Wildlife Zoonoses for the Veterinary Practitioner

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Abstract

There is increasing concern regarding wildlife zoonoses. It is important that veterinarians are able to give their clients and the general public appropriate advice regarding the potential risks, what to do in the event of possible exposure, input regarding early recognition of the signs of wildlife zoonotic infections, and practical advice to prevent or reduce exposure to wildlife zoonotic pathogens. This advice is summarized for a variety of wildlife zoonoses in North America including rabies, hantavirus, tularemia, plague, psittacosis, baylisascaris, alveolar echinococcosis, arthropod-borne encephalitis, tick-borne diseases, and food safety related to game meat. This is a US government work. There are no restrictions on its use.

Keywords: **disease prevention; North America; wildlife; zoonosis**

Zoonotic infections are diseases that occur primarily in wild and domestic animals that can be transmitted to humans. Infectious pathogens that originate in wildlife have become increasingly important in recent decades.[1,2] The emergence and reemergence of these wildlife zoonoses are associated with a range of casual factors, most of them as a result of human activities such as increasing human populations, global human travel and trade of wildlife, changing land-use patterns, and other environmental changes. Veterinarians are often considered a source of information by the general public as well as clients on all topics relating to animal health and zoonotic diseases. Although all persons who feel they have been exposed to a zoonotic pathogen should be immediately referred to his or her health care provider so that a diagnosis can be made and the correct treatment prescribed, it is important that veterinarians are able to give advice regarding the potential risks and what to do in the event of exposure, assist in early recognition of disease, as well as provide information to help prevent exposure. There are many excellent reviews of wildlife zoonoses (see Suggested Readings), and the intent of this article is not to repeat this work, but to synthesize practical information and advice that veterinary practitioners can give to their clients and the general public regarding measures that can be taken to prevent or reduce exposure to wildlife zoonotic pathogens. If more detailed information is required, the reader is referred to the Suggested Readings and web sites at the end of the article.

Rabies

Rabies is an acute encephalomyelitis caused by viruses belonging to the genus *Lyssavirus* in the family Rhabdovirus. It is one of the oldest, recognized infectious diseases and has a cosmopolitan distribution except for Antarctica. The *Lyssavirus* genus contains

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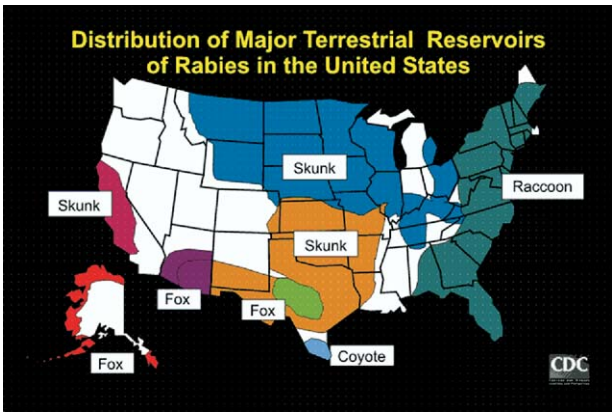

Figure 1. Geographic distribution of the major terrestrial reservoirs of rabies in North America (Figure courtesy of the Centers for Disease Control and Prevention).

at least 7 antigenically distinct viruses that are maintained in different reservoir hosts. Within each serotype or genotype, there are also a number of variants that are also maintained by different hosts. All mammals are considered susceptible; however, terrestrial carnivores and bats are the major reservoirs. The major terrestrial reservoir species in North America are the raccoon (*Procyon lotor*), skunk (*Mephitis mephitis* and other species), fox, (*Vulpes vulpes*, *Urocyon cinereoargenteus*, and *Alopex lagopus*), and coyote (*Canis latrans*). These species are responsible for maintaining distinct rabies strains in various geographic regions of North America (Fig 1). In contrast, rabies in insectivorous bats, caused by several bat-adapted strains of rabies, occurs throughout the continental United States.

Rabies virus is shed in the saliva and is usually introduced by a bite wound. Rare forms of transmission include a contaminated scratch or wound, mucous membrane exposure, aerosol, laboratory accident, or organ transplantation.[3] Incubation is variable, but is usually less than 3 months. The clinical course of the disease is short, and once clinical signs develop, it is invariably fatal. Animals with rabies will typically have markedly abnormal behavior, which is often classified into two forms. "Dumb" rabies is characterized by aimless wandering, lethargy, ataxia, hindleg weakness, paralysis, and loss of awareness. Other signs include pruritis, hyperexcitability, hyperesthesia, photophobia, hypersalivation, dysphagia, change in phonation, and mydriasis. Less frequent in raccoons, "furious" rabies may occur, with vicious attacks on any object and self-mutilation. Both forms ultimately result in seizures, coma, and death.

Rabies is only transmitted when the virus is introduced into bite wounds, open cuts, or onto mucous membranes from saliva or other potentially infectious material such as neural tissue. People are usually aware if they have been bitten; however, because bats have small teeth, the bite marks may be small and easily missed. Consequently, if a person awakens to find a bat in the room, or if a bat is near a child or mentally impaired or intoxicated person, then rabies exposure should be suspected. Persons who have been exposed should be advised to wash the wound thoroughly with soap and water and should be referred to his or her physician and state or local health authorities. The wild animal suspected of having rabies should be killed without damage to the brain and placed in double-layered bags for submission to a diagnostic laboratory. Latex gloves should be worn when handling the carcass, which should be refrigerated. It is vital that the veterinary practitioner obtain a detailed case history including names and contact information of persons exposed, as well as the identity of any exposed domestic animals. Diagnosis of rabies in animals is confirmed postmortem with fluorescent antibody testing on central nervous tissue.

People should be advised to not approach or handle unfamiliar wild or feral animals, especially if they appear friendly. Wild animals should not be fed, or unintentionally attracted to human-inhabited areas. People should not bring wild animals into their homes nor try to nurse sick animals. People should be advised to call animal control or the local wildlife agency regarding sick, injured, or nuisance wildlife. "Bat proofing" houses and community buildings may also help prevent exposure. This can be achieved by caulking or filling any holes that are larger than a quarter-inch diameter. Window screens, chimney caps, and draft guards beneath doors to attics should be used, and all doors to the outside should be closed tightly. Attics can be bat proofed by covering outside entry points with hanging bird netting or plastic sheeting. When the bats leave, the holes can be permanently sealed. The best time to bat proof a home is in the fall and winter, because most bats will leave to hibernate.

Any domestic animal bitten or scratched by either a wild carnivorous mammal or a bat that is not available for testing should be regarded as having been exposed to rabies. Unvaccinated dogs, cats, and ferrets exposed to a rabid animal should be euthanized immediately. If the owner is unwilling to have this done, the animal should be placed in strict isolation for 6 months and vaccinated 1 month before being released. Animals with killed vaccinations need to be evaluated on a case-by-case basis. Dogs and cats that are currently vaccinated should be kept under observation for 45 days. All dogs, cats, and

Figure 2. Picture of a rabies vaccine–laden bait used to orally vaccinate raccoons and other terrestrial reservoirs for rabies (picture courtesy of the Centers for Disease Control and Prevention).

ferrets should be vaccinated against rabies and revaccinated according to the *Compendium of Animal Rabies Prevention and Control 2005* produced by the National Association of State Public Health Veterinarians, Inc (http://www.nasphv.org). Cats and ferrets should be kept indoors, and dogs should be supervised when outside to minimize the potential for exposure.

Considerable resources are dedicated to controlling rabies in free-ranging wildlife populations. Currently, the United Stated Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services program is distributing oral rabies vaccines in an effort to create a rabies-free barrier along the Appalachian ridge by vaccinating raccoons. The vaccine consists of a live vaccinia vector with a rabies virus glycoprotein spliced into the vaccinia virus. Although the vaccinia virus is highly attenuated, it does present a remote risk to immunocompromised persons, particularly those who have skin disease or those who are pregnant.[4] The plastic vaccine sachets are ice-cubed size and are coated with a sticky, scented substance. Some are placed inside fish meal polymer baits (Fig 2). The baits have a toll-free number (1-877-722-6725) printed on them for people to call in the event of human or domestic animal contact. People should be advised not to touch the bait and wash their hands after handling one. There is no harm from touching an intact bait. Pet owners should be warned not to attempt to remove a bait from an animal's mouth, because a bite wound from an animal that has broken the sachet may result in exposure to the vaccine. Contact with the liquid vaccine inside the sachet should be reported to the local health department. In addition, the exposed area should be washed thoroughly with soap and water. Vaccine consumption is not harmful to animals and does not interfere with the regular rabies vaccination schedule; however, some diarrhea may develop if multiple baits are consumed.

Hantavirus Pulmonary Syndrome

This disease, caused by infection with a variety of hantaviruses, was first recognized in 1993 in the Southwestern United States; this outbreak was later found to be caused by the Sin Nombre virus. Since then, several pathogenic hantaviruses have been identified in the United States, and each virus has a single rodent host. All hantaviruses known to cause hantavirus pulmonary syndrome are carried by New World rats and mice of the family muridae, subfamily Sigmodotinae. The deer mouse (*Peromyscus maniculatus*) is the host for Sin Nombre virus. The deer mouse is common and widespread in rural areas throughout much of the United States. Other hantaviruses associated with sigmodontine rodents and known to cause hantavirus pulmonary syndrome include New York virus, which is hosted by the white-footed mouse (*Peromyscus leucopus*); Black Creek Canal virus, which is hosted by the cotton rat (*Sigmodon hispidus*); and Bayou virus, which is hosted by the rice rat (*Oryzomys palustris*). Nearly the entire continental United States falls within the range of one or more of these host species. Early symptoms in humans include fever, headaches, myalgia, nausea, vomiting, diarrhea, dizziness, and chills. Later symptoms include severe respiratory distress due to pulmonary edema, which can be rapidly fatal. Humans are exposed through the inhalation of aerosolized rodent urine, feces, and saliva, as well as the handling of rodents. Prevention involves excluding rodents from homes and buildings including shelters and cabins, watching for signs of rodent infestation, and promptly removing any infestations. Homes should be kept clean and food should be covered in rodent-proof containers. Garbage should also be secured. All entry holes to buildings wider than ¼ inch should be sealed. Spring-loaded rodent traps and Environmental Protection Agency-approved rodenticides can be used to reduce infestations. Predators such as nonvenomous snakes and raptors are excellent natural methods to reduce local rodent populations. Infested areas can be cleaned using 10% bleach solution. Workers who regularly handle rodents are at increased risk for this disease and should contact the Centers for Disease Control and Prevention (CDC) for more detailed safety precautions (www.cdc.gov).

Tularemia

Tularemia is a serious, life-threatening human disease caused by the bacterium *Francisella tularensis*. At least two subspecies are recognized: *F. tularensis* biovar *tularensis* (also known as type A) and *F. tularensis* biovar *palaeartica* (or type B). Type A is considered the more virulent subspecies. *F. tularensis* has one of the broadest host ranges of all bacteria, but is primarily a disease of lagomorphs and rodents. In North America, tularemia most commonly involves cottontail rabbits (*Sylvilagus* spp., black-tailed rabbits (*Lepus californicus*), snowshoe hares (*Lepus americanus*), beaver (*Candor canadensis*), and muskrat (*Ondatra zibithecus*). Tularemia is highly infectious and can be transmitted by all known epidemiologic routes including arthropod vectors by inoculation of skin, ocular or oral mucuus membranes with contaminated water, blood or tissues, inhalation, and ingestion. Symptoms in people will vary depending on the route of exposure, but include ulceroglandular and glandular syndromes typified by fever and swollen lymph nodes, or oropharyngeal form typified by pharyngitis and tonsillitis. Typhoidal tularemia presents with fever, chills, headaches, diarrhea, myalgia, joint pains, and progressive weakness, and may be accompanied by bronchopneumonia. Pneumonia is usually a sequelle to inhalation exposure. The practitioner should advise the general pubic to avoid touching and handling sick animals, especially lagomorphs and rodents, and wear latex gloves and wash hands thoroughly after handling animal carcasses. Game meat should be cooked well (see section on Game Meat). Persons frequenting areas with arthropod vectors should take the appropriate precautions (see section on Tick-Borne Diseases). Finally, people should be advised to avoid areas where tularemia is known to be occurring in wildlife.

Plague

Plague is a rare bacterial disease caused by *Yersinia pestis*, and there is a long history of human outbreaks. Its importance is illustrated by the fact it is one of a very few international quarantinable infectious diseases of people. It is flea transmitted and perpetuated by rodents. Infection in humans results in severe disease with a high case fatality rate. In North America, plague is mostly confined to the southwestern areas, with most cases reported from New Mexico, Arizona, Colorado, and California. Periodically, there are outbreaks among more susceptible species of rodents, such as prairie dogs (*Cynomys* spp.), and these die-offs are often the first indication of plague activity in an area. Public education, particularly for hunters, trappers, and other outdoor recreationists, and restriction of activities in areas with active plague are important preventive strategies. People should also be advised not to touch dead animals and make homes and human-inhabited buildings rodent proof (see section on Hantavirus Pulmonary Syndrome). Persons frequently outdoors should take appropriate precautions to prevent flea bites (see section on Tick-Borne Diseases). Cats are very sensitive to plague and can bring infected fleas into homes. Consequently, domestic pets should be treated for fleas and not allowed to roam freely.

Psittacosis

Psittacosis, also known as avian chlamydiosis or ornithosis, is due to infection with the intracellular bacteria *Chlamydophila psittaci*. Waterfowl, herons, and pigeons are the most commonly infected wild birds in North America, although it will occasionally infect gulls and terns, shorebirds, songbirds, and upland gamebirds. The organism is excreted in feces and nasal discharges and can remain infective in the environment for several months. It can be a serious health problem in humans, usually causing an atypical pneumonia. Human infection from wild birds is rare, although persons who work closely with birds are more at risk. People should avoid areas with large buildup of bird droppings such as rookeries. Masks and respirators will decrease the possibility of inhaling airborne avian fecal material in high-risk areas. Dry, dusty areas with bird guano can be wetted down with 5% bleach solution or other disinfectant. Furthermore, working with large numbers of birds in dusty, closely confined areas should be avoided.

Baylisascaris

Baylisascaris procyonis is a large intestinal roundworm of raccoons. It is indigenous in raccoons from North America and is more common in the Midwestern and Northeastern United States and along the West Coast. The adult worms produce eggs which are shed in the feces. The larvae develop within the egg and are infective 2 to 4 weeks after shedding. People and other animals become infected when they accidentally ingest the infective eggs. In these intermediate or aberrant hosts, the larvae undergo aggressive somatic migration. Clinical signs vary depending on the dose and site of migration, but ocular and neural larval migrans are commonly reported. Larvae mi-

grating in the brain produce traumatic damage and inflammation, resulting in progressive central nervous system disease.

Sources of infection include any areas or objects contaminated with raccoon feces. Raccoons will often defecate at latrines that are found at the base of trees, logs, rocks, and other horizontally orientated structures. They are often found in barns, lofts, or garages, on decks, woodpiles, and roofs, and these areas become important long-term sources of infection. It appears that young children and developmentally disabled persons are at highest risk for infection when they spend time outdoors because of poor hygiene and a propensity for pica and geophagia. Infection is rare; however, there are an increasing number of deaths or cases of severe disabling central nervous system disease in infants.

To prevent exposure, people should be advised to avoid contact with raccoons, and raccoons should not be adopted as pets. Raccoons should be discouraged from living around homes and parks by preventing access to food and shelter. Children should be kept away from known or potentially contaminated areas and taught to recognize and avoid raccoon latrines. Dealing with contaminated environments is more problematic because of the resistance of the eggs. Once in the environment, the eggs can survive for years, and they are resistant to all common disinfectants. Heat is the best method of killing the eggs. Boiling water, propane flame gun (with the appropriate care), steam cleaner, autoclave, and burning can be used for contaminated areas. For heavily contaminated areas, it may be desirable to discard the top several inches of soil. Raccoon feces and contaminated materials should be removed promptly and burned, buried, or sent to a landfill. Gloves and face masks should be used when handling such material. Education regarding basic personal hygiene and cleanliness of equipment is also important for people in close contact with raccoons, for example, hunters, trappers, wildlife rehabilitators, and animal control officers. Finally, persons who suspect they have been infected should consult a health care provider, because early treatment might reduce serious damage caused by infection.

Alveolar Echinococcosis

Red foxes, arctic foxes, and coyotes are major definitive hosts for the microscopic tapeworm *Echinococcus multilocularis*. The eggs are shed in the feces, and if accidentally ingested by humans, larvae develop into large cysts that can destroy the liver and, less commonly, lungs, brain, and other organs; so-called hydatid cyst disease. If left untreated, it can be fatal. *E. multilocularis* is found primarily in the North Central region of the United States as well as Alaska and Canada. In these areas, prevalence among wild foxes and coyotes is high, and the prohibition of interstate transport of these species is an important preventive strategy. Further advice the veterinary practitioner can give includes avoiding foxes and coyotes and discouraging wild carnivores from coming close to homes. Dogs and cats should not be allowed to eat wild rodents, because these species are the major intermediate host. Because wild foods such as herbs and berries may be contaminated with the tapeworm eggs, all wild-picked foods should be washed carefully or cooked well before eating.

Arthropod-Borne Viral Encephalitis

There are a number of arthropod-borne viruses in North America that cause encephalitis in humans including St. Louis encephalitis, Eastern and Western equine encephalitis, LaCrosse encephalitis, Jamestown Canyon encephalitis, and, most recently, West Nile virus (WNV). Infection with these diseases is most often asymptomatic, or results in transient, mild clinical signs such as fever, headache, nausea, vomiting, and lymphadenopathy. However, rarely, immunocompromised and elderly patients will develop severe illness including high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, vision loss, and paralysis. The most severe encephalitis is caused by Eastern equine encephalitis, which can have a case fatality rate of 50%. The arboviruses are maintained in complex cycles involving different wild vertebrate hosts (birds, rodents, and deer for Jamestown Canyon encephalitis) and a variety of mosquito species, and humans will acquire infection through the bite of infected mosquitoes. The most effective way to avoid WNV and other arboviruses is to prevent mosquito bites. People should be advised to use insect repellent containing an Environmental Protection Agency-registered active ingredient. It is important that the directions on the package are followed. Many mosquitoes are most active at dusk and dawn, and avoiding outdoor activities during these times is advisable; otherwise, persons should wear long-sleeved shirts and trousers. Houses and other buildings should be made mosquito proof with appropriate screens on doors and windows. Finally, it is advisable to remove potential mosquito breeding sites by eliminating standing water from flower pots, buckets, wading pools, blocked gutters and drains, and other containers including water bowls and bird baths. Holes should be drilled

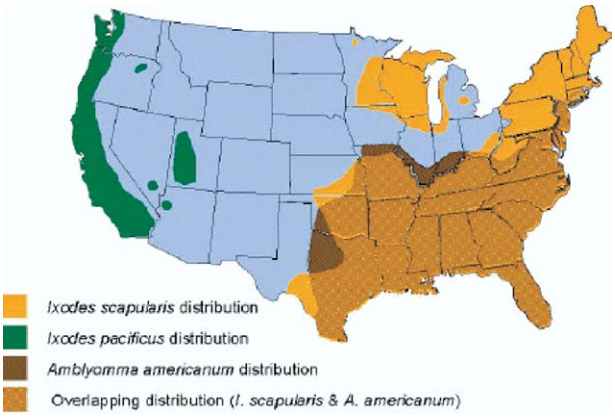

Figure 3. Geographic areas of the United States where human ehrlichiosis may occur based on the approximate distribution of the tick vector species. Ixodes scapularis and Ixodes pacificus are the main vectors of human granulocytotropic ehrlichiosis. Amblyomma americanum is the main vector for human monocytotropic ehrlichiosis. (Figure courtesy of the Centers for Disease Control and Prevention).

in any receptacle that could collect water, such as tire swings, to allow drainage.

There is currently no evidence that WNV can be transmitted directly through handling infected birds or handling and consuming infected meat.[5] However, people should be advised not to handle wild birds directly with bare hands. The local health department should be contacted for advice on reporting and disposing of the carcasses. Hunters and trappers should wear gloves when handling and cleaning animals, and meat should be cooked thoroughly (see section on Game Meat).

Tick-Borne Diseases

There are an increasing number of tick-borne diseases that appear to be increasing in prevalence in certain regions of North America. These diseases occur most commonly from May to September when ticks are most active. Lyme disease is caused by the spirochete bacterium *Borrelia burgdorferi*, and is found most commonly in the Northeast from Massachusetts to Maryland as well as the upper Midwest. Human ehrlichiosis is a recently recognized tick-borne disease caused by at least two types of bacteria that infect leukocytes. The distribution of human infections correlates with the distribution of the tick vectors, and human cases have been reported in the Southeast, Northeast, upper Midwest, and West Coast (Fig 3). For *Ehrlichia chaffeensis*, the causative agent of human monocytotropic ehrlichiosis, white-tailed deer (*Odocoileus virginianus*) is the primary reservoir, and the geographic distribution of naturally infected animals was found to be a good sentinel system for predicting risk for human infection.[6] Rocky Mountain spotted fever is caused by the bacterium *Rickettsia ricketsii* and occurs most commonly in the Southeastern and South Central states. Finally, babesiosis is caused by hemoprotozoan parasites of the genus *Babesia*. *Babesia microti* and *Babesia divergens* have been identified in most human cases and occur most frequently in the Northeast and Midwest.

All these diseases have complex life cycles involving many species of wild mammals, birds, and possibly reptiles as natural reservoirs for these organisms and different species of ticks as vectors. Furthermore, white-tailed deer are not important reservoirs for Lyme disease, but are important in the epidemiology of the disease as the primary host for adult *Ixodes scapularis*, which is the main tick vector in the Northeastern, Central, and Southeastern states.

Despite the number of tick-borne diseases and the complex epidemiology, prevention and control are the same for these diseases and rely on methods to limit exposure to ticks. Ticks prefer wooded and bushy areas with high grass and leaf litter, and people should be advised to avoid tick-infested areas, especially during May to September. Insect repellents with 20 to 30% DEET (*n, n*-diethyl-*m*-toluamide) applied to the skin can be used to prevent tick bites. Use DEET with caution on children. In addition, permethrins can be applied to clothing, but should not be applied directly to skin. Persons at risk should be advised to wear long trousers, long-sleeved shirts and socks, as well as light-colored clothes to help detect ticks more easily. Eliminating gaps in clothing, such as tucking pant legs into socks, can also be helpful. After being outdoors, all parts of the body should be carefully checked, especially haired areas. Outdoor clothes should be thoroughly washed and dried to kill any ticks. Ticks should be removed from the body immediately with fine-tipped tweezers. The tick should be grasped as close to the skin as possible and pulled upward with steady, even pressure. The tick should not be jerked or twisted to prevent the mouthparts remaining in the skin. Ticks should not be handled with bare hands, and care should be taken not to puncture the body. After removing the tick, the areas should be disinfected, and some people may wish to freeze the tick for later identification should illness occur within 2 to 3 weeks. Community-based methods such as the application of acaricides and landscape manipulation can be applied if the risk warrants these more intensive and expensive measures. Deer movement and population control can also be an important strategy.

Table 1. Early symptoms of tick-borne diseases found in North America

Disease	Non-specific signs (Fatigue, chills, fever, headache, myalgia, swollen lymph nodes)	Rash
Lyme disease	Yes	Yes: Circular rash called erythema migrans with a bullseye appearance that expands to 30 cm diameter (70-80% of patients)
Ehrlichiosis	Yes: Including nausea, vomiting, diarrhea, cough, joint pains, and mental confusion	Rare
RMSF	Yes: Including nausea, vomiting, and anorexia	Yes: Macules on wrists, forearms, and ankles
Babesiosis	Yes: Including sweating, hepatosplenomegaly, and hemolytic anemia	None

This is initiated at a local level in consultation with the state wildlife agency. However, activities that can artificially increase deer populations, such as feeding, should be discontinued. There are some new tools available such as bait boxes that will treat wild rodents with an acaricide; these are available from licensed pest control companies, and research is continuing to investigate other tick control measures such as treatment of deer with acaricides and biologic control measures.

Finally, it is important to be able to recognize the early symptoms of these diseases, so that medical attention can be sought promptly. Table 1 summarizes the symptoms of the tick-borne diseases mentioned above.

Game Meat

Fishing, hunting, and trapping of game animals for food is a popular outdoor activity. Concern over food safety is no reason not to enjoy wild game meat, because it provides healthy and wholesome food. However, wild game meat has the potential to cause food-borne illnesses, and therefore the practices for safe food preparation recommended by the United States Government should be followed (http://www.foodsafety.gov/). For example, wild game meat is one of the most common sources of human *Trichinella* spp. infection.[7] In addition, an outbreak of *Escherichia coli* O157: H7 was traced to jerky made from deer meat.[8] Furthermore, there is concern that handling and consumption of wild game may result in human exposure to novel microorganisms and the emergence of new diseases.[9] Finally, there is concern about exposure to a variety of contaminants through the consumption of wild fish and game, and fish consumption advisories are often issued.[10,11] People should be advised to contact the state health department regarding current fish consumption advisories. In general, for fish it is advisable to eat smaller, younger fish (within legal limits), because they are less likely to contain harmful levels of contaminants. The skin, fat, and internal organs should be removed before cooking, and fish should be cooked in a manner that allows the fat to drain, for example, by baking, broiling, or grilling.

Hunters should avoid killing and consuming wild animals that are obviously sick. Wild game such as deer and waterfowl should be promptly eviscerated, taking care to avoid contamination of the meat with the gastrointestinal contents. The carcass should then be chilled before further preparation. Abscesses and other localized lesions can be carefully trimmed away; however, hunters should contact the local state wildlife agency if more generalized pathologic lesions are encountered, or if the meat appears of poor quality. Bovine tuberculosis has been confirmed in a Michigan hunter (http://www.michigan.gov/mdch) and illustrates the importance of appropriate hygienic measures, in particular, wearing gloves during carcass preparation.

Chronic wasting disease is a progressive, fatal, neurologic disease of deer and elk. It is caused by infectious proteins called prions, and is classified in the same group of diseases as scrapie of sheep and goats, bovine spongiform encephalopathy, and Creutzfeldt-Jakob disease of humans. Ongoing surveillance and at least two detailed epidemiologic investigations[12,13] have found that there is currently no evidence that chronic wasting disease has in-

fected humans, and this is the position of the World Health Organization and the (CDC). However, the following advice is given to hunters to avoid possible exposure:

1. Do not shoot, handle, or consume any animal that is abnormal or appears to be sick. If you see a sick deer, please contact the local state wildlife agency immediately.
2. Wear latex or rubber gloves when field dressing the deer carcass.
3. Bone out meat from the animal. Do not saw through bone and avoid cutting through the brain or spinal cord (backbone).
4. Minimize the handling of brain and spinal tissues/fluids.
5. Wash hands and instruments thoroughly after field dressing is completed.
6. Avoid consuming brain, spinal cord, eyes, spleen, tonsils, and lymph nodes of deer. Normal field dressing coupled with boning out a carcass will remove most, if not all, of these body parts.
7. If the deer is commercially processed, request that the animal be processed individually, without meat from other animals being added.

These bullets are adapted from the Chronic Wasting Disease Alliance web site (http://www.cwd-info.org).

Finally, the meat should be stored carefully, protected from vermin, and cooked thoroughly. More details on carcass preparation can be found on the Pennsylvania Game Commission web site (http://www.pgc.state.pa.us).

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Useful Web Sites

www.cdc.gov
www.aphis.usda.gov
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www.nasphv.org