



Zoonotic Diseases (Mammalian): Work Smart, Stay Safe

Including information on:
Disease and Biosafety

Rabies

Hantavirus

Plague

Tularemia

Lyme Disease

Baylisascariasis

Giardiasis

Echinococcosis

Work Smart, Stay Safe

Disease Concepts and Biosafety

Disease is anything that interrupts or interferes with normal body function.

Zoonotic diseases are diseases of animals that can infect people.

For disease to occur you need a susceptible host- disease agent- environment suitable for both (**Disease triad**). Must break a triad link to stop or prevent disease process.

Host susceptibility can vary depending on age, nutritional status and response to cumulative stressors such as temperature extremes, overcrowding and parasite loads.

Disease agents include bacteria, viruses, fungi, parasites, trauma, toxins.

The **environment** must be hospitable to both the host and the agent.

Routes of infection include: inhalation, ingestion (particularly contaminated food and water), direct contact, absorption (through mucus membranes), injection (bites and scratches).

Need to protect human health and wildlife health. Want preserve human health and avoid mechanically transporting disease agents from site to site on clothing and equipment.

Personal Protective Equipment (PPE). Masks, gloves, boots, coveralls, respirators, goggles. Puts a barrier between you and the disease agent. Level of protection required depends on situation.

Prevent mechanical transmission of disease agents though disinfecting supplies and equipment between sites and/or animals. Bag and clean items before leaving site, clean more thoroughly as soon as possible.

Disinfect: Wash hands in warm soapy water and supplies in detergent and water. Disinfect using germicidal compounds, 10% bleach and water solution (1 part bleach to 9 parts water) or other suitable disinfectant. Follow label directions. Must remove mud and muck first or will overwhelm disinfectant and will not disinfect completely. Sunlight/UV light and drying can kill some organisms. Disinfect boats and vehicles as necessary. Wash bag clothing as soon as possible in warm or hot water and separately from other clothing.

Medical Care: Follow up with physician. Be familiar with zoonotic diseases you may encounter. Make sure health professionals know you work with wildlife. Be persistent if necessary.

Sources of further information: <http://www.cdc.gov/nczved/>
<http://www.cdc.gov/niosh/> and <http://www.cdc.gov/ncidod/osr/>
<http://www.aphis.usda.gov/library/forms/pdf/APHIS260.pdf>

RABIES

Organism — rabies virus, a Lyssavirus in the Rhabdoviridae family

Hosts — reservoir hosts: raccoons, skunks, foxes, coyotes, bats

Geographic Regions and Habitats — world wide: endemic areas in wildlife and urban dogs

Seasonality — year round

Transmission — bite of an infected animal or exposure of a fresh wound or mucous membranes to saliva from infected animal. Aerosol of urine from infected bats.

Disease in Mammals — all species of mammals susceptible; small rodents (squirrels, rats, mice, hamsters, guinea pigs, gerbils, chipmunks) and lagomorphs are almost never found to be infected with rabies.

Field Signs — abnormal behavior: dumb form: lethargy, incoordination, quadriplegia, loss of swallowing reflex; furious: abnormally alert, discomfort and uneasiness, restlessness, hypersensitivity to external irritation, constant licking and chewing of infected area. Both forms end in convulsion, coma, and death.

Gross Lesions — non-specific

Diagnosis — post-mortem demonstration of virus antigen in brain

Disease in Humans — transmission by bite wounds, contamination of mucous membranes, aerosol transmission, corneal transplantations

Symptoms — incubation period: days to years; non-specific flu-like signs; discomfort or tingling at site of exposure; symptoms of cerebral dysfunction; death due to respiratory arrest usually within days of onset of symptoms

Diagnosis — ante-mortem: virus detection in saliva, antibody tests on serum and spinal fluid, antigen detection in skin biopsy

Treatment — wound care, post-exposure prophylaxis. Once clinical signs of rabies appear, the disease is nearly always fatal.

Minimizing Risk of Human Infection — pre-exposure prophylaxis for workers in high-risk jobs. Vaccination programs in animals.

Sources of Further Information —

CDC- cdc.gov/rabies

cdc.gov/ncidod/dvrd/kidsrabies/

cdc.gov/healthypets/diseases/rabies/htm

WHO-www.who.int/mediacentre/factsheets

HANTAVIRUS PULMONARY SYNDROME

Organism— *Sin Nombre virus, NY virus, Black Creek Canal virus and Bayou virus.*

Hosts — Rodents including Deer, Pinon and Brush mice, W chipmunk (Sin Nombre virus). White-footed mice (NY virus) , Cotton rats (Black Creek Canal virus) and Rice rats (Bayou virus).

Geographic Regions and Habitats — Western half of the US

Seasonality — primarily spring and summer

Transmission — Virus is shed in urine, saliva and feces and transmitted through inhalation or ingestion of contaminated food and water or rodent bites.

Disease in Mammals — None.

Disease in Humans —

Symptoms — Onset 1-5 weeks post exposure. Fever, fatigue, muscle pain, headaches, dizziness, vomiting, chills, progressing to severe respiratory problems and possibly death.

Diagnosis — confirmed with laboratory tests

Treatment — Supportive care and broad-spectrum antibiotics

Minimizing Risk of Human Infection — N100 respirator to avoid inhaling viral particles. Gloves and protective clothing. Disinfect with 10% bleach/water solution. Wet down dust and fecal material where feasible.

Sources of Further Information —

<http://www.cdc.gov/ncidod/diseases/hanta/hps/index.htm>

<http://www.srd.gov.ab.ca/fishwildlife/livingwith/diseases/pdf/WDhantavirus.pdf>

PLAGUE

Organism — bacterium *Yersinia pestis*

Hosts — major animal reservoirs are rodents (rats, squirrels, prairie dogs, mice), rabbits

Geographic Regions and Habitats — endemic in rodent and flea populations: southwestern states, particularly New Mexico and Arizona; California, southern Oregon, far western Nevada; also in Africa, Asia, South America; absent from Europe, Canada, Australia, Japan

Seasonality — most cases in US occur during warmer months (May to October); winter cases in US typically occur among hunters, trappers, cat owners handling infected animals

Transmission — bites of infected fleas, direct contact with tissue or body fluids of infected animal, inhalation, ingestion

Disease in Mammals — endemic in rodent populations (chipmunks, prairie dogs, ground squirrels, mice, rats); rabbits, wild carnivores that prey on these animals; domestic cats highly susceptible

Field Signs — large die-offs of rodents occur periodically; rapid death with no clinical signs in most wildlife species

Gross Lesions — may see none if animal dies rapidly; swollen lymph nodes, pneumonia, hemorrhages, enlarged liver and spleen

Diagnosis — tissue cultures (lymphoid tissues, bone marrow); antibody tests on serum; flea testing

Disease in Humans — reportable disease; usually transmitted by flea bites; also through handling infected animals or exposure to persons or animals with plague pneumonia and cough

Symptoms — incubation period: 2-6 days; Bubonic plague: swollen, tender lymph node (bubo), usually in groin, armpit, neck; sudden onset of fever, chills, headache, extreme exhaustion. If untreated, progresses to septicemic plague and secondary pneumonia. Death from delay in seeking treatment or misdiagnosis. Plague pneumonia is highly contagious by airborne transmission. Primary pneumonic plague (rare): high fever, cough, bloody sputum, difficulty breathing, high death rate (>50%).

Diagnosis — bubo; blood and tissue cultures for plague bacteria; microscopic examination of lymph gland, blood, sputum samples

Treatment — early treatment is life-saving; untreated plague has an estimated mortality rate of >50%; isolation; antibiotics (streptomycin reduces case fatality rate to <5%, gentamicin, tetracycline, chloramphenicol); evaluation of contacts, preventive antibiotics

Minimizing Risk of Human Infection — rodent control, flea control, preventive drug therapy—antibiotics may be taken in the event of plague exposure

Sources of Further Information —

CDC-- <http://www.cdc.gov/ncidod/dvbid/plague/index.htm>
<http://www.bt.cdc.gov/agent/plague/index.asp>
<http://www.cdc.gov/healthypets/diseases/plague.htm>
<http://wwwn.cdc.gov/travel/yellowBookCh4-Plague.aspx>

TULAREMIA

Organism — bacterium *Francisella tularensis*

Host — Over 200 vertebrate species including rodents, rabbits, carnivores, ruminants and birds. Most often occurs in rabbits and rodents.

Geographic Regions and Habitats — various regions across US, primarily Arkansas, Missouri and Oklahoma

Seasonality — Year-round

Transmission — Bacteria are shed in feces, urine and tissues of infected animals, therefore transmission is via direct contact, ingestion or inhalation. It can also be transmitted by arthropod vectors.

Disease in Mammals —

Field signs — May be none because death is sudden. Affected hosts may be depressed and lethargic. May not cause any apparent illness. Host can shed bacteria for extended periods of time.

Gross lesions — Pale spots on liver, spleen or lung. Swollen liver or spleen.

Disease in Humans:

Symptoms — flu like illness- fever, chills, headache vomiting. Possibly an ulcer where bacteria entered body.

Diagnosis — confirmed with laboratory tests

Treatment — antibiotics and supportive care

Minimizing Risk of Human Infection — Tick bite prevention. Wear long pants and long-sleeve shirts. Use insect repellent. Wear gloves when handling animals, especially dead ones. Wear a mask and goggles to prevent splashes of urine, feces, and blood into mouth or eyes.

Sources of Further Information —

<http://emergency.cdc.gov/agent/tularemia/>

http://www.unbc.ca/nlui/wildlife_diseases_bc/tularemia.htm

LYME DISEASE

Organism — Bacterium *Borrelia burgdorferi*

Host — Mice, squirrels and other small animals

Geographic Regions and Habitats — US Northeast, Upper Midwest – primarily Minnesota and Wisconsin

Seasonality — Most cases in humans occur in spring and summer when tick nymphs are most active and human outdoor activity is highest.

Transmission — Tick bites: Deer tick in northeastern and north-central US. Western black-legged tick in the Pacific coastal US. 24-36 hours of attachment needed for transmission.

Disease in Mammals —

Field signs — none

Gross lesions — none

Disease in Humans — reportable disease; usually transmitted by flea bites; also through handling infected animals or exposure to persons or animals with plague pneumonia and cough

Symptoms — Initially flu-like symptoms. 60% of time a characteristic “bull’s eye” rash 3 days to 1-month post tick bite (may not be at tick bite site). Illness may progress to affect multiple body systems. Neurologic changes, heart problems. Months or years after initial infection can have chronic arthritis or neurologic changes. Rarely if ever fatal.

Diagnosis — Confirmed with laboratory tests.

Treatment — antibiotics, although they may not have much effect in later stages of disease.

Minimizing Risk of Human Infection — Minimize tick bite opportunities. Minimize contact if possible with leaf litter, fallen logs and stone walls. Wear long pants and long sleeve shirts. Tuck pants into socks. Use insect repellent such as DEET and Permethrin as per label directions. USDA recommends taping juncture of shoes, socks and pants legs as well entirely covering shoelaces/eyelets. Examine self for ticks. Remove carefully by grasping close to skin/mouthpart and pulling without squeezing.

Sources of Further Information —

<http://www.cdc.gov/ncidod/dvbid/lyme/>

<http://www.ars.usda.gov/Main/docs.htm?docid=11021>

http://www.michigan.gov/dnr/0,1607,7-153-10370_12150_12220-26945--,00.html

BAYLISASCARIASIS

Organism — *Baylisascaris procyonis*, intestinal roundworm (nematode) of raccoons

Hosts — raccoons are definitive host: worms develop into adults in intestine and eggs are shed in feces; worm larvae form tissue cysts in intermediate hosts (>90 species in North America): small mammals (rabbits, woodchucks, mice, rats), birds. Domestic dogs may shed eggs.

Geographic Regions and Habitats — US: highest prevalence in Midwest, Northeast, Mid-Atlantic, and West coast; also found in Europe, parts of Asia

Seasonality — year round: eggs resistant to most environmental conditions and with adequate moisture can survive for years

Transmission — ingestion of embryonated eggs (primary route for young raccoons and intermediate hosts) and ingestion of tissue cysts in infected prey species (primary route for adult raccoons)

Disease in Mammals — most transmission to intermediate hosts occurs at raccoon latrines

Field Signs — infection in raccoons rarely causes symptoms. Other animals may develop symptoms depending on organs affected by larval migration.

CNS signs: incoordination, circling, paralysis, blindness.

Gross Lesions — adult worms in raccoon intestines. Intermediate hosts: brain lesions include hemorrhagic foci and tracks, congestion, swelling and softening, cerebellar herniation. Birds generally lack gross lesions.

Diagnosis — raccoons: find adult worms in intestine, eggs in feces by floatation; intermediate hosts: see larvae in histological sections

Disease in Humans — transmission occurs by ingestion of eggs in soil, water, or on objects contaminated with raccoon feces.

Symptoms — can be asymptomatic; larvae tend to invade spinal cord, brain, and eye of humans causing permanent neurologic damage, blindness, or death

VLM — migration through liver, heart, lungs; nausea, fatigue, liver enlargement

OLM — unilateral loss of vision; usually related to low-level infection

NLM — severe or fatal neurologic disease

Diagnosis — difficult; based on clinical signs, history of exposure, antemortem laboratory findings, postmortem gross and histopathologic lesions, recovery and/or identification of larvae at necropsy, in biopsies, or in or from affected eyes.

Treatment — early treatment may reduce serious damage; no drugs have been demonstrated to be totally effective; OLM—laser photocoagulation to destroy the intraretinal larvae to prevent further migration damage

Minimizing Risk of Human Infection — Avoid direct contact with raccoons, especially their feces. Prompt removal and incineration of raccoon feces will reduce risk for exposure and possible infection. Wear gloves. Wash hands well.

Sources of Further Information —

CDC--<http://www.cdc.gov/ncidod/dpd/parasites/baylisascaris/default.htm>

GIARDIASIS

Organism — flagellate protozoan, *Giardia intestinalis*, which colonizes small intestine

Hosts — mammals; reservoirs: domestic dogs and cats, livestock small rodents, beavers and muskrats

Geographic Regions and Habitats — worldwide, in temperate and tropical regions

Seasonality — cysts may survive for extended periods outside the host in environment

Transmission — ingestion of cysts by fecal-oral contamination, water-borne, food-borne

Disease in Mammals —

Field Signs — rarely associated with overt symptoms or clinical disease; malabsorption and diarrhea in immature mammals

Gross Lesions — none

Diagnosis — microscopic analysis of feces — cyst identification; need at least 3 samples taken on non-consecutive days because of intermittent cyst shedding; coproantigen testing (ELISA)

Treatment — quinacrine, metronidazole, tinidazole

Disease in Humans — most common pathogenic intestinal parasite of humans; humans are likely to be the main reservoir of human infection with animals constituting an additional source of infection. In US, it is the most frequently diagnosed water-borne disease.

Symptoms — incubation period 3 days - 6 weeks; may be asymptomatic; nausea, headache, bloating, anorexia, cramps, fever, diarrhea, constipation, weight loss

Diagnosis — microscopic analysis of feces—cyst identification; need at least 3 samples taken on non-consecutive days because of intermittent cyst shedding; coproantigen testing (ELISA)

Treatment — quinacrine, metronidazole, tinidazole

Minimizing Risk of Human Infection — Filtration necessary to remove *Giardia* from water; chlorination alone is insufficient without high concentrations of chlorine and long contact times. Primary health-care activities to promote hygiene. Protect water supplies against contamination by human or animal feces. Sanitation control and education. Precautions when travelling and hiking in areas without potable water.

Sources of Further Information —

CDC- www.dpd.cdc.gov/dpdx/HTML/Giardiasis.htm
www.cdc.gov/ncidod/dpd/parasites/giardiasis/moreinto_giardiasis.htm
www.cdc.gov/travel/yellowBookCh4-Giardiasis.aspx
www.cdc.gov/ncidod/dpd/parasites/giardiasis/factsht_giardia.htm
www.cdc.gov/healthyswimming

ECHINOCOCCOSIS

Organism — tapeworms of genus *Echinococcus*; *E. granulosus* and *E. multilocularis* are important species in North America. Adult worms are 1-5 mm long, typically five segments.

Hosts — definitive hosts: foxes, coyotes, wolves, domestic dogs and cats. Adult worms live in intestines and eggs are shed in feces. Worm larvae form tissue cysts in intermediate hosts: small rodents, moose, caribou, domestic livestock.

Geographic Regions and Habitats — *E. granulosus* occurs worldwide in rural, grazing areas; *E. multilocularis* occurs in northern hemisphere (Europe, Asia, North America). In North America—north central region from eastern Montana to central Ohio, as well as Alaska and Canada.

Seasonality — year round

Transmission — ingestion of eggs (intermediate hosts) and ingestion of tissue cysts in infected prey species (definitive hosts)

Disease in Mammals —

Field Signs — no signs in definitive hosts; tiny (mm) adult worms in intestines, eggs in feces. *E. granulosus* infection may show no or minimal signs in animals with larval cysts. *E. multilocularis* may cause weakness, anorexia, enlarged abdomen, death.

Gross Lesions — *E. granulosus* and *multilocularis* cause unilocular and multilocular cysts, respectively, in intermediate hosts, typically in liver and lungs.

Diagnosis — definitive host: coproantigen-ELISA test, associated with risk for lab workers, identification of adults in intestine at necropsy. Intermediate host: necropsy

Treatment — praziquantel in dogs

Disease in Humans — infection occurs by ingestion of eggs. Flies may mechanically transport eggs.

Symptoms — Cysts occur primarily in liver, lungs, and brain. Cysts are slow-growing so may not produce any symptoms for many years. Symptoms occur due to dysfunctions caused by the parasite, mainly in the liver: enlarged liver, abdominal pain, jaundice, fever, anemia. Duration variable —weeks to years; chronic cancer-like disease with high mortality in untreated patients.

Diagnosis — Survival rates depend on stage of disease at time of diagnosis; ultrasound and/or other imaging techniques; serology. Leakage following diagnostic puncture or rupture may induce mild or serious complications.

Treatment — surgery, medication (albendazole)

Minimizing Risk of Human Infection — Avoid direct contact with wild canines; wear gloves. Strict safety precautions during necropsies of wild canids; deep freeze carcasses for one week prior to necropsy to kill eggs and don't open intestine unless needed.

Sources of Further Information —

CDC: www.cdc.gov/ncidod/dpd/parasites/alveolarechinococcosis/default.htm
www.dpd.cdc.gov/dpdx/HTML/Echinococcosis.htm