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## Canine and Feline Infectious Diseases in the Pacific Northwest: What are we looking for?

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### UPPER RESPIRATORY INFECTIONS IN CATS

Infective agents:

- **Viral**
  - Feline Herpes Virus (FHV-1) [also called feline rhinotracheitis]
  - Feline Calicivirus (FCV)
- **Bacterial**
  - Bordetella bronchiseptica
  - Mycoplasma felis (this not the same as Mycoplasma Hemofelis)
  - Chlamydia felis
  - Streptococcus spp
- Bacteria causes secondary infections and are rarely the primary cause
- Up to 90% of infections are caused by FHV-1 and FCV.
- **Clinical signs:** depressed, lethargic, fever, sneezing, inappetence, nasal & ocular discharge
  - Less commonly: ulceration of the tongue, palate and oral cavity
- **Transmission:** Spread cat to cat via secretions from the eyes, nose, mouth and via sneezing. The virus can survive in the environment up to 18 hours. Infected cats become carriers where the virus goes dormant. There is no viral shedding during dormancy, but the virus can be reactivated during times of stress: pregnancy, environmental, illness, medications that suppress the immune system
- Infection can damage the nasal cavity causing chronic sneezing and nasal discharge
- FHV-1 causes more severe symptoms. FCV tends to cause milder disease symptoms but may be associated with chronic stomatitis in cats. There is a less common strain of FCV called virulent FCV (VS-FCV) that causes much more severe illness and has a high mortality (up to 60%). Outbreaks have been associated with overcrowding in shelters and a spontaneous mutation of FCV.
- **Diagnosis:** Based on clinical signs
- **Treatment:**
  - Minimizing clinical signs and improving quality of life
  - Treat secondary bacterial infections (antibiotics)
  - Educate client about remission and minimizing stress in the home (<https://indoorpet.osu.edu/cats>)
  - NSAID to reduce inflammation or corticosteroid?

- Topical medications to reduce nasal inflammation (Little Noses decongestant or saline) or ocular inflammation (various ophthalmic drops or ointment)
- Usually self-limiting and will resolve on its own in 7-10 days. Disease can last longer in kittens. FeLV + or FIV + cats can have more severe disease as can any immunosuppressed cat.
- L-lysine is no longer recommended
- Nutritional support. Cats do not eat if they cannot smell their food. Educate clients to clean the face, offer warm, canned food and humidification can be helpful to thin nasal mucus (take the cat into the bathroom anytime someone is taking a shower)
- **Prevention:**
  - Vaccination (FVR, FVRCP, distemper combo vaccine, 4 in 1)
  - Isolate new cats in the home for 14 days to monitor for signs of upper respiratory infection
  - Minimize stress in the home (see the Ohio State's Indoor Cat Initiative website)
  - Regular veterinary care and low stress at home is the best way to prevent relapses
- Brachycephalic cats can have much more severe disease and more susceptible to upper respiratory infections due to their anatomy.

### **FeLV and FIV (FELINE LEUKEMIA AND FELINE IMMUNODEFICIENCY VIRUS)**

Both are retroviruses (they infect cells and turn them into virus factories)

- **Infective agents**
  - FeLV (feline leukemia virus)
  - FIV (feline immunodeficiency virus)
- **Transmission:**
  - FeLV: "Friendly cat disease"
    - Saliva, nasal secretions
    - Possible but rare: urine, feces, milk, shared bowls and litterboxes
    - Cat to cat transfer via mutual grooming is the most common transmission route. Cat bites are route of transmission as well.
  - FIV: "Angry cat disease"
    - Saliva
    - Bite wounds are the main route of transmission
    - Non-aggressive contact is not efficient route of transmission
- **Risks:** kittens, unvaccinated cats, cats that fight with other cats, outdoor cats
- **Clinical Signs:** *FeLV*: can be asymptomatic
  - Early signs: anorexia, progressive weight loss, poor coat, enlarged lymph nodes, persistent fever, gingivitis/stomatitis, infections of urinary tract/skin/URTI and persistent diarrhea
  - Cats can mount a defense against FeLV and eliminate FeLV from the bloodstream, but not the body. Cannot spread the virus and will test

negative on ELISA test. The virus can reactivate in the future. Called a regressive infection and occurs in ~ 10% of infections.

- Progressive infections are when the cat tests positive and has clinical signs.
- *FIV*: same as FeLV plus neurological disorders, other infectious diseases present (Toxoplasmosis, *Mycoplasma haemofelis*, FIP)
- **Diagnosis**
  - ELISA (enzyme-linked immunosorbent assay) testing
  - SNAP test, Witness test
    - -Detects presence of FeLV antigens in the blood-stream. Vaccination does not affect test.
    - Detects presence of FIV antibodies in the blood-stream. Vaccination will affect test.
    - Testing kittens under 12-14 weeks can result in a positive FIV result due to maternal antibodies. Retesting at 6 months old is recommended.
    - Other testing is available for cats that test positive, but they are not the first tests to establish viral status.
      - IFA, PCR, bone marrow aspirates
- **Treatment**
  - No cure only management of infections and diseases that may develop.
  - Immunomodulators such as T-cyte?
  - Antiviral medications such as Interferon?
- **Prevention**
  - FeLV—vaccination
    - AAFP recommends all kittens be vaccinated with the initial series regardless of their indoor/outdoor status and re-evaluate in one year on whether to continue FeLV.
  - FIV/FeLV: keep cats indoors/spay/neuter to prevent fighting viral test new cats coming into the home the FIV vaccine was discontinued in 2017, but cats vaccinated will test positive
- **Care of FeLV/FIV positive cats**
  - Prevent endo and ectoparasites to prevent stress on the immune system
  - Keep the home stress free
  - Provide warm places to sleep
  - Keep bowls and litter boxes clean to prevent bacterial infections
  - Exam every 6 months to check for early onset of disease good nutritional support (no RAW diets)
- **Prognosis**
  - Median age of survival post diagnosis is 2.5 years
  - Cats can be healthy for years before diagnosis.
  - Death is from opportunistic infections and cancer (lymphoma)

**MYCOPLASMA HAEMOFELIS:** aka Hemobartonella, hemoplasmosis, hemotrophic mycoplasmas, feline infectious anemia

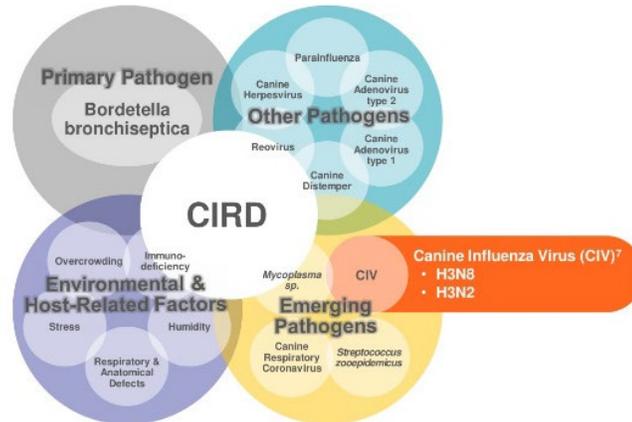
- **Infective agent**
  - Mycoplasma Haemofelis bacteria
    - Bacteria that parasitizes the red blood cells (this is not the same Mycoplasma spp involved in upper respiratory infections)
- **Transmission**
  - Infected blood (blood transfusions, contaminated needles/surgery instruments), cat bites that involve blood, vector transmission (lice, ticks, mosquitoes, fleas??)
- **Clinical signs**
  - Weakness, pale mucus membranes, dehydration, decreased appetite, weight loss, tachypnea, tachycardia, fever in acutely ill cats
- **Laboratory findings**
  - Anemia with moderate to marked regenerative anemia (increased number of nRBCs, polychromasia, anisocytosis, Howell-Jolly bodies and increased reticulocyte count), Coombs' test will be positive in acute phase only, organism may be seen in peripheral blood smear (< 50% of the time in acutely infected cats)
- **Treatment**
  - Supportive care (may include oxygen support and blood transfusions), antibiotic treatment to eliminate the bacteria (2-4 weeks of treatment needed)
- **Prognosis**
  - Good if treated. Earlier treatment provides a better outcome. One-third of cats that are not treated will die.
- **Prevention**
  - Transmission is not fully understood in regard to the role of vectors so it is recommended to prevent ectoparasites, keep cats indoors to prevent fighting with other cats
    - Cats that are pre-disposed are: male cats, outdoor cats, cats with history of cat bite abscesses, older cats and cats that are FeLV or FIV positive.

### **CANINE INFECTIOUS RESPIRATORY DISEASE (CIRD)**

aka: kennel cough, upper respiratory, canine infectious tracheobronchitis

- **Infectious agents:**
  - Bacteria: Bordetella bronchispetica, mycoplasma spp, streptococcus zooepidemicus
  - Viruses: canine herpesvirus (CHV), canine adenovirus-1 (CAV-1), canine adenovirus-2 (CAV-2), parainfluenza (CPiV), distemper (CDV), reovirus, coronavirus (CRCoV), canine influenza (CIV)
- Other factors: environmental/host related (stress, age, immune-system, anatomical defects, overcrowding)

## Etiology of CIRD<sup>6</sup>



<sup>6</sup> infectious respiratory disease. *Veterinary pathology*. 51, 492.

**ZOETIS PETCARE**

- **Transmission**
  - Direct contact with nasal/oral secretions, aerosolized virus/bacteria via coughing and sneezing, fomites (kennels/bowls/bedding/environment/clothing/unwashed hands, etc)
- **Clinical signs**
  - Coughing (dry and harsh or wet), sneezing, retching, nasal/ocular discharge (watery or mucopurulent), more severe cases can have fever, lethargy, inappetence and progress to pneumonia
- **Diagnosis**
  - Treatment started based on clinical signs
    - Canine Respiratory Panel to culture pathogen
    - 3 view chest radiographs to rule out pneumonia in more severe cases
- **Treatment**
  - Supportive care
    - Antibiotics for primary or secondary pathogen and infection
    - Antitussives to decrease coughing so the pet can rest
    - Anti-inflammatory medications +/-
      - Rest and exercise restriction for 10-14 days
      - Isolate from other dogs for at least 2 weeks, preferably 3-4 weeks
      - Hospitalization may be needed for pneumonia
- **Prevention**
  - Vaccination (DAP, DHLPP, DHPP, distemper combo, etc and Bordetella, CIV vaccines)
    - avoid dog parks and public spaces until dog is fully vaccinated
- **Risk factors**
  - Boarding in kennels/dog day cares

- Recently adopted dogs from shelters/rescues
- Dogs that travel and participate in shows/events
- Unvaccinated dogs
- **Canine Influenza Virus (CIV)**
  - Emerging pathogen—the US dog population has no immunity to this virus.
    - First appeared in the US in April 2015
    - CIV is viable in the environment up to 48 hours, on clothing for up to 24 hours and unwashed hands for 12 hours
    - Cats can become infected from dogs and may be asymptomatic or develop mild URTI signs. It is unknown if they can transmit CIV to dogs.
    - Imported from South Korean dogs where CIV is endemic. A 21-day in-home quarantine is recommended for all dogs coming from Southeast Asia.
    - Signs are like regular upper respiratory except they become sick very quickly and are more likely to have; a fever over 104 F, mucopurulent nasal discharge, lethargy, anorexia and signs of pneumonia
    - Incubation period is 1-5 days, but signs appear 2-8 days later. Dogs will appear fine but are shedding the virus.
    - All dogs exposed will become infected unless they have been vaccinated against this strain.
      - 80% of dogs will develop clinical signs and require some sort of treatment
      - 20% of dogs will not become sick, but will spread the virus
      - Mortality is 8-10%
  - Vigilance is important since this is a new virus.
    - Have a protocol for your clinic for any possible CIRDC dogs (ask owner to remain in their car outside the clinic and call when they arrive, have owner and pet come in a side door if possible, disinfection protocols in place, limit the number of staff that interact with the pet, check out client in the exam room, escort them out a side door, etc)
    - Know the signs of CIRDC
    - Have your vaccine manufacturer give staff a lunch and learn about vaccines and prevention
    - June 2019—Oakland Animal Shelter and the Oregon Humane Society prevented an outbreak due to their vigilance!

## **SALMON POISONING**

- **Infectious agents**
  - Parasite: Nanophyetus Salmincola
  - Bacteria: Neorickettsia Helminthoeca
    - Found in freshwater fish in coastal streams in the Pacific Northwest (plus the Pacific Giant Salamander)
- **Clinical signs**

- Vomiting, diarrhea, bloody diarrhea, lethargy, dehydration, fever (> 104), lymphadenopathy, nasal/ocular discharge
  - Signs appear 6-10 days post exposure
  - If not treated up to 90% of dogs will die within 14 days of exposure
- **Diagnosis**
  - Made primarily on clinical signs and history of exposure
    - Parasitic eggs not consistently shed in feces
    - Lymph node aspirates may show rickettsial bacteria
- **Treatment**
  - Supportive care including IV fluids, antibiotics, anti-emetic if needed, deworming
- **Geographical area**
  - Pacific Northwest (Alaska to San Francisco) but prominent from Puget Sound to northern California
- **Immunity**
  - Most dogs will be immune after infection and treatment but can have a milder form of infection due to other similar infectious agents (Neorickettsia Elokominica and Stellanchasmus Falcatus).
- **Prevention**
  - Do not allow dogs to eat raw fish.
- **Affected species**
  - Dogs, cats, raccoons and bears are not affected. Bears that are relocated from east of the Rocky Mountains to west of the Rockies can be affected though.

## **GIARDIA**

- **Infectious agent:** Giardia protozoa (many different “strains” called assemblages)
  - Cats: Giardia F
  - Dogs: Giardia A1, C and D
  - Humans: Giardia A and B
  - Because we do not test what strain of Giardia in fecal tests, it does have zoonotic potential but almost all cases are spread between the same species
  - Giardia LOVES the Pacific Northwest
    - Can survive in the moist, cold environment for weeks to months
- **Clinical Signs:** Can be asymptomatic
  - Diarrhea (the big one)
  - Vomiting, weight loss, lethargy
  - Giardia is THE most common intestinal parasite in the Pacific Northwest.
    - 2018 Companion Animal Parasite Council (CAPC) data: Of 40,000 fecal samples tested 10% were positive for Giardia in Multnomah County. For the same timeframe only 1.87% tested positive for roundworms.
  - Symptoms can also be from Coccidia, Cryptosporidium and Toxoplasmosis
- **Diagnosis:** Fecal centrifuge (70% chance of detection)

Giardia antigen testing (95% chance of detection)

Based on clinical signs

- **Treatment:** No medications are approved for treatment of Giardia in dogs in the U.S.
  - Metronidazole 10-25mg/kg BID for 5-10 days
  - Fenbendazole 50mg/kg SID for 3-5 days
  - Both medications might be used together or alone
  - Praziquantel/pyrantel/febantel SID for 3 days
  - Bathe on last day of treatment to remove cysts on fur
  - Pick up all feces in yard to prevent re-infection
  - Don't take your dog to public places during treatment!
  - Retest fecal in 3-4 weeks to make sure infection has cleared, that re-infection has not occurred, and that patient does not have resistant/chronic infection (immunosuppression, drug resistance, inadequate drug levels, Giardia sequestration in the gall bladder or pancreatic ducts)
- **Prevention**
  - Pick up feces
  - Avoid high risk environments (dog parks, muddy environments, rivers/lakes and streams)
  - Do not allow pets to eat feces
  - Do not allow pets to drink from rivers, lakes, puddles, ponds, etc

## **HEARTWORM**

- **Infectious agent:** *Dirofilaria immitis* (heartworm)
- **Transmission:** The parasite is transmitted to the pet via the mosquito (the mosquito is required for transmission)
- **Clinical signs:**
  - Dogs: Persistent cough, fatigue after activity, weight loss, decreased appetite, Caval Syndrome (sudden onset of labored breathing, pale mucus membranes and dark urine in heartworm positive dogs). The adult heartworms impair the blood flow through the heart.
  - Cats: Atypical host for heartworm.
    - Most worms do not survive to adulthood in cats
    - The cat immune system is very efficient at eliminating microfilaria
    - Pulmonary signs rather than cardiovascular signs as in dogs.
      - HARD (heartworm associated respiratory disease)
        - Increased respiratory rate, coughing, dyspnea
    - Ascites
    - Sudden collapse or death
- **Diagnosis:**
  - Dogs: Antigen testing (in-house or to an outside lab)
    - Detects a protein produced by an adult female heartworm
    - Antigen will not appear until at least 5 months post infection
    - Reasons for a negative heartworm test:

- The dog is negative (yay!)
- The dog was infected less than 6 months ago.
- The dog has a low adult worm burden (less than 2 adult females or no adult females)
- Cats: Difficult to diagnose due to low worm burden and the cat's immune system eliminating the microfilaria.
  - Antigen and antibody testing are recommended
    - Antibody testing can be performed as early as 2 months post infection
    - Antigen testing can detect antigens 7 months post infection
- **Treatment**
  - Cats: There is no treatment, only supportive care for respiratory signs. Heartworm prevention is still recommended. Keep cats indoors.
  - Dogs: Treatment is difficult and may cause the dog's death. Surgery to remove worms from the heart may be required. I am including the link to the American Heart-worm Society treatment guidelines due to how extensive they are: <https://www.heartwormsociety.org/veterinary-resources/american-heartworm-society-guidelines>  
(The page long treatment protocols are on page 25)
- **Prevention**
  - Heartworm preventives (monthly oral, 6 or 12 Heartworm is in all 50 states
  - Climate change and urban heat islands are increasing mosquito habitats
  - Relocation of pets from natural disasters (Hurricane Katrina). The American Heartworm Society now has guidelines for relocating pets on their website.
  - Importing pets from other countries via rescue organizations

## **LEPTOSPIROSIS**

- **Infectious agent:** Leptospira bacteria
  - Over 250 serovars of Lepto
  - 10 important in dogs
  - 4 that we can vaccinate against
- **Transmission**
  - Via infected urine, soil, water, food or bedding. A bite from an infected animal.
  - Eating infected tissue.
  - From mother to fetus.
- **Clinical signs**
  - Fever, muscle tenderness/pain, increased thirst, dehydration, decreased urination, lethargy, anorexia, diarrhea and jaundice.
  - Less common: bleeding disorders
  - Infection can progress to renal failure and/or liver failure.
- **Diagnosis:** Can be difficult.
  - MAT (microscopic agglutination testing)
    - Detects antibodies

- Vaccination will also produce antibodies
- Paired titers are recommended
  - Convalescence
  - 2-4 weeks later
- ELISA (enzyme-linked immunosorbent assay)
  - Detects antibodies
  - Vaccination “may” produce a positive
- PCR (polymerase chain reaction)
  - Detects Lepto DNA
  - Whole blood and urine tested simultaneously
    - Blood is positive early in infection usually less than 5-7 days post infection
    - Urine is positive 7-14 days post infection
- **Treatment:** Supportive care (IV fluids, antibiotics, isolation from other pets, close monitoring of urine production).
  - Continuous renal replacement therapy (CRRT) in advanced cases may be needed
  - Consider treating other dogs in the household
- **Zoonotic potential**
  - Humans can become infected treating a Lepto patient (usually from contaminated urine). Infection can lead to renal failure, liver failure, respiratory illnesses and meningitis. Most infections are from contaminated water though.
- **Prevention:** Vaccination with the 4-way serovar annually.
  - Keep yard free of debris that can attract rats (carriers of lepto)
  - Remove standing water from yard
  - Remember this is not a “rural” disease anymore
- **Cats**
  - They can become infected, but they usually have no clinical signs and clear the infection on their own. It is unknown the extent they can contaminate the environment while infected.
- **Risks**
  - Climate change is increasing the risk of exposure to Leptospirosis due to flooding. Flooding leads to outbreaks.
  - Urban farmers (goats, chickens) attract rats to back yards and neighborhoods.
  - Active dogs are exposed while camping, swimming, hiking or at dog parks an infected dog has visited.
  - Late fall is peak season for infections
  - Exposure to streams, rivers, standing water
  - Areas with over 40” of rainfall a year

## **LYME DISEASE**

- **Infectious agent:** Borrelia burgdorferi spirochete bacteria

- **Transmission**
  - Western black-legged tick (*Ixodes Pacificus*). Bacteria is spread during tick feedings. Ticks must be attached 24-48 hours before transmission can occur.
- **Risks:** Habitats are moist environments with wooded leaf litter and tall grasses.
  - Dogs are 50-100 times more likely to be infected than humans.
  - Cats are fastidious groomers and less likely to allow tick attachment.
  - Lyme disease cannot spread from dogs to humans (ticks must attach and feed). A tick can move from a dog to a human before feeding.
- **Ticks have a 3-year life cycle that includes deer and mice populations.**
  - Reforestation of farmlands leads to increased deer and mice populations.
  - Suburbanization puts humans closer to forests and deer population.
- **Prevention**
  - Year-round tick preventives
  - Lyme vaccine?
    - Not recommended for general population
    - Vaccination must occur before exposure
- **Clinical signs**
  - Fever, lameness, anorexia, arthritis, fatigue, protein losing nephropathy (PLN), edema, Lyme nephritis (Lyme antibodies deposit in the kidneys and there are no clinical signs, but damage to the kidneys is occurring. This is a fatal complication and Labs/Goldens appear to be pre-disposed)
- **Endemic areas:** Northeastern US, Upper Midwest and California.
  - 50-95% of dogs in these areas will test positive for Lyme antibodies, but only 5-10% of those will develop clinical signs
  - Lyme disease is spreading due to:
    - Climate change
    - Travel with pets
    - Reforestation of farmlands
    - Lack of year-round preventives in use for dogs
- **Risk**
  - Living or travel to endemic area
  - Not being on year-round preventives
  - Dogs that hike, camp or hunt
- **Diagnosis**
  - Clinical signs
  - Lyme testing (antibody testing in-house, Quantitative C6 testing to an outside lab, Lyme Multiplex through Cornell)
  - Diagnosis is difficult due to long incubation periods, antibodies can persist for years, antibodies bind to connective tissue and escapes detection
  - The immune system needs 4-6 weeks to mount a response for a positive test. (The Lyme Multiplex can detect antibodies as early as 3 weeks post infection)
- **Treatment:** Antibiotics for 4-8 weeks (Doxycycline)

- The goal is a latent state without clinical signs. Eradication with antibiotics may not be possible. Relapse is possible in the future.

### **RABIES-yes this is still a concern!**

- **Infectious agent:** rabies virus
  - Post exposure prophylaxis (PEP) costs the global economy 10 times the amount it would cost to eliminate canine rabies at the source (vaccinating dogs).
- **Transmission:** Via the saliva of an infected animal (bites or scratches)
  - Transmission can also occur via organ and corneal transplants, aerosolized saliva but it is rare
- **Rabies is 100% preventable**
- **Risk:** 5.5 billion people worldwide live with the daily risk of rabies
  - 59,000 deaths a year worldwide
  - Children are at the greatest risk
  - Most human rabies transmissions come from dogs
  - Why should we (the U.S) care about rabies?
    - It is preventable
    - Vaccinating is cheaper than prophylactic treatment
    - It saves lives
    - The US and Europe are now “importing” rabies from other countries.
      - Importing pets from rabies endemic countries with no rabies certificates or forged certificates
      - Travel to rabies endemic countries and we, as Americans (and Europeans) are not educated about rabies and its transmission. We can become infected, not seek treatment and bring rabies back to the US (or Europe).
    - There is no treatment. Once signs appear, rabies is fatal.
    - Anti-vaccination attitudes of clients
      - This puts veterinary support staff at risk
      - Educate your self about rabies transmission and laws regarding rabies to be able to educate clients
        - The Global Alliance for Rabies Control offers a free course about rabies (transmission, stats and how to prevent the spread of rabies)
          - <https://rabiesalliance.org/capacity-building/gep>
- **Treatment:** None (for humans or pets)
  - The Milwaukee Protocol is considered a failure by the medical community
- **Prevention:** Vaccination of dogs and cats
  - Dogs and cats are a barrier between humans and wildlife
    - 70% of dogs need to be vaccinated to protect humans from rabies exposure
  - Indoor cats need to be vaccinated as well

- Cats are now four times more likely to test positive for rabies than dogs
- Rabies vaccines are required by law (usually through state or county ordinances)
- Educate clients.
  - About rabies and the requirement for rabies vaccination. Mark in the chart if the owner declines rabies vaccination to protect yourself and business.
  - The Zero by 30 worldwide initiative was launched in 2015 to eradicate rabies in the world.  
<https://www.who.int/rabies/resources/9789241513838/en/>
- Do not handle fractious dogs and cats with no proof of rabies vaccine. It is not your “job” to get bit! Advocate for your patients and yourself.
- Know what your county requires when a human is bitten by a vaccinated pet and unvaccinated pet.
- Know what the wildlife vector is for your geographic area.
  - Bats, raccoons, and skunks are the big 3
- Don’t let the zombie apocalypse happen (it starts with rabies!)

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- Feline Retrovirus Management Guidelines by the American Association of Feline Practitioners
- [www.oregonvma.org](http://www.oregonvma.org)
  - Rabies exposure requirements
- [www.tickcounter.org](http://www.tickcounter.org)
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- [www.merckmanual.com](http://www.merckmanual.com)
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  - [www.dogflu.com](http://www.dogflu.com) (Supported by Nobivac)
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