PPE) to reduce your risk of exposure.

How much do you need to know? You do not need medical-level expertise, but you do need enough knowledge to protect yourself and others and to answer customers' questions accurately.

Concerns about wildlife diseases are sometimes greater than the actual risk of infection. An unethical WCO may try to sell a job by overstating that risk. Your job is to communicate accurate, credible information without minimizing the hazard or unnecessarily alarming the customer.

Some wildlife diseases can be fatal, and customers may want to understand the worst-case scenario. However, the chance of catching many of these diseases is low, and many are treatable when addressed promptly.

It is also important not to jump to conclusions. For example, distemper can cause signs that resemble rabies. The only way to know for certain is through testing.

The trick is to have good, complete, and credible information from a trusted source. One extremely valuable source for current and accurate information on zoonoses is the national Centers for Disease Control and Prevention (CDC) at https://www.cdc.gov/onehealth/basics/zoonotic-diseases.html. Most of the pages on their website about wildlife-related health issues are written in simple language and get right to the point.

Other good sources for information about wildlife diseases include physicians; veterinarians; medical entomologists; your state health, wildlife, and agriculture departments; trade

This material is copyrighted by the National Wildlife Control Training Program LLC.

magazines; professional organizations; wildlife conferences; books; fact sheets; videos; and websites.

One last medically-related point: When you remove wildlife from people's homes, it's important to plan for the parasites that may be left behind. Birds and mammals are host to a variety of parasites including fleas, ticks, mites, and lice. Although these parasites generally prefer their original host species, if you remove those animals, the hungry parasites may look to humans for a meal. Many of these parasites will bite people, and they can be extremely annoying. Also, itchy customers are generally not happy, which isn't good for business.

Pests may fly or crawl into a home through windows, ventilators, cracks, and crevices. Droppings, feathers, fur, food, and carcasses can also attract other pests such as flies and carpet beetles. This can be a significant problem if an animal has died in inaccessible locations, such as in the wall. That can happen when an animal is poisoned, and it's one of the risks of using that management method.

Effective clean-up should remove any parasites present in the home. If a site is severely infested, you should wear protective clothing before entering. If you don't offer clean-up services, know how to properly advise your clients to do so. Most states have an integrated pest management (IPM) program, usually associated with the land grant university. In New York, for example, that's Cornell University's New York State Integrated Pest Management Program. These programs offer information about how to deal with many pests, including those associated with wildlife. IPM stresses a combination of practical, economical pest management methods that minimize the risks to people and the environment.

The zoonotic diseases that are potentially fatal for people are listed first. So, for example, we've listed hantavirus before mange. Although a WCO is far more likely to encounter mange, hantavirus can cause a much more serious health problem. At the

This material is copyrighted by the National Wildlife Control Training Program LLC.

end of the list are 2 wildlife diseases that people generally encounter from contact with either a mosquito or tick.

Agents of Disease Transmission

Awareness of how people are infected by diseases will help you take precautions. For example, use the proper PPE to prevent exposure to disease agents. This information may also be important for your clients.

Disease agents or pathogens can be:

- bacteria,
- viruses,
- protozoans (single-celled organisms),
- rickettsia (microorganisms that combine aspects of both bacteria and viruses),
- fungi,
- nematodes (multi-celled worms), and
- prions (modified proteins).

Agents can enter your body through a method of **disease transmission**

- injection by a tick or wildlife bite,
- ingestion (biting contaminated fingernails, eating contaminated food),
- inhalation (breathing contaminated dust or airborne eggs), and
- absorption (organism enters through mucosal membranes around the eyes and mouth, or a break in the skin).

This material is copyrighted by the National Wildlife Control Training Program LLC.

Methods of Disease Transmission

Disease agents pass from animals to people in many ways. Some of the most common methods of transmission are described below.

Fecal-oral transmission — Pathogens often live in animal feces. Fecal-oral transmission occurs when a person inadvertently ingests animal feces, usually by transferring it from their hands to the mouth. For example, if a wildlife operator cleans a trap contaminated with animal feces and does not wash hands before eating, disease transmission may occur. Wearing gloves and practicing regular hand washing, especially before eating and after using the bathroom, is very important.

Deer ticks (male left; female center pre-feeding and right post-feeding) are capable of transmitting the agent of Lyme and other diseases.

Respiratory transmission — Disease-causing organisms are frequently released into the air when the feces, bedding, or carcass of an infected animal are disturbed. People inhaling these particles may contract the disease. For example, respiratory transmission can occur when a wildlife operator is working in an old chicken house thick with starling droppings. Movement in and around the droppings may kick up dust particles that the WCO inhales, and cause disease. Using a respirator in high-risk situations can help prevent inhalation of disease agents.

Direct contact transmission —Humans can sometimes contract diseases from wildlife simply by handling animals or by touching

This material is copyrighted by the National Wildlife Control Training Program LLC.

tissues or fluids from infected animals. In these cases, the disease-causing organisms may live on the outside of the animal. To protect yourself, always wear gloves when working. Keep skin that may come in contact with animals covered when handling animals or their tissues and fluids. Wash well after contact with any animal.

Penetrating wound transmission — Organisms need a direct entrance into the human body to cause disease. A wound that penetrates the skin can provide the ideal opening. WCOs may contract these diseases through an animal bite, scratch, or other injury that breaks the skin. Certain vaccinations will help protect you from many diseases transmitted through an open wound. Wear sturdy clothing that can help prevent penetrating wounds.

Vector-borne diseases — A disease vector is a living organism that carries a disease. Humans usually contract vector-borne diseases through the bite of an infected vector. Common vectors of wildlife-related diseases include mosquitoes and ticks. Insect and tick repellents, along with daily checks for ticks, will help protect against this type of transmission. Fleas are vectors of plague, a bacterial disease. According to the Centers for Disease Control, an average of about 7 cases of plague are diagnosed per year in the southwestern U.S. (northern New Mexico, northern Arizona, southern Colorado, California, southern Oregon, and far western Nevada). Wear long sleeve shirts and pants and use repellents when working in the field.

Vaccines are available to prevent or reduce the severity of some diseases. People who work with wildlife should consider receiving vaccinations for rabies and tetanus. Your doctor may also suggest routine examinations to monitor for some diseases.

There's a lot of information in this section. The next chart should help you remember the answers to three critical questions: who? what? how? **Who** (what species) is likely to transmit the disease to people? **What** diseases are most frequently encountered? And what is the method of disease transmission - **how** do people catch it?

This material is copyrighted by the National Wildlife Control Training Program LLC.

Common diseases vectored by mammals

- Rabies (any mammal, but most commonly from bats, skunks, raccoons, foxes, and coyotes)
- Raccoon roundworm (mostly raccoons. Also: mice, squirrels, woodchucks, rabbits)
- Hantavirus (deer mouse, white-footed mouse)
- Mange (foxes, coyotes, squirrels)
- Toxoplasmosis (contact with contaminated meat, cat feces, or soil)

Common diseases vectored by birds

Histoplasmosis (from bird roosts, poultry barns, not directly from birds)

Histoplasmosis (from bat roosts and caves, not directly from bats)

Common diseases from reptiles

Salmonellosis

Diseases vectored by mosquitos and ticks

Lyme disease (from ticks. People are most likely to be infected from May through July). West Nile virus (mostly from mosquito bites)

Method of Transmission

Bites or scratches

- Rabies (mammal bites or scratches)
- West Nile virus (mosquito bites)
- Lyme disease (tick bites)
- Hantavirus (possible from rodent bite but uncommon)

Protect yourself by

This material is copyrighted by the National Wildlife Control Training Program LLC.

1. Get rabies pre-exposure vaccine and keep it current
2. Wear animal handling gloves
3. Use a restraining device such as a catchpole
4. Capture animal in a trap
5. Avoid contact with animal's mouth and saliva
6. Shower soon after work, every day

Inhalation

7. Histoplasmosis
8. Hantavirus
9. Canine distemper? (not definitively established)

- Wear a respirator, use disposable clothing, goggles, gloves, hood.
- Ventilate area, if possible.
- Dampen contaminated materials, wipe up with wet sponge.
- Spray contaminated area or dead animals with disinfectant.
- If possible, schedule job for cool, damp weather.

Contaminated hands touch mouth, eyes, or nose

Contaminated means come in contact with whatever causes that disease, such as a virus, bacterium, or a parasite's eggs.

- Raccoon roundworm (mouth)
- Toxoplasmosis (mouth)

This material is copyrighted by the National Wildlife Control Training Program LLC.

- Rabies (infected saliva gets into mouth, eyes, or nose)
- Wear a proper respirator, disposable clothing, and rubber gloves.
- Wash your hands thoroughly with soap and water, especially before eating, drinking, or smoking.
- Avoid contact between your hands and your face. Pay attention when you sneeze, eat, drink, smoke, adjust glasses, put in contact lenses, or take medication.

Disease gets into wound

Hantavirus (mouth, eyes, or nose)

Rabies

- Protect wounds with bandages, if practical.
- Wear gloves or clothing that covers the wound.
- Check wounds and keep them clean.

Contaminated food or dirty object in mouth

- Raccoon roundworm (dirty object)
- Toxoplasmosis (contaminated meat or dirty object)
- Hantavirus? (via contaminated food or water)
- Wash your hands thoroughly after outdoor activities and especially before eating, drinking, or smoking.

Handle infected animal or contaminated equipment

Mange

- Wear gloves and use restraining devices
- Minimize contact with contaminated clothing and equipment.

This material is copyrighted by the National Wildlife Control Training Program LLC.

- Dry clothing at high heat to kill any mites on it.

Common Zoonotic Diseases

Rabies

Disease agent: virus.

Method of transmission: The most common route is a **bite from an infected mammal**.

Worst-case scenario: death.

How common? The virus is widespread in wildlife. At times it may be common in certain species, especially skunks, raccoons, foxes, coyotes, and bats. Human cases in the U.S. are rare, averaging about 1 to 2 deaths each year.

Most vulnerable groups: people with unvaccinated pets and people who handle animals, especially wildlife.

Rabies is a viral infection that can affect any mammal, including humans. According to the CDC, the wildlife species most often reported with rabies include raccoons, skunks, bats, and foxes. Rabies is extremely rare in small rodents such as squirrels, mice, and rats, as well as in opossums, rabbits, and hares.

Rabies attacks the nervous system and is almost always fatal once symptoms appear. The good news is that vaccination can protect both people and pets. If an unvaccinated person is exposed, prompt medical treatment can still prevent the disease from developing.

How do you catch it?

Rabies virus is found primarily in saliva and in tissues of the central nervous system, especially the brain. It is usually spread through the bite of an infected animal.

Transmission can also occur if saliva or nervous tissue enters your eyes, nose, mouth, or an open wound. Airborne transmission is possible but rare. It is mainly a concern for laboratory workers

This material is copyrighted by the National Wildlife Control Training Program LLC.

handling infected animals or for people in moist, poorly ventilated caves.

You **cannot** catch rabies from contact with blood, feces, urine, or scent glands. The rabies virus hitches a ride through the nervous system, traveling directly from the bite wound to the brain. Later, it may travel from the nerves to other organs, but it never enters the blood. That said, if the animal's head has been damaged, spinal tissue or fluid could be mixed in with splattered blood. Animals may catch rabies by eating infected animals. Rabies might be passed from mother to offspring in the womb. However, when people encounter very young animals that are rabid, it's more likely that they were infected after they were born, either from contact with their mother, or another rabid animal.

Although deadly, the rabies virus is actually fragile. It can be destroyed by exposure to ultraviolet rays (UV light) in sunlight.

Symptoms

An animal may carry rabies for a long time before showing signs, from about two weeks to several months. The incubation period is often around two to three weeks.

Different species show different signs of the disease. Expect variations even within the same species, because few animals show all of the signs of rabies. Some signs are subtle and easily missed.

You cannot tell whether an animal has rabies based on behavior alone. Other diseases, such as distemper or toxoplasmosis, can cause similar signs. Poisoning from substances such as lead, mercury, or antifreeze can also make an animal appear rabid. The only way to confirm rabies is by laboratory testing of brain tissue. That is why precautions matter.

Below are some rabies symptoms you may see in wild animals:

- unprovoked aggression ("furious" rabies). Some animals may attack anything that moves, or even inanimate objects.

- unusual friendliness ("dumb" rabies).

This material is copyrighted by the National Wildlife Control Training Program LLC.

- animal may stumble, fall, appear disoriented or uncoordinated, or wander aimlessly.

- paralysis, often beginning in the hind legs or throat. Paralysis of the throat muscles can cause the animal to bark, whine, drool, choke, or froth at the mouth.

- vocalizations ranging from chattering to shrill screams.

- nocturnal animals may become unusually active during the day (remember, some daytime activity is normal, especially when nocturnal animals are feeding their young).

- raccoons walk as if they're on very hot pavement.

Skunks, raccoons, foxes, and dogs more often show the aggressive form commonly called "furious" rabies. Bats more often show the quiet or "dumb" form and may be found on the ground unable to fly. This is especially risky for children, who may try to handle them. In domestic animals, rabies should be suspected when there is a sudden change in behavior, refusal to eat or drink, paralysis, or repeated collisions with objects.

Another similarity between rabies and distemper is that both are "density dependent" diseases. That means they spread more easily when wildlife populations are higher, because there's more contact between individual animals. When enough animals die from rabies or distemper, these viruses can't spread as easily. That's why the number of cases spikes and then drops off; this rollercoaster pattern repeats over time.

Common vector species are raccoons, skunks, foxes, and bats. Photos by CDC.

This material is copyrighted by the National Wildlife Control Training Program LLC.

Protection on the job and legally required actions.
Situations involving potentially rabid animals should take priority over all other work.

Contact the local health department immediately. Locate your county or regional health department. **You must talk to them and follow their directions.** You must report bites or other exposures. Even such details as how a specimen is packaged matter, because you don't want to endanger anyone who may handle the package.

Contact doctors and veterinarians as needed. Local police and dog control officers may also help, especially in emergencies.

Follow these guidelines with all species:

Use caution when approaching the suspect animal, because many are aggressive and can bite even if paralyzed. Wear animal handling gloves and use restraining devices to minimize contact with the animal. Avoid bites, scratches, and direct skin contact. Handle dead animals with care, too, especially when your hands are near their mouths.

Restrain and isolate the suspect animal.

The animal may be choking. Resist the impulse to clear the "obstruction" from its throat! Do not put your hand in or near the animal's mouth.

If rabies testing is required, you must kill the animal without damaging its head. The test can't be done on a live animal because brain tissue is needed for the rabies test. Even with this restriction, it's still possible to humanely dispatch animals in most circumstances. For example, raccoons and skunks can be captured in cage traps. The trap can then be placed in a CO_2 chamber to euthanize the animal. If the animal is aggressive, and you're in an area where you can legally discharge a firearm, you may prefer to restrain the animal with a catchpole and then shoot it in the heart and lung area using a low caliber rifle or pistol. That method reduces contact with the animal and may be safer for the operator.

This material is copyrighted by the National Wildlife Control Training Program LLC.

If you can't capture the suspect animal, describe the situation to the local health department or doctor in as much detail as possible. They'll want to know which species was involved, how the animal was behaving, whether or not the attack was provoked, and what type of first aid was administered. Immediate medical care should be sought for the exposed person or pet.

When you're done dealing with the animal, disinfect any surfaces contaminated by the animal's fluids or tissues with a 10% bleach solution (one part chlorine bleach to nine parts water). You may want to mist spray your gloves with the bleach solution. Wear protective gear, especially if using a power washer.

Clean everything that might have been contaminated before you go to your next job.

Guidelines for bats:

Quarantine is not an option. There's no conclusive research data on safe quarantine periods. The only way to be sure whether or not the animal is rabid is to kill it and examine its brain tissue.

Capture any bat that's been found in a room with a sleeping person, an unattended child, a mentally impaired person, or an intoxicated person. This is a very good recommendation, and required by some states, such as the NY State Health Department. Why? Children and impaired people might not be aware, or be able to tell you whether they were bitten. In these cases, talk to the local health department to determine if the bat needs to be killed and tested for rabies.

To capture a bat, use a soft-sided container to scoop up the bat after it's landed. Plastic yogurt containers or cardboard boxes are less likely to hurt the bat than a metal coffee can. Don't release or discard any bat found in people's living quarters, unless the possibility of human exposure has been absolutely ruled out. If you're sure that no person or pet has had contact with the bat and it appears healthy, it can be released.

This material is copyrighted by the National Wildlife Control Training Program LLC.

Individual bats will sometimes enter a home in the evening, especially during July or August. This doesn't mean there's a roost in that home. The bats may just have wandered in, as wild animals, especially young ones, sometimes do while exploring their territories or feeding.

Guidelines for domestic animals (cats, dogs, ferrets) and livestock:

There are vaccines to protect cats, dogs, ferrets, and livestock from rabies. A vaccinated domestic animal that's been exposed can receive a booster to prevent it from developing rabies.

An unvaccinated pet that's been exposed can be quarantined for six months (at the owner's expense) and observed to determine whether or not it's infected. The other option is to have the animal killed to avoid the possibility of it developing rabies and exposing people or other animals later on.

Guidelines for exotic pets, such as monkeys, gerbils, guinea pigs, hamsters, snakes, iguanas, birds:

Only mammals get rabies. Not birds. Not reptiles (such as snakes, iguanas, and turtles) or amphibians (frogs, salamanders).

Even though they're living in a home, exotic pets are not domesticated species. They're wild species that are native to another country. Again, unfortunately, quarantine is not an option. If an exotic pet has been exposed, the health department may require that it be killed and tested. A few species of common exotic pets, such as gerbils and guinea pigs, *almost* never get rabies.

Prevention: Rabies vaccination

WCOs and other people in high-risk jobs should get a rabies pre-exposure vaccine. This consists of three shots. Your doctor should test your blood every two years to determine whether you need a routine booster.

First aid and treatment after exposure

This material is copyrighted by the National Wildlife Control Training Program LLC.

It is extremely important to get immediate medical care for people and pets who have been exposed to a potentially rabid animal! This is especially true if you can't capture the suspect animal and have no way to determine whether it was infected.

If anyone has been wounded, disinfect the wound by washing it *thoroughly* with soap and warm water. You can then apply Betadine, a liquid surgical soap available in many drug stores. Cover the wound with a sterile bandage, then apply direct pressure to control bleeding.

If possible, capture the suspect animal and have it tested for rabies. If the animal was rabid, everyone who was exposed will need treatment. This includes pets and livestock. For someone who received pre-exposure rabies vaccinations, the post-exposure treatment amounts to two shots of rabies vaccine given three days apart.

Unvaccinated people who may have been exposed to the rabies virus will be given six shots in a span of 28 days. Again, treatment must begin as soon as possible. Emphasize to your customers that the shots are now given in the arm, not the stomach. There's a good chance that your customers have heard and believed scary stories about how horrible the rabies treatment is. That's not true! Calm them down and persuade them to call their doctors right away. Call the local health department and give them the contact information for anyone who's been exposed.

What your customers may want to know:

How are they most likely to encounter rabies? The most common link between rabid wildlife and people is through an unvaccinated pet. Even indoor cats should be vaccinated because if an infected bat gets inside, the cat will probably chase it. If the bat is sick, the cat has a better chance of catching it and being exposed.

A nocturnal animal that is active during the day is not necessarily rabid. Healthy female raccoons, for example, sometimes feed during the day, especially during the spring, when they're nursing their young.

This material is copyrighted by the National Wildlife Control Training Program LLC.

A shabby-looking animal is not necessarily rabid. It could be a nursing female. The young will sometimes pull at her fur as they feed.

As with other diseases, exposure to the virus does not automatically mean that you are going to get the disease. But there is no way to test or tell whether or not you were infected, and only post-exposure vaccination will prevent rabies from developing.

Antibiotics will not treat rabies because the disease is caused by a virus. Antibiotics are used to kill bacteria.

What qualifies as a rabies emergency?

All cases of direct human contact with a bat, when a bite or contact with mucous membrane cannot be ruled out.

Cases in which an animal that is very likely infected with rabies has bitten a person, and the doctor is waiting for the results before beginning treatment. “Very likely infected” is determined by the animal’s species, behavior, and the location of its capture.

Questions about the handling of animal bites should first be directed to your local/county health department.

Review questions

1. Rabies is usually spread through
   a. the bite of an infected animal
   b. contact with blood
   c. the air
   d. skunk spray

2. You can tell whether or not an animal is rabid by its behavior.
True **False**

3. Wildlife species most likely to carry rabies
   a. dogs and cats
   b. raccoons, opossums, and skunks

This material is copyrighted by the National Wildlife Control Training Program LLC.

c. skunks, pigeons, and rats

d. skunks, bats, raccoons, and foxes

4. If you think you're dealing with a rabid animal, you should not do.

a. wear heavy-duty gloves

b. call the local health department

c. shoot it in the head immediately

d. carefully restrain the animal

e. more than one answer is correct

5. What qualifies as a rabies emergency?

a. a raccoon walked through the customer's yard during the day

b. a person was bitten by a bat

c. a skunk is living under the deck

d. a bat flew into house through an open window, fluttered around, and flew out a few minutes later

Answers:

1—a
2—false
3—d
4—c
5—b

For more information about rabies:

www.cdc.gov/ncidod/dvrd/rabies/

Raccoon Roundworm

Disease agent: parasite.

Transmission: The most common route is hand-to-mouth contact after touching contaminated material or placing a contaminated object directly in the mouth.

This material is copyrighted by the National Wildlife Control Training Program LLC.

Worst-case scenario: Death.

How common? The parasite is common in raccoons, but human infections are rare.

Most vulnerable groups: Young children.

This disease is caused by the roundworm *Baylisascaris procyonis*. Problems occur when the larvae migrate through body tissues, including the liver, lungs, eyes, and brain. The severity of infection depends on how many eggs were swallowed and where the larvae travel. Although serious infections are rare, raccoon roundworm can be fatal.

Raccoons are the primary host of this roundworm, which is commonly found in their small intestines. The parasite has also been found in mice, squirrels, rabbits, birds, woodchucks, and dogs.

How do you catch it?

Raccoon droppings may contain microscopic raccoon roundworm eggs.

Raccoons shed millions of microscopic roundworm eggs in their feces. Newly deposited eggs need about a month to become infective. The eggs only develop into worms inside an animal, but

This material is copyrighted by the National Wildlife Control Training Program LLC.

they are very hardy and may survive for years in soil, sand, or water.

People may be exposed by touching raccoon droppings, contaminated surfaces, or contaminated soil and then transferring the eggs to their mouths. Young children are at greatest risk because they are more likely to put their hands, toys, bark, wood chips, soil, or other objects into their mouths.

Can people become infected by inhaling raccoon roundworm eggs? In theory, yes, but the risk is very low. The eggs are sticky and relatively large compared with many other microscopic disease agents, so they do not become airborne easily. Even if some eggs were inhaled, they would still need to be swallowed to cause infection. The main risk remains hand-to-mouth transfer, not inhalation.

Other animals may become infected by eating an infected animal or through contact with the feces of an infected animal.

Symptoms

Symptoms in people may include nausea, skin irritation, fatigue, liver enlargement, loss of coordination, loss of muscle control, blindness, lack of attention, and coma.

Raccoons rarely show symptoms of the disease but wildlife species that aren't usually host to this worm (such as woodchucks, squirrels, birds) tend to show abnormal behaviors when infested. They'll tilt their heads and have difficulty walking or climbing. They may lose their fear of people, circle, roll on the ground, fall over, lay on their sides and paddle their feet, or fall into a coma.

Treatment

If someone has been exposed, or even suspects exposure, seek medical care immediately. If treatment begins before the larvae migrate through the body, the disease may be prevented. Once migration has occurred, diagnosis and treatment become much more difficult.

This material is copyrighted by the National Wildlife Control Training Program LLC.

Protection on the job

If you're working in an area that's contaminated with raccoon feces, wear a proper (N-95) mask or respirator, rubber gloves, rubber boots, and disposable coveralls.

Because the roundworm egg's outer shell is so sticky, you have to change your clean-up method to make sure the cleaning agent can break through this coating to kill the developing worm. Disinfectants alone will not do the trick. Intense heat is the best option for anything that can withstand open flames. Use a handheld propane torch (weed burner) to flame the droppings, contaminated areas of soil or concrete, and your traps. Do not use near wood, plastic, cardboard, or any materials that might burn or melt. If flaming is impractical, pour boiling water on the feces to kill the eggs. And if that's not feasible, double-bag the materials and bury them completely.

Contaminated clothing can be double-bagged and discarded or washed in boiling water with bleach. Clean your gear while the feces are still fresh and easier to remove. Scrub rubber boots with bleach and a scrub brush.

Advice for customers

Have your pets "wormed" three to four times each year.

To prevent your children from encountering roundworm eggs, keep them away from areas that are frequented by raccoons. Cover their sandboxes. Train them to wash their hands and scrub their fingernails after playing outdoors, especially if they were in your garden or the sandbox.

Discourage raccoons from living in and around your home.

Prompt removal and destruction of raccoon feces will reduce the risk of human exposure. Raccoons typically defecate at the base of trees, on fallen logs, on large rocks, and wood piles, and in barns or other outbuildings. Raccoon feces may also be found in children's sandboxes, attics, fireplaces, garages, decks, rooftops, haylofts, and compost piles.

This material is copyrighted by the National Wildlife Control Training Program LLC.

Areas of soil or concrete are best decontaminated by a thorough flaming using a handheld propane torch (weed burner). Use safe fire practices. Wooden decks and patios can be cleaned with boiling water. Soil can be turned over with a rake or shovel, then flamed. Repeat this process several times. To decontaminate a fireplace or woodstove and chimney, build a roaring fire.

For more info about raccoon roundworm:

http://www.cdc.gov/parasites/baylisascaris/

https://extension.entm.purdue.edu/publications/ADM-17.pdf

https://www.cdc.gov/parasites/baylisascaris/resources/raccoonlatrines.pdf

Review questions

1. You can tell by looking at it if a raccoon is infested with *Baylisascaris* roundworms.
   (Circle correct answer) true false

2. Young children are most vulnerable to this disease because
   a. they're more likely to put contaminated objects and their hands into their mouths
   b. they have small bodies, so the worms reach their brains faster
   c. raccoons prefer them
   d. their immune systems haven't been exposed to the disease yet.

3. Your customer has five raccoons living in the backyard. The parents want to know how to clean up the area so their kids can play outdoors safely. You tell them:
   a. forget it, and buy them a computer game.
   b. clean the deck with boiling water. Soil should be raked and flamed repeatedly if safe to do so. Replace the sand

This material is copyrighted by the National Wildlife Control Training Program LLC.

in the sandbox. Build a roaring fire to clean out the fireplace, stove, and chimney.

c. don't worry, the rain will take care of it.

d. Dress your children in full body protection "bunny suits".

Answers:

1—false

2—a

3—b

Histoplasmosis

Caused by: fungus.

Most common way people catch it: by inhaling fungal spores.

Worst-case scenario: Death.

How common? Exposure is common in some regions, especially where the fungus is established in the environment. Most infections are mild or unnoticed, but severe illness can occur.

Most vulnerable groups: Very young or very old people, and people with compromised immune systems, because they're more likely to develop the most dangerous form of the disease. Construction workers, WCOs, and cavers are more likely to encounter the spores due to their jobs.

Histoplasmosis is a lung infection caused by inhaling spores of the fungus *Histoplasma capsulatum*. It is generally described in three forms: mild, chronic, and disseminated histoplasmosis.

Most people either have no symptoms or develop only a mild flu-like illness that improves on its own. Some cases progress to a chronic form that can resemble tuberculosis and worsen over time. The most serious form, disseminated histoplasmosis, means the infection has spread beyond the lungs to other organs and can be life-threatening without treatment.

This material is copyrighted by the National Wildlife Control Training Program LLC.

In an attic, the fungus *Histoplasma caspulatum* (1) may be present in bat droppings. Image by CDC.

Why do some people become so much sicker than others? It probably depends on the number of spores inhaled and the person's age and health. Young children, long-term smokers, and the elderly, especially those already suffering from a lung disease, are more likely to show symptoms of histoplasmosis. People with compromised immune systems (such as those with diabetes, cancer, HIV or AIDS, and transplant recipients) are at the greatest risk for developing the most dangerous form of this infection. Histoplasmosis is one of the most frequent opportunistic infections afflicting people who are HIV-positive. The Histoplasma fungus is common in the central and eastern U.S., especially along the Ohio, Mississippi, and St. Lawrence River Valleys and the Rio Grande. The CDC estimates that as many as 80% of the people living in these areas have been exposed to histoplasmosis. Also, 10-25% of those residents who are HIV-infected develop the most severe form of the infection. Overall, each year in the U.S., there are about 500,000 infections, 5,000 people hospitalized, and 800 deaths due to histoplasmosis.

How do you catch it?

This material is copyrighted by the National Wildlife Control Training Program LLC.

People become infected by inhaling airborne spores. If symptoms develop, they often begin about 10 days after exposure. Risk is higher in old or abandoned bird or bat roosts, chicken coops, caves, and other places where contaminated droppings or soil are disturbed.

Histoplasmosis is not contagious. It does not spread from person to person. Birds and bats do not directly carry the disease, but their droppings can enrich the environment in ways that support fungal growth.

The fungus is naturally occurring and can grow in various soils, with or without droppings. Although it's almost always associated with soil, the fungus has, in rare cases, been found in droppings alone. It grows readily in the soil beneath bird roosts, but it cannot form spores under the acidic conditions of fresh droppings; this means that an active roost may only give off a few spores. The droppings must dry out and then get wet before spores can be released. Generally, droppings need to accumulate for three or more years before the spores increase to significant levels underneath a roost.

If the soil is stirred up under dusty conditions, massive numbers of spores may be released. Severe epidemics have occurred in association with bird roosts that were bulldozed during construction projects. Once airborne, spores can easily be carried long distances by the wind.

Treatment Antifungal medications are used to treat severe cases of histoplasmosis. Mild cases usually resolve themselves without treatment.

Protection on the job

Take precautions when working around old or abandoned roost sites, especially if they have been exposed to rain. Avoid stirring up dust. If possible, schedule this work during cool, damp weather. Wear an appropriate respirator, disposable coveralls, goggles, gloves, and disposable shoe coverings. If overhead debris may fall, wear a hood. Ventilate the area when possible. Dampen

This material is copyrighted by the National Wildlife Control Training Program LLC.

contaminated materials before disturbing them and keep them damp while working. Wipe up droppings with a damp sponge and double-bag them for disposal. Spray dead birds or bats with a household disinfectant before bagging them.

An industrial vacuum with a high-efficiency filter can also be used to clean up the site.

Advice for customers:

The fungus is common, so it's smart to protect yourself before going near bird or bat droppings. If you're concerned about exposure, avoid dusty places that might be contaminated with the mold, such as construction and demolition sites, caves, attics, and poultry barns with dirt floors.

If you develop flu-like symptoms anywhere from 3-18 days after a potential exposure to the spores, you may want to see a doctor for testing.

The best way to prevent exposure to histoplasmosis is to discourage birds and bats from roosting within buildings.

To minimize exposure to airborne diseases, clean and disinfect infested areas.

This material is copyrighted by the National Wildlife Control Training Program LLC.

For more information about histoplasmosis:

http://www.cdc.gov/fungal/diseases/histoplasmosis/index.html

http://www.cdc.gov/fungal/diseases/histoplasmosis/risk-prevention.html

http://www.cdc.gov/niosh/docs/2005-109/pdfs/2005-109.pdf

https://www.nlm.nih.gov/medlineplus/ency/article/001082.htm

Review questions

1. People catch histoplasmosis from
   a. sexual contact with an infected person
   b. inhaling the mold spores
   c. rubbing their eyes after they've touched an area contaminated with bat droppings
   d. cleaning the cat's litter box
   e. birds

2. Histoplasmosis is common in the U.S..
(Circle correct answer) True False

3. Typical hot spots for this disease include
   a. caves
   b. attics that are inhabited by rodents
   c. old, abandoned bird or bat roosts
   d. poultry barns
   e. answers "a," "b," and "c" are correct
   f. answers "a," "c," and "d" are correct

Answers:

1—b, 2—true, 3—f

This material is copyrighted by the National Wildlife Control Training Program LLC.

Toxoplasmosis

Caused by: parasite.

Most common way people catch it: touching contaminated material and then touching the mouth, or handling or eating contaminated raw or undercooked meat.

Worst-case scenario: Can cause miscarriages or serious birth defects.

How common? Common.

Most vulnerable groups: people with compromised immune systems, pregnant women, and fetuses. Most infections are mild, but infection during pregnancy can sometimes result in miscarriage or serious birth defects.

Toxoplasmosis is an infection caused by the microscopic parasite *Toxoplasma gondii*. In many people it is mild and may be mistaken for a minor viral illness.

Toxoplasmosis resembles histoplasmosis in several ways: most people who are infected never realize it; it often causes flu-like symptoms; people with compromised immune systems are at greater risk for developing a much more severe infection; and severe infections may result in brain damage or death.

A key concern is that a pregnant woman can pass the infection to her unborn baby. Miscarriage, stillbirth, and serious birth defects are possible. Transmission is more likely later in pregnancy, but infection earlier in pregnancy may cause more severe effects.

On average in the U.S., one out of a thousand babies is born with toxoplasmosis each year. But that doesn't tell the whole story. The March of Dimes reports that up to 90% of infected babies appear normal at birth, and 55-85% of them develop symptoms months to years later, suffering from eye infections, hearing loss, and learning disabilities. Toxoplasmosis is common, but very few people have symptoms because the immune system usually keeps the parasite from causing illness. Symptoms in adults include swollen lymph glands, mild fevers, muscle aches,

This material is copyrighted by the National Wildlife Control Training Program LLC.

headaches, tiredness, confusion, and pains that last for a few days to several weeks. Severe infections can result in brain damage and damage to the eyes, and may become chronic.

How do you catch it?

People usually become infected by handling or eating raw or undercooked meat that contains the parasite, especially pork, lamb, or venison, or by contacting contaminated cat feces or soil and then transferring material to the mouth. Common exposure routes include cleaning litter boxes, gardening, or handling contaminated objects without washing hands afterward. In rare cases, transmission can occur through organ transplantation or blood transfusion.

Cats acquire the *Toxoplasma* parasite by eating infected wild animals or raw meat. Most mammals can be infected with this parasite. The eggs take about two days to become infective.

According to the American Veterinary Medical Association, infected cats only shed the eggs for one to two weeks of their lives, right after their first exposure to the parasite. Like humans, cats rarely have symptoms when first infected, so most people don't know if their cat has been exposed to *Toxoplasma*. There are no good tests available to determine if your cat is passing *Toxoplasma* in its feces.

Treatment

In an otherwise healthy person who is not pregnant, treatment is often not needed. Symptoms will usually go away within a few weeks. For pregnant women or people who have weakened immune systems, drugs are available to treat toxoplasmosis. Tests are available to determine if a fetus is infected; if so, medication may prevent or reduce the severity of the effects of the infection.

Protection on the job

Even WCOs who never handle nuisance complaints involving cats may still encounter this disease because cats and wildlife use

This material is copyrighted by the National Wildlife Control Training Program LLC.

many of the same areas. Follow standard precautions to avoid contact with cat feces, and wash your hands thoroughly with soap and warm water, especially before eating, smoking, or handling food.

Advice for customers:

Keep the risk in perspective. Toxoplasmosis is mainly a concern for people who are pregnant or immunocompromised. Simple precautions, especially careful hand washing, greatly reduce the chance of infection.

There's no need to get rid of pet cats or avoid adopting a cat. To prevent infections, keep cats indoors and feed them dry or canned cat food.

Feral cats, stray cats, and pets who are allowed to roam outdoors may eat infected small mammals and defecate on your property. Remove food sources to discourage stray cats.

Avoid handling stray cats, especially kittens. If you want to adopt a stray, or don't know whether or not a cat you'd like to adopt roamed outdoors or was fed raw meat, talk to your veterinarian before you bring the cat into your home.

Cover sandboxes, and carefully wash your hands after working in your garden (or wear gloves).

If the litter box is cleaned daily, any eggs present would still be in the non-infective stage.

Ideally, someone who's healthy and not pregnant should clean the litter box and handle raw meat. If this isn't possible, wear gloves while doing either activity, then wash your hands well with soap and warm water. Remember to wash any cutting boards, sinks, knives, and other utensils that might have touched raw meat or unwashed vegetables.

Cook all meat thoroughly, at least to 150 degrees (no longer pink in the center, or until the juices run clear). Don't sample meat before it is fully cooked. Red meat that's been smoked, cured, or frozen for at least 24 hours is also safe from this parasite.

This material is copyrighted by the National Wildlife Control Training Program LLC.

Chicken, other fowl, and eggs almost never contain this parasite, according to the CDC.

For more information about toxoplasmosis:

https://www.cdc.gov/parasites/toxoplasmosis/printresources.html

Review questions

1. Toxoplasmosis is like histoplasmosis because

    a. they're both caused by a parasite

    b. both cause flu-like symptoms that are often mistaken for something else

    c. with both diseases, people with compromised immune systems are more likely to develop a severe infection than others

    d. a pregnant woman can pass either disease to her unborn child

    e. answers "b" and "c" are correct

    f. answers "a," and "c" are correct

10. How do people catch toxoplasmosis?

    a. direct contact with cat feces

    b. eating or handling raw or undercooked meat

    c. inhaling the spores

    d. gardening

    e. answers "b" and "c" are correct

    f. answers "a," "b," and "d" are correct

This material is copyrighted by the National Wildlife Control Training Program LLC.

11. WCOs just need to know how to answer customers' questions about this disease, because they're not likely to be exposed to it. (Circle correct answer) true false

Answers:

1.—e
2.—f
3.—false (cats and wildlife use some of the same areas. Feral cats, strays, and pets that roam outdoors are also more likely to be infected than indoor house cats, because they eat more wild animals.

Hantavirus:

Disease name: Hantavirus pulmonary syndrome.

Caused by (**agent**): A **virus**.

Most common way people catch it (transmission): by cleaning, working in, or living in rodent-infested areas where virus-containing urine, droppings, or saliva may be disturbed.

Worst-case scenario: Death.

How common? Relatively uncommon. Most reported cases in the U.S. have occurred in western states, including California, Arizona, Colorado, and New Mexico.

Most vulnerable groups: People in close contact with rodent nesting areas (such as those whose homes are infested, agricultural workers, WCOs, and people who clean out buildings that are only used seasonally).

Several hantaviruses can cause a serious respiratory illness in people called hantavirus pulmonary syndrome. The disease was first officially recognized in the U.S. in 1993, although earlier cases likely occurred. It is uncommon, but it can be severe and potentially fatal.

This material is copyrighted by the National Wildlife Control Training Program LLC.

Early symptoms often include fever and muscle aches beginning 1 to 5 weeks after exposure. These may be followed by cough and shortness of breath. Once breathing symptoms begin, the disease can worsen quickly and hospitalization is often needed within 24 hours.

Chest x-ray of person with hantavirus. Photo by CDC.

How do you catch it?

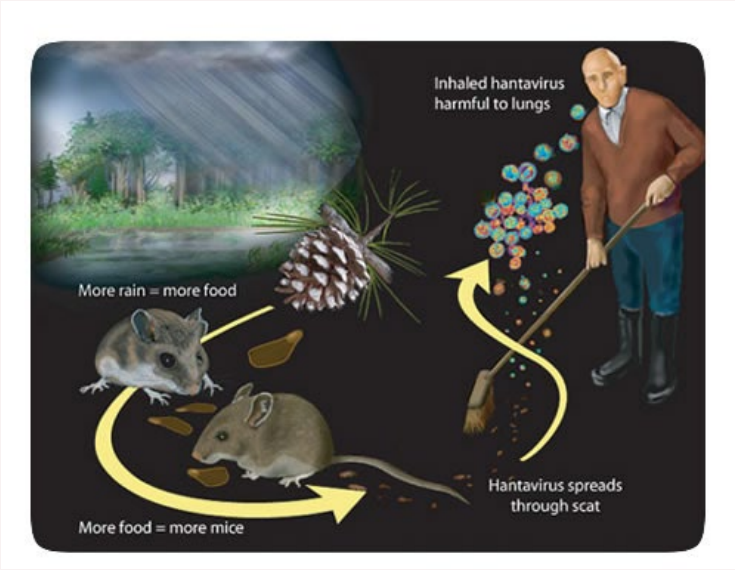
In the U.S., hantavirus pulmonary syndrome is associated mainly with deer mice and white-footed mice. Other hantaviruses are associated with rodents such as rice rats and cotton rats.

Rodents shed the virus in urine, droppings, and saliva. People are most often infected by inhaling contaminated particles after these materials are disturbed. Less common routes include bites from infected rodents, contact with contaminated material entering the eyes or an open wound, and possibly contaminated food or water. In the United States, this disease is not transmitted from person to person.

WCOs face higher exposure risk than many people because they often enter infested areas such as crawl spaces, attics, sheds, barns, cabins, and storage buildings. These spaces can contain

This material is copyrighted by the National Wildlife Control Training Program LLC.

contaminated nesting materials, droppings, and urine that are easily disturbed during work.



Pathway for hantavirus to infect humans. Image by CDC

Rodents catch hantaviruses by touching other rodents. Transmission is probably associated with fighting. Rodents are a vector; there's little evidence that they suffer from the disease. No other animals are known to have a direct role in the transmission of hantaviruses.

Treatment

Patients receive supportive treatment, often in the intensive care unit, and antibiotics to prevent secondary bacterial infections.

Protection on the job

Ventilate the area before entering, if possible. This is particularly important if the building has been closed for a while, such as a seasonal cabin.

Wear rubber gloves and an appropriate respirator when handling rodents, traps, droppings, urine, or nest materials. Avoid stirring up dust. Wet contaminated materials with a 10% bleach solution

This material is copyrighted by the National Wildlife Control Training Program LLC.

or another suitable disinfectant, allow time for it to soak in, then wipe up with a damp towel or sponge. Mop or sponge the area with disinfectant. Double-bag waste for disposal. Spray dead rodents with disinfectant before bagging them. Clean and disinfect your gear and traps afterward.

Advice for customers

Toys, silverware, and such items can be disinfected, but it's best to discard contaminated foods, drinks, napkins, paper plates, or cups.

There are several good reasons to exclude mice from your home. They spread diseases, such as hantavirus. They chew on wires and sometimes make their nests in fans or vents, which could lead to fires. They may destroy insulation and cause your heating and cooling bills to increase. Once they're removed, repairs may be needed to ensure that they can't get back in.

For more information about hantaviruses:

www.cdc.gov/ncidod/diseases/hanta/hps/index.htm

Review questions

1. Hantavirus is spread by deer mice and white-footed mice, not rats. (Circle correct answer) true false

12. Hot spots for hantavirus include

    a. crawl spaces and attics

    b. buildings that are only used seasonally, such as farm equipment storage sheds, summer camps, barns

    c. abandoned bird and bat roosts

    d. "a" and "b" are correct

13. To protect themselves from exposure to hantavirus, many WCOs wear respirators. Which other diseases are commonly caught by airborne transmission?

This material is copyrighted by the National Wildlife Control Training Program LLC.

a. histoplasmosis

b. West Nile virus

c. rabies

d. toxoplasmosis

e. raccoon roundworm

Answers:

1—false
2—d
3—a

Mange and Distemper

These two diseases aren't a serious medical concern for people, but they do commonly affect wildlife and pets. People can catch mange and canine distemper, but canine distemper doesn't cause symptoms in humans. So why are we including these diseases in the manual?

Distemper can be mistaken for rabies. You could pick up the mites that cause mange from contact with a mangy animal or contaminated equipment. Both diseases can be fatal. WCOs should try to avoid spreading either disease. For example, if you deal with a mangy animal, clean your equipment carefully before moving on to your next job (handle carcasses with care, too). Do your best to avoid giving the mange mites a free ride into a new area.

Mange

Disease name: "sarcoptic mange and chorioptic mange"

Caused by (**agent**): mites

Most common way people catch it (transmission): Mites migrate from infected animals or nests to people.

This material is copyrighted by the National Wildlife Control Training Program LLC.

Worst-case scenario: blisters and inflammation that itches, which could lead to other infections**.**

How common?

Most vulnerable groups:

The term “mange” applies to several skin diseases in mammals that are caused by microscopic burrowing mites. It’s a contagious infestation that affects many species, including wildlife and domestic animals. Two forms, “sarcoptic mange” (also known as “scabies”) and “chorioptic mange” can be transmitted to people.

New hosts pick up the parasites from direct contact with an infested animal or its nesting area, or when the mites leave an abandoned nest in search of a new host. So, for example, if squirrels are removed from an attic but no one’s cleaned up after them, their mites might wander into the home looking for another source of food and shelter (a new host).

Mange is almost always fatal to red foxes and takes a heavy toll on coyotes, too. It may be a significant cause of death among squirrels during the winter. Although rare in well-fed, well-kept cats, mange is a problem in domestic dogs.

Sarcoptic mange in wildlife and domestic animals usually causes itchiness, hair loss, crusty scabs (often seen first on the head), and thick, wrinkly skin. The skin changes can cause blindness, impaired hearing, and difficulty in eating. In advanced cases, the animal may be weak and emaciated and smell foul, a result of secondary infections caused by scratching. If untreated, the animal may die of exhaustion, dehydration, or a secondary infection.

In people, this infestation causes a rash that usually looks like pimples, but may look like blisters or an inflammation; it usually appears on the forearms, thighs, and abdomen. Reactions vary. Generally, the mites die off, because they don’t do as well on people. Although doctors don’t often attempt to kill the mites with drugs, they may offer patients medication to control the

This material is copyrighted by the National Wildlife Control Training Program LLC.

itchiness so the patient doesn't scratch constantly, which could invite other infections.

Protection on the job

- Wear disposable gloves.
- Minimize contact with mangy animals, by using restraining devices. Wash promptly afterwards.
- Minimize contact with potentially infected gear or clothing. Clean your gear with if you think it may have picked up mites.
- Freezing kills the mites and may be useful for decontaminating clothing or other gear.

Advice for customers:

If your pet is scratching a lot or developing bald spots, take it to a veterinarian. Mange is treatable. Treatment for pets usually includes clipping, medicated baths or sprays, and medication.

The dog's bedding, and household furniture, may need to be treated, removed, or burned.

Distemper

Disease name: Canine Distemper, Feline Distemper

Caused by (**agent**): viruses

Most common way people catch it (transmission): Humans are not susceptible. It is listed here because the **the symptoms can be confused with rabies.**

"Distemper" is often used to refer to two diseases that show some of the same symptoms but are caused by different viruses. These diseases affect dogs and cats and many carnivorous species of wildlife, such as raccoons, foxes, and coyotes. In fact, many raccoons that are tested for rabies actually prove to be suffering from canine distemper.

This material is copyrighted by the National Wildlife Control Training Program LLC.

Dogs suffer from “canine distemper,” characterized mostly by respiratory and neurological symptoms. The cat version is called “feline distemper” or “panleukopenia” (previous names included “cat fever” and “cat typhoid”). Members of the raccoon and weasel families may also catch feline distemper.

Panleukopenia symptoms are usually related to diarrhea and anemia. The term “panleukopenia” means “total loss of white blood cells.” That should give you a sense of the seriousness of this disease. Panleukopenia is a complex disease. Its symptoms can range from very mild to extreme and are sometimes atypical. It has been mistaken for poisoning or swallowing a foreign object.

Neither disease has been shown to cause illness in people.

Canine distemper is the greatest single disease threat to the world’s dog population. It’s highly infectious and it’s nearly impossible for a dog to avoid exposure to this virus. More than 50% of the adult dogs and 80% of puppies that contract it die. Other effects include permanent problems with vision, hearing, sense of smell, and partial or total paralysis. Younger dogs and puppies are the most vulnerable. In wildlife, most cases are seen in the spring and summer, when wild canids, such as foxes and coyotes, bear their young.

Panleukopenia is also a highly contagious and common viral disease. Cats may catch distemper from contact with the blood, urine, droppings, nasal secretions, or fleas from infected cats, or from contact with contaminated bedding, cages, food dishes, and the hands or clothing of handlers. Young kittens, sick cats, and indoor cats that have not been given boosters recently are most susceptible; older cats are more likely to have acquired some immunity. Pregnant females that contract the disease, even in its mildest form, may give birth to kittens with severe brain damage. Kittens less than 16 weeks of age may die at a rate of about 75%, and others at a rate of 50%.

Advice for customers:

Vaccinate your pets. Vaccinate your pets. Vaccinate your pets.

This material is copyrighted by the National Wildlife Control Training Program LLC.

Both diseases are so common and the symptoms are so varied that any sick young dog or sick cat should be taken to a veterinarian.

The virus that causes feline distemper is resistant to many chemicals and may remain infectious at room temperature for as long as one year.

Indoor cats can catch this disease because you may bring the virus into the house if you've petted an infected cat or if it's brushed against your clothing. Hand-me-down cat carriers, beds, or food dishes could be contaminated.

For more information:

Mange:

https://edis.ifas.ufl.edu/mg118

Canine distemper:

https://www.avma.org/public/PetCare/Pages/Canine-Distemper.aspx

Feline panleukopenia:

https://www.avma.org/public/PetCare/Pages/feline-panleukopenia.aspx

Review questions

1. People can catch mange, but they can't catch distemper. (Circle correct answer) True False

2. Distemper can be confused with rabies because the symptoms are similar. (Circle correct answer) True False

Answers: 1—true, 2—true

West Nile Virus

Caused by: A virus.

Most common way people catch it: Mosquito bite.

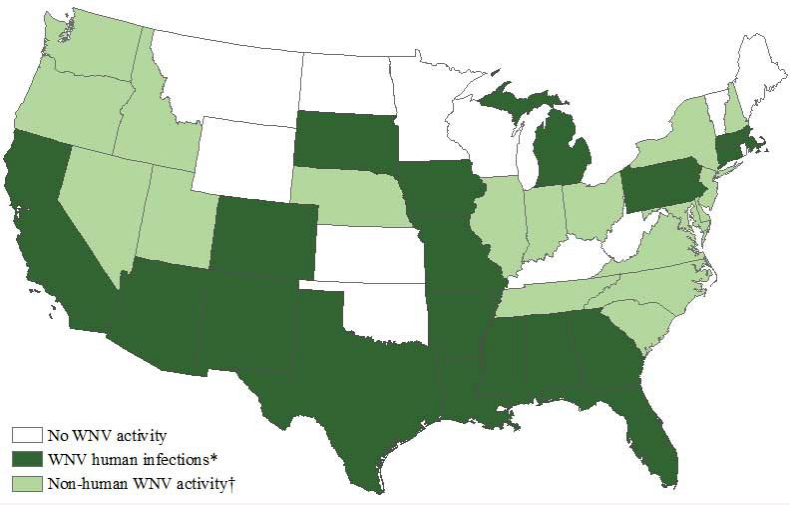
This material is copyrighted by the National Wildlife Control Training Program LLC.

Worst-case scenario: Death.

How common is the virus? The disease is relatively uncommon in people and most infections are mild. The range of the virus is expanding. Because it's mosquito-borne, many people can be exposed to the virus.

Most vulnerable groups: Elders and those with compromised immune systems.

West Nile virus affects more than 70 species of domestic and wild birds (especially American crows jays, hawks, and owls) and mammals (especially people and horses). It's also been found in bats, chipmunks, raccoons, skunks, squirrels, domestic rabbits, mountain goats, and reindeer. It was recently identified as the cause of death of a few American alligators, although we don't yet know how susceptible reptiles are to this virus. Most mammals do not become sick if infected with West Nile virus.



West Nile Virus Activity by State – United States, 2020 (as of September 9, 2020). Image by CDC.gov

The virus causes a variety of symptoms that usually appear in 3-14 days (although the precise incubation period is not yet known). Most common are a group of mild, flu-like symptoms including fever, rash, tiredness, and loss of appetite. A small

This material is copyrighted by the National Wildlife Control Training Program LLC.

percentage of people develop a more serious condition, an infection of the central nervous system that may cause encephalitis and meningitis, and in an even smaller group, paralysis or death.

About 1 in 5 people who are infected develop a fever and other symptoms. About 1 out of 150 infected people develop a serious, sometimes fatal, illness.
https://www.cdc.gov/westnile/index.html

The disease was first reported in the eastern U.S. in the summer of 1999, although it may have been present before then. It's now believed to be permanently established in the U.S. There's good evidence that birds spread the disease as they migrate.

Mosquitoes are vectors of West Nile virus. Photo by Jim Kalisch.

How do you catch it?

People primarily catch West Nile virus from the bite of infected mosquitoes. The disease lives in the insects' salivary glands.

Mosquitoes are vectors of West Nile virus, which means that they can transmit the disease, but do not suffer from it themselves. *Culex pipiens,* is an important vector of West Nile virus but we're not sure what role it plays in the transmission of the virus to

This material is copyrighted by the National Wildlife Control Training Program LLC.

mammals. There are other ways a person might be exposed to West Nile virus, such as from blood transfusions, organ transplants, and breast milk, or by handling infected birds (the virus may be present in feathers, feces, or dander).

Normally, the virus cycles between mosquitoes and birds. When an infected mosquito bites a bird, it transmits the virus to the bird. The virus circulates in the bird's blood for a few days. Uninfected mosquitoes that bite an infected bird may then pick up the virus, which reproduces in the mosquito's body. Once there's a certain amount of virus in the mosquito's body, it can transmit the virus to another animal.

Mosquitoes don't bite only birds, of course. When an infected mosquito bites a person, horse, or other mammal, it transmits the virus to that animal. The virus then multiplies and may cause illness. But the virus doesn't reproduce effectively in mammals, so later on, an uninfected mosquito biting an infected mammal probably can't pick up the virus. That's why mammals are currently considered "dead-end" hosts for the West Nile virus.

Some species of mosquito prefer to feed on birds, some tend to bite large mammals such as horses, and others bite people. Which mosquitoes find which animals tastiest? Do their preferences change during the season? Researchers are trying to answer these questions, which will help us better understand how, when, and where people are most likely to catch West Nile virus.

Some wildlife biologists are concerned that West Nile virus could seriously affect the populations of some rare or endangered birds. When dogs and cats are infected, the virus doesn't appear to cause serious illness in them.

Treatment

People infected with West Nile virus receive general supportive treatment. There is no vaccine for people yet, but specific medications and a vaccine are under development. In 2021, four West Nile virus vaccines licensed by the USDA for horses were

This material is copyrighted by the National Wildlife Control Training Program LLC.

available. Horses vaccinated against other related viruses, such as eastern equine encephalitis, western equine encephalitis, and Venezuelan equine encephalitis, are not protected against West Nile virus.

Protection on the job

Until we have a better understanding of which mosquitoes are most likely to transmit the virus to people, we can't offer a strategy that takes advantage of the particular habits of the vector. For example, some mosquitoes feed during the day while others are active from dusk to dawn. They're found in different habitats. And mosquitoes may not be the only vector of West Nile virus. Scientists are currently studying whether or not the bird louse can transmit the virus to people.

With all these unknowns, what should you do? Avoid getting bitten by mosquitoes and don't handle dead birds with bare hands (wrap carcasses in layers of plastic instead). Wear loose-fitting clothing or mosquito repellent to reduce your chance of being bitten by an infected mosquito. Light colors are less likely to attract mosquitoes. Long sleeves aren't a bad idea, either.

Advice for customers:

If you notice conditions at your customer's home that would encourage mosquito breeding, you may wish to point these out. The *Culex* mosquito has a small home range. It usually doesn't fly more than 300 feet from its breeding site. It's possible to dramatically reduce the number of *Culex* mosquitoes near the home by removing breeding habitat. These mosquitoes breed in small pools of water that contain leaves or other debris.

- Dump out standing water from rain gutters, recycling bins, tires, tarps, children's pools, garbage can lids... wherever it collects.

- Turn over items that might collect water, like wheel barrows and pools.

This material is copyrighted by the National Wildlife Control Training Program LLC.

- Change the water in bird baths at least once a week.
- Clean the debris from rain gutters early in the spring. Clean up any garbage piles.
- Keep roadside ditches clear, so water can flow freely through them.
- Remove decaying plants and any other floating debris from garden ponds.
- Stock ornamental ponds with mosquito predators such as dragonflies and goldfish to reduce mosquito populations. Or aerate the pond by adding a fountain. A variety of pesticides will kill mosquito larvae in water; read the labels.

For more info about West Nile virus:

www.cdc.gov/ncidod/dvbid/westnile/index.htm

Review questions

1. People generally catch West Nile virus from

   a. birds

   b. bats

   c. mosquitoes

   d. inhaling spores

WCOs are at risk for this disease from a vector other than mosquitos. True False

This disease is more deadly than people realize.
True False

Answers: 1—c, 2—true (although primarily spread by mosquito bites, it is possible to be exposed to histoplasmosis by handling infected birds). 3—false

This material is copyrighted by the National Wildlife Control Training Program LLC.

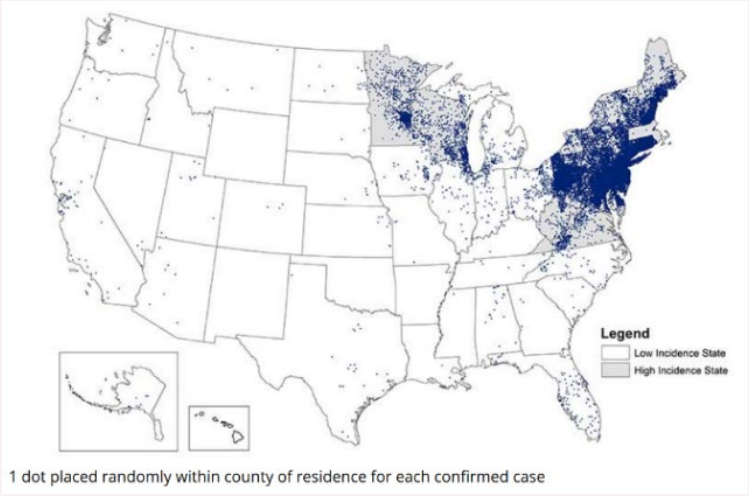
Lyme Disease

Caused by: Bacteria

Most common way people catch it: Bite from a deer tick, also known as a blacklegged tick—the only way it is caught.

Worst-case scenario: Can lead to disabling conditions including arthritis, problems with the heart and nervous systems, and personality changes.

How common? Common in Northeast U.S., Minnesota, and Wisconsin.



Reported cases of Lyme disease in 2018. Map by CDC.

Most vulnerable groups: People who spend more time outdoors and those who work in landscaping, forestry, and related jobs.

Lyme disease is caused by a bacterium, *Borrelia burgdorferi*. The bacteria are transmitted to people by bites from the deer (a.k.a. "blacklegged") tick, *Ixodes scapularis*. The western blacklegged tick (*Ixodes pacificus*) spreads the disease on the Pacific Coast.

There are more than 30,000 cases reported to the CDC each year. According to the CDC in 2018, "Recent estimates using other methods suggest that approximately 476,000 people may get Lyme disease each year in the United States."

This material is copyrighted by the National Wildlife Control Training Program LLC.

https://www.cdc.gov/lyme/datasurveillance/index.html If untreated, Lyme disease can cause arthritis, especially in the knees; heart problems; cognitive disorders; sleep disturbance; fatigue; and personality changes. Infrequently, Lyme disease may be severe, chronic, and disabling but it's rarely if ever fatal.

Some infected individuals show no symptoms, or only mild, flu-like symptoms such as fever, headache, fatigue, and muscle pain. Symptoms often begin 7 days after infection, although they may be noticeable 3-30 days afterwards.

Early symptoms include a flu-like illness with headache, slight fever, muscle or joint pain, neck stiffness, swollen glands, jaw discomfort, and inflammation of the eyelids. A diagnostic rash appears in 65-75% of cases. This red rash starts at the site of the tick bite. It often has a bulls-eye appearance. The rash grows quickly, often forming a nearly circular lesion of about 1-8 inches, and may burn or itch. Additional smaller skin lesions may appear at other sites of the body and may last for days or weeks.

Additional symptoms may develop in untreated patients. These often include arthritis, especially of the knees. The joint pain and swelling usually occur one or more months after infection, may involve one or more joints, and may recur in different joints. Problems might develop with the heart, muscles, and nervous system, causing cognitive disorders, sleep disturbance, fatigue, and personality changes.

People who spend more time outdoors and those who work in landscaping, forestry, and related jobs are at higher risk for the disease. Gardening, hiking, camping, fishing, and hunting may expose you to Lyme disease. WCOs are not necessarily in a higher risk category, but should take precautions, especially if working in an area favored by ticks.

The disease's name comes from its discovery in Lyme, Connecticut in 1977.

How do you catch it?

This material is copyrighted by the National Wildlife Control Training Program LLC.

People catch the disease when an infected tick feeds on them—if the tick has remained attached to their bodies long enough to transmit the disease. That usually takes about two days. If the tick is located and removed within 24 hours, infection is unlikely.

For Lyme disease to exist in an area, at least three things must be present outdoors: the Lyme disease bacteria; blacklegged ticks that can transmit the bacteria; and host mammals such as mice and deer that provide a blood meal for the ticks through their various life stages.

Lyme disease has a more complicated transmission cycle than the wildlife diseases discussed earlier because the life cycle of the vector, the blacklegged tick, takes two years to complete. Although the tick may be infected with the Lyme disease bacteria in three of its four life stages, it's almost always a nymphal tick that transmits the disease to people. That's because larval ticks are rarely infected when they're feeding. Adult ticks are much larger, so they're more likely to be removed before they've had a chance to transmit the bacteria to the person.

Lyme disease affects humans and dogs but doesn't cause illness in deer.

Treatment

Patients treated with antibiotics during the early stages of the disease usually recover quickly and completely.

Even patients treated during later stages generally respond well and recover. A vaccine is available for dogs, but there's no reliable vaccine for people yet.

Protection on the job

When possible, avoid tick-infested areas, especially from May through July. Blacklegged ticks in the northern U.S. prefer deciduous forests and habitats that contain leaf litter. They need moist cover that provides protection from the wind and other elements. Suburbs often contain prime habitats (forested areas

This material is copyrighted by the National Wildlife Control Training Program LLC.

interspersed with residential development); ticks also prefer overgrown brushy areas, particularly along forest edges.

To see ticks better, wear light-colored clothing and tuck your pant legs into your socks. You could also tape the tops of the socks over the pant legs with duct tape for added protection. If you decide to use tick repellent, follow the label's instructions carefully.

Check yourself for ticks while you're outdoors, and remove any you find. Do this during your lunch break as well. Once indoors and naked, inspect your body carefully and remove ticks. Make sure to do this by bedtime. Showering, with vigorous scrubbing, may also help to remove ticks.

Place the tick in alcohol or a vial for identification. Note the date of removal. If it proves to be a blacklegged tick, see a doctor if symptoms develop.

After outdoor activity, remove and wash your clothing promptly and dry the clothes at a high temperature.

Advice for customers:

Research has shown that tick populations can be reduced by 72-100% when leaf litter is removed. Clean up your yard and keep it well-trimmed. Remove brush piles and wood piles from areas right around the house.

Hunting helps to stabilize deer populations, which may reduce the number of blacklegged ticks because deer are one of the hosts of this parasite.

Carefully inspect yourself and your pets for ticks soon after going indoors, and remove any ticks right away.

To remove feeding ticks, dab them with alcohol. If feeding has just started the ticks may release easily. If they don't let go in a few minutes, take a pair of tweezers with a pointed tip and grasp the tick close to your skin. Pull steadily until the tick is removed.

This material is copyrighted by the National Wildlife Control Training Program LLC.

Don't be alarmed if the tick's mouthparts remain in the skin. The bacteria that cause Lyme disease are contained in the tick's midgut, not its mouth. Just cleanse the area with an antiseptic to prevent infection.

Don't use petroleum jelly, a hot match, nail polish, or other products to remove ticks. Grasping the tick at its back end, or heating it, can force disease organisms into the wound.

For more info about Lyme disease:

www.cdc.gov/ncidod/dvbid/lyme/index.htm

Review question

What's the best way to remove a tick from your body?

a. hold a lit cigarette or hot match next to the tick

b. smother it with petroleum jelly ("Vaseline")

c. dab it with alcohol, then pull it out with a pair of tweezers

d. shower and scrub furiously

If you remove the tick soon enough, you're not likely to get the disease. (Circle answer) True False

Answers: 1—c,

Dealing with Contaminated Materials and Dead animals.

Most WCOs do a certain amount of clean-up of the site as part of their service. If the site presents a formidable mess, some WCOs contract for clean-up separately while others recommend a cleaning service. Whether you do a little or a lot of cleaning on site, you'll still need to clean your gear and your truck.

Clean and disinfect your equipment with a commercial disinfectant or a 10% chlorine bleach solution—that's one part bleach to nine parts water. This doesn't last long, so mix up a new

This material is copyrighted by the National Wildlife Control Training Program LLC.

batch every day. Many WCOs keep a 10% bleach solution in a quart-sized spray bottle in the truck, for quick, small cleaning jobs. Always read the label on any cleaning product or disinfectant before using it.

This module covered some of the most common zoonotic diseases that a WCO may encounter on the job. There are many more. Familiarize yourself with the diseases you may encounter in the field. Pay attention to the vectors and method of transmission so that you have the appropriate **personal protection equipment** (PPE) for the animals that you are managing. Scat and urine can be as dangerous as scratches and bites.

Remember this about Diseases

Agent: — what causes a disease

Vector: — animal or insect that carries or transmits the agent

Symptoms in people: — evidence of disease

Transmission routes — how people catch a disease:

- **Fecal-oral:** Person touches pathogens and then, with unwashed hands, touches mouth.
- **Ingestion:** Person eats or drinks contaminated product.
- **Inhalation**: Person inhales disease agent.
- **Wound/eye/nose/mouth:** The contaminant invades a person's wound, eyes, nose, or mouth.

Take the Test

This material is copyrighted by the National Wildlife Control Training Program LLC.