



HEROES FOR  
HEALTHY PETS™



# INFECTIOUS DISEASE HANDBOOK



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# TABLE OF CONTENTS



INTRODUCTION (Steve Dale, CABC) .....	5
---------------------------------------	---

## **PART 1: INFECTIOUS DISEASES OF DOGS** 7

Canine Parvovirus (Dr. Justine Lee) .....	8
Canine Distemper (Dr. Justine Lee) .....	10
Canine Hepatitis (Dr. Garret Pachtinger) .....	12
Rabies (Dr. Garret Pachtinger) .....	14
Leptospirosis (Dr. Michelle Evason and Dr. Jason Stull) .....	16
Canine Influenza (Dr. Jarod Hanson) .....	19
Canine Infectious Cough (Dr. Michelle Evason and Dr. Jason Stull) .....	22
Lyme Disease (Dr. Charine Tabbah Ahmed) .....	25

## **PART 2: INFECTIOUS DISEASES OF CATS** 29

Panleukopenia (Dr. Christopher Lee) .....	30
Feline Herpes Virus (Dr. Christopher Lee) .....	33
Calicivirus (Dr. Christopher Lee) .....	36
Rabies (Dr. Christopher Lee) .....	38
Feline Leukemia Virus (Dr. Christopher Lee) .....	40
Chlamydia (Dr. Christopher Lee) .....	43
<i>Borrelia Burgdorferi</i> (Lyme) (Dr. Christopher Lee) .....	45

## **PART 3: PREVENTION OF INFECTIOUS DISEASE** 49

Vaccines Made Easy (Dr. Kathryn Primm) .....	50
Strategic Vaccination Recommendation for Social Dogs (Dr. Ronald Schultz) .....	52
Cleaning and Disinfection Guidelines (Dr. Melissa Bourgeois) .....	53
The Veterinary Technician’s Role in Managing Infectious Disease Outbreaks (Julie Legred) .....	58
What Every Pet Sitter and Dog Walker Should Know About Infectious Diseases (Dr. Nyssa Reine-Salz) .....	60

## **PART 4: LESSONS LEARNED** 63

March 2015: Chicago, Illinois—The Initial H3N2 Outbreak (Dr. Natalie L. Marks) .....	64
December 2015: H3N2 Dog Flu Hits Texas (Michael Mayer) .....	66
March 2016: H3N2 Dog Flu Hits Indiana (Dr. Brenda Dines) .....	68
May 2017: H3N2 Dog Flu Outbreak in the Southeast Follows Dog Show (Dr. Richard Hawkes) .....	69

BIOGRAPHICAL INFORMATION ABOUT THE AUTHORS AND EDITOR .....	71
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# INTRODUCTION



*By Steve Dale, Certified Animal Behavior Consultant*

Dogs and cats are frequently faced with exposure to infectious diseases. These disease threats are often related to lifestyle. Is this an indoor-outdoor cat or one that is strictly kept indoors? Does this dog regularly visit places where other dogs go? In general, dogs are more frequently at risk of infectious disease exposure than cats. Infectious diseases can have devastating consequences for the individual cat or dog, as well as to entire communities when some of these diseases are introduced into an inadequately vaccinated population.

Dogs that are social or visit pet businesses, such as doggie day cares and boarding facilities, are at risk for infectious diseases, as are animal shelters and rescues. This was proven as a fact when an outbreak of canine influenza H3N2 hit the US in 2015; thousands of pets were affected, as were a number of the pet businesses that cared for them. Some of the impacted facilities, such as those shelters, kennels, groomers and daycares, were forced to close for weeks. Within nine months, the virus had spread to more than half the country. Countless pets were sickened, and some succumbed to H3N2.

In Chicago where H3N2 began in the US, the community was completely unprepared, but all came together: Veterinarians, veterinary technicians (nurses), pet professionals, and pet lovers — and we worked together to help significantly slow the spread of disease.

We have learned that the key to success is prevention.

Better understanding of infectious diseases and preventative care, including strategic vaccination and cleaning protocols, can help keep pets healthy. I am very proud to be part of this Infectious Disease Handbook. This handbook was created to help veterinarians and other pet businesses create facilities dedicated to being disease free, ultimately bettering pets, saving dog and cat caretakers money, and saving them from heartache.

The Infectious Disease Handbook brings together veterinary professionals and experts to recommend best practices for pet care and safety for pet professional businesses such as kennels, veterinary facilities, shelters, doggie daycares, dog walkers, groomers, and training facilities.

There is too much misinformation, distortion, or half-truths found online; I want to emphasize that the information in this handbook is written by real experts and includes the most up-to-date information available. I encourage you to read on and learn more about infectious diseases, and how to prevent them.



**YOUR PET WILL THANK YOU**





PART 1:

# INFECTIOUS DISEASES OF DOGS







# CANINE PARVOVIRUS

Justine Lee, DVM, DACVECC, DABT

## What Is Canine Parvovirus?

**Canine parvovirus** (CPV) is a highly contagious viral infection that affects young dogs that are unvaccinated, undervaccinated, or immunosuppressed. CPV is a small, single-stranded, non-enveloped DNA virus that preferentially infects rapidly dividing cells (e.g., bone marrow, gastrointestinal tract, myocardium).<sup>1</sup> Without treatment, CPV can be life threatening because of severe fluid losses and electrolyte derangements secondary to anorexia, vomiting, and diarrhea.



## Signs of Disease

Clinical signs of parvovirus include:

- Anorexia
- Lethargy/listlessness
- Malaise
- Hypersalivation (e.g., secondary to nausea)
- Vomiting
- Abdominal pain
- Diarrhea
- Hematochezia



## TRANSMISSION/INCUBATION

CPV is transmitted through the oral-fecal route and is highly contagious. One single gram of feces can contain up to 10 million infective doses of parvovirus.<sup>1</sup> CPV is shed extensively in the feces for up to 10 days post-infection as detected by fecal enzyme-linked immunosorbent assay (ELISA) methods, but can be detected in the feces for several weeks with polymerase chain reaction (PCR) assays.<sup>2</sup>



## Diagnosis

The diagnosis of parvovirus is based on clinical suspicion based on history (e.g., unvaccinated puppy), clinical signs (e.g., lethargy, vomiting, malodorous diarrhea), and a positive fecal antigen or ELISA blood test. In some dogs, a negative fecal antigen test may be seen (e.g., because of dilutional effect from diarrhea, or early stage of disease); the patient should ideally have a blood smear performed to look for the presence of leukopenia (which increases the index of suspicion of CPV). The use of a fecal antigen ELISA test is the most rapid, cost-effective way of diagnosing CPV for the practitioner. The fecal antigen ELISA is sensitive to detect both CPV-2b and CPV-2c.<sup>3</sup> Other tests that can be considered include PCR, virus isolation, and hemagglutination inhibition, but these are less commonly performed.



## CANINE PARVOVIRUS *(continued)*



### Prognosis

The prognosis for canine parvovirus infection is fair to good with treatment, with recent reports of 80% to 90% survival with various modalities of treatment.<sup>4</sup> Perhaps surprisingly, severity of neutropenia is not a negative prognostic factor, but severity of dehydration and lymphopenia may be.<sup>5</sup> Recently, studies have compared standard in-hospital treatment versus a modified outpatient treatment (using volume resuscitation followed by subcutaneous fluid therapy and supportive care). Both protocols can be successful, with a survival only slightly lower in outpatients.<sup>4</sup> A modified outpatient protocol may be a good alternative for less severely affected cases or those with financial limitations.



### Treatment

Treatment of the canine parvovirus patient is aimed toward fluid therapy, antibiotic therapy, nutritional support, gastrointestinal support, supportive care, and monitoring. Specific goals of pediatric medicine include temperature control, fluid therapy, nutritional support (with the goal of weight gain), and control of infectious disease and parasites.



### CONCLUSION:

Pet owners should be educated about the highly infectious nature of CPV. Once dogs develop CPV, aggressive treatment is necessary to minimize morbidity and mortality. Appropriate vaccination is necessary and is almost 100% protective.

**References:** **1.** Mazzaferro EM. The Parvo puppy: what is the best approach and what's new? Abstract presented at: International Veterinary Emergency and Critical Care Symposium; September 7–11, 2013; San Diego, CA. **2.** Greene CE, Decaro N. Canine viral enteritis. In: Greene CE, ed. *Infectious Diseases of the Dog and Cat*. 4th ed. St. Louis, MO: Saunders-Elsevier; 2012:67–75. **3.** Markovich JE, Stucker KM, Carr AH, et al. Effects of canine parvovirus strain variations on diagnostic test results and clinical management of enteritis in dogs. *J Am Vet Med Assoc*. 2012;241:66–72. **4.** Venn EC, Preisner K, Boscan PL, et al. Evaluation of an outpatient protocol in the treatment of canine parvoviral enteritis. *J Vet Emerg Crit Care*. 2017;27:52–65. **5.** Macintire DK. Pediatric intensive care. *Vet Clin North Am Small Anim Pract*. 1999;29:971–988.



# CANINE DISTEMPER

Justine Lee, DVM, DACVECC, DABT



## What Is Canine Distemper?

**Canine distemper** (CDV) is a highly contagious viral infection that affects dogs that are unvaccinated, undervaccinated, or immunosuppressed. While this disease is rarely seen now because of vaccination, it is more prevalent in areas where there is an increased prevalence of unvaccinated animals (e.g., urban environments, reservations, shelters, etc.). CDV is a large, enveloped, single-stranded, ribonucleic acid (RNA) virus and can affect many species (including foxes, raccoons, skunks, ferrets, wolves, wild cats, seals, etc.). CDV affects 3 main systems: the respiratory system, gastrointestinal system, and the central nervous system (CNS). There is no treatment for CDV, and many dogs fail to respond to therapy because of the severity of the disease.



## Signs of Disease

Clinical signs of distemper include:

- Anorexia
- Lethargy/Listlessness
- Malaise
- Fever
- Purulent nasal discharge
- Conjunctivitis
- Purulent ocular discharge
- Upper respiratory infection
- Cough
- Dyspnea
- Skin pustules
- Vomiting
- Diarrhea
- Ataxia
- Tremors
- Chewing-gum fits
- Seizures
- Myoclonus
- Hypersalivation
- Hyperkeratosis of the paw pads
- Paralysis
- Death

Acute signs can be seen in as little as 1 to 2 weeks, but these can progress to delayed neurologic signs within weeks to months.



## TRANSMISSION/INCUBATION

Distemper can be transmitted via multiple routes, including airborne exposure, oral exposure, or even placental transfer. CDV can replicate quickly within the body.<sup>1</sup> Clinical signs are thought to appear within 14 days of exposure.<sup>1</sup> CDV can be excreted up to 60 to 90 days after infection.<sup>1</sup>



## CANINE DISTEMPER *(continued)*



### Diagnosis

The diagnosis of distemper is based on clinical suspicion based on history (e.g., unvaccinated puppy), clinical signs, evidence of leukopenia (e.g., lymphopenia), and evidence of distemper inclusions (on blood smear). Unfortunately, there is no practical laboratory test that is readily available to test for CDV. Diagnostic tests may include viral isolation, antibody testing (on blood or cerebral spinal fluid), immunofluorescent assay (IFA), polymerase chain reaction (PCR), immunohistochemistry, immunocytology, or even based on cerebrospinal fluid analysis; however, these are rarely performed. Diagnosis is often made based on necropsy findings.



### Prognosis

The prognosis for CDV is poor, even with treatment.



### Treatment

Treatment of the canine distemper patient is aimed toward symptomatic supportive care. This may include fluid therapy, antibiotic therapy for secondary bacterial infections, nutritional support, gastrointestinal support, CNS support, and nursing care. A balanced, maintenance crystalloid should be used for fluid therapy. Patients should be carefully monitored for hydration status. In patients with viral pneumonia or secondary bacterial pneumonia, broad spectrum antibiotic therapy is warranted. Patients should be carefully monitored for signs of dyspnea or hypoxemia; humidified oxygen therapy is indicated for patients with a pulse oximeter reading <93%. Nebulization and coupage is indicated in patients with lower airway disease. In anorexic patients, nutritional support (e.g., via nasoesophageal or nasogastric tube) may be indicated. Gastrointestinal support, such as antiemetic therapy (e.g., ondansetron, maropitant, dolasetron), is indicated if vomiting is present. Antidiarrheals (e.g., metronidazole) may be necessary. In patients with CNS signs, the use of muscle relaxants (e.g., methocarbamol, 22 to 55 mg/kg, intravenously, as needed) and anticonvulsants (e.g., levetiracetam, phenobarbital, diazepam, etc.) are warranted. Finally, nursing care, such as wiping away nasal and ocular discharge, keeping patients warm and dry, and monitoring, is indicated.



### CONCLUSION:

Pet owners should be educated about the highly infectious nature of CDV. Once dogs develop CDV, the prognosis is grave, even with treatment, because of the progression of CNS signs that can develop. Appropriate vaccination is necessary and is almost 100% protective.

**Reference:** 1. Greene CE, Appel MJ. Canine distemper. In: Green CE, ed. *Infectious Diseases of the Dog and Cat*. 3rd ed. Saint Louis, MO: Saunders-Elsevier; 2006:25–41.

# CANINE HEPATITIS: CANINE ADENOVIRUS TYPE 1

Garret Pachtinger, DACVECC



## What Is Canine Hepatitis?

**Canine adenovirus type 1 (CAV-1)** is a non-enveloped DNA virus responsible for infectious canine hepatitis (ICH).<sup>1</sup> CAV-1 recognizes vascular endothelial cells and hepatic (liver) and renal (kidney) cells resulting in variable disease, including liver (hepatic) injury.<sup>2</sup> CAV-2 is antigenically related to CAV-1, but does not cause the same disease. CAV-2 results in respiratory disease in dogs (one of the causes of infectious canine tracheobronchitis).<sup>2</sup>



## Signs of Disease

Early in the infection, patients will present with vague clinical signs, including loss of appetite, lethargy, vomiting, diarrhea, conjunctivitis, serous discharge from the eyes and nose, and notably fever. Patients with more advanced or serious clinical disease may progress to disseminated intravascular coagulation (DIC) as a result of vascular endothelial compromise.<sup>3</sup> Bleeding tendencies seen with DIC may be worsened by liver failure and lack of replacement of consumed clotting factors.<sup>3</sup> Central nervous system (CNS) signs (hypersalivation, ataxia, seizures) are uncommon but thought to result from vascular damage in the CNS. Corneal opacity (“blue eye”) and interstitial nephritis may occur 1 to 3 weeks after recovery due to deposition of immune complexes in these organs.<sup>3</sup>



## TRANSMISSION/INCUBATION

Oronasal exposure is the most common route of infection resulting from ingestion of urine, feces, or saliva of infected dogs. The incubation period is 4 to 9 days following exposure.<sup>4</sup> Recovered dogs shed virus in their urine for potentially 6 months or longer.<sup>4</sup> Viral spread can also occur via fomites, such as food bowls and clothes, and hands of people.



## Diagnosis

A tentative diagnosis is based on the history, supportive clinical signs, and changes in laboratory tests consistent with this infection. Laboratory test changes may include elevation of bloodwork values associated with the liver and kidney; coagulation system disease with abnormalities in prothrombin time (PT), partial thromboplastin time (PTT), and platelet counts; and complete blood count (CBC) changes showing neutrophilia and lymphocytosis. Definitive antemortem diagnosis can be made via commercially available enzyme-linked immunosorbent assay (ELISA), serologic, and polymerase chain reaction (PCR) testing. PCR or restriction fragment length polymorphism is required to definitively distinguish CAV-1 from CAV-2.<sup>5</sup> Postmortem evaluation can also be confirmed by virus isolation, immunofluorescence, characteristic intranuclear inclusion bodies in the liver, or PCR studies of infected tissue performed.



## CANINE HEPATITIS: CANINE ADENOVIRUS TYPE 1 *(continued)*



### Prognosis

The mortality rate ranges from 10% to 30%, highest in very young dogs. Concurrent parvoviral or distemper infection worsens the prognosis.



### Treatment

Treatment is symptomatic and supportive and may include:

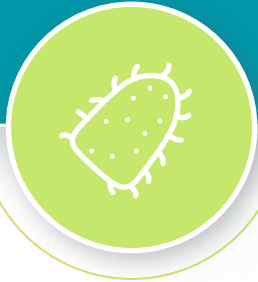
- Fluid therapy to correct fluid deficits as a result of lack of intake or gastrointestinal losses (vomiting and diarrhea) and maintenance fluid requirements.
- Electrolyte supplementation (e.g., potassium and magnesium) due to either lack of intake or gastrointestinal losses.
- Broad-spectrum antibiotic therapy to prevent or treat secondary infection (e.g., aspiration pneumonia).<sup>4</sup>
- Administration of fresh frozen plasma for replacement of clotting factors for patients in liver failure with increased hemorrhagic tendencies.
- Nutritional support, either enteral if tolerated or intravenous nutrition if oral feeding is not tolerated by the patient.



**VACCINATIONS MAY BE THE BEST WAY TO PREVENT THE DISEASE.**

**References:** **1.** Kearns S. Infectious hepatopathies in dogs and cats. *Top Companion Anim Med.* 2009;24:189–198. **2.** Decaro N, Martella V, Buonavoglia C. Canine adenovirus and herpesvirus. *Vet Clin North Am Small Anim Pract.* 2008;38:799–814. **3.** Greene CE. Infectious canine hepatitis and canine acidophil cell hepatitis. In: Green CE, ed. *Infectious Diseases of the Dog and Cat.* 3rd ed. St. Louis, MO: Saunders-Elsevier; 2006:41–47. **4.** Watson PJ. Chronic hepatitis in dogs: a review of current understanding of the etiology, progression, and treatment. *Vet J.* 2004;167:228–241. **5.** Creevy KE. Overview of infectious canine hepatitis. In: *Merck Veterinary Manual.* Whitehouse Station, NJ: Merck & Co., Inc.; 2008.





# RABIES

Garret Pachtinger, DACVECC

## What Is Rabies?

**Rabies**, a lyssavirus in the Rhabdoviridae family, is a preventable viral disease of mammals.<sup>1</sup> This virus is an enveloped, bullet-shaped, ribonucleic acid (RNA) virus.

## Signs of Disease

While variability exists between species, clinical signs of rabies infection include behavioral changes and progressive paralysis. Especially noted in wildlife,<sup>1</sup> rabid animals may lose their fear of humans.

Three phases have been described following rabies infection. While there are expected time frames where each phase will present, phases may be variable and overlap:

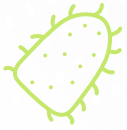
- **Prodromal phase:** Signs in the stage may be vague, including behavioral changes, mydriasis (dilated pupils), hyperesthesia, and fever. This stage may last 1 to 3 days.<sup>2</sup>
- **Excitative phase:** Signs in this stage include exaggerated reactions to stimuli, miosis (smaller pupils), aggression, hypersalivation, ataxia, and convulsions. This stage may last 1 to 7 days.
- **Paralytic or dumb phase:** In this final stage, signs may include progressive lower motor neuron paralysis and prolapse of third eyelid. Foaming at the mouth from an inability to swallow food or water due to an absent swallowing reflex may also be seen. Ultimately, these patients may suffer from a dropped jaw, respiratory paralysis, coma, and death.<sup>2,3</sup> This stage lasts 2 to 4 days.

Other classifications include the furious form of rabies or the dumb/paralytic form of rabies. The term “furious rabies” refers to animals in which aggression (the excitative phase) is pronounced.<sup>3</sup> “Dumb or paralytic rabies” refers to animals in which the behavioral changes are minimal, with paralysis being the hallmark sign.<sup>3</sup>



## TRANSMISSION/INCUBATION

Transmission often results from the bite of a rabid animal as the virus is introduced into the tissues via virus-laden saliva.<sup>2</sup> Less common sources of transmission include virus-infected saliva, spinal fluid, or brain tissue entering the recipient via fresh wounds or intact mucous membranes. Important for the veterinary team member: saliva should be considered infectious at the time of examination when clinical signs are present. Even more concerning, dogs, cats, and ferrets may shed the virus for several days before onset of clinical signs. Most rabies cases in dogs show clinical signs within 21 to 80 days following exposure,<sup>4</sup> but the incubation period may be shorter or considerably longer ranging from 3 weeks to over 6 months depending on the site of infection, the amount of virus deposited, and the species involved.



## RABIES (continued)



### Diagnosis

Clinical diagnosis is difficult in a live animal. Areas where rabies is uncommon may not have this on the expected differential list, making evaluation even more challenging. As the clinical signs in the early phases of rabies are vague, they are often similar to other diagnoses or clinical concerns. Moreover, a definitive diagnosis with simple or routine available testing is not possible premortem. The definitive diagnosis is made postmortem. Rabies diagnosis is made via immunofluorescence microscopy on fresh brain tissue, which allows direct visual observation of a specific antigen-antibody reaction.<sup>2,3</sup>



### Prognosis

Once clinical signs are evident, the prognosis is poor. The disease is fatal once clinical signs appear.<sup>2</sup> Unfortunately, there is no known effective treatment once clinical signs appear. This emphasizes the importance of vaccination and prevention.



### Prevention

There are several things you can do to protect a pet from rabies. First, rabies vaccinations must be kept up-to-date for all cats, ferrets, and dogs.<sup>5</sup> Second, maintain control of pets by suggesting clients keep cats and ferrets indoors and keep dogs under direct supervision. Third, spay or neuter pets to help reduce the number of unwanted pets that may not be properly cared for or vaccinated regularly. Finally, advise clients to call animal control to remove all stray animals from their neighborhood because these animals may be unvaccinated or ill.

**References:** **1.** Blanton JD, Palmer D, Dyer J, et al. Rabies surveillance in the United States during 2010. *J Am Vet Med Assoc.* 2011;239:773–783. **2.** Rupprecht C. Rabies. Merck Veterinary Manual website. Available at: <https://www.merckvetmanual.com/nervous-system/rabies/rabies?query=rabies> Accessed October 5, 2020. **3.** Tepsumethanon, V, Wilde, H, Meslin FX. Six criteria for rabies diagnosis in living dogs. *J Med Assoc Thai.* 2005;88:419–422. **4.** Rupprecht C. Rabies in dogs. Merck Veterinary Manual website. Available at: <https://www.merckvetmanual.com/dog-owners/brain,-spinal-cord,-and-nerve-disorders-of-dogs/rabies-in-dogs?query=rabies%20in%20dogs>. Accessed October 5, 2020. **5.** Hunter T, Ward E. Rabies in dogs. VCA website. Available at: <https://vcahospitals.com/know-your-pet/rabies-in-dogs>. Accessed October 4, 2020.

# LEPTOSPIROSIS

Michelle Evason, BSc, DVM, DACVIM  
Jason Stull, VMD, MPVM, PhD, DACVPM

## What Is Leptospirosis?

**Leptospirosis** is caused by infection with one of various types (serovars) of the bacteria *Leptospira* spp. In dogs, leptospirosis is typically diagnosed when a patient presents with acute (and frequently severe) kidney or liver disease.<sup>1</sup> There is concern that the frequency of leptospirosis infection is increasing in dogs, particularly in North America.



## Who Gets It?

Numerous species, including dogs, rodents, humans, and cats, can all be infected with *Leptospira* spp.; however, clinical disease appears rare in cats. Urban wildlife (e.g., raccoons, skunks, rats, mice, opossums) may act as reservoirs or carriers and spread the bacteria into the environment through contaminated urine.

## Can People Get Sick With It?

People can be infected with leptospirosis and multiple human outbreaks have occurred.<sup>2</sup> These are often associated with athletic competitions and swimming in contaminated water sources; however, humans are infected the same way as dogs, from exposure to infected urine.

Although it is considered uncommon, infected dogs can infect people. Veterinary staff are at higher risk of infection because of increased exposure to clinically ill dogs with infectious urine, through needle stick injuries (blood-to-blood transmission), or infected animals.

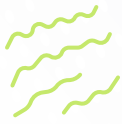


## TRANSMISSION/INCUBATION

Most commonly, leptospirosis is spread (transmitted) to a dog, cat, or human through contact with an infected animal's urine on the mucous membranes or open (abraded) skin.<sup>3</sup> Transmission may also occur through infected urine contaminated fomites, such as food, soil, bedding, or water bowls.<sup>2</sup> Once within the animal the bacteria may rapidly multiply, and dependent on the animal's immune function either clinical disease, subclinical infection, or clearance of infection (no disease) will result.<sup>2</sup>

*Leptospira* spp. can survive in the environment for many months, and prefers warm, wet environments and stagnant water sources (e.g., lakes, ponds, rivers, and puddles). Different types (serovars) of *Leptospira* spp.<sup>3</sup> will vary based on geographic location and local populations of reservoir hosts.<sup>3</sup>





## LEPTOSPIROSIS (continued)

### Signs of Disease

In dogs, subclinical disease is considered common and many dogs may show no obvious signs of disease. Similarly, long-term persistent shedding of the bacteria in the urine (i.e., a renal carrier state) may occur with the dog-adapted serovar (*Leptospira canicola*).

Clinical signs generally include vomiting, not eating (or reduced appetite), lethargy, weakness, and polyuria (increased urination) and polydipsia (increased drinking).

Less commonly, difficulty or changes with breathing can occur. Muscle pain and bleeding tendencies, for example, petechiae (“pin-point” bleeding), nose bleeds, blood in stool, and neurologic signs of stiffness and disorientation, may also be noted.

In cats, clinical disease is considered rare; however, when clinical signs do appear they are similar to those in dogs.



### Diagnosis

Diagnosis is usually made after dogs present to veterinary clinics with acute kidney, liver, or a combination of the 2 diseases. Various specific blood and urine tests are available to assist in diagnosing leptospirosis. A number of factors may complicate (or confuse) diagnosis, such as prior vaccination, past exposure, and antibiotic use.

Infection with *Leptospira* spp. should be considered in any dog that presents with acute illness, concurrent kidney and/or liver blood value changes, and lower platelet counts.



### Prognosis

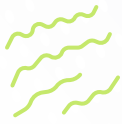
Prognosis and successful outcome is related to speed of diagnosis, therapy, and in some cases pet-owner capability to seek referral for dialyses with acute kidney disease. Dogs who develop chronic kidney disease may be successfully managed according to kidney stage and pet-owner compliance with monitoring.



### Treatment

Therapy for leptospirosis hinges on prompt and appropriate antibiotics, together with supportive care based on clinical disease severity. Many dogs will require intensive hospitalization, intravenous fluids, anti-nausea medications, and careful 24-hour monitoring in an ICU facility with dialyses capabilities, transfusion, and oxygen support. Doxycycline is typically recommended for therapy and to eliminate development of persistent bacterial shedding in the urine.

Follow-up monitoring of the patient’s liver, kidney, and platelet values is important, and chronic kidney disease may result in some dogs.



## LEPTOSPIROSIS (continued)



### Prevention

While avoidance of contaminated environments is the best way to reduce disease risk, this is rarely practical. Knowledge and awareness of endemic areas (i.e., where leptospirosis has been known to occur) and slow moving water, puddles, or areas known to have high populations of rodents or raccoons, may help reduce exposure and increase attention to need for precautions and control measures.

Vaccination is recommended in areas known to have leptospirosis and for dogs at increased risk, for example, field trial dogs, hunting, and those traveling to field areas, urban areas, and areas that are known to have had an outbreak (human or canine).<sup>3,4</sup>

Leptospirosis is thought to be rarely transmitted from dogs to people. However, infection-control precautions for veterinary hospitals and pet businesses, like boarding kennels, doggie day cares, dog walkers or sitters, and groomers, are strongly advised with suspect patients. These should include clearly identifying suspect or known hospital cases, wearing gloves, avoiding contact with contaminated urine or bedding, and having patients urinate in a specific area away from other patients or where there is heavy human or canine traffic. Avoidance of contact with urine is recommended for pet owners and hospital staff, particularly for the first 72 hours after antimicrobial use initiation while bacteria are more likely infective.

Therapy of other dogs that live in the same household where one dog has been diagnosed with leptospirosis is advised. Additionally, a pet owner who has a dog diagnosed with leptospirosis should be instructed to contact their health professional because of concerns for common environmental exposure.

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# CANINE INFLUENZA

Jarod Hanson, DVM, PhD, DACVPM

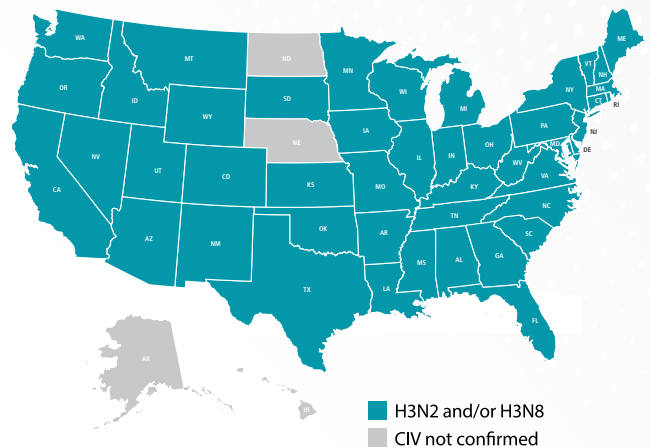
## What Is Canine Influenza?

**Canine influenza** is caused by one or more influenza A viruses. Two distinct canine influenza viruses, H3N8 and H3N2, have actively circulated in dog populations in the last several years, although H3N8 has infected dogs for over 10 years<sup>1</sup> and H3N2 may have infected dogs in Asia before the year 2000.<sup>2,3</sup> H and N refer to the hemagglutinin and neuraminidase proteins, respectively, which are protrusions on the surface of the virus that allow the virus to attach to a host, and allow a laboratory to initially identify and categorize the virus. Despite its name, canine influenza has also been shown to infect other species, including cats,<sup>4,5</sup> ferrets (experimentally),<sup>4,6</sup> and guinea pigs,<sup>7</sup> so it is important to note if any other animals are also acting sick. Cats have also recently been infected with an H7N2 avian influenza, or bird flu, strain (along with the attending veterinarian),<sup>8</sup> so it is important to note that although this is not classified as a canine influenza virus (CIV), many different influenza A strains can potentially infect companion animals.



Influenza viruses are most likely to infect large groups of animals during the winter months when environmental conditions (low temperatures and elevated moisture) allow the virus to live longer outside the host animal,<sup>9</sup> and animals are in closer proximity to one another. However, the H3N2 outbreak in the United States began in the late winter months and continued well into the summer, so flu may be an issue any time of year. In companion animal species, canine influenza typically circulates in shelters and boarding facilities after the introduction of an infected animal, because of the number of unexposed dogs in the population, as well as the constant introduction of new, susceptible animals into the population.<sup>10</sup>

## THE GROWING PREVALENCE OF CIV H3N2 AND H3N8\*



\*Cornell University, Test Summary for Canine Influenza Virus in Dogs not Affiliated with Greyhound Racetracks, 2009; Crawford, et al., Transmission of Equine Influenza Virus to Dogs, P.C., 2005. Syndromic surveillance data of Cynda Crawford, DVM, PhD, University of Florida; Edward Dubovi, PhD, Cornell University; Sanjay Kapill, DVM, PhD, ACVIM, Oklahoma State University; IDEXX Laboratories and Cornell AHDC CIV Surveillance Network.



## CANINE INFLUENZA *(continued)*

### Clinical Signs

The onset of clinical signs is quite rapid, and usually occurs in the first few days following infection. Many patients display few, if any, clinical signs (essentially asymptomatic), or display fairly mild symptoms. Initially, flu-infected dogs may have a fever,<sup>11</sup> but this often decreases or goes away entirely after the first few days of infection. Patients may be lethargic, or lie around, and may not want to eat. They may also have runny noses, sneeze excessively, and/or cough.<sup>11</sup> The severity of the cough is often dependent on if the influenza infection is followed by a bacterial pneumonia. In more severely affected dogs, some difficulty breathing may be observed, while the most severely affected animals can exhibit severe respiratory distress (although this is rare, and most likely to be seen with H3N2, if observed at all).



### TRANSMISSION/INCUBATION

The influenza virus can be directly spread from one animal to another via nose-to-nose contact (direct contact). The virus can also be acquired through breathing in aerosolized droplets from an infected patient,<sup>4</sup> or from contacting a virus-infected surface.<sup>12</sup> Anyone handling the infected patient can also potentially move the virus from one animal to another via unwashed hands or other contaminated equipment, so anything that contacts a suspected flu patient should be disinfected with diluted bleach, Lysol®, or other suitable disinfectant. It is also important to wash hands after handling a dog suspected of having influenza to help minimize virus transmission to other patients. Dogs exhibiting clinical signs should be isolated from other animals if possible to minimize any additional spread.



### Diagnosis

Influenza can be diagnosed from a nasal swab of the patient. Polymerase chain reaction (PCR) is used as the initial screening test to look for H3N8 and H3N2. Isolation of the virus can also be attempted from the same nasal swab sample. Paired serum samples can also be collected, where an initial serum sample is compared with another serum sample collected 2 to 3 weeks later to look for antibodies in the serum against influenza. Both methods are limited in that they may miss an infection if the second sample is taken too early and antibodies have not yet been produced.





## CANINE INFLUENZA (continued)



### Prognosis

While most dogs recover within 7 to 14 days, a small percentage may experience severe respiratory distress that can lead to death if left untreated. The prognosis is generally worse if multiple co-infections (with other viruses and/or bacteria) are involved. Additionally, infected dogs can shed the virus in respiratory secretions anywhere from 10 to more than 20 days<sup>13,14</sup> after they are first infected, especially if infected with the H3N2 virus, meaning even dogs that appear to have recovered can still infect other dogs, cats, or other animals.



### Treatment

Treatment usually involves supportive care, which may include supplemental oxygen, fluids, bronchodilators, and/or antibiotics (if secondary bacterial infections are suspected in the patient). Antiviral drugs are typically reserved for use in humans, and oseltamivir (Tamiflu®) specifically is not recommended in companion species because of unknown effectiveness. It would likely need to be given to the pet within the first 24 to 48 hours of infection, something not typically possible with the majority of veterinary influenza cases as most do not exhibit clinical signs for several days after they are first infected.

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# CANINE INFECTIOUS COUGH

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## Who Gets It and Why?

This is a very common clinical syndrome in dogs, and frequently related to infection with one or more combinations of the following bacteria and viruses:

- Bacterial causes: *Bordetella bronchiseptica*, *Streptococcus equi* subspecies *zooepidemicus*, and *Mycoplasma* spp. Other animal species, including cats, can be infected with these bacteria.
- Viral causes: Canine adenovirus 2, canine distemper virus, canine respiratory coronavirus, canine influenza viruses, canine herpes virus, canine parainfluenza virus, and pneumovirus.



## What Is Canine Infectious Cough?

Canine infectious respiratory disease complex (CIRDC) is known by many names, the most common being “kennel cough.” It has recently been defined as a syndrome (spectrum of clinical signs) in dogs, and clinical disease is associated with a number of bacteria and viruses.

Acute onset of a harsh cough is the hallmark of CIRDC, and dogs may have concurrent sneezing, and/or ocular (eye) or nasal discharge (or both). Typically, dogs improve within 7 to 10 days with basic nursing care, and the disease does not generally require extensive diagnostic testing or specific drug therapy.

## Can People Get Sick With It?

Human infection from dogs is unlikely; infections with *Bordetella bronchiseptica* have rarely been reported in people (generally those who are highly immunocompromised).



## CANINE INFECTIOUS COUGH *(continued)*



### TRANSMISSION

Most commonly, infection is spread directly from the respiratory tract (nose, throat) of one infected dog to another. Gastrointestinal shedding (from feces) may occur with distemper virus. Transmission may also occur through contaminated fomites, such as bedding, grooming equipment, or human hands. High-density canine housing (e.g., boarding facilities, shelters, doggie daycare, kennels) or events with large dog groups (e.g., dog shows, puppy classes) with frequent dog mingling and interactions increase risk of both exposure and transmission. Veterinary hospitals are another source of infection between dogs. Time to infection is short for most bacterial and viral pathogens (2–10 days), and co-infection (multiple bacteria and viruses involved in one dog) is common. Many CIRDC pathogens can be present without clinical disease, which presents a challenge for diagnosis and prevention, that is, bacteria or viruses can be present incidentally and without obvious disease signs.

The majority of the pathogens involved in CIRDC are short lived in the environment. Different pathogens vary in importance based on geographic location and sometimes season.

### Signs of Disease

In dogs, the “goose honk” harsh or honking cough is classically reported or elicited on palpation (pressure) of the trachea in an otherwise bright and alert pet. Pet owners often report gagging, retching, or vomiting. Nasal or ocular discharge is frequently present, along with mild fever. Dogs infected with distemper virus may have skin, ocular, or intestinal disease (diarrhea) along with respiratory signs. Less commonly, more severe difficulty or changes with breathing due to pneumonia can occur.



### Diagnosis

CIRDC is diagnosed based on history of likely exposure to infected dogs (e.g., recent adoption) and physical exam. Extensive diagnostic testing is not typically advised or necessary (aside from severe or long-lasting progressive disease or in outbreak scenarios with multiple dogs affected) due to similarities between pathogens and high likelihood of co-infections.<sup>1</sup>





## CANINE INFECTIOUS COUGH *(continued)*



### Prognosis

Most dogs have an excellent prognosis, complete disease resolution, and cure. Dogs with distemper virus infections have a guarded prognosis.



### Treatment

Therapy for CIRDC entails supportive nursing care, rest, and “tincture of time,” as infection is self-limiting in <7 to 10 days in most dogs. Cough suppressant therapy may be considered, with reducing tracheal stimulation (e.g., use Halti® or harness instead of pressure from a collar).

Progressive disease or fever, mucopurulent (pus) nasal or ocular discharge, not eating, and/or lethargy may prompt consideration of antimicrobial therapy. Patients with pneumonia should be treated with appropriate antimicrobials.<sup>1</sup>



### Prevention

Vaccination is considered core for many CIRDC associated viruses. Vaccination also decreases severity and risk of infection for *Bordetella bronchiseptica*.

Vaccination is not completely protective, and it is important to convey to pet owners that while vaccination will reduce risk and severity of infection due to many CIRDC pathogens, it cannot prevent all disease risk.<sup>2,3</sup>

Transmission of many of these pathogens can be effectively reduced with decreased canine mingling and stress, together with rapid identification of ill dogs and proper infection control.

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# LYME DISEASE

Charine Tabbah Ahmed, DVM

## What is Lyme disease?

Lyme disease was first identified in 1975 in children who developed arthritis, fever, and a rash in Lyme, Connecticut, earning this disease its name. A few years later in 1982, researcher Willy Burgdorfer identified a spirochetal bacterium transmitted by *Ixodes* ticks as the causative agent, which was named *Borrelia burgdorferi* in his honor.<sup>1</sup> This disease was recognized in dogs soon after, and today over 30 subtypes of the North American variant, *Borrelia burgdorferi sensu stricto*, have been identified.<sup>2</sup> It remains an important vector-borne disease of dogs with seroprevalence as high as 13.3% in endemic areas and is considered the most common vector-borne disease of people in the United States.<sup>3</sup>



## Where is Lyme disease endemic?

Lyme disease is endemic in the Northeast, upper Midwest, and West Coast of the United States.<sup>3</sup> Within these areas, upward of 50% of *Ixodes* ticks are infected with *Borrelia burgdorferi*. Recently, the geography of these endemic areas has expanded, owing to migration of common tick hosts, such as birds and deer.<sup>2</sup>

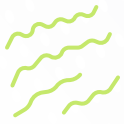
## Signs of disease

While this disease affects both humans and dogs, the clinical picture presents differently. Most people develop symptoms; however, about 95% of exposed dogs do not.<sup>4</sup> For those dogs who become sick, the most common clinical signs include fever, decreased appetite, limping, and swollen lymph nodes.<sup>3</sup> Interestingly, dogs do not typically develop erythema migrans, or the bull's-eye rash, that is commonly associated with Lyme disease in people.<sup>4</sup>

In 2% of canine cases, Lyme nephritis can develop, a disease of the filtration system of the kidneys marked by protein loss in the urine. Clinical signs are consistent with kidney failure, including decreased appetite, vomiting, dehydration, increased thirst and urination, and muscle wasting. This disease is hard to definitively diagnose, and it is not well understood why some dogs develop Lyme nephritis while others don't; however, new research suggests retriever breeds are overrepresented.<sup>2,4</sup>

## Tick life cycle

The *Ixodes* tick that transmits Lyme disease is a 3-host tick that requires bloodmeals from 3 distinct animals in order to advance its 2-year life cycle. *Ixodes* ticks are not born with *Borrelia*. Instead, the ticks pick up the spirochete after feeding on an infected reservoir host, typically a small mammal, such as the white-footed mouse, shrews, or chipmunks. *Ixodes* ticks are often referred to as "deer ticks" due to the adult stage's affinity to feed on deer. Interestingly, deer are not considered a reservoir for *Borrelia*, but play an important role in sustaining the life cycle of this Lyme disease-transmitting tick.<sup>2</sup>



## LYME DISEASE *(continued)*



### TRANSMISSION/INCUBATION

Transmission time is estimated at 24 to 48 hours from the time of tick attachment and is aided by the expression of outer surface proteins (Osp) that the spirochete changes like coats.<sup>3</sup>

Before feeding, the spirochete expresses outer surface protein A (OspA) and is anchored in the midgut of the tick. Changes associated with the bloodmeal, such as temperature, trigger the spirochete to downregulate OspA and upregulate outer surface protein C (OspC). This cleaves the anchor so the spirochete can cruise from the midgut into the salivary glands of the tick and into the new host.<sup>5</sup> OspA and OspC both play a key role in the transmission of this disease and are targets of canine Lyme vaccines.<sup>2</sup>

The incubation period between infection and development of clinical signs of Lyme disease ranged from 2 to 5 months in experimentally infected puppies.<sup>4</sup>



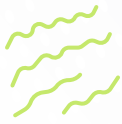
### Diagnosis

The Companion Animal Parasite Council, American Animal Hospital Association, and the American College of Veterinary Internal Medicine Lyme Consensus Statement all agree that dogs living in endemic areas should be screened for Lyme disease annually.<sup>2,3,6</sup> Lyme disease tests look for antibodies against the spirochete, which are detectable approximately 4 to 6 weeks post infection.



### Prognosis

Dogs that present with classic signs of Lyme disease, such as fever and limping, typically respond to antibiotic treatment within 1 to 3 days. Chronic cases of Lyme arthritis are rare and not well documented.<sup>2</sup> Unfortunately, the prognosis for Lyme nephritis is much worse and many dogs succumb to this disease within days to weeks.<sup>4</sup> Continuous monitoring of protein levels in the blood and urine, kidney function tests, and blood pressure is necessary to assess response to treatment.<sup>2</sup>



## LYME DISEASE (continued)



### Treatment

The decision to treat a dog for Lyme disease is based on a combination of a positive test result and clinical disease. While many antibiotics are effective at treating the symptoms of Lyme disease, the recommended treatment protocol is 30 days of doxycycline administered orally at a dose of 10 mg/kg/day.<sup>2</sup>

Aggressive treatment of Lyme nephritis is necessary and correlates with the severity of kidney damage. In addition to doxycycline, treatment requires medications to reduce protein loss in the urine and control blood pressure, as well as supplements and a protein-restricted diet to support kidney function. All dogs that test positive for Lyme disease should be screened for protein loss in the urine 2 to 3 times a year.<sup>2</sup>



### Prevention

Daily tick checks are a mainstay of prevention of any tick-borne disease. Attached ticks should be removed immediately to decrease risk of disease transmission. Owing to concerns of zoonotic risk, pet owners should remove ticks using forceps or a commercially available tool designed for tick removal.<sup>3</sup>

The Companion Animal Parasite Council, American Animal Hospital Association, and the American College of Veterinary Internal Medicine Lyme Consensus Statement all agree that dogs living in endemic areas should be maintained on flea and tick prevention year round.<sup>2,3,7</sup> Many forms of prevention are commercially available and capable of killing ticks before they can transmit disease, including oral chews, topicals, and collars.<sup>2</sup>

While these preventatives are highly effective, data suggest pet owners are not compliant with year-round administration recommendations.<sup>2,9</sup> Vaccines offer another layer of protection against Lyme disease by safely providing high efficacy and good duration of immunity, but they do not replace the need for good tick control.<sup>2,3</sup>

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PART 2:

# INFECTIOUS DISEASES OF CATS





# PANLEUKOPENIA

Christopher A. Lee, DVM, MPH, DACVPM

## What is Panleukopenia?

Genetically similar to the canine parvovirus, veterinarians previously referred to feline panleukopenia (FP) as “feline parvovirus.”<sup>1</sup> Both FP and canine parvovirus focus on rapidly dividing cells, such as the intestines and bone marrow. The etymology of the word pan- (all)<sup>2</sup>, leuko- (white)<sup>3</sup>, and -penia (deficiency)<sup>4</sup> highlights the dangerous reduction of white blood cells associated with this disease.



## Signs of disease

While many adult cats present asymptotically, this virus often generates fatal disease in kittens.

Clinical Signs of Panleukopenia Include:

- Sudden death (“fading kitten” syndrome)
- Acute fever (104°–107°F [40°–41.7°C])
- Depression
- Anorexia
- Vomiting
- Diarrhea
- Severe sequelae include dehydration, hypothermia, septic shock, and disseminated intravascular coagulation (DIC)



## TRANSMISSION/INCUBATION

Transmission characteristics of panleukopenia highlight the need for this as a core vaccine, delivered as early as defined by feline vaccination guidelines and the vaccine label. Copious amounts of viral particles exude in nearly all secretions and excretions, including nasal discharge, urine, and feces.

Being a non-enveloped virus, panleukopenia survives in the environment for up to a year and represents a consistent fomite risk. Thus, exposure occurs via the oronasal route with infected secretions, excretions, or contaminated fomites.

While resistant to many disinfectants, 1:32 dilution of household bleach (6% aqueous sodium hypochlorite), 4% formaldehyde, 1% glutaraldehyde, and peroxygen disinfectants consistently inactivate this virus.<sup>5</sup> Disinfection must follow proper reconstitution of disinfectants, cleaning protocols, and contact time for successful decontamination. Panleukopenia’s incubation period is typically between 2 and 7 days.<sup>5</sup>





## PANLEUKOPENIA (continued)



### Diagnosis

Clinicians often make a presumptive diagnosis based on history, clinical signs, and a complete blood count (CBC). Neutropenia remains the most consistent abnormality. Leukopenia (nadir 50–3000 WBC/ $\mu$ L) is common, and values below 2000 cells/ $\mu$ L drive a lower prognosis. Rebound neutrophilia with a marked left shift characterize CBCs obtained in recovery phases.

Point-of-care tests for canine parvovirus may be used to help establish a diagnosis; however, false negatives and vaccine-induced false positives have been identified. Some hospitals stock in-office, fecal CPV antigen, immunochromatographic test kits, but false negatives are common because fecal antigen is detectable for only a short time after infection. The exclusion of other diseases is essential to avoid misdiagnosis or overlooking a comorbidity.



### Prognosis

Depending upon age, the prognosis varies from grave to poor to excellent. Kittens under 8 weeks of age have the poorest prognosis and older cats have a greater chance of survival with adequate treatment if provided early.

Cats living beyond the first 5 days of clinical signs, dramatically improve their chances of survival. Most symptomatic cats require intensive, hospitalized, supportive care. Without it, roughly 90% die. Older and adult cats may be asymptomatic and thus have a better prognosis.



### Treatment

Vigorous fluid therapy and supportive care are required for successful treatment in acute cases. Crystalloid fluids with supplements to address fluid and electrolyte abnormalities, glucose for hypoglycemia, fresh frozen plasma for hypoproteinemia, and whole blood transfusions for anemia may all be necessary. Antiemetics, antibiotics, and vitamin B supplementation are often needed.<sup>6</sup>

While not FDA-approved for this use, recombinant feline interferon omega (rFeIFN) may help. Data have supported interferon's effective and approved use in canine parvovirus treatment.



## PANLEUKOPENIA (continued)



### CONCLUSION:

Feline panleukopenia represents a ubiquitous threat to cats, especially kittens. By following standard vaccine protocols, veterinarians can prevent most infections. Owing to the fomite transmission risk, even indoor cats should be protected with vaccines according to USDA labeling and vaccine guidelines.

**References:** **1.** Feline panleukopenia. American Veterinary Medical Association website. Available at: <https://www.avma.org/resources-tools/pet-owners/petcare/feline-panleukopenia>. Accessed August 12, 2020. **2.** Pan-. Online Etymology Dictionary website. Available at: <https://www.etymonline.com/word/pan->. Accessed August 12, 2020. **3.** leuko-. Online Etymology Dictionary website. Available at: <https://www.etymonline.com/search?q=leuko->. Accessed August 12, 2020. **4.** -penia. Free Dictionary website. Available at: <https://medical-dictionary.thefreedictionary.com/-penia>. Accessed August 12, 2020. **5.** Squires R. Overview of feline panleukopenia. Merck Veterinary Manual website. Available at: <https://www.merckvetmanual.com/generalized-conditions/feline-panleukopenia/overview-of-feline-panleukopenia>. Accessed August 12, 2020. **6.** Feline panleukopenia. University of Wisconsin Madison website. Available at: <https://www.uwsheltermedicine.com/library/guidebooks/feline-panleukopenia/recognition-and-diagnosis>. Accessed August 12, 2020.



# FELINE HERPES VIRUS

*Christopher A. Lee, DVM, MPH, DACVPM*

## What is Feline Herpes Virus?

Feline viral rhinotracheitis (FVR) represents a principle pathogen within the feline respiratory disease complex. The causative agent, feline herpesvirus type-1, is the most common cause of conjunctivitis (inflammation involving the eyelid, third eyelid, and surrounding tissues) in cats. While residing in the same viral family as human herpes, the feline herpes virus is not zoonotic and only afflicts domestic and wild cats.



## Signs of disease

The clinical signs of feline herpes virus include<sup>1</sup>:

- Conjunctivitis with discharge and blepharospasm
- Corneal ulceration
- Keratitis (corneal inflammation with potential stromal edema)
- Fluctuating fever (typically between normal and 103°F [39°C]). The fever may reach up to 105°F (40.5°C)
- Sneezing and nasal discharge
- Nasal congestion
- Depression
- Loss of appetite
- Lethargy



## TRANSMISSION/INCUBATION

The virus sheds in oral, nasal, and ocular discharges. Cats frequently become infected from direct and close contact with infected cats. Aerosol and fomite transmission also present as effective methods of transmission.<sup>2</sup> The virus survives on surfaces for several hours under normal conditions. Conditions supporting moisture of viral secretions prolong infectivity.

While cats of all ages and signalments remain susceptible, brachycephalic breeds, such as Persian cats, live at higher risk. Crowding, immune suppression, comorbidity, or stress may support more aggressive clinical signs.



## FELINE HERPES VIRUS *(continued)*



### Diagnosis

History and clinical signs support a presumptive diagnosis.<sup>2</sup> Corneal ulceration and decreased tear production increase the likelihood of feline herpesvirus being the cause of the feline respiratory disease complex. Fluorescein dye and Schirmer tear tests may prove helpful.<sup>3</sup> While polymerase chain reaction (PCR) amplification establishes the presence of feline herpesvirus DNA, intermittent viral shedding may lead to false-negative results. With high seroprevalence within clinically healthy cats, antibody titers provide little diagnostic help. Feline herpesvirus instills chronic infections. Stress, corticosteroid administration, and illness can trigger recrudescence and relapse of clinical signs and virus shedding.<sup>4</sup> PCR testing when the virus is in a latent state and the cat does not appear ill, often leads to false-negative results.



### Prognosis

Unfortunately, no cure exists for cats infected with feline herpesvirus. Fortunately, most uncomplicated cases respond well to symptomatic treatment. Keratitis and corneal ulcerations during initial infection can induce long-term conditions, such as keratoconjunctivitis sicca (KCS) and corneal scarring.<sup>3</sup> Aggressive ophthalmic treatment and support should be performed to reduce the risk of permanent ocular disease.



### Treatment

Treatment largely relies on supportive care. Corneal ulceration and keratitis require attentive treatment and monitoring. Consultation with a veterinary ophthalmologist may be necessary.

Antiviral drugs hold virostatic properties, and several have been studied and used in cats.

Famciclovir (2-(2-(2-amino-9H-Purin-9-yl)ethyl)-1,3-propanediol diacetate; Famvir<sup>®</sup>) remains a popular choice.<sup>5</sup>

Supportive care may require systemic antibiotics to address secondary bacterial infections.<sup>6</sup> The probiotic FortiFlora<sup>®</sup> may reduce illness duration and supports intestinal health while on antimicrobial therapy.

Lysine represents one of the most controversial and well-studied therapies to control symptoms of feline herpesvirus. A systematic review of the available literature does not support the use of lysine therapy.<sup>1</sup>

Supplementation of this amino acid in the diets of cats has consistently been safe with a low incidence of adverse events. Thus, lysine continues to be used with anecdotal success.



## FELINE HERPES VIRUS *(continued)*



### CONCLUSION:

With chronic infections, recrudescence, and high infectivity, most cats will be exposed to this disease in their lifetime. Adhering to vaccine protocols for this core infectious disease remains essential.

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# CALICIVIRUS

*Christopher A. Lee, DVM, MPH, DACVPM*

## What is Calicivirus?

Along with feline herpesvirus (FHV), feline calicivirus represents a principle pathogen within the feline respiratory disease complex. Unlike FHV, feline calicivirus remains stable in the environment and resists many common disinfectants. While often instilling mild clinical signs, this virus can have fatal effects. Feline calicivirus is not zoonotic.

## Signs of disease

The clinical signs of feline calicivirus include:

- Sneezing and nasal congestion
- Ocular and nasal discharge
- Hyperptyalism
- Fever
- Ulceration of tongue and mouth
- Lethargy
- Loss of appetite
- Multifocal, acute joint pain (associated with some strains)
- Generalized disease, multiple organ disease (associated with some strains)



## TRANSMISSION/INCUBATION

Calicivirus spreads through direct, oral, aerosol, and fomite methods.<sup>1</sup> Beyond saliva, nasal mucus, and ocular discharge, viral particles have been detected in urine, feces, and blood.<sup>2</sup> From infection, most cats shed virus for 2 to 3 weeks.<sup>3</sup> If a long-term carrier, some cats intermittently shed virus for months. The incubation period, time from infection to clinical signs, is between 2 days and 2 weeks.<sup>3</sup> Depending upon the severity and viral strain, clinical signs persist from 5 days to 6 weeks.



## CALICIVIRUS *(continued)*



### Diagnosis

Within the clinical signs of feline respiratory disease complex, the presence of oral and/or tongue ulceration sways the presumptive diagnosis toward feline calicivirus.<sup>3</sup> Clinicians confirm the diagnosis by submitting oral, nasal, and/or ocular swabs for polymerase chain reaction (PCR) testing.<sup>3</sup> Patients with lung involvement may benefit from additional diagnostics, such as transtracheal washes and radiographs.<sup>3</sup>



### Prognosis

For most cats, the prognosis is good. This worldwide, ubiquitous virus can cause mild-to-severe respiratory signs. While the majority of cats recover entirely, a rare strain generates systemic disease, which has been associated with a mortality rate of 67%.<sup>3</sup>



### Treatment

Most afflicted cats respond well to symptomatic treatment and prescription medications at home when needed. Veterinarians may use antibiotics, anti-inflammatories, ocular prescriptions, and more to support and treat patients.<sup>2</sup> Currently, no antiviral medications that specifically target or affect the virus directly have been identified. As some patients experience severe and life-threatening disease, hospitalized care may be necessary.



### CONCLUSION:

Bearing the qualities of a non-enveloped virus, calicivirus remains infective in the environment and on fomites for extended periods of time. While typically generating mild signs, this RNA virus often mutates. Some strain variations impart severe and even fatal disease. For these reasons, this virus is maintained as a core vaccination for both indoor and outdoor cats.

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# RABIES

*Christopher A. Lee, DVM, MPH, DACVPM*

## What is Rabies?

The CDC reports 3.5 to 4.1 times more rabies-confirmed domestic feline cases in the United States than canine.<sup>1</sup> The AVMA cites a lack of pet-owner feline vaccination as a significant factor in cats being the number one, domestic, rabid animal in the United States.<sup>1</sup> Often exposed by infected bats, the AVMA reminds us that both indoor and outdoor cats remain at risk for this deadly, zoonotic disease.<sup>1</sup>



## Signs of disease

The canine rabies section details the prodromal, excitative, and paralytic or dumb phases that afflicts all mammals. Once clinical signs begin, the disease quickly progresses toward death.<sup>2</sup>

Clinical signs of rabies include<sup>3</sup>:

- Acute behavioral changes
  - Hiding behavior
  - Irritability and apprehension
  - Unusual aggression
- Loss of appetite
- Neurologic signs
  - Inability to swallow and subsequent drooling
  - Difficulty walking
  - Paralysis
- Death



## TRANSMISSION/INCUBATION

While bite wounds remain the most common method of transmission, any direct exposure of contaminated saliva to mucous membranes (eyes, nose, mouth, etc.) or broken skin may result in infection. Direct contact with contaminated nervous tissue, such as the brain, represents a risk.

Direct contact with fur, feces, urine, or blood of a rabid animal has not been associated with disease transfer. However, any cat that has been near a wild animal of unknown status needs to be considered as potentially exposed. The rabies incubation period for infected cats ranges from a couple weeks to many months, and potentially years.<sup>4</sup> On average, clinical signs begin 2 months from infection.<sup>5</sup>



## RABIES (continued)



### Diagnosis

For domestic animals, the gold standard consists of immunofluorescence microscopy on a post-mortem, fresh brain tissue sample.<sup>6</sup> Avoid freezing brain tissue samples.



### Prognosis

Once clinical signs from a rabies infection have begun, the disease progresses in a universally fatal syndrome for nearly all mammals.<sup>6</sup>



### Treatment

If a cat is suspected to be infected and clinical, the pet should be immediately euthanized, and confirmatory tests should be run. No attempt at treatment should be made.<sup>5</sup>



## CONCLUSION:

While human rabies cases remain rare in the United States, rabies-positive wildlife, livestock, and pet cases occur annually.<sup>7</sup> With cats representing the most-commonly infected domestic animal, the importance of following local and state guidelines for indoor and outdoor cats remains vital.

Despite safe and effective vaccines, over 59,000 people worldwide die from rabies.<sup>8</sup>

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# FELINE LEUKEMIA VIRUS

Christopher A. Lee, DVM, MPH, DACVPM

## What is Feline Leukemia Virus (FeLV)?

In the winter of 1985, the first feline leukemia vaccine emerged to provide protection against the “number one killer of cats.” At the time, over a million cats annually died from this disease.<sup>1</sup> Despite the widespread availability of the vaccine, this disease remains one of the most dangerous and common feline pathogens. The 2020 AAFP *Feline Retrovirus Testing and Management Guidelines* recognize a 4% antigen prevalence when reviewing the testing of over 2.5 million North American cats.<sup>2</sup>

## Signs of disease

The clinical signs of feline leukemia include:

- Often asymptomatic during early infection that may last weeks, months, or even years
- Persistent fever
- Pale mucous membranes secondary to anemia
- Ophthalmologic disease
- Progressive weight loss and decreased hair coat quality
- Loss of appetite
- Stomatitis and/or gingivitis
- Variety of neurologic diseases, including seizures
- Secondary infections (skin, bladder, respiratory)
- Lymphadenopathy
- Chronic diarrhea

## Secondary disease conditions

- Aplastic anemia
- Neoplasia (i.e., leukemia, lymphoma)
- Immune suppression
- Immune-mediated diseases
- Inflammatory conditions
  - Stomatitis, gingivitis
  - Intestinal inflammation
- Neurologic disease (i.e., blindness and nerve dysfunction)
- Reproductive disease
  - Abortion
  - “Fading kitten” syndrome





## FELINE LEUKEMIA VIRUS *(continued)*



### TRANSMISSION/INCUBATION

The virus is shed in the saliva and urine and quickly deteriorates when outside the body. Direct contact with an infected cat's fluids through grooming, sharing food bowls, and even litter boxes transfer the virus to a new host.<sup>3</sup> While transplacental transmission occurs, transmammary transmission and grooming more commonly transfer the virus from an infected queen to her kittens.<sup>4</sup> Prolonged close contact or exposure to infected cats increases the risk of infection. Kittens and juveniles hold lower resistance against infection as compared with adult cats.<sup>5</sup>



### Diagnosis

Enzyme-linked immunosorbent assay (ELISA) testing detects the FeLV p27 antigen from within a cat's blood sample. After this point-of-care test, diagnostic labs can confirm the diagnosis through an indirect immunofluorescent antibody assay (IFA) test.<sup>6</sup> The confirmatory test establishes viral infection within white blood cells. As a result, IFA-positive cats typically remain persistently infected for their lifetime.<sup>6</sup>



### Prognosis

Unfortunately, the average survival time is 2.4 years from diagnosis.<sup>4</sup> The younger the age of infection, the faster that clinical disease progresses. At 3 years from diagnosis, only 20% of FeLV-positive cats will typically remain alive.<sup>7</sup>



## FELINE LEUKEMIA VIRUS *(continued)*



### Treatment

As retroviruses, such as feline leukemia, incorporate themselves within a host's genome, no cure exists. Retroviral treatments for human immunodeficiency virus (HIV) show promise within in vitro tests; however, more research is needed. Feline interferon omega and human interferon alpha have also demonstrated positive responses, but again lack strong field trials.

Treatment focuses on supportive care to address primary and secondary disease conditions. Positive cases that develop lymphoma may benefit from chemotherapy. Roughly half of lymphoma-treated, FeLV-positive cats will undergo remission and live an average of 6 additional months. Similarly, lymphoma-treated cats who are FeLV negative live an average of 9 months after remission.



### CONCLUSION:

A 2017 study evaluated 62,301 cats tested at veterinary clinics and animal shelters across North America. Seroprevalence established at veterinary clinics was higher at 3.4% than shelter seroprevalence at 2.6%.<sup>8</sup> In addition, positive adult cats outnumbered positive juvenile cats at 3.6% compared with 2.5%.<sup>8</sup> These findings parallel the findings in the 2006 study, which evaluated 18,038 North American cats.<sup>9</sup>

Owing to the high adult seroprevalence, grave prognosis, incurability, and lack of medical management options—FeLV vaccines are essential for cats with any level of established risk.

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# CHLAMYDIA

Christopher A. Lee, DVM, MPH, DACVPM

## What is *Chlamydia felis*?

This intracellular, gram-negative bacterium endured multiple taxonomic renaming over the recent years, from *Chlamydia psittaci* to *Chlamydophila felis* and currently to *C. felis*.<sup>1,2</sup> Despite the moniker of feline pneumonitis, this bacterium typically generates conjunctivitis rather than pneumonia.<sup>3</sup> *C. felis* may induce feline rhinitis and is occasionally zoonotic.



## Signs of disease

The clinical signs of *C. felis* include:

- Conjunctivitis with discharge and blepharospasm
- Sneezing and nasal discharge
- Low-grade fever
- Lethargy



## TRANSMISSION/INCUBATION

As an obligate intracellular organism, *C. felis* dies quickly outside a host.<sup>4</sup> Thus, transmission requires direct or close contact with an infected cat.<sup>3</sup> After the incubation period of 3 to 10 days, infected cats express clinical signs, typically conjunctivitis.<sup>3</sup> Clinical signs may persist for several weeks; however, the most severe clinical signs occur between 9 and 13 days.<sup>3</sup> If left untreated, infected cats shed this bacterium for months.<sup>3</sup>



## Diagnosis

Feline herpesvirus 1 and feline calicivirus remain the most common causes of the feline respiratory disease complex. Clinicians can identify *C. felis* as the primary or secondary infection by running one of several tests: cytology to demonstrate intracytoplasmic inclusions, cell culture isolation, or by polymerase chain reaction (PCR) amplification using conjunctival swabs.<sup>5</sup>





## CHLAMYDIA (continued)



### Prognosis

Most cats respond well to therapy. Young cats, particularly those between 2 and 6 months of age, represent the majority of clinical infections.



### Treatment

Clinicians may successfully treat this infection by prescribing topical and/or systemic antibiotics for a minimum of 4 weeks, provided the pet owner and patient are compliant.<sup>6</sup> Pet owners need to continue treatment for at least 10 days beyond the point when the cat is free of all clinical signs.



### CONCLUSION:

*Chlamydia felis* contributes to the pathogen list within the feline respiratory disease complex. Annual vaccination may help prevent disease, especially in higher-risk populations, such as within catteries, rescues, and shelters.

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# BORRELIA BURGENDORFERI (LYME)

Christopher A. Lee, DVM, MPH, DACVPM

## What is *Borrelia burgdorferi*?

This tick-vectored, spirochete bacterium generates the condition, known as Lyme disease, in people and some domestic animals. Despite this pathogen's likely prehistoric origins, the discovery of the disease remains recent.<sup>1</sup>

In the mid-1970s, an outbreak of juvenile arthritis in Old Lyme, Connecticut, led the Connecticut State Department of Health and Yale School of Medicine to investigate what would become known as "Lyme disease." By 1982, Wilhelm "Willy" Burgdorfer and his team isolated the bacteria which bears his name, *B. burgdorferi*.<sup>2</sup>

For people in the United States, Lyme disease stands as the most common arthropod-borne disease. Researchers document the increase in incidence and geographic expansion of this pathogen across the United States, Central Europe, and Asia.<sup>3,4</sup>

## Signs of disease

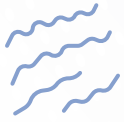
While some recent studies support the correlation of clinical signs with *B. burgdorferi*-seropositive cats, definitive causative data remains elusive. Currently, it is unknown whether *B. burgdorferi* infection in cats generates illness.<sup>5,6</sup>

Potential clinical signs of *B. burgdorferi* infection include<sup>7</sup>:

- Asymptomatic (most common)
- Lameness
- Hyporexia (reduction of appetite)
- Fever
- Fatigue or malaise
- Difficulty breathing

A recent case-series report documented bradyarrhythmia in naturally infected, client-owned cats.<sup>8</sup>





## **BORRELIA BURGDORFERI (LYME)** (continued)



### **TRANSMISSION/INCUBATION**

Worldwide, 4 species of *Ixodes* ticks hold the ability to transfer the causative agent of Lyme disease, including *I. scapularis* (black-legged tick or deer tick), *I. pacificus* (western black-legged tick), *I. ricinus* (castor bean tick or deer tick), and *I. persulcatus* (taiga tick). With little to no transovarial transmission of *Borrelia*, most newborn ticks begin their lives free of the bacterium. Small mammals, such as the white-footed mouse, serve as natural reservoirs for the bacteria.<sup>9-12</sup>

When *Ixodes* larvae feed off small mammals harboring *B. burgdorferi*, the bacteria infect the ticks. When these pathogen-carrying ticks feed in their nymphal and adult stages, they may pass the bacteria onto other hosts, such as humans, dogs, cats, and deer.<sup>13</sup>

The smaller, poppy seed–sized nymphs transfer *B. burgdorferi* more commonly to incidental hosts, such as humans, dogs, and cats, than do the larger adult ticks. The short, 3 to 4 days of nymphal feeding on a host may easily go unnoticed.<sup>13</sup>



### **Diagnosis, Prognosis, and Treatment**

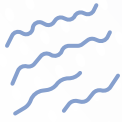
Clinicians may document feline patient exposure to *B. burgdorferi* through serology at reference laboratories. Until a clear association between clinical signs and infection exists for feline patients, treatment is not generally indicated for *B. burgdorferi*–seropositive cats. If general practitioners suspect potential clinical signs and disease from a borrelial infection in a cat, then referral to an internal medicine specialist would be warranted.<sup>5,14</sup>



### **Prevention**

Beyond *B. burgdorferi*, other arthropod-vectored pathogen risks occur. *Ixodes* ticks may transfer *Anaplasma phagocytophilum* (anaplasmosis) infection to cats. *Amblyomma americanum* (lone star tick) can transfer deadly *Cytauxzoon felis* (Cytauxzoonosis). Fleas (*Ctenocephalides felis*) may transfer pathogens to cats that hold the potential for zoonosis, such as *Bartonella henselae* (cat-scratch disease) and *Rickettsia felis* (cat-flea typhus).<sup>15-18</sup>

In many geographic regions, year-round protection against fleas and ticks is warranted for indoor and/or outdoor cats. A variety of safe options are available for cats. This strategy helps protect the cat, other household pets, and people.<sup>19</sup>



## BORRELIA BURGENDORFERI (LYME) (continued)



### CONCLUSION:

*B. burgdorferi*, the causative agent for Lyme disease, has been geographically expanding in recent years. While the medical implications of feline infection remain unclear, increasing reports support the potential for disease. Year-round, feline-safe acaricide use helps protect cats against ticks and may reduce pathogen transmission.<sup>5</sup>

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PART 3:

# PREVENTION OF INFECTIOUS DISEASE





# VACCINES MADE EASY

*Kathryn Primm, DVM*

## Why Do We Recommend Vaccination?

Infectious disease has existed as long as history has been documented. In 1796, a country physician named Edward Jenner administered the first documented inoculation. Dr. Jenner had noticed that milk maids who had been exposed to cowpox (as evidenced by pustules on the hands and arms) did not become ill from the smallpox outbreaks. Cowpox did not cause significant illness and death in humans, so Jenner famously inoculated a boy with pus from a cowpox lesion on a milk maid's hand and then was able to demonstrate the boy's resistance to infection from future exposure to smallpox.<sup>1,2</sup> The smallpox vaccine saved millions of lives that would have been lost to smallpox epidemics. Smallpox was a devastating epidemic, killing millions of people during the 20th century. For centuries, vaccination has been saving lives and today's vaccines are significantly improved over a pus sample!

## How Do Vaccines Do Their Job?

Vaccines work by engaging the immune system in a "mock battle" so that it is armed and ready to react swiftly and effectively when exposure to the actual pathogen occurs. Immune systems are amazing in the way they can respond to threats and then be able to "remember" markers that flag the infectious agent. The next time the threat attacks, the immune system quickly recognizes the marker and calls up the appropriate cells to fight. In the case of the cowpox and smallpox exposure, the viruses are so similar that an immune reaction to cowpox would trigger resistance to smallpox as well, so when the boy was exposed to smallpox after the cowpox, his immune system engaged in a rapid battle to eliminate it.

Vaccines take advantage of this extraordinary ability. They are able to teach the immune system how to recognize a specific threat without actually being at risk. They accomplish this feat through an inactivated threat (killed vaccine) or by utilizing the actual pathogen, modified to be harmless, just like the inoculation of the boy with the harmless cowpox primed his immune system to be ready for attack from smallpox. There are different types of vaccines, but the goal of all of them is to reduce infection and subsequent death from the disease.

## How Do We Decide Which Vaccines Are Appropriate?

Many diseases with a high mortality (lots of individuals die) and/or high morbidity (high numbers become ill) are the ones for which vaccines are developed. Most vaccine protocols are based on the individual pet's lifestyle and risk factors. Find out what your hospital's protocol is on vaccination. Gone are the days when vaccination is a "one size fits all" concept. Each pet should be treated as an individual, taking into account his/her history, age, species, breed, lifestyle, environment, and disease risk factors. Be sure the appropriate questions are being asked when deciding the vaccine choices and only the necessary ones are recommended and administered according to local laws.



### Why Do I Have to Repeat (Booster) Vaccines?

The immune system is able to remember threats for a time. We do not really know how long that time is for an individual pet and it is better to truly have current protection than to think that the pet is protected when he is not. Young animals always require multiple boosters of certain vaccines because some of the immunity that they get from their mothers can interfere with the effectiveness of their own immune recognition. We need to make certain that the vaccine is present when the maternal interference wanes and it is somewhat variable in each animal.

### Are Vaccines Safe?

There has been an odd push on the Internet and social media to smear vaccinations and blame them for a variety of health issues, ranging from cancer to autism. Educated and informed medical sources have refuted many of these claims. Be aware that, by and large, vaccination is a very good idea and has saved countless animal and human lives. There are rare cases of allergic reactions to vaccines and these should be handled on an individual basis. That is not to say that random vaccines should be given regardless of risk, because even though the risk of complications is small, if the chance of disease is smaller, one must find the balance. Those who speak out against vaccination may have forgotten that their ancestors might not have survived at all without them.

### Why Do I Need to Know About Vaccines?

As a pet business professional, you are viewed by the public as an influencer in the area of animal health. You want to be sure that you stay aware of all the current recommendations so that you can confidently answer questions and concerns. As the animal's advocate, you may be the only source of credible information to combat the onslaught of bad advice. In most cases, the risk of disease far outweighs the risk of significant side effects, and pets should be vaccinated with vaccines deemed necessary by the pet's veterinarian. Some vaccines protect pets from diseases that are zoonotic (infectious to humans) and because of human health risk, at-risk pets must be identified and vaccinated properly.

**References:** 1. Meckel RA. Levels and trends of death and disease in childhood, 1620 to the present. In: Golden J, Meckel RA, Prescott HM, eds. *Children and Youth in Sickness and Health: A Handbook and Guide*. Westport, CT: Greenwood Press; 2004:3–24. 2. Jenner E. *Inquiry into the Causes and Effects of the Variolae Vaccine*. London: Sampson Low; 1798.



# STRATEGIC VACCINATION RECOMMENDATION FOR SOCIAL DOGS

Ronald Schultz, PhD, DACVM Honorary

In August 2016, experts in infectious disease, vaccinology, and veterinary medicine formed a consensus statement based on the needs of social pets and those that visit pet professional businesses, such as boarding kennels, groomers, training facilities, and doggie day cares. The results were key recommendations of best practices for pet businesses. The following has been agreed upon as appropriate guidelines for facilities seeking to ensure the highest standard of animal care and safety.

Vaccination is a medical decision made by a pet owner's veterinarian that should entail the same consideration and reasoning as other medical treatments. The American Animal Hospital Association (AAHA) and the World Small Animal Veterinary Association have created guidelines that recommend 2 categories of vaccines: core and non-core. Core vaccines are those vaccines that every dog should have. Core vaccines include rabies, canine distemper, parvovirus, and hepatitis (adenovirus). Non-core vaccines are those that are only recommended for dogs that are at risk or live in certain geographical areas. Non-core vaccines include canine parainfluenza, canine influenza (H3N8 and H3N2), *Bordetella*, leptospirosis, and Lyme (*Borrelia burgdorferi*).

## EXPERT RECOMMENDATIONS FOR PET CARE AND SAFETY BASED ON CURRENT AAHA VACCINATION GUIDELINES (2017).

<b>NON-CORE VACCINATIONS:</b>	<b>RECOMMENDED BY A VETERINARIAN</b> based on the risk of the dog's exposure to specific viruses and bacteria, often based on the lifestyle or environment of the dog. <b>VIRAL:</b> <ul style="list-style-type: none"><li>• Canine Parainfluenza</li><li>• Canine Influenza (dog flu), H3N8 and H3N2</li></ul> <b>BACTERIAL:</b> <ul style="list-style-type: none"><li>• <i>Bordetella bronchiseptica</i></li><li>• Leptospirosis</li><li>• Lyme (<i>Borrelia burgdorferi</i>)</li></ul>
<b>CORE VACCINATIONS:</b>	<b>RECOMMENDED FOR ALL DOGS:</b> <ul style="list-style-type: none"><li>• Canine Distemper</li><li>• Canine Adenovirus Type 2</li><li>• Parvovirus</li><li>• Rabies</li></ul>

Social dogs, including those that are boarded, groomed, group trained, or group walked, are at more risk of infectious disease, especially respiratory diseases. Therefore, in addition to core vaccinations, social dogs should be vaccinated against infectious respiratory diseases, including *Bordetella*, adenovirus type 2, parainfluenza virus, and both types of canine influenza virus (H3N2 and H3N8).

Leptospirosis is a very serious disease should be of concern to all pet businesses, because it can affect dogs and humans. Dogs that are at risk for leptospirosis should be vaccinated.

For more information about vaccination recommendations, please review the AAHA Vaccine Guidelines: <https://www.aaha.org/aaha-guidelines/vaccination-canine-configuration/vaccination-canine/>





# CLEANING AND DISINFECTION GUIDELINES

*Melissa Bourgeois, DVM, PhD, DACVM*

Cleaning and disinfection are very important parts of stopping the spread of disease, but it is very important that they are carried out correctly so as to be effective. If the wrong products are used, or cleaning and disinfecting is not carried out correctly, infectious pathogens can be left behind on surfaces. Before cleaning and disinfecting, users should review product labels as well as the safety data sheets (SDS) to familiarize themselves with the product chemistry, directions for use, and safety information.

**Following these steps will ensure that an area or surface is properly cleaned and disinfected.**

1. Before spraying any disinfectant, remove organic debris by sweeping or wiping the area.
2. Next, clean the area with a detergent or a degreaser, then rinse.
3. Apply an appropriate Environmental Protection Agency (EPA)-registered disinfectant and let it sit for the required contact time as directed by the product label. The contact time is the length of time the disinfectant needs to remain wet on a surface to kill the microorganisms listed on its label.
4. Finally, rinse the area and dry thoroughly. Drying is important because a lot of microorganisms can survive in a moist, humid environment.

## HOW TO CLEAN AND DISINFECT



When disinfecting floors, applying the disinfectant by spraying then rinsing is the preferred method. Spray application does not contaminate the disinfectant, whereas if using the bucket method, continual dipping of the mop after using it on the floor can contaminate the disinfectant. But if you don't have drainage, use the 2-bucket system for mopping—a bucket of clean water and a bucket of disinfectant—so there is a rinse step between disinfecting and putting the mop back in the disinfectant without contaminating it. Remember to wait the full length of the contact time after applying disinfectant, and change disinfecting solutions regularly to avoid cross-contamination.





## CLEANING AND DISINFECTION GUIDELINES *(continued)*

### A NUMBER OF FACTORS ARE IMPORTANT WHEN IT COMES TO CORRECT DISINFECTING:

- **Ambient conditions.** UV light, temperature, and humidity—can affect contact times (the time the disinfectant needs to stay wet on the surface).
- **The concentration and disinfectant contact time.** You should always use an EPA-registered disinfectant and read the label to determine the correct concentration to use and the required contact time.
- **Organic soil and debris can affect disinfectant efficacy.** Surfaces often require cleaning with a detergent before the application of a disinfectant. However, some products are manufactured as 1-step cleaner-disinfectants because they contain cleaning agents and a disinfectant, and may have been shown to be an effective disinfectant in the presence of soil. It is important to always read the label directions for use prior to using a product.
- **Disinfectants should be stored under the correct conditions,** including temperature, to ensure that they are effective throughout their shelf life.
- **Disinfectants may be ready to use or concentrates that require dilution prior to use.** If using a dilutable disinfectant, fresh solutions should be prepared and used, and then discarded according to label instructions.
- **A disinfectant should be compatible with the surfaces it will be used on.** The label will provide instructions on what surfaces the disinfectant can be used on.
- **Disinfectants should never be mixed** because this can have serious consequences because of the formation of toxic compounds.

Keep in mind that when you are cleaning and disinfecting, areas to focus on include cages and the materials in the cages, the floor outside the cages, and the floor throughout your facility, including the waiting room. Where and when possible, dog runs and yards should be cleaned and disinfected regularly.

Humans are most commonly responsible for spreading disease or any kind of infectious outbreak. If you are handling infected dogs, it is critical to practice correct hand hygiene at all times, preferably using soap and water. If it's not possible to wash with soap and water, an alcohol-based hand rub can be used. Additionally, all office spaces, storage areas, ventilation and heating ducts, as well as frequently handled items and frequently touched surfaces—pens, cell phones, door knobs, light switches, keyboards, computer mice—need to be cleaned and disinfected regularly.



## CLEANING AND DISINFECTION GUIDELINES *(continued)*

### Clean Hands:



#### First Choice:

Soap (plain or antimicrobial)

- When hands are visibly dirty or contaminated with organic material or blood/bodily fluids



#### Second Choice:

Alcohol-based hand rub

- ONLY use if soap and water not available
- When hands are not visibly dirty and no present residue
- Not effective against some pathogens (e.g., parvovirus, *Clostridium* spp.)

### Critical Hand Hygiene:



- Before and after touching animals, their environments, or bodily fluids
- When leaving or entering a group setting and/or new location in the facility
- Before putting on gloves and after removal
- After using the bathroom
- Before eating, drinking, or smoking while at work

When you need to set up an isolation and quarantine facility, consider those dogs sick and potentially shedding. If you don't have an isolation room, use physical barriers. It is preferable to use separate ventilation, so the airflow of the rooms with infectious diseases is not mixed with the rest of the facility. The bare minimum in personal protective equipment in an isolation and quarantine situation is a gown, double gloves, and dedicated shoes. A disinfectant foot bath at the door of the isolation room is also recommended. Scrubs should be washed using a hot cycle with bleach and detergent—specifically, the clothes should be held at 130°F for at least 5 minutes, or 108°F for at least 10 minutes. Drying will also kill a lot of microorganisms. Handwashing should include at least 20 seconds of scrubbing and drying.

### Isolation and Quarantine

- Consider all exposed and sick dogs as potentially infected or shedding organisms
- Isolate exposed dogs on site—use physical barriers if no isolation room
- Consider separate ventilation and use separate entrances for sick and healthy dogs
- Wear single-use personal protective equipment and dedicate shoes for isolation rooms



## Confronting Contamination

What contributes to contamination?

- Poor ventilation
- Ineffective cleaning techniques, use of an incorrect disinfectant or the wrong concentration of a disinfectant
- Porous surfaces that are difficult to clean and disinfect properly
- Lack of isolation and quarantine
- Prevalence of fomites due to incorrect cleaning and disinfection
- Improper identification of the organism
- Accumulation of organic material
- Infrequent diagnostics (due to cost and staff time)

## The Four Levels of Decontamination

Cleaning	Sanitization	Disinfection	Sterilization
Manual or mechanical removal of debris and soil. Provides basic hygiene; prepares items for decontamination	Decreases the number of infectious agents to safe levels as judged by public health requirements	Destroys or inactivates most harmful microorganisms	Kills all viable microorganisms on a product or surface
Sweeping floors before disinfection	Sanitizing food preparation areas	Disinfecting kennels	Sterilizing surgical instruments



### CLEAN SURFACES:

**Pathogens can survive on surfaces for days, weeks, even months.**  
Decontamination is essential to help prevent the spread of infection.



## Selecting the Proper Disinfectant

Factors to consider when selecting a disinfectant include the following:

- Is it EPA registered?
- Does it have approved claims for target microorganisms that can be spread via contaminated surfaces?
- Is it compatible with the surfaces on which it is to be used?
- Is the contact time suitable for the facility? Also note that the contact time may not be the same for all approved microorganism claims
- Is the odor, safety rating, and the personal protective equipment required acceptable?

## How to Decontaminate

**Ideal decontamination:**

- Remove organic debris
- Scrub area with an effective detergent/degreaser
- Rinse
- Apply appropriate disinfectant to area
- Let disinfectant stand for appropriate contact time
- Rinse
- Dry using clean towel or squeegee

## Where to Decontaminate

**Important areas to clean and disinfect:**

- Exam tables, countertops, sinks, and laboratory surfaces
- Diagnostic equipment and scales
- Shared patient care items
- Cages, carriers, toys, bowls, and bedding
- Dog runs and floors outside the cages
- Waiting room and floors throughout the facility
- Ventilation and heating ducts

## Decontamination:

- Staff reception area/waiting room: **DAILY**
- Exam/treatment/operating rooms: **AFTER EACH PATIENT**
- Inpatient housing/kennels: **DAILY; IN LIFE STAGE GROUPS:**
  1. Puppies/kittens
  2. Healthy adult dogs and cats
  3. Sick/injured dogs and cats
- Isolation/quarantine: **DAILY**



## URGENT:

**ALWAYS DECONTAMINATE  
AFTER A SPILL OF BODILY FLUIDS**

# THE VETERINARY TECHNICIAN'S ROLE IN MANAGING INFECTIOUS DISEASE OUTBREAKS



*Julie Legred, CVT*

## Introduction

Infectious disease is a problem that all veterinary facilities face, whether it is dealing with a parvo puppy or helping to managing a community-wide dog flu outbreak. The role of the veterinary technician when managing infectious disease is multifaceted and involves assistance with diagnosis, maintaining effective sanitation and isolation, and pet owner communication regarding preventative care. This chapter discusses how a veterinary technician can help support infectious disease management in a veterinary facility.

## Diagnosis

There are 2 main types of infectious viral and bacterial diseases, those that cause mostly gastrointestinal signs, such as parvovirus, and those that cause respiratory signs, such as dog flu. Because pathogens can cause similar clinical signs, viruses cannot be diagnosed by clinical signs alone. Parvo SNAP® tests have been the proven way to diagnose parvo in clinic within a few minutes and can be run by a credentialed veterinary technician/nurse. The best approach to diagnose cases of canine influenza and other infectious respiratory diseases is through viral isolation, polymerase chain reaction (PCR), and serology, which necessitate proper sampling techniques and shipping to accredited veterinary diagnostic laboratories.

Nasal swab collection for pathogens testing is recommended for dogs that have been ill for 3 days or less. There is less of a chance of finding viruses if the sample is taken past this time period. If samples are taken after the animal has been placed on antibiotics, bacteria may not be identified in the culture.

Serology testing is typically recommended for dogs that have been sick for 21 days or more. This test checks for presence of antibodies to specific viruses in the blood sample. If the blood sample is taken too soon (before the animal has had time to produce antibodies), the test may be falsely negative. Serological testing can distinguish between canine influenza H3N8 and H3N2; however, serological testing cannot distinguish antibodies from natural infection or vaccination. Therefore, single sample serology testing is not considered diagnostic in dogs that have been vaccinated. In these cases, paired titers 2 to 4 weeks apart are most helpful.

Each veterinary diagnostic laboratory has specific requirements for both obtaining samples and also shipping of samples and it is best to contact the laboratory directly before sampling for disease.





## THE VETERINARY TECHNICIAN'S ROLE IN MANAGING INFECTIOUS DISEASE OUTBREAKS *(continued)*

### **Nursing Care**

Patients that are sick with moderate-to-severe signs of illness from infectious disease typically require good nursing care and support. For instance, parvo patients typically develop hemorrhagic gastritis and suffer from dehydration and require intensive fluid therapy and monitoring. Patients suffering from infectious disease resulting in pneumonia often require frequent lung evaluation and nebulization treatment.

A credentialed veterinary technician/nurse should be sure to treat healthy animals first, those sick from noninfectious nature second, and then finally pets sick with infectious disease last. Always make sure to leave the sick room after removing contaminated clothing, including shoes or shoe protection, to avoid spreading the disease. If possible, it is best to assign 1 veterinary technician/nurse to take care of the infectious disease animal(s), so to have 1 veterinary technician/nurse labeled as "clean" assigned to the healthy and noninfectious animals to keep risk at a minimum.

Good sanitation and isolation protocols can help stop the spread of the disease in the facility. Veterinary technicians/nurses can help identify areas of infectious disease contamination in the hospital through placing cage signs to alert all team members and also can work closely with the veterinarian in cases of patient triage, especially when triage involves intaking clients from outside the building (car or triage tent).

### **Client Communication**

Veterinary technicians/nurses are a wonderful source of client educational support. It is important that the veterinary technician/nurse understands how to take complicated language and transcribe it into a conversation suitable for a pet owner. It is also important that the veterinary technician/nurse become familiar with terminology regarding infectious disease, the management of infectious disease, and preventative care through vaccinations. Understanding the mechanism of immunology can further help explain the importance of vaccination to the pet owner.

# WHAT EVERY PET SITTER AND DOG WALKER SHOULD KNOW ABOUT INFECTIOUS DISEASES



*Nyssa Reine-Salz, DVM, DACVIM*

Pet sitters and dog walkers can be very busy and they often visit several dogs each day. Some dog walkers walk multiple dogs from multiple families at the same time. Although most dogs enjoy the company of other canines, contact between dogs can lead to the spread of infectious diseases, even without direct contact between dogs.<sup>1</sup> Pet sitters and dog walkers should be aware of the dangers of infectious diseases and how they can help keep their clients' pets healthy.

In particular, canine influenza virus (CIV), also known as dog flu, is an important infectious respiratory disease for socially active dogs—including dogs that are visited by pet sitters and dog walkers. The newest form of dog flu, H3N2, was first found in the United States in the spring of 2015. Since that time, it has spread to over half the country. H3N2 dog flu is considered extremely contagious and, according to a study by the University of Wisconsin, dogs infected with canine influenza can spread the disease for more than 24 days.<sup>2</sup>

Dog flu is infectious and can spread through direct dog-to-dog contact. It also can be spread through indirect contact, like sharing of water bowls, toys, or leashes and also by general handling of sick pets.

Cats can also become infected with H3N2 dog flu.<sup>3</sup> In fact, a shelter in Indiana found that cats became infected in their facility in a separate area from sick dogs, despite being housed separately from the dogs. These cats most likely became infected by being handled by shelter staff that did not appropriately disinfect themselves after treating sick dogs.

While most dogs that develop dog flu will have a mild illness, some dogs can become very sick and require veterinary treatment. Therefore, it is necessary that dog walkers and pet sitters understand the disease better and how to prevent the spread.



# WHAT EVERY PET SITTER AND DOG WALKER SHOULD KNOW ABOUT INFECTIOUS DISEASES

## Five Tips for Pet Sitters/Dog Walkers to Prevent the Spread of Infectious Disease

1. Require appropriate vaccines for your clients—including dog flu.
2. With dogs that are not fully vaccinated, it is recommended to walk them individually and avoid both direct and indirect contact with other dogs. This is even more important when dealing with puppies, because they must complete a series of vaccinations before they are completely protected and are at more risk for disease, such as parvo and distemper.
3. Make sure to sanitize hands, clothing, and equipment between dogs—even those that are not obviously sick.
4. Dog flu can also be spread by clothing and shoes. Using protective covering and practicing good sanitation, especially when tending to sick animals, can help stop the spread of the disease.
5. Visit sick animals last and make sure not to expose them to other pets. Always sanitize thoroughly after caring for sick pets.

## Potential Points of Indirect Contact



**BOWLS**



**LEASHES**



**BRUSHES**



**TOYS**

**References:** 1. Stull JW, Kasten JI, Evason MD, et al. Risk reduction and management strategies to prevent transmission of infectious disease among dogs at dog shows, sporting events, and other canine group settings. *J Am Vet Med Assoc.* 2016;249:612–627. 2. Newbury S, Godhardt-Cooper J, Poulsen KP, et al. Prolonged intermittent virus shedding during an outbreak of canine influenza A H3N2 virus infection in dogs in three Chicago area shelters: 16 cases (March to May 2015). *J Am Vet Med Assoc.* 2016;248:1022–1026. 3. University of Wisconsin Shelter Medicine Veterinary Diagnostic Lab find canine influenza transmitted among cats. News release. University of Wisconsin; March 31, 2016.





PART 4:

# LESSONS LEARNED







## MARCH 2015: CHICAGO, ILLINOIS— THE INITIAL H3N2 DOG FLU OUTBREAK

Natalie L. Marks, DVM  
Blum Animal Hospital, Chicago, Illinois

“ I never thought I would wake up one morning as a veterinarian in Chicago and have to become a local expert on a South Korean influenza virus that had never before been seen on US soil. The physical and emotional stress on me, my veterinary team, and my clients was indescribable. Although it was medically fascinating to work through an epidemic, it was incredibly frustrating to not have all of the knowledge initially and even more so that containment was practically impossible based on this virus’ biological behavior. While I wouldn’t wish for another experience like this in my lifetime, I did learn a great deal from our missteps and hope to help others faced with a possible similar epidemic on their doorstep. ”

### Tips for Veterinary Clinics

- Be ready for any situation—a daycare could call with 70 cases in 48 hours. The entire veterinary team needs to be cross-trained to assist in all areas of the hospital.
- The reception team started screening phone calls for any respiratory cases—using triage and quarantine, we were able to roughly categorize severity of disease and assist most emergent cases first.
- We had clients/patients waiting in the parking lot in cars or on the street and they were escorted inside by personal protective equipment–gowned employees.
- All diagnostics were performed in the exam room.
- Patients were checked out in exam rooms and carried outside to their vehicles.
- As soon as possible, we established a separate prompt on our phone line with canine influenza virus (CIV) current updates and added a link to our website.

### No Borders for Infectious Disease

- US quarantine for companion animals DOES NOT exist.
- There are many domestic groups rescuing animals from other countries—there are no established or standardized protocols to alleviate or prevent importing disease with the pet.
- Many veterinarians are certified by the United States Department of Agriculture (USDA) to sign health certificates/international travel—what protocols are being used and what is being screened?

We found that many of our clients did frequent weekend travel—we had to consider all vectors and alert partner weekend veterinary clinics that may have not been up to date on recent regional outbreaks.

### You and Your Staff Can Also Spread Disease

- CIV can live in the environment for 24 hours and on organic substances (clothing) for up to 48 HOURS.
- We found that we were very inadequately disinfecting between exams—shoes, clothing, face, jewelry, exam table, scales, chairs, door knobs, and lids on garbage cans.



## MARCH 2015: CHICAGO, ILLINOIS— THE INITIAL H3N2 DOG FLU OUTBREAK

### Every Pet Business Owner Should Be Media Trained

- In the span of 2 weeks, I gave live or taped reports on the Today Show, CBS Nightly News, NBC, CBS, ABC, WGN TV, WGN radio, *Chicago Tribune*, *Chicago Sun Times*, *Journal of the American Veterinary Medical Association*, CNN, NPR, PBS, and many other local stations.
- It is very important to answer the phone when news outlets call—unfortunately, misinformation can be given out or other sources may be pursued that are inaccurate.
- Become your own expert—as mentioned before, I never dreamed that after graduating veterinary school, that one day I would need to become my own local expert on a South Korean CIV.
- It is impossible to know absolutely EVERYTHING on a topic without consulting with other experts in the field. During the epidemic, I reached out to the USDA, Chicago Public Health Department, the Animal and Plant Health Inspection Service (APHIS), and our state veterinarian.
- In some cases, it is also very important and helpful to reach out to the media proactively with press releases. This encourages a bond and connection for future projects and also gives the media a print version of accurate information as the foundation for a story.

### Pet Businesses Need to Work Together

- Surveillance is essential—currently, there is not a centralized agency to manage infectious or zoonotic disease outbreaks. The New York State Veterinary Diagnostic Laboratory at Cornell University has a current incidence map using results of polymerase chain reaction (PCR) testing for H3N2 around the country and other respiratory pathogens.
- Viral outbreaks are NOT a competition—they are exhausting, frustrating, hard to contain, and very expensive to clients and the practice.
- Ignorance is not bliss. Knowledge is power.
- We initiated very proactive discussions with other pet businesses: daycares, boarding, pet stores, dog walkers, and emergency veterinary clinics.
- Because of the severity of the epidemic and the impossibility of containment, we contacted local politicians to help us spread the word. This path ended up with Chicago dog park closures, an essential component of slowing down the viral disease.

### Communication is Key—Be Transparent With Your Clients and the Community

- After the first week, we initiated e-mail blasts weekly to contact clients en masse with updates and the latest information.
- It is important to vastly utilize social media with alerts—Facebook, Twitter, Pinterest, Instagram.
- When an epidemic occurs, be prepared for phone lines to be overwhelmed with calls from clients, many of them with hysteria. It dramatically helped to direct clients to a separate prompt on phone line for CIV updates that we created very easily.
- Make sure someone in your facility is dedicated to answering social media questions in timely fashion—it can be more damaging to the company's reputation if these client contacts are ignored or answered several days later.
- E-mails should be succinct and without hysteria.



## DECEMBER 2015: H3N2 DOG FLU HITS TEXAS

*Michael Mayer*  
Owner, Hip Hounds, Austin, Texas

During December 2015, my daycare and boarding facility experienced a significant outbreak of the H3N2 strain of canine influenza. While managing a kennel full of sick dogs, their concerned owners, and a curious media, I learned a few valuable lessons on how to deal effectively with an outbreak:



### LESSON 1: Customers Count

The biggest strength of our facility has always been our customer service. Hip Hounds is a single location, non-franchised entity, so we can easily treat every client and situation on a case-by-case basis. Our policy is simple: be fair and treat our clients the way we would expect to be treated. The same rules applied while we were dealing with H3N2.

For the vast majority of cases, we offered the owners 2 free nights of boarding or 3 free days of daycare to offset the inconvenience and vet bills associated with having a dog with H3N2. This was for dogs that may or may not have had to make a visit to the vet and who had mild-to-moderate cases of influenza. When dealing with the extreme cases, we offered more substantial discounts and credits. One client had 2 dogs who both ended up with severe pneumonia and were hospitalized for over a week. We ended up comping them a few months of free daycare. At first glance, this may seem excessive. Instead, we retained them as clients, garnered a mountain of good will, and were able to feel that we had treated them compassionately and fairly.

The outbreak was not our fault and our customers knew that. The vaccine was not available at the time of our outbreak. But because we empathized with our clients and did our best to compensate them, we minimized the long-term damage to our reputation and retained clients, even those hit hardest by the outbreak.



### LESSON 2: The Press Will Get Their Story

Nothing surprised me more than seeing a news van parked in front of my business. We had closed for 4 days during the outbreak to clean (and clean, and clean) and on day 2 of our cleaning spree, a local news crew came knocking. Here is where I made my biggest mistake. I was polite but firm and told them I did not want to do an on-air interview or have them bring their cameras into our facility. What I quickly learned was that they had an assignment and would complete it whether I helped them or not. They ran a story that featured a grainy shot of the front of our facility (taken from across the street) with the headline: "Flu outbreak forces Round Rock facility to close." When I would not help them, they simply drove a few miles down the road and took their cameras inside a competitor's facility who had not experienced an influenza outbreak. My competitor ended up with a free, 3-minute commercial where they raved about their "wellness checks" and I got that terrible, blurry photo and an ominous headline. Lesson learned. If I had it to do again, I would have welcomed them in and taken the opportunity to educate the public about H3N2 while they took shots of my spotless facility.



## DECEMBER 2015: H3N2 DOG FLU HITS TEXAS



### LESSON 3: Look Ahead

During the whirlwind of our first few days dealing with the outbreak, I completely forgot about the upcoming holidays. We had dogs booked to stay over Christmas who had been at our facility during the exposure period and who could very likely be carrying the virus even if they were not showing symptoms. While I did my best to contact those dogs and let them know they could not come to our facility (or any other kennel) for a few weeks, some dog owners fell through the cracks. Had I been more diligent about double-checking all dogs who risked exposure, I could have kept from ruining a few client's Christmas vacation plans.

While I hope that no one would have to deal with canine influenza in the future, it seems that another outbreak is probably inevitable. Those few weeks in December were a hectic and demanding time for me, but I learned some valuable lessons. I learned how customers should be treated in a crisis, how the news does not need my cooperation to tell my story, and the value of planning ahead. I hope that my story helped to shed some light on how best to navigate something as stressful as canine influenza and how your business can survive and even thrive afterward.





## MARCH 2016: H3N2 DOG FLU HITS INDIANA

Brenda Dines, DVM

There was much learned after dealing with an outbreak of H3N2 in a limited admission shelter. First and foremost, if you think there is a problem, pursue it. When we had an extremely large and unusual number of sick dogs and cats, we performed further diagnostics. This testing allowed us to identify H3N2 as the cause for the many sick canine and feline animals in our care.

“

*Disease outbreaks can be scary and intimidating. It is very important in this process to be transparent. In our circumstances we advised all prior adopters that there was potential for exposure. We also notified surrounding clinics in hopes of keeping the disease out of veterinary offices. Before disseminating any information, be sure to have all the information and release the information in a neat and organized manner.*

”

During an outbreak it is also critical to effectively communicate with staff, the community, and the media. It quickly became evident that something obvious to me was not always obvious to others. Addressing what is going on with the staff will give them a sense of empowerment and understanding, which is necessary because dealing with disease in a facility can be taxing.

Furthermore, learn to be clear and succinct with the media. It is critical that you do not amplify any hysteria that the media may want to produce. If at any point you are uncomfortable with addressing the media, seek out the help of other qualified professionals in a university setting. Most universities will have teams that work through media releases. Declining all contact with the media can sometimes be a recipe for disaster and pushes the media to publish a story, but without your perspective. When you are able to give your perspective, be sure to address how you are being responsible with the situation and positive progress you are making with animals in your care. This is also important to express to the community, as you want to represent yourself as accountable and actively seeking solutions.

It is also advisable to seek professional help very early on. We were able to utilize the University of Wisconsin's shelter medicine program and Merck Animal Health. Both of these entities were able to provide a wealth of knowledge and financial assistance in our case to follow through with testing our large population of animals. Additionally, they were also able to help us reassess our preventions and interventions along the path of recovery.

Finally, as hard as it may seem, remain calm. These situations are manageable with the right assistance. This also becomes a period where you are able to reassess your protocols. It is a good idea to prepare for an outbreak, even if one may never happen. It always seems to be a better option to be proactive, rather than reactive. However, if you do notice an increase in disease, assessing your sanitation procedures, preventions (including vaccination protocols and husbandry of animals), and the stress level of animals in your care is critical.





## MAY 2017: H3N2 DOG FLU OUTBREAK IN THE SOUTHEAST FOLLOWS DOG SHOW

Richard Hawkes, DVM  
Arendell Animal Hospital, Morehead City, NC

On Sunday, May 14, 2017, 3 of my dogs were in Perry, Georgia at the Peach Blossom Cluster. One of my dogs, Arisha, takes Best of Breed in Black Russian Terriers and stays with her handler for the groups. My wife prepared to pack up the boys, Oli and Charlie, for the 10-hour drive home to North Carolina. It is a good weekend for “the bears,” as we call them. The dogs showed well and points were earned.

After returning home on Monday, my 2 Black Russian Terriers, Oli and Charlie, seemed a little tired. By Tuesday afternoon, Oli had developed an occasional cough and by that evening, both were coughing.

By Wednesday, it was apparent that the boys had contracted some sort of bug. Thursday brought even more bad news. The eldest, Juri, was now coughing and not eating much. One by one, over the next 3 days, the entire crew had come down with it. **Oli and Charlie were very sick. They had fevers and were dehydrated. The coughing was severe and breathing was harsh and fast. They repeatedly spit up phlegm and had no energy.**

“

*On Saturday morning, I put out a feeler in a Facebook forum populated by dog show people. I asked: “Anyone else from the Perry show have sick dogs?” The response was much more than I had anticipated.*

*This was big. There were dozens of sick dogs, including some hospitalized in the isolation unit at the University of Florida. I performed a [polymerase chain reaction] PCR upper respiratory panel on the last dog that became ill, Nika, and she tested positive for H3N2. It was exactly what I had feared—the dreaded canine influenza virus.*

”

Because H3N2 is so contagious, I chose to treat my dogs at home. The dogs were very sick, lying around, coughing, and spitting up phlegm. They were miserable. Ten big strong Black Russian Terriers were all brought down in a matter of days. It was horrible.

All the dogs but 1 would go on to recover. Kira, a 4.5-year-old female, succumbed to the disease. Treatment was a lot of work and scary at times. My wife and I spent hours each day and night administering fluids and other medications. We would hand feed to try and encourage an appetite. We were very concerned that several of them may not recover. They were sick for about 2 weeks before the signs eased up. Oli lost over 15 pounds. It had cost over a thousand dollars in medications alone to treat the crew. Maks still has shortness of breath and decreased exercise tolerance to this day.



## MAY 2017: NORTH CAROLINA, H3N2 DOG FLU OUTBREAK FOLLOWING DOG SHOWS IN THE SOUTHEAST

### *So what if you show dogs? What should you do now?*

1. You must decide what is right for you and your situation. If staying home for a few weeks while this bug hopefully sorts itself out is something you can do, then that is not a bad idea. If you plan on attending a dog show in the near future, there are some strategies you can try to help decrease exposure risk for your dogs.
2. I would strongly recommend the H3N2 vaccine for any dog you are going to be showing. An initial injection followed by a second booster in 2 to 4 weeks will help provide protection for your dog.
3. Try to avoid the crating areas and grooming areas, if possible. Areas where large numbers of dogs are housed together for extended periods of time increase exposure risk. Groom and prep your dogs at your RV or hotel, if possible. Take your dogs to the ring, avoid letting your dog socialize with other dogs waiting to enter rings, and remove your dog from the building as soon as possible.
4. Make sure you are washing hands frequently and keeping your dog equipment clean and disinfected. Wash food bowls and spray down your show leads and collars. It is not a bad idea to change clothes when you are done showing for the day and put on a “clean” ensemble before handling and feeding your other dogs. You do not want to carry this virus from an infected dog to an uninfected dog.
5. If possible, show your dog’s own bite. A judge that handles a dog’s mouth and then moves to the next dog without proper disinfecting can be a transmission hazard. Most judges should be aware of this.
6. When you leave the show, try to disinfect your “show” equipment and supplies before bringing it into your home or kennel. Not a bad idea for a quarantine of the show dogs away from those that were not shown when you arrive home as well. If this virus is picked up by your dogs at a show and brought home, it can spread through your kennel quickly!

“ Remember, it will help if we are all diligent and cooperative in trying to halt its continued spread. If your dogs are sick, or have been exposed to sick dogs, leave them home. It is the best thing to do—for the dogs and the sport. ”



BIOGRAPHICAL INFORMATION  
**ABOUT THE AUTHORS  
AND EDITOR**





# BIOGRAPHICAL INFORMATION ABOUT THE AUTHORS AND EDITOR



## ● Steve Dale, Certified Animal Behavior Consultant

Steve is the host of 2 nationally syndicated radio shows, Steve Dale's Pet World and The Pet Minute (together heard on more than 100 radio stations, syndicated Black Dog Radio Productions, since 2005). He's also a special contributor at WGN Radio, Chicago, and program host of Steve Dale's Pet World (since 1997). He formerly hosted the nationally broadcast Animal Planet Radio. For 21 years, his twice weekly newspaper column was syndicated by the *Chicago Tribune*. Steve was a contributing editor for *USA Weekend* (2002 to 2014), and regular columnist at *Cat Fancy magazine* (2006 to 2014). He has written for a long list of magazines, from *People* to *Dog World* (where he was a columnist). He's currently a columnist and contributing editor for *CATster*, and authors a column called *Steve Dale's Vet World* for *Veterinary Practice News*. He also contributes blogs for various websites, including for Victoria Stilwell and the Pet Health Network.

## ● Justine Lee, DVM, DACVECC, DABT

Justine is a board-certified veterinary specialist in both emergency critical care (DACVECC) and toxicology (DABT). Dr. Lee attended veterinary school at Cornell University and completed her internship at Angell (Boston, MA). She completed her fellowship and residency in emergency and critical care at the University of Pennsylvania. Previously, she was on the faculty at the University of Minnesota (2008) and the head of an animal poison control center (2008–2013). She is the founder and CEO of VETgirl, a subscription-based podcast and webinar service offering RACE-approved, online veterinary continuing education.

## ● Garret Pachtinger, DVM, DACVECC

Garret is the Chief Operating Officer and Co-Founder of VETgirl and committed to veterinary education through technology. Dr. Pachtinger is a graduate of the University of Pennsylvania School of Veterinary Medicine. Following veterinary school, he completed a 1-year internship in small animal medicine and surgery, a 1-year internship in emergency and critical care, and a 3-year residency in emergency and critical care at the University of Pennsylvania, becoming a Diplomate of the American College of Veterinary Emergency and Critical Care in 2010. After completion of his residency, Dr. Pachtinger joined the Veterinary Specialty and Emergency Center in Levittown, PA.

## ● Michelle Evason, BSc, DVM, DACVIM (Small Animal)

Michelle completed her veterinary training at the Western College of Veterinary Medicine in Saskatoon. She has worked in general practice, academia, and in the animal health industry. She is an associate professor at the Atlantic Veterinary College and is concurrently working on her PhD with the University of Guelph within the Department of Pathobiology.



# BIOGRAPHICAL INFORMATION ABOUT THE AUTHORS AND EDITOR *(continued)*



## ● **Jason Stull, VMD, MPVM, PhD, DACVPM**

Jason is an assistant professor at the Ohio State University College of Veterinary Medicine. He obtained his PhD in Pathobiology at the University of Guelph and his Masters of Preventive Medicine at the University of California, Davis. Before coming to the Ohio State University, he was the State Public Health Veterinarian in New Hampshire.

## ● **Jarod Hanson, DVM, PhD, DACVPM**

Jarod is a veterinarian in Maryland. He completed his DVM in 2006 at the University of Minnesota and was subsequently a swine practitioner for a large swine producer with a focus on population health and disease eradication programs. In 2010, he transitioned into a public health position that involved mixed animal practice as well as food safety. Dr. Hanson completed a PhD in Infectious Diseases at the University of Georgia with a focus on influenza A virus infection dynamics among species. His current position involves public health research and disease surveillance. Dr. Hanson also lectures on large animal virology for the University of Georgia College of Veterinary Medicine and has lectured at multiple state and national veterinary meetings. He also serves as an associate editor for ProMED-mail.

## ● **Christopher A. Lee, DVM, MPH, DACVPM**

Dr. Christopher A. Lee is a preventive medicine specialist who hails from sunny California, where he earned his Bachelor of Science and Doctor of Veterinary Medicine from the University of California, Davis. He focuses on the interlacing disciplines of infectious and parasitic diseases, toxicology, immunology, scientific study design, and epidemiology. He also previously owned a veterinary practice. This diversity establishes a foundation from which Dr. Lee constructs practical wisdom for the everyday practitioner.

In his current role as senior professional services veterinarian with Merck Animal Health, Dr. Lee provides educational and technical support for veterinary hospitals and staff in the Southern California region on various medical topics, as well as Merck Animal Health products. He also promotes the veterinary profession by sitting on the NAVLE Item Writing Committee, volunteering as an ACVPM mentor, conducting various veterinary lectures nationwide, and producing free educational podcasts.

## ● **Charine Tabbah Ahmed, DVM**

Dr. Charine Tabbah Ahmed has practiced primary care medicine in both corporate- and independent-owned veterinary practice settings in Rhode Island and Massachusetts, respectively. Before earning her DVM from Tufts Cummings School of Veterinary Medicine, Dr. Tabbah graduated summa cum laude from Emory University.

## BIOGRAPHICAL INFORMATION ABOUT THE AUTHORS AND EDITOR *(continued)*



### ● Kathryn Primm, DVM

Kathryn is the owner and founder of Applebrook Animal Hospital in Ooltewah, Tennessee. She also enjoys writing and speaking to and engaging veterinary professionals and pet lovers. She has written and contributed content to many outlets, including magazines like *Woman's Day*, *Prevention and Health*, as well as *Veterinary Economics*, *dvm360*, *Firstline*, *Vetted*, and *dvm360.com*. Her regular "Ask A Vet" column is featured on *iheartdogs.com* and *iheartcats.com*, reaching more than 3 million viewers. Dr. Primm was also the nation's first Fear Free Certified Professional and is the Module Chair for a second level of certification for Fear Free. She is scheduled to speak nationwide in 2017 about implementing strategies to help pets feel safer and more comfortable at the vet hospital. She and her dog, Skye, frequently do pet therapy at assisted living and mental health facilities around Chattanooga. Her first book, *Tennessee Tails: Pets and Their People*, received recognition as a runner-up in the "Memoirs" category at a national book festival. The next book is well underway with more stories about the animals that Dr. Primm treats and the people who love them.

### ● Ronald D. Schultz, PhD

Ronald, the founding Chairman of the Department of Pathobiological Sciences at the University of Wisconsin-Madison School of Veterinary Medicine, has been a professor of Veterinary Immunology since 1973. He was the first president of the American Association of Veterinary Immunologists and is an honorary diplomate of the American College of Veterinary Microbiologists. He received the Distinguished Veterinary Immunologist Award in 1988. Dr. Schultz has served on the Vaccine Task Forces of the American Animal Hospital Association, the American Association of Feline Practitioners, and the World Small Animal Veterinary Association. He has authored many publications, including the textbook *Veterinary Immunology—Principles and Practice* with Michael Day. Dr. Schultz lectures about canine and feline vaccination principles to breed associations, veterinary groups, and pet lovers around the world. He has trained more than 50 graduate students and post-doctoral fellows and has taught generations of veterinary students.

### ● Melissa Bourgeois, DVM, PhD, DACVM (Virology, Immunology)

Melissa graduated from the University of Florida, College of Veterinary Medicine in 2007 with a DVM, and in 2010 with a PhD in veterinary medicine, focusing on gene expression in the equine host following West Nile virus infection. Dr. Bourgeois became a diplomate of the American College of Veterinary Microbiologists (ACVM) in virology (2011) and immunology (2013). Since 2012, Dr. Bourgeois has worked for Merck Animal Health and currently holds the role of Associate Director of Professional Services, South Zone.

# BIOGRAPHICAL INFORMATION ABOUT THE AUTHORS AND EDITOR *(continued)*



## ● **Nyssa Reine-Salz, DVM, DACVIM (Small Animal)**

Nyssa graduated from the University of Florida, College of Veterinary Medicine in 1993. Dr. Reine-Salz then went on to complete an internship in Small Animal Internal Medicine and Surgery at the Animal Medical Center in NYC. After working in private practice in New Jersey for 2 years, Dr. Reine-Salz returned to the Animal Medical Center for a residency in Small Animal Internal Medicine, which she completed in 1998. Dr. Reine-Salz became a diplomate of the American College of Veterinary Internal Medicine in 2001. She was on staff at the Animal Medical Center with a focus on nephrology and endocrinology until 2009. From 2009 to 2011, Dr. Reine-Salz served as a consultant on the Veterinary Information Network (VIN). Since April 2015, she has worked for Merck Animal Health as an Internal Medicine Consultant in the Pharmacovigilance Department.

## ● **Natalie Marks, DVM**

Natalie obtained her bachelor's degree with High Honors in Animal Science from the University of Illinois in 1998, and then proceeded to obtain a Masters in Veterinary Medicine and Doctorate of Veterinary Medicine degree with High Honors from the University of Illinois College of Veterinary Medicine. She has been a veterinarian at Blum Animal Hospital since 2006 and a co-owner since 2012. Prior to 2006, Dr. Marks worked at a small animal practice just north of Atlanta, GA. Since her return to Chicago, Dr. Marks became very active in the Chicago Veterinary Medical Association, serving on the executive board.

She is a past board member of the Illinois State Veterinary Medical Association, the American Veterinary Medical Association and American Animal Hospital Association. Dr. Marks recently received the prestigious Dr. Erwin Small First Decade Award, presented to a veterinarian that has contributed the most to organized veterinary medicine in his or her first decade of practice. In 2012, Dr. Marks was awarded Petplan's nationally recognized Veterinarian of the Year. Additionally, she was awarded America's Favorite Veterinarian by the American Veterinary Medical Foundation in 2015. Finally, she was honored as the Nobivac Veterinarian of the Year for 2017 for her work nationally educating on canine influenza.

Dr. Marks is very active in all aspects of media, both locally and nationally. She has appeared on Good Day Chicago, WGN-Pet Central, NBC Morning News, ABC, CBS, NPR, WBBM, Northwestern University media channel and many local websites. Dr. Marks was featured nationally on the Today Show and CBS Nightly News during the canine influenza epidemic of 2015 and in multiple issues of *JAVMA*. She is a guest contributor in multiple media campaigns for Merck, Zoetis (formerly Pfizer), Boehringer-Ingelheim, and Royal Canin and has been a speaker at both NAVC and WVC. Additionally, Dr. Marks has been published in *Veterinary Medicine* magazine, *DVM* magazine, *Vetted*, and is a columnist for *Today's Veterinary Business*.



## BIOGRAPHICAL INFORMATION ABOUT THE AUTHORS AND EDITOR *(continued)*



### ● **Michael Mayer**

Michael is the owner of Hip Hounds Kennel in Round Rock, Texas. He has worked in the pet services business for over 15 years. In 2016, Michael participated in the Pet Business Consensus Statement roundtable and he also presented “Lessons Learned” at the North American Veterinary Conference and the Western Veterinary Conference.

### ● **Brenda Dines, DVM**

Brenda graduated from the University of Illinois College of Veterinary Medicine in 2015. Dr. Dines started practicing shelter medicine immediately after graduation. After receiving assistance from the University of Wisconsin Shelter Medicine Program and Dr. Sandra Newbury during an infectious disease outbreak, Dr. Dines decided to pursue a residency in shelter medicine. She entered her first-year residency in shelter medicine in 2016.

### ● **Richard Hawkes, DVM**

Richard is a 1996 honors graduate from the Atlantic Veterinary College in Prince Edward Island, Canada. He moved to North Carolina in 1997 and spent 3 years working in Winston-Salem before moving to practice in Goldsboro. He purchased Arendell Animal Hospital on February 2, 2007, achieving his lifetime goal of owning/operating a veterinary hospital. He hopes to provide the great compassion and quality of service people have come to expect from Arendell Animal Hospital, and he always enjoys meeting the many great clients. Dr. Hawkes was an avid hockey player in Canada, but now prefers to spend his spare time grooming and showing Black Russian Terriers. He and his wife also enjoy spending time at the beach. Dr. Hawkes is married to DeAnne, a Registered Nurse who has given up her nursing career to assist with managing the practice. Together they run Guardian Bears Kennel, a Black Russian Terrier hobby kennel. They are members of St. Egbert Catholic Community Church in Morehead City.

### ● **Madeleine Stahl, DVM**

Madeleine is Associate Director of Scientific Marketing Affairs for Merck Animal Health’s Companion Animal business with a focus on biological and endocrine products. She obtained a Bachelor of Science degree in Biology and Biological Sciences from Purdue University, and earned her Doctor of Veterinary Medicine from Purdue University College of Veterinary Medicine. After graduation, she practiced small animal medicine in New Jersey and Virginia. Over the past 25 years, Dr. Stahl has held several positions in sales, training, and technical services within the animal health industry.



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