

# Pet Parent's Guide

to **Infectious Diseases of Dogs**

Authored by  
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With a foreword from  
Steve Dale

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# **Heroes for Healthy Pets**

## **Pet Parents Guide to Infectious Diseases**

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## **Foreword**

By Steve Dale, CABC

Dogs that are social or visit pet businesses such as doggie day cares and boarding facilities are at risk for infectious diseases. This was proven as a fact when an outbreak of dog flu hit the US in 2015; thousands of pets were affected. Within nine months, the virus had spread to more than half the country. Countless pets were sickened, and some succumbed to the flu.

In Chicago, where the H3N2 strain of dog flu began in the US, the community was completely unprepared for this, but we 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, and better understanding of infectious diseases and preventative care, including strategic vaccination, can help keep pets healthy.

I am very proud to be part of the Heroes for Healthy Pets program, which was created to help keep pets disease free. The Heroes for Healthy Pets Pet Parent's Guide brings together pet owners and veterinary professionals. I encourage you to read on and learn more about infectious diseases, how to prevent them, and how to become a Hero, like me.

Your dog will thank you.



**Within nine months, the virus had spread to more than half the country.**



# Parvo Uncovered



Dr. Kathryn Primm

**If you have never been around a dog that is infected with parvoviral enteritis, commonly called parvo,** you will have to trust me and those who have when we say that there is a very distinctive odor associated with this disease.

and their own immune system needs to step up to handle challenges on its own. If the puppy's immune system is naïve to the parvovirus in the absence of vaccination, the puppy gets very sick very quickly.

### **What is canine parvovirus?**

A highly contagious viral disease that can produce a life-threatening illness. The virus attacks rapidly dividing cells in a dog's body, most severely affecting the intestinal tract. Parvovirus also attacks the white blood cells, and when young animals are infected, the virus can damage the heart muscle and cause lifelong cardiac problems.

It is characterized by vomiting, tiredness, and extreme bloody diarrhea. The dog will become so sick and depressed that without treatment, he will suffer and die. Parvovirus is a disease that is routinely prevented by routine vaccination; fortunately, in my community, we do not see it very often.

The occasional cases that arise are puppies that have been inadequately or inappropriately vaccinated by people who are not veterinarians. But when I first opened Applebrook Animal Hospital, I had not had the chance to spread the news about appropriate vaccination nearly as far as I have now. I did see more cases of sick dogs with parvovirus. These heart-wrenching cases are usually puppies around 5-6 months of age, when they start to lose what immunity they had gotten from their mothers

I bought the facility that is now Applebrook Animal Hospital as a residential house. It required intensive remodeling to make it into an animal hospital, and the funds to do so were sparse and borrowed. I did not have a separate isolation ward like I do now. But parvovirus is so contagious that affected

animals must be strictly quarantined from other pets. When I first opened and the parvovirus cases started to creep in, the only place in the whole of the new Applebrook Animal Hospital that did not have ongoing traffic with other pets was my upstairs office. When these two puppies came at once very sick with parvovirus, I suited myself up like an astronaut and carried them resolutely to my office. We rigged up a makeshift isolation ward in my walk-in closet. We have portable kennel cages and IV fluids. We even rigged up a foot bath made of a cat litter box with antiseptic to cleanse our shoes before leaving the closet. I was quite impressed by our resourcefulness at being able to treat and help these puppies and still protect all the others, even without an official isolation ward. I was impressed until....the diarrhea began again. With it came the odor. This odor is unlike anything

that you have smelled before. It is pungent and repugnant. It is quite literally the smell of death, and, left untreated, that is exactly what it becomes.

**My patients, Darla and Duffy**, two darling Basset hound puppies, had been home-vaccinated by a well-meaning breeder. After valiant conversion of my closet to a medical isolation ward, we began aggressive fluid therapy and the other treatments recommended to treat parvoviral enteritis. If a puppy is already pretty far into the course of the disease, the odds of beating it decrease. Darla and Duffy were already dehydrated and well into the course of the disease before I saw them.

But my assistant and I were not dissuaded. I explained everything to the owner and gave them a 50/50 chance of survival and took up watch in my office, peering into the closet frequently. Since we had just opened, we did not have a busy day planned. So I was able to keep vigil over these sick pups, carefully attending to their every need.

My closet smelled so bad that I could imagine a green vapor emanating from the closet like you

would see in a cartoon. The smell did not stop or even slow me down. Those puppies needed me and I was going to fix them. I cleaned up foul diarrhea every few minutes and cleaned the puppies too as best I could. I checked IV fluids and gave medications. I made sure that they were warm and as comfortable as possible and I made sure that they never felt alone. I told them that if they could just hang in there, I would do everything I could to support them while their bodies tried to fight.

Despite my best care, my projected 50/50 odds were sadly correct. Darla recovered but sadly Duffy did not. To this day, I can't walk near my closet without my brain remembering those floppy ears and sad eyes.

It is truly sad that a readily available vaccine could have prevented the whole tragedy, but at least I was able to save Darla. I am a more empathetic doctor because of my experiences with these two sickly pups.



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# Distemper, Adenovirus, Parainfluenza, and Parvovirus

Dr. Courtney Campbell



### **When a law enforcement agency issues an APB broadcast, you know it's a serious situation.**

APB stands for all-points bulletin, and it signals to other law enforcement agencies that the subject they are looking for is a person of interest, with a possibility that the subject may be extremely dangerous.

There's a trio of extremely dangerous diseases that can affect young puppies. Although the acronym for these three dangerous diseases isn't exactly the same as an all-points bulletin (APB), they can be abbreviated as ADP, and they are also extremely dangerous. ADP, in this case, stands for adenovirus, distemper, and parvovirus. Protecting your pet from these viruses is practically a prerequisite for them to survive into adulthood.

### **DISTEMPER**

Your puppy has goopy eyes, nasal discharge, and he's just not eating well. He feels warm to the touch and he's sleeping all the time. For any pet parent that would be cause for concern. Innocently, one might assume that their puppy caught a "cold" and may need some basic medications – possibly some money-saving, over-the-counter medications – to clear the cough and runny nose. It's only after a consultation with your veterinarian that you discover that this condition could indeed be more serious.

When a dog is infected with the distemper virus, the symptoms may begin with goopy eyes, fever, and poor appetite. As the virus burrows deeper into the respiratory tract, coughing may start, and then the virus may slowly percolate down to the lungs to cause pneumonia.

After attacking the respiratory tract, the virus begins to terrorize the nervous system. Your puppy may begin to tremble and stumble off balance. Seizures – classically starting with snapping or tremors of the jaws – can culminate to full-body convulsions. This is a classic distemper sign called a "chewing gum fit". The degree of damage to the nervous system depends on the strain of the virus as well as the status of your puppy's immune system. Even if distemper infects the nervous system, it does not automatically result in nervous system symptoms. In fact, some dogs do not develop neurological signs. Unfortunately, it's impossible to predict which dogs will develop convulsions and which ones will not.

The good news is that some puppies can recover even after the nervous system has been affected. Other dogs appear to recover, only to break with neurologic disease 1 to 3 weeks later. For some, those neurologic signs will remain permanent, and sadly, there are many puppies that die from this condition. Some report the mortality rate to be close to 80%.

The distemper virus is closely related to the human measles virus. It's made with a natural shell called a fatty envelope. The fatty envelope is easily disrupted in the environment, making it nearly impossible for the virus to live outside the body. Its only recourse is to survive through dog-to-dog contact or contact with extremely fresh, infected body secretions.

**Coughing is a vehicle for the virus to spread to other dogs.** With each cough, the virus is suspended in the air for another dog to inhale.



Urine is also a rich source of virus particles, which makes contact with bodily secretions another stealthy mode of virus transmission.

The virus then hitches a ride on white blood cells and travels to the lymph nodes, intestines, and the liver. Your dog's fever begins to spike and at the most critical stage of the illness. The immune system begins to wage war on the virus. If it wins the war, it will clear the virus in 14 days. A weak response, however, and the virus will invade the respiratory system and the brain. Your dog will continue to get sick. The vigor and strength of the immune system is what makes the difference in the symptoms from pet to pet. The last stage of the virus's life could include covert hiding in the nervous system and skin. Because of this phenomenon, thickening of skin or seizures may occur long after the infection was thought to be cleared.

The most intense viral shedding occurs in the first 2 weeks. An infected dog may shed virus for up to 2 to 3 months after infection. It is important to keep this in mind when taking a pet that has survived distemper anywhere where there are other dogs. If a dog survives the infection, the adult teeth may appear stained and have pitted enamel. This is called enamel hypoplasia. This occurs because the distemper virus attacks the rapidly dividing cells of the mouth (epithelial cells). In puppyhood, the buds of the permanent teeth are still developing. Distemper will attack these immature cells, leaving these tooth buds permanently damaged.



The colostrum suckled in the first day of a puppy's life will offer initial protection. This immunity will have completely waned by 16 weeks of age, leaving the puppy vulnerable if vaccines have not been administered for further protection.

There is no special test to confirm distemper. Because the virus can hide in the nervous system and skin, a combination of tests, symptoms, and history are used to confirm the diagnosis.

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Veterinarians have used everything from direct observation of the virus under a microscope, measuring antibody levels, and PCR – a test used to detect viral DNA – to diagnose the condition.

Initial immunity for a newborn comes from the mother in the form of maternal antibodies (i.e. colostrum), and lifelong immunity comes in the form of regular scheduled vaccinations. The

Puppies are vaccinated beginning at age 6-8 weeks and then every 2 to 4 weeks thereafter until age 16 weeks. The next vaccine occurs one year later. After that subsequent vaccination, boosters are given every 1 to 3 years. Some choose to base vaccines on antibody levels, while others believe that antibody levels do not give a complete picture of the immune response.

distemper vaccine is usually combined with vaccine for canine parvovirus, parainfluenza, and adenovirus 2 (DA2PP).

Other vaccines are given based on your dog's lifestyle. Puppies are vaccinated with either a modified live virus or recombinant form. A recombinant

But virus detection is difficult. A positive test result is meaningful in confirming the infection, but a negative test result does not necessarily exclude it.

Support the immune system. That's the main goal when treating a dog with a distemper infection. The only real therapy is supportive care while your dog mounts an immune response. Support can include fluids, antibiotics for secondary infection, nebulization, and cough suppressants.

Compared to the emotional and financial toll required to treat distemper, prevention is relatively straightforward. Fortunately, effective distemper vaccines have been available since the 1950s. Before vaccination, distemper was the scourge of the canine community, wiping out entire towns of pet dogs. Thanks to vaccination, distemper is a relatively rare disease. There are still infrequent, isolated outbreaks among household pets, shelters, rescues, and pet stores.

vaccine involves another live virus (other than the distemper virus) being used as a surrogate to carry a portion of the distemper virus in order to generate the immune response.

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## ADENOVIRUS

A 5-month-old puppy in a pet shop dies from fever and bleeding from the liver and the abdomen. A few days later, two more puppies that had been raised in the same room with the first puppy develop similar symptoms. These

two puppies are treated early, and fortunately they survive. That is a true story of an outbreak of canine adenovirus type 1 (CAV-1). The pet shop did not provide these puppies with a thorough vaccine regimen, and it resulted in exposure to this infectious disease.

Canine adenovirus type 1 causes infectious canine hepatitis (ICH). This is a highly contagious, often fatal, infection. This virus has a long history. It was first identified in North America in silver foxes in 1925 and then eventually in domestic dogs in 1947. This virus is not finicky. It can not only infect other members of the canine family like foxes, coyotes, and wolves, but it can even affect black bears, polar bears, skunks, otters, and raccoons.

When this virus strikes, it strikes fast and hard. The course of the disease can evolve rapidly, varying from hyper-acute, where dogs may die only a few hours after symptoms are noted (fulminating fatal hepatitis), to acute, where puppies have only a few short days to live before they die from adenovirus. Both the hyper-acute and acute forms usually occur in puppies.

The virus particles are highest in the bodily secretions – including urine, feces, or saliva – of infected dogs. Ingestion of one of these bodily secretions is the main route of infection. Once a dog is infected, they will continue shedding virus in their urine for 6 months, which seeds the environment with virus. With the environment replete with adenovirus, unvaccinated puppies are under constant barrage from this virus, and they are at the highest risk of infection. The virus will enter the body and aggressively target the tonsils, liver, kidney, spleen, lungs, and blood vessels. As the virus begins to attack the blood vessels, clotting factors are exhausted and severe bleeding results. Spontaneous bleeding into the brain may cause seizures or convulsions. A classic

sign of this disease is the “blue eye,” which is caused by clouding of the eye’s corneas.

Like that one unfortunate puppy in the pet shop outbreak, signs of adenovirus infection can vary from slight fever to death. Refusal to eat, eye discharge, abdominal pain, and vomiting are signs that trouble is on the horizon. Approximately 30% of dogs will succumb to this condition, and the youngest dogs are the most vulnerable. Without a mature immune system, some dogs may have co-infections with parvovirus or distemper, which makes the possibility for recovery grim. The virus will swarm the body, but symptoms won’t be seen for 4-9 days. This is called the incubation period.



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Diagnosing this condition is difficult because the signs occur so quickly. Although tests are available to diagnose adenovirus, your veterinarian may

The biggest hurdle in vaccination is the presence of maternal antibodies. Puppies receive protection from adenovirus in the form of antibodies from

their mothers. These “borrowed” protective antibodies dissipate from the puppy’s body around 9 weeks of age. For this reason, the vaccine schedule is recommended to start between 6 and 8 weeks of age, then every 2 to 4 weeks thereafter until age 16 weeks. The next vaccine should be

scheduled one year later. After that, subsequent vaccination boosters are given every 1 to 3 years. Talk with your veterinarian about the ideal vaccine schedule for your pet.

## PARAINFLUENZA

Your dog had a blast at the dog park yesterday. By greeting his “friends” and rolling in the dog park, your dog manages to mess up his fresh new haircut that he received from a groomer 4 days ago. Now you’re at home relaxing and you hear your dog cough once. Then twice. Now, the cough is happening every hour. You are growing more and more concerned by the hour. Parainfluenza has struck again.

Did your dog pick up the virus from the groomer? From the dog park? The answer to those questions may be unclear because parainfluenza is a virus that can be found anywhere dogs are socializing, including dog parks, sidewalks,

### Where...when...how??

Did your dog pick up the virus from the groomer? From the dog park? The answer to those questions may be unclear because parainfluenza is a virus that can be found anywhere dogs are socializing, including dog parks, sidewalks, groomers, doggie day care, and more.

want to start treating a sick puppy immediately before tests are performed because of the virulence of this virus. A sick puppy will likely need antibiotics, fluids, and possibly blood transfusions. The classic sign of “blue eye” can sometimes result in a painful eye, and eye drops may be needed.

Thanks to the marvels of science, a vaccine for adenovirus is available. Canine adenovirus type 2 is typically used in the vaccine to provide cross-protection against adenovirus type 1. This is because the canine adenovirus type 2 vaccine tends not to cause inflammation of the eye (corneal edema and uveitis) like canine adenovirus type 1. Furthermore, canine adenovirus type 2 is not shed in urine. This vaccine comes in the modified live form. Adenovirus vaccine is usually combined with the distemper, parainfluenza, and parvovirus vaccine.

groomers, doggie day care, and more.

- The disease is transmitted through respiratory secretions that can be exchanged during sniffing (“the doggie handshake”), or it may be aerosolized, which others may inhale.
- The virus may also survive on food bowls, toys, and other objects.
- Shedding typically starts 2 to 10 days after a dog is exposed and typically begins before you even know that your dog is sick.
- The fact that your dog may be excreting virus, before it’s obvious that your dog is sick, is one of the most crucial aspects of disease transmission.
- More importantly, not all dogs shedding the virus show signs of the infection, and dogs become de facto virus distributors.


The good news is that the cough can be treated. Some veterinarians will prescribe antibiotics in case the virus involves both a virus and bacteria (i.e. *Bordetella* or *Mycoplasma* organisms). Cough suppressants can also help keep some dogs

comfortable, especially the dogs that have a sore, inflamed throat.

Parainfluenza is a highly contagious virus that is excreted from the respiratory tract of acutely infected animals and is an important component of canine infectious respiratory disease complex (also known as kennel cough or infectious canine cough). Signs of disease typically occur 2 to 8 days after exposure (known as the incubation period), and the classic presentation is that dry, hacking cough described above. Most of the time, the cough will last a total of 2 to 6 days. The cough isn’t the only part of the suffering. Many dogs that are infected with parainfluenza will also have a runny nose, a sore throat, and inflamed tonsils.

As with most infectious conditions, there is a rigorous focus on prevention. Fortunately, there is a vaccine for parainfluenza. The vaccine for this virus is commonly included with the DA2PP vaccine (distemper, adenovirus-2, parvovirus) that is given to puppies starting between 6 and 8 weeks of age. While parainfluenza virus vaccine is not considered a “Core” vaccine, the other agents in the vaccine combination are required;





consequently, this vaccine is given to dogs fairly commonly.

To prevent this disease, your dog can receive a vaccine that is administered via injection under the skin (subcutaneous) or as drops in the nasal cavity (intranasal). The subcutaneous version will help prevent your dog from acting sick, but it doesn't appear to stop a dog from shedding the virus, nor does it give a dog full protection. The intranasal vaccine does not have these shortcomings. The vaccine for parainfluenza is usually combined with other agents of kennel cough (i.e. canine adenovirus type 2, *Bordetella*, etc), which is preferable because it can do a better job of preventing your dog from getting sick and it will inhibit shedding.

The social dog is most at-risk for parainfluenza infection. These social dogs are the individuals that greet other dogs on a walk or who go to boarding, grooming, daycare facilities, obedience classes, or any social setting.

Talk to your veterinarian about an intranasal vaccine that will work quickly, only has to be given annually, will inhibit viral shedding, and will protect your dog from at least 3 agents that are implicated in infectious canine cough.

## PARVOVIRUS

Parvo is everywhere. It's an absolutely devastating disease. If left untreated, the mortality rate is >90%.

The parvovirus family is virtually universal among mammals. There is a parvovirus for almost all mammals, including dogs, cats, pigs, humans, and many other species.

The original parvovirus (CPV-1) was originally discovered in 1967 and did not shock the canine community like the new variant (CPV-2) did when it first appeared in the US. This new virus was more ferocious than the first and caused more severe illnesses. Parvovirus didn't wait for science to catch up with its ongoing rampage. By 1979, a second mutation, CPV-2a, had occurred, and it seemed to be even more aggressive. Vaccine was at a premium, and many veterinarians had to make do with feline distemper vaccine, as it was the closest related vaccine available. This was occurring while the manufacturers struggled to supply the nation with true parvovirus vaccines. These new variants had several deadly characteristics. The two most pernicious features of the virus were that the virus is shed in gigantic numbers by infected animals and that the virus is especially hardy in the environment. These two main traits resulted in virus being spread worldwide.

The virus then mutated to a new strain called CPV-2b. Because of the virus's pervasiveness, all dogs can be considered to have been exposed to it at some point in their lives, by either vaccination or natural exposure.

The latest mutation, canine parvovirus type 2c (CPV-2c), is now the most common variant of the canine parvovirus in the United States. CPV-2c was discovered in 2000.

Wreaking havoc since the 1970s, the virus has made its way into every environment where dogs live. Any environment, every carpet, every floor, and every yard and park should be considered contaminated. An infected dog will shed virus into the environment for 2 weeks. The amount of

stool that can fit on a pinhead is all that's needed to cause infection. And because of parvovirus's resilience in the environment, the stool can be months old. Furthermore, some dogs are infected with the virus but they don't appear sick. This is called a subclinical infection. These dogs become "silent seeders" as they continue to seed the environment with virus particles without anyone knowing. These animals tend not to be confined, since no one knows they are infected. Thus, they can spread virus around a large area, depending on where they leave their droppings.

Even though the virus is everywhere, it doesn't guarantee that a dog will become infected. Infection depends on 3 factors, including the host (vaccination status, natural immunity); virulence of the virus (number of viral particles,

body, there is a lag period before the signs of illness are noticed. This is called the incubation period. There is a 3- to 7-day incubation period before the puppy seems obviously ill.

Upon entering the body, the virus seeks out the nearest rapidly dividing group of cells. The lymph nodes in the throat are the first stop the virus makes before heading to the bone marrow and the delicate intestinal cells. During this process, the blood stream is constantly being showered with virus particles. The virus deftly takes aim at the body's natural defense mechanism: the immune system. By deliberately targeting its enemy – the cells of the immune system – the virus ensures its own survival. From there it travels to the gastrointestinal tract, where it overwhelms the intestines and prevents them from absorbing

vital nutrients. Puppies and young dogs vomit uncontrollably. The torrential flow of diarrhea causes severe fluid loss and provides an opening for bacterial invasion.

If a puppy survives a parvovirus infection, it can seem like a miracle. A veterinarian may diagnose the condition by using a fecal sample to perform a parvo test

or another test specific to the parvovirus. Once the diagnosis is confirmed, treatment should start immediately (even in cases when the diagnosis is not confirmed).

## PARVOVIRUS PREVENTION

The most potent protection a puppy can have against the parvovirus is by way of a vaccine. This

**The virus enters the body through the mouth as the puppy cleans itself or eats food off the ground or floor. As mentioned previously, a minuscule amount of infected stool is all it takes to make a puppy sick. Once the virus gains entrance to the body, there is a lag period before the signs of illness are noticed. This is called the incubation period. There is a 3- to 7-day incubation period before the puppy seems obviously ill.**

aggressiveness of the virus); and environmental factors. All three of these factors are related and influence each other.

The virus enters the body through the mouth as the puppy cleans itself or eats food off the ground or floor. As mentioned previously, a minuscule amount of infected stool is all it takes to make a puppy sick. Once the virus gains entrance to the

sounds simple enough, but maternal antibodies can get in the way. The antibodies that puppies obtain from their mother's first milk – the colostrum – to protect against the parvovirus will also inactivate vaccine.

**Treatment for this condition can involve days of hospitalization, fluid support, medications to limit vomiting and diarrhea, and other therapies. The toll on a pet parent emotionally and financially can be tremendous. Despite the most assertive life-saving efforts, many puppies don't make it. This is why prevention is the overarching goal for every puppy.**

If a parvo vaccine is given when a puppy still has maternal antibodies, it will destroy that vaccine before it's had a chance to stimulate the puppy's immune system. Furthermore, the age at which the vaccine can be effective is different for each individual puppy.

A vaccine is basically a weakened or harmless version of the virus. It's either live or weakened (attenuated or modified) or killed (inactivated). A high titer, modified live, parvo vaccine is the most common vaccine used to protect newborns against the parvovirus. High titer vaccines are vaccines that contain a large amount of virus. This type of vaccine is used so that after all the maternal antibody has been exhausted, there is still virus left over to stimulate the puppy's immune system.

Puppies need a series of vaccines to give them the best chance to prevent disease and start life right. A vaccine is given every 2 to 4 weeks until at least 16 weeks of age. Giving the same vaccine more frequently than every 2 weeks will cause

interference between the two vaccines, and neither can be expected to be effective. This includes giving vaccines for different infections. Vaccines should be spaced 2 to 4 weeks apart. Puppies need at least 3, sometimes 4, vaccines for them to be protected. To be sure, there is no magic number

or exact amount of vaccines that are needed. The primary focus has to be timing of the vaccine so that it is not inactivated by maternal antibodies.

Parvovirus vaccine is commonly included with distemper, adenovirus, and parainfluenza. This vaccine was previously given annually; however, the American Animal Hospital Association recommends that parvo vaccination be given to adult dogs on a 3-year schedule, after completing the proper immunization schedule during the first year of life.

In addition to vaccines, many concerned pet parents want to know how they could potentially decontaminate or reduce the viral load of parvovirus in their environment. To be sure, there is absolutely no practical way to remove all of the virus from the environment. All environments



must be considered contaminated. However, if an infected puppy has contaminated an environment that a new puppy is entering, a thorough cleaning is imperative.

Bleach is one disinfectant that has been touted as the best and most effective disinfectant against viruses, including parvoviruses. The cleaning solution should be composed of one part bleach mixed with 30 parts water. This solution can be used on bowls, floors, surfaces, toys, bedding, and any other bleach-safe surfaces for at least 10 minutes. Steam cleaning should be used for surfaces that are not safe for bleach, such as the carpet or grass.



**The only way we  
can rid our pet  
population of these horrible  
viruses is by diligent  
vaccination protocols.**



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#### **Further Reading:**

1. Saito TB, et al. Detection of canine distemper virus by reverse transcription-polymerase chain reaction in the urine of dogs with clinical signs of distemper encephalitis. *Res Vet Sci.* 2006;80(1):116-119.
2. Ellis JA, et al. Comparative efficacy of an injectable vaccine and an intranasal vaccine in stimulating Bordetella bronchiseptica-reactive antibody responses in seropositive dogs. *J Am Vet Med Assoc.* 2002;220(1):43-48.
3. Ford RB, et al. Canine infectious tracheobronchitis. In: Greene CE, ed. *Infectious Diseases of the Dog and Cat*, 2nd ed. Philadelphia: W.B. Saunders Co.; 1998.

# History of Rabies



Dr. Kathryn Primm

**Rabies is a viral disease that causes suffering and death in affected patients.** The virus attacks and spreads through the nervous system, eventually leading to neurologic signs and death.

There is an unusually prolonged time between exposure and disease symptoms, which made early vaccine innovator Louis Pasteur think that the disease could be amenable to immunologic protection. As early as 1885, Pasteur and two physicians vaccinated a 9-year-old boy after he was attacked and bitten by a rabid dog. Pasteur's vaccine did indeed prevent the boy from becoming ill with rabies symptoms and saved his life, as he was most certainly exposed when he was attacked by a confirmed rabid dog.



**Ninety percent of all human exposure worldwide is because of rabid dogs. Worldwide, 59,000 people die each year from rabies, and is most commonly found in India and Africa. Somehow worse still is the fact that 40% of rabies deaths occur in children under the age of 15.<sup>1</sup>**

Although rabies was (and still is) a rare disease in the US, the disease stands out because the resulting death is long and arduous with striking symptoms, like foaming at the mouth and hallucinations. Other countries still have rabies.

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people die each year from rabies; it is most commonly found in India and Africa. Somehow worse still is the fact that 40% of rabies deaths occur in children under the age of 15.<sup>1</sup>

Because of Pasteur's work, rabies is 100% preventable today. Because of the safety and efficacy of rabies vaccines, the World Health Organization has begun to stockpile dog and human rabies vaccines.

For over 20 years, Merck Animal Health has partnered with the Afya Serengeti project in the Serengeti region of Tanzania in eastern Africa. Part of the initiative provides rabies vaccination and, in 2015, 200,000 doses of preventive rabies vaccine were given to local dogs. Hospitalization for human rabies infection in this region has dropped 92 percent. Because of the success of Afya Serengeti, Merck has commenced a new initiative called Mission Rabies to address this issue in other rabies hotspots in Africa and India.

In the US, laws regarding the vaccination of pets have protected humans and kept our country virtually rabies free, with only 1-3 cases reported each year. Rabies vaccine programs have been able to contain and control the risk of exposure from domestic dogs, but according to the CDC, 80-100 cases of rabid dogs and >300 infected cats are reported each year. Animal control and vaccination programs were implemented in the US in the 1940s, and there has been a steady decline in rabies cases ever since.

Vaccination and education can end deaths from rabies worldwide, so we should all work together to address this highly preventable issue. Success is inevitable if we can work together to spread the word and the vaccine. The vaccines are safe and effective. Why wouldn't we want to prevent this horrible disease?

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#### **Further Reading:**

1. World Health Organization. Rabies Fact Sheet No. 99. Available at: <http://www.who.int/mediacentre/factsheets/fs099/en>. Updated July 2013. Accessed March 5, 2018.

# Leptospirosis in Real Life



Dr. Kathryn Primm

**It was late in the afternoon when a new client came in with a very sick dog.** I didn't know the owner or the dog, even though my town is fairly small. I am not even sure why he chose to come into my animal hospital, other than the location right on the "main drag". My hospital had not been open long, so I was not running at the crazy pace we all run at most of the time nowadays. When you have a new practice, sometimes the people that come in (since you have no reputation) are those that are unhappy elsewhere or just don't have a regular veterinarian.

A 4-year-old Beagle mix named Toby, with no medical history of vaccination and no solid history with a veterinarian was a typical case that day. It



was just me and my skeleton crew of dedicated friend and veterinary technician that had come with me from my previous job. The best part was that my technician was smart and experienced and my friend was quickly becoming so as well, after her complete immersion training left on her own

with my telephone. She ran to ask me every time a question came up and kept notes of the answers. I was lucky to have a smart animal-loving friend who was between jobs willing to help me and a licensed technician.

The poor little dog had a fever and looked terrible. He was trembling and wet with drool from his nausea. He did not want to move and I was not sure if he was stiff and painful or just scared stiff, since he had not been to an animal hospital before. The whites of his eyes were vaguely yellowed. The owner said that he had been lying around for days, but he did not know exactly how long. He said that the dog probably had not eaten in a day or two. After a physical exam, I gathered together a cost estimate for the diagnostics and treatments I felt were in order. The man seemed reluctant, but agreed to the first round of testing, which included a complete blood count (CBC) and chemistry panel. We put in an intravenous catheter and started the poor little dehydrated thing on some fluids to help him feel better. I didn't know exactly what was wrong, but I could tell the dog felt really rotten.

We drew blood samples and got started with what we could do with our in-house lab machines. Fortunately, I had invested in them as a startup and have never been sorry to have them. Today, I wanted to know as many answers as I could find out. A complete blood count is what it sounds like – a counting of the cells in the blood. Disease can alter these numbers, sometimes in predictable ways. Toby's CBC showed a white blood cell elevation, which is suggestive of an infection, and his red cells were slightly low too.

A lot of things can cause these changes, and so we did not have an answer. When the results of the chemistry panel showed some kidney compromise and suggested liver involvement, I became really worried about

leptospirosis. As I watch my technician sit on the edge of the cage, cleaning up this dog's urine, I thought I should mention my concern to her. "Do you remember leptospirosis? Because I think that this dog could have it." She wisely went to wash her hands and promptly put a WEAR GLOVES sticker on the cage. Leptospirosis is a zoonotic disease, which means it can be spread from affected animals to human beings through exposure to infected urine.

Leptospirosis can usually be treated with symptomatic care and antibiotics, provided the infection is on your rule-out list. Sometimes, if the patient has progressed to kidney damage and liver involvement, it can be much harder to treat. In Toby's case, I wanted to get confirmation of the diagnosis, but at that time diagnostics were more limited than they are today, and even if they had not been, Toby's dad really wanted to try symptomatic treatment because of budget concerns.

Fortunately, Toby did respond to the treatment (he was a tough little guy), but he was sick for a long time. No one on my staff became ill, and we had a great opportunity to teach Toby's dad the importance of vaccination and preventive care.

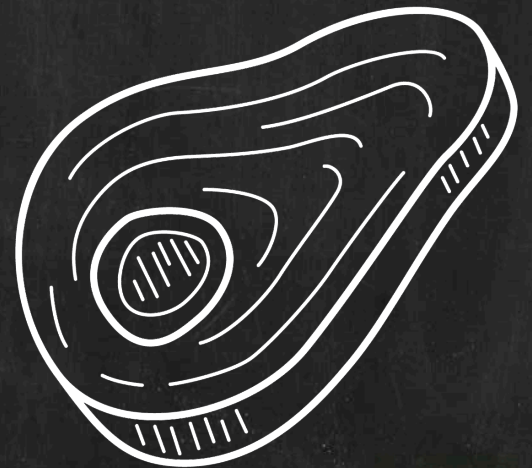
When Toby recovered, he returned to catch up on all of his preventive care. It was really fun for us to see a happy and healthy Toby and know that we were able to protect him and all of our other patients from the devastation of preventable disease.

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# What Every Pet Owner Needs to Know About Leptospirosis

Dr. Courtney Campbell



**Leptospirosis is a bacteria that can cause jaundice, and it can ultimately be a fatal condition in animals and people.** All mammals can potentially be infected with leptospirosis. But it's the fact that this bacteria can jump from

have different host ranges and abilities to infect other species. This information is vital to properly understanding the disease.

Leptospirosis is now considered a reemerging disease. It's making a comeback because it cleverly takes residence in places that people and animals like to go. The animal species the bacteria selects as its home base, by which it will infect other animals, is called the reservoir.

Leptospirosis has picked as its reservoir the white-tailed deer, raccoon, striped skunk, red fox,

gray fox, opossums, rats, and mice, among others. These reservoir hosts are unique in that some can harbor the leptospirosis agent without getting sick. They can serve as a source from which other individuals can be infected. Although the bacteria lives much more comfortably in a living body, in ideal conditions the bacteria can live outside of the body in the environment for quite a while.

Under those correct conditions – high humidity and heat – leptospirosis will live in the soil for weeks or months. Rainwater will cause water and soil from infected urine to spread into the drinking water. The bacteria drift from wetlands, swamps, and grass into residential areas like streets and alleys with the help of rainwater from storms and torrential downpours.

### **Does your dog like wandering the woods?**

Splashing in puddles? Do any of your pets walk on the ground outside? Answering yes to any of these questions means that your pet could be at risk for contracting leptospirosis. Leptospirosis is usually spread through most bodily fluids except saliva. The bacteria infiltrate the skin or mucous membranes.

one species to another, all while causing virulent disease, that makes this condition so distressing. A zoonotic disease is a disease that can be transmitted from animals to humans. Leptospirosis is the most common zoonotic disease worldwide.

*Leptospira* is a corkscrew-shaped bacteria, and there have been over 250 pathogenic strains identified. They are divided into categories called serovars, based on the characteristic of their surface proteins. Eight of these are known to cause disease in dogs and cats. They are: *Leptospira icterohaemorrhagiae*, *L. canicola*, *L. grippotyphosa*, *L. pomona*, *L. bratislava*, *L. autumnalis*, *L. bataviae*, and *L. hardjo*. The first four are the most common strains that infect dogs in the US. Categorizing them into different serovars, or strains, is important because different serovars



Does your dog like wandering the woods? Splashing in puddles? Do any of your pets walk on the ground outside? Answering yes to any of these questions means that your pet could be at risk for contracting leptospirosis. Leptospirosis is usually spread through most bodily fluids except saliva. The bacteria infiltrate the skin or mucous membranes (eyes, nose, and mouth), especially if the skin is broken from a cut or a scratch. Dogs usually become infected by drinking contaminated water, ingesting contaminated soil, or consuming animals that are infected with leptospirosis.

- The time between initial exposure to leptospirosis and signs of illness (incubation period) ranges from a few days to 30 days; the incubation period range is usually 5-14 days.
- Both pets and wild animals – including rats and mice – can secrete leptospirosis into the environment. This makes suburban sprawl into previously rural areas more dangerous because it puts pets at greater risk of exposure to leptospirosis.
- Pets can experience vomiting, abdominal pain, diarrhea, reduced appetite, weakness, depression, muscle stiffness, fever, and pain.

If any of these symptoms match what you are seeing in your dog, seek medical attention from your veterinarian immediately, wash your hands thoroughly, and avoid contact between your dog's bodily fluids and your mucous membranes. Once infected, your pet can shed the bacteria into the environment for months if not treated.

If you suspect your pet has been infected with leptospirosis, your veterinarian may want to take blood and urine samples to confirm the diagnosis. Once they do, treatment may require

hospitalization, antibiotics, and fluid therapy to start. More severe cases will likely require more aggressive treatment. Your veterinarian may even recommend bathing your dog in an antimicrobial shampoo just in case your pet is harboring leptospire in moist areas of the haircoat.

**Prevention is the key to battling the spread of leptospirosis. To be successful, a three-pronged approach is recommended.**

1. The first step is to limit wildlife in your neighborhood. This includes keeping rodent problems under control and, if you're noticing eyes reflecting back at you from the woods when you are coming home at night, please contact your local wildlife control department.
2. Vaccination is the second step. If your pet could choose, they would want to be vaccinated against leptospirosis. This would help shield them from the four most common dangerous strains. And you will feel better knowing your pet is better protected. There is no vaccine that protects against the aforementioned 250 strains, but the vaccine does prevent against the four common serovars, namely *L. canicola*, *L. icterohaemorrhagiae*, *L. pomona*, and *L. grippityphosa*. If the dreaded condition strikes your pet and they become infected with leptospirosis, it's comforting to know that if you act early it can be treated. If the treatment is successful, your veterinarian may still recommend vaccinating your pet again because they can still get infected with a different strain of leptospirosis. Because the vaccine does not provide 100% protection, it's still important to stay vigilant regarding your pet's access to potentially contaminated water sources.

3. The third step is simply to do more of your favorite thing: watch your pet. By observing your pet closely, you can prevent them from romping in swamps, playing in or drinking from puddles, roaming the neighborhood, or walking around with exposed, open wounds.

**This is the most common zoonotic disease in the world, so pet parents need to take precautions so that they don't become infected.**

If at all possible, avoid all contact with your pet's bodily fluids if you suspect your pet is infected. If handling the bodily fluids is unavoidable, then wear protective clothing like gloves or boots.

Diligent handwashing is essential, and avoid contact with your eyes or face.

Always clean with an antibacterial solution that includes a 1:10 ratio of bleach to water.

Seek medical attention through your physician if you are experiencing flu-like symptoms or you are concerned about possible contact.

Our pets are assaulted by hostile actors like bacteria and viruses every day, but fortunately many pets don't get sick. That is largely due to their immune system and the outstanding care by pet parents nationwide.

Just arming yourself with the best information about leptospirosis gives you the upper hand on this dangerous bacteria.

**When it comes to leptospirosis, the 3 I's of prevention are:**

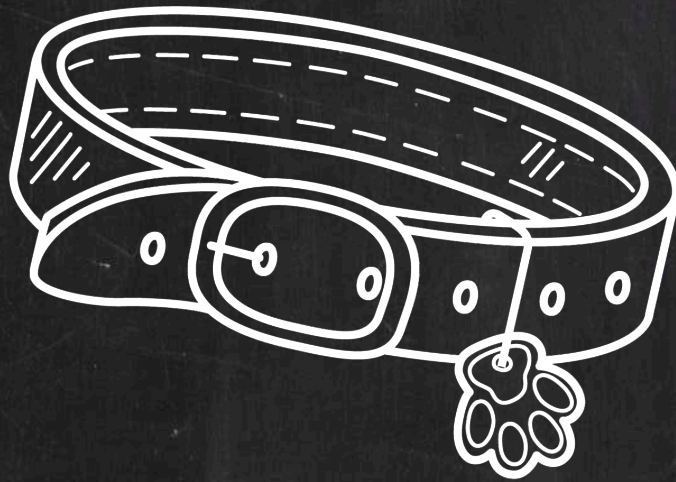
1. Inhibit (rodents and wildlife from coming into your neighborhood)
2. Immunize (vaccinate your pet against leptospirosis)
3. Interrupt (stop your pet if they are drinking out of a puddle, playing in potentially contaminated water sources, or eating dead animals)

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### **Further Reading:**

1. Sykes JE, et al. 2010 ACVIM small animal consensus statement on leptospirosis: Diagnosis, epidemiology, treatment, and prevention. *J Vet Intern Med.* 2011;25(1):1-13.
2. Langston CE, et al. Leptospirosis. A re-emerging zoonotic disease. *Vet Clin North Am Small Anim Pract.* 2003;33(4):791-807.
3. Jansen A, et al. Leptospirosis in Germany, 1962-2003. *Emerg Infect Dis.* 2005;11(7):1048-1054.
4. Gaudie CM, et al. Human *Leptospira interrogans* serogroup icterohaemorrhagiae infection (Weil's disease) acquired from pet rats. *Vet Rec.* 2008;163(20):599-601.
5. Guerra B, et al. Detection and characterization of *Leptospira interrogans* isolates from pet rats belonging to a human immunodeficiency virus-positive patient with leptospirosis. *J Med Microbiol.* 2008;57(Pt 1):133-135.
6. Allard R, et al. Explanatory notes on statistics for reportable disease and other infectious diseases under surveillance, period 3, year 2006 (weeks 9-12) [26 February 2006 to 25 March 2006]. Montreal Public Health Department, 2006.
7. Vincent C, et al. La leptospirose: Cas de transmission d'un chien a un humain. *Reseau d'Alerte et d'Information Zoosanitaire.* 2007;51:1-4.
8. Weese JS, et al. Bacterial diseases. In: Weese JS, et al., eds. *Companion Animal Zoonoses.* Ames, Iowa: Wiley-Blackwell; 2011.
9. Brown K, et al. Leptospirosis in the family dog: A public health perspective. *CMAJ.* 2008;178(4):399-401.

# The Coughing Conundrum



Dr. Kathryn Primm

**It was summer and the middle of vacation season. Our kennel was packed with happy dogs.**

We love to call our boarding experience “dog camp”, because all of our boarders are regulars that we know well. In fact, we restrict our boarding to pets with whom we are familiar so that we can avoid less wonderful experiences for all involved. We find if we do not know a pet, we cannot address any issues that they might have with being away from home and owners. All was great, until one of our dogs started to cough.

At the time, we were treating and altering several rescue puppies, and even when we kept them isolated, they seemed to be the source of the cough. These dogs come from all manner of background and are often immune suppressed from the stress of travel and handling.

Just like most good boarding facilities, we require that dogs be vaccinated for contagious diseases prior to boarding, but no vaccine is 100% effective. In fact, we view vaccination as doing our best to stop disease, but we also do strict isolation of only seemingly healthy dogs in our kennel. We typically do not mix our sick hospital population with our healthy boarding dogs, and we are lucky enough to have a separate space for the kennel runs.

I was surprised when one pet parent called back a few days after discharge to say that her dog was coughing. Many of my staff members often

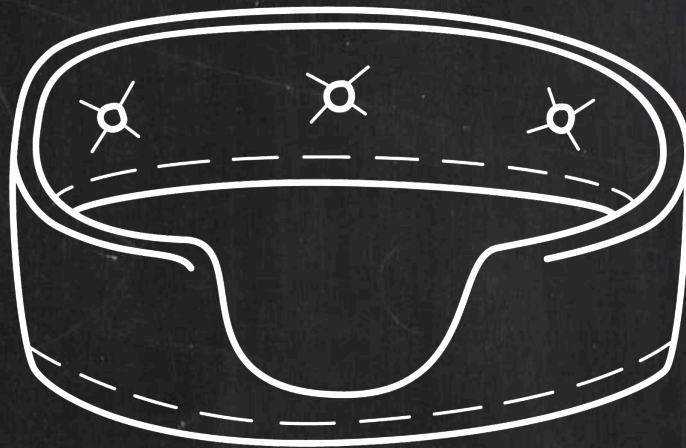
bring their healthy pets to work as kennel space allows, and gradually some of those pets started to cough. Because I have a great relationship with most of my regular boarders as well as easy access to my staff pets, I immediately submitted testing to find out why the dogs were coughing.

Fortunately for me, the dogs tested negative for canine influenza, which would have required an aggressive kennel closure. All the dogs that we tested were positive for parainfluenza, an important canine respiratory virus. All dogs responded well to symptomatic treatment.

Just another day in the life of a veterinarian.



# Kennel Cough



Dr. Courtney Campbell

**To cough is human. To cough is also canine, feline, equine, and even delphinid (yes, even dolphins have been shown to have the ability at a voluntary cough.)**



Because we know what it feels like to cough and, for the most part, we know how to recognize it in our pets, we empathize with them when they do it. Most of us have an intimate understanding of how a cough or a sneeze can transmit the common cold. Indeed, few medical conditions underscore the human-animal bond better than the condition of kennel cough.

A cough is a rapid expulsion of air from the lungs. It's typically used to clear the lungs and airways of fluids, mucus, or other material. There are times in which coughing can be beneficial.

In fact, coughing is an important way for our pets to keep their airways and throat clear from debris. However, excessive coughing may signal a problem. This is especially true if your dog has a social lifestyle which puts them at an increased risk for a contagious illness.

If this sounds like a description of your pet, then kennel cough is an extremely important condition to understand.

Kennel cough (also known as infectious canine cough) is a highly contagious infectious disease. Not only is kennel cough transmitted by an actual organism (bacteria or virus), but it also means that it can be transmitted between pets with simple contact and not just in a kennel. Examples of simple contact include a romp at a daycare, a brief touch of noses during a walk, sharing of a toy that a sick pet has already touched, or even walking through contaminated grass or concrete sidewalks.

There have been volumes of information written about kennel cough. There are studies on how these diseases are transmitted, and there are even vigorous debates on the degree of infectivity between the offending organisms.

One challenge with resolving the mystery behind kennel cough is that there are a slew of different organisms that can cause the condition.

Kennel cough can be caused by a bacteria or a virus. In fact, it can be caused by the complex interaction of many different bacteria and viruses. This fact is vital in helping to diagnose, treat, predict, and prevent the condition. Knowing that kennel cough may not simply be one singular organism but instead may be caused by a myriad of organisms makes further investigation imperative. That investigation hopefully leads to identifying the biological culprit(s) and strategies for prevention can then be developed.

Just to make the issue slightly more thorny, many of these organisms will cause co-infections. This means multiple organisms can invade the respiratory system simultaneously to cause illness.

## Infections with the following organisms frequently cause a case of kennel cough:



***Bordetella bronchiseptica*** - A bacteria that is the most widely known infectious cough agent; frequently involved in co-infections

**Canine influenza virus** - Two strains from different origins: H3N8 (equine) and H3N2 (avian)

**Canine distemper virus** - Attacks the respiratory, intestinal, and neurologic systems

**Canine adenovirus type 2** - Produces a dry hacking cough, discharge from the eyes and nose (very common agent implicated in infectious canine cough), and can affect the conjunctiva

**Canine parainfluenza virus** - Easily spread from dog to dog; produces a cough, runny nose, and sneezing; highest instances of infection are seen with high dog populations, such as race tracks, boarding kennels, and pet stores; contagious to any dog of any age

**Canine herpesvirus** - Severe viral infection of puppies worldwide, which often has a 100% mortality rate in affected litters; can cause nasal discharge, conjunctivitis, swelling of the cornea

**Canine pneumovirus** - Commonly called canine infectious respiratory disease complex (CIRDC), it is a syndrome of diseases that are of significant concern in any multi-dog setting

**Canine respiratory coronavirus** - Related to the human coronavirus that causes the “common cold” in people. Signs can range from a cough, sneezing, and nasal discharge or pneumonia. Some dogs have a subclinical infection with no clinical signs, yet they shed bacteria into the environment to infect other dogs

***Streptococcus equi subsp. zooepidemicus*** - A bacteria that has been linked to cases of acute fatal pneumonia in dogs in several countries. Outbreaks can occur in kennelled dog populations and result in significant levels of sickness and sometimes death; highly contagious and quickly results in fever, breathing difficulty, and nasal discharge

***Mycoplasma cynos.*** - Extremely small bacteria, *Mycoplasma* infection in the respiratory tract weakens a dog, increasing susceptibility to bacterial and viral infection. In many cases, it can be hard to tell which organism is the primary cause. Mycoplasmas may live in the upper respiratory tract of healthy dogs, but when they descend into the lower respiratory tract they cause infection and even pneumonia in severe cases

Coughing is an important way for our pets to keep their airways and throat clear from debris. However, excessive coughing may signal a problem. This is especially true if your dog has a social lifestyle which puts them at an increased risk for a contagious illness.

*Bordetella bronchiseptica* is by far the most infamous of this list of usual suspects; it's so notorious, in fact, that many people will refer to canine cough as simply "*Bordetella*." However, infections with these bacteria are usually mild, limited to the upper respiratory tract, and self-

period. This "calm before the storm" phenomenon is paramount in understanding why these organisms can spread so rapidly. The incubation period is the time between exposure to an infectious agent and the first symptoms of illness. For example, the incubation periods for

parainfluenza, respiratory coronavirus, and canine adenovirus type 2 are approximately 3-10 days. Shedding of the virus is another significant concern. Shedding is intermittent release of the organism from the body after it has replicated within the body. Shedding

### **Prevention is always better than cure.**

Vaccines prime the army of immune cells to prevent and reduce the signs of canine cough. Vaccines are in constant development but for now, there are only vaccines available for *Bordetella*, canine adenovirus type 2, canine parainfluenza, canine distemper, and canine influenza.

resolving. Canine influenza, or dog flu, on the other hand, is a much more serious disease, with dogs experiencing lower respiratory disease, including pneumonia.

Dogs shed respiratory infectious organisms via aerosolized secretions, casual contact, or on shared objects. Therefore, these organisms can be floating in the air, living on other dogs, or simply everywhere. These organisms adeptly bind to the lining of the respiratory tract and limit the body's ability to clear the infection. Furthermore, they can secrete substances that disable the immune cells normally tasked with destroying bacteria. If the respiratory system is overwhelmed by one organism or multiple organisms, more serious symptoms such as pneumonia may result.

One of the most difficult aspects in treatment and prevention is understanding the incubation

time ranges can vary with organism due to co-infections, stress level, or immune system competence.

Dog flu virus illustrates one of the most flagrant examples of dangerous viral shedding. H3N8 and H3N2 are the two main strains of this virus that affect dogs. They have different windows of time that a dog may remain infectious: For H3N8, a dog remains infectious for 7-10 days; and for H3N2, it is over 20 days. Some dogs may be infective but look completely normal.

Fortunately, many pet parents recognize the signs of canine cough in their dogs early enough to have them treated immediately. Many veterinarians will conscientiously recommend nasal swabs to identify the offending organism. It may take days before the results of that test are available, and there are some rare cases of



false-negative results. Meanwhile, your dog's symptoms may be getting worse. Therefore, many veterinarians will take the precaution of performing X-rays or blood tests. It is important to have the peace of mind that your pet is not in a health crisis while test results are pending.

Prevention is always better than cure. Vaccines prime the army of immune cells to prevent and reduce the signs of canine cough. Vaccines are in constant development but for now, there are only vaccines available for *Bordetella*, canine adenovirus type 2, canine parainfluenza, canine distemper, and canine influenza.



### When it comes to vaccines, there are several important realities to know:

- Vaccines will help to prevent infection from other organisms contained within the specific vaccine, but not from other organisms of the complex if they are not contained within the vaccine.
- Most vaccines are not immediately effective. Some vaccines may take 14 – 28 days to reach their full protective effect. Some vaccines also require a booster when first given. For this reason, vaccination the day of boarding is

suboptimal, and you likely need to schedule vaccinations in advance of boarding.

- *Bordetella* and dog flu vaccination are recommended for social pets. Vaccination is intended to minimize the symptoms of illness but may not entirely prevent infection.
- **Canine Influenza.** Vaccine for one strain will not protect against the other strain. A dog must be vaccinated against both strains of the virus. This can be achieved by using a vaccine called a bivalent vaccine. Be sure to ask your veterinarian for this form of vaccine.
- Vaccines are not useful for dogs who are already incubating an infectious organism. Your dog may be incubating a virus (or bacteria) without your knowledge.
- **Kennel Cough.** For dogs that develop a cough shortly after vaccination, it is important to know that they may have been incubating the organism without showing any symptoms.

Prevention comes in the form of vaccination and observation. Talk to your veterinarian about which vaccines would be best for your pet so that their vaccine regimen fits with their lifestyle. Pet parents are exquisitely observant and they recognize signs of illness in their pets. If coughing or nasal discharge is noted, many will elect to voluntarily quarantine their pets to keep them away from social settings like daycare facilities and boarding kennels.

This approach is excellent and should be encouraged whenever possible, but it does have its limits.

All-around prevention is key. As an example, keeping your pet away from daycare during the day is going to do little if your pet walks on a

contaminated sidewalk or grass at night. Viruses, particles, and bacteria are quite ubiquitous and pervasive. That's why prevention strategies must be broader than just avoidance, because these microbes can find clever ways into your dog's body.

The social facilities (i.e. boarding kennels, daycare, etc.) are also doing their part to prevent the spread of infectious agents by assiduously following infection-control measures. Some of these measures include: regular hand washing requirements, installing dispensers for hand sanitizer, providing faucets and bathroom doors that turn on automatically, frequent kennel disinfection, adequate ventilation, and avoidance of overcrowding. All of these strategies help to reduce the chance that viral particles will be aerosolized, exchanged between dogs, and ultimately settle on the surface (epithelium) of your dog's nose or eyes.

It's precisely those kinds of infection-control measures upon which we must rely to keep our furry family members healthy and prevent outbreaks of infectious canine cough in the pet population.



**All-around prevention is key. As an example, keeping your pet away from daycare during the day is going to do little if your pet walks on a contaminated sidewalk or grass at night.**

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### **Further Reading:**

1. 2017 American Animal Hospital Association Vaccination Guidelines.
2. Edinboro CH, et al. A placebo-controlled trial of two intranasal vaccines to prevent tracheobronchitis (kennel cough) in dogs entering a humane shelter. *Prev Vet Med.* 2004;62(2):89-99.
3. Datz C. Bordetella infections in dogs and cats: Prevention and treatment. *Compend Contin Educ Pract Vet.* 2003;25:902-914.
4. Schultz RD. Considerations in designing effective and safe vaccination programs for dogs. In: Carmichael LE, ed. *Recent Advances in Canine Infectious Diseases.* Ithaca, NY: International Veterinary Information Service; 2000.

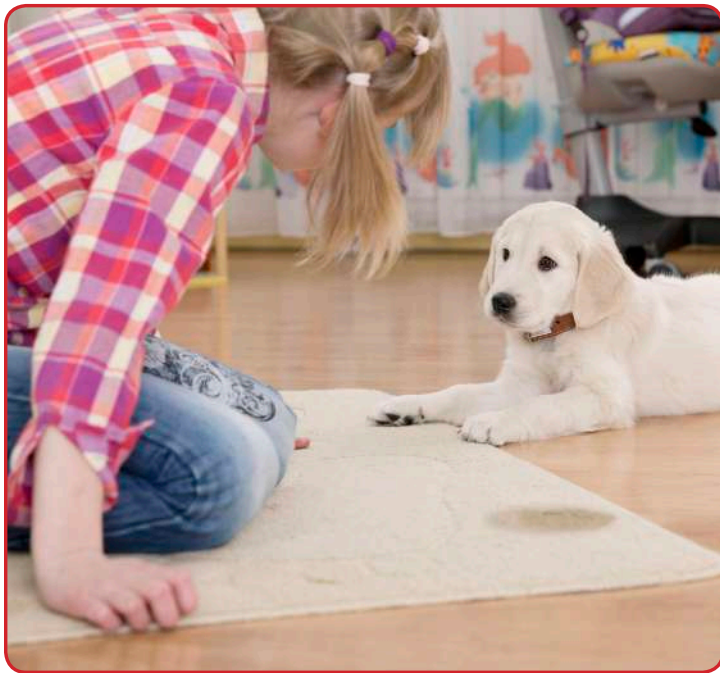
# Cleaning Up After Pets



Dr. Courtney Campbell

## We all love our pets.

They entertain us, comfort us, and reassure us, providing health, social, and emotional benefits. And we do the same for them. But, our pets can also be carriers of harmful germs. The germs that can be shared between people and animals are referred to as zoonotic pathogens and can be a concern, given that in households with pets, close interactions between humans and animals are part of everyday life.



### How germs spread from pets to people

Pet bodily fluids, most commonly feces and urine, can contain harmful pathogens. These can be indirectly transferred from hard surfaces such as floors and soft surfaces such as carpets to hands. Direct contact with pets may also transfer harmful germs onto hands, which can then be transferred to the mouth, nose, or eyes and potentially cause an infection.

### The risk of getting an infection from a pet

The risk of getting an infection from a pet varies among the population. In generally healthy people aged 5 to 65, the risk is low, but the risk increases in children under 5, adults over 65, pregnant women, and people with compromised or weakened immune systems. If there are people in your household in these groups, practicing good environmental and personal hygiene in your house and around your pets is especially important.

### Cleaning and disinfection in your household

#### How to select cleaning and disinfectant products to use around your pets

There are many products that can be used for cleaning and disinfecting, and choosing the right products can be difficult. This guidance can help you select which products to use.

- Always read the product label to determine whether it's appropriate to use around pets.
- Remember that many cleaning and disinfecting products are safe to use around pets if directions for use are followed. For example, some products may state "keep pets and children away from the area until dry".
- Some cleaning products may carry "pet safe" language, but disinfectants may not.
- Many disinfectants used in homes, veterinary, and pet boarding and grooming facilities will contain label language requiring disinfected surfaces to be rinsed with potable water before pets are allowed on or near them.

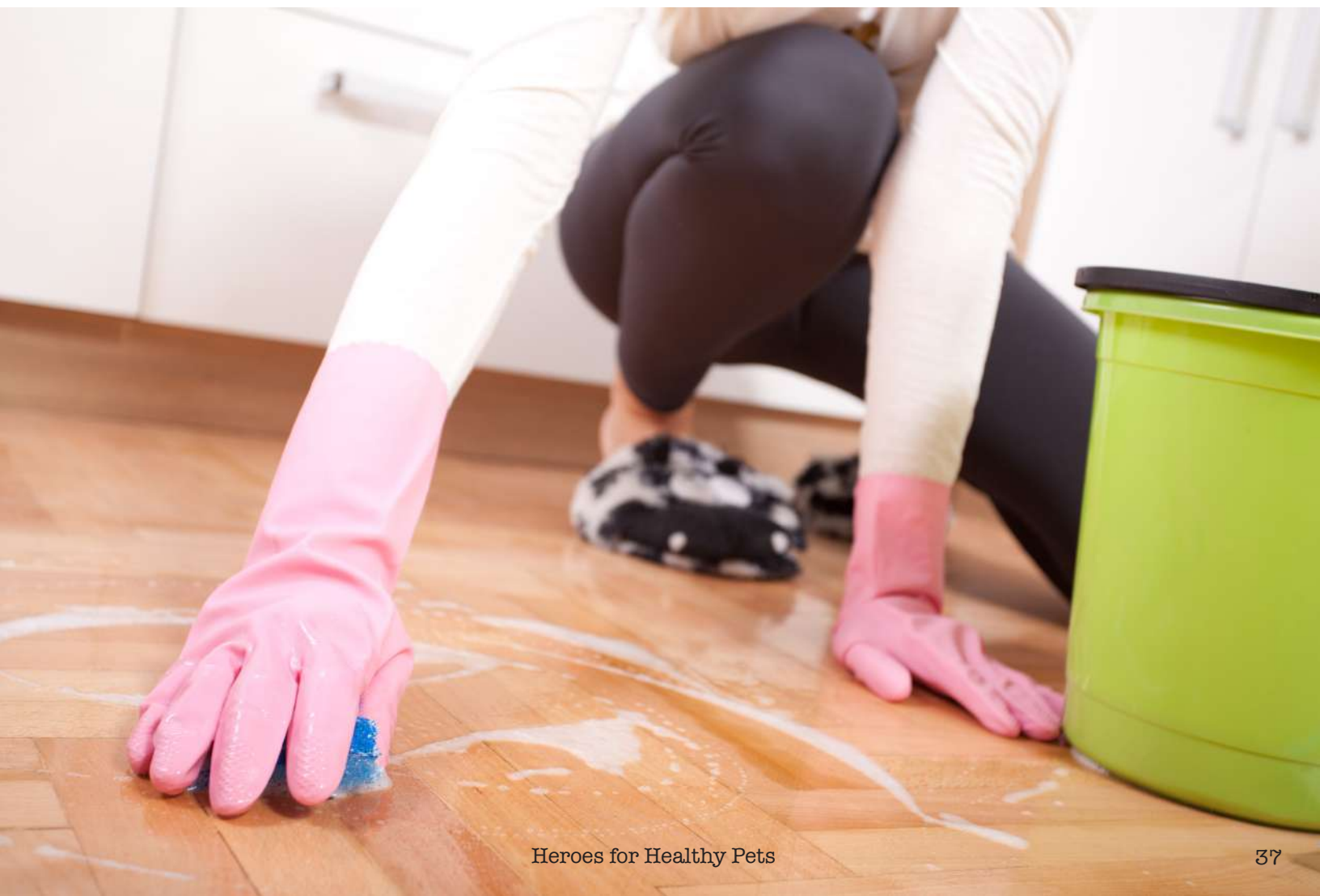
- Some products may be labeled for use on food contact surfaces, which means they can be applied to a surface that comes into contact with food and left to dry without a rinse step.
- Always ensure that cleaning and disinfecting products are safely and securely stored out of reach of pets.

### **Staying healthy with good hand hygiene**

Good hand hygiene practices are key to preventing the spread of harmful germs from pets to people. Thoroughly washing your hands with soap and water is most effective, but if not available, use an alcohol-based hand sanitizer. If you have young children in the house, adults should always supervise them when they wash their hands.

### **Key Hand Hygiene Moments:**

- Before eating, drinking, preparing food
- Before and after playing with your pet
- After cleaning up after your pet when they have had an accident
- After cleaning out a litter box
- After picking up pet waste in the house or yard



Keep your pet's home clean with these easy steps:

## HOW TO CLEAN AND DISINFECT

**REMOVE**  
organic debris

**CLEAN** the area  
with a detergent,  
then rinse

**APPLY** an appropriate EPA-  
registered disinfectant; let it sit  
for the required contact time

**RINSE AND DRY**  
with a clean towel  
or squeegee

### Here's how to clean up pet accidents:

- Remove excess urine or feces with a paper towel, then clean the area with a detergent-based cleaner to remove organic material. Spray or wipe the area with a disinfectant and wait the full contact time. Rinse with water and dry with a towel.
- On colorfast carpet, rugs, upholstery, and mattresses, first blot away excess liquid or solids with a clean, dry absorbent cloth. Spray color-safe cleaner directly onto stain until completely covered. Wait 3 minutes, then wipe with a clean damp cloth. Keep the treated area clear of people and pets while it dries completely. Remember, always test for colorfastness on a hidden area before use.
- On sidewalks and outdoor tile, first rinse surfaces to remove excess dirt and debris. Spray a cleaner, stain remover, or disinfectant directly onto the affected area and allow to air dry. If indicated by label instructions, rinse the surface with water. Remember, never rinse products into a storm drain that could then flow into a lake, stream, or other body of water.

### Cleaning toys and bowls

It's easy to keep your pet's toys and dishes sanitized.

#### Here's how:

- Clean hard plastic toys and bowls with soap and water, then rinse thoroughly
- In a plastic dishpan, prepare a sanitizing bleach solution. Read the label of the bleach product you are using to determine how to prepare this solution.
- Add pre-washed items and let them soak for 2 minutes
- Rinse, then dry with a clean towel or allow to air dry
- Always use cleaning agents as directed and keep away from children and pets

### Important things to remember when cleaning and disinfecting:

- Always follow the label instructions
- Clean with a detergent to remove organic material such as urine, feces, and hair before disinfecting. Some products are cleaner-disinfectants and can be used for both the cleaning and disinfection steps.
- First test products on surface you plan to clean to ensure they are compatible
- Avoid contaminating areas adjacent to the spill when cleaning up

### Further Reading:

<https://www.clorox.com/cleaning-and-laundry-tips/cleaning/multi-room/cleaning-up-after-pets/#dEU5EtIROcDMiTbX.99>  
<https://www.clorox.com/cleaning-and-laundry-tips/cleaning/multi-room/what-pets-touch-and-how-to-clean-it/>

# The History of Vaccines



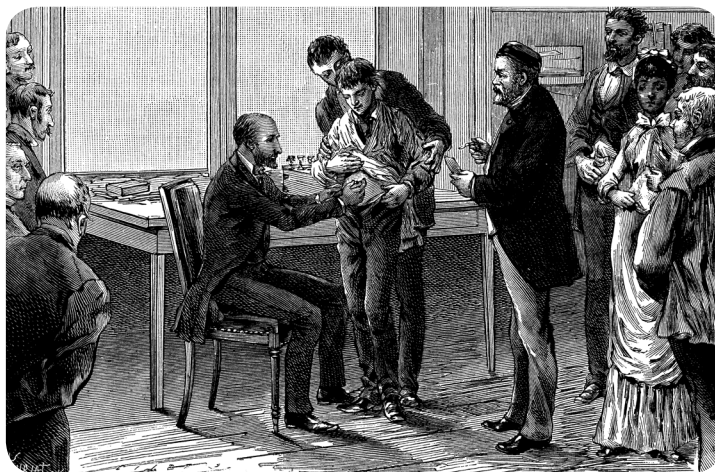
Dr. Kathryn Primm

**There has never been a time in recorded history that infectious disease has not existed.**

In 1796, a country physician named Edward Jenner administered the first documented inoculation. At that time, smallpox was a devastating epidemic, killing millions of people during the 20th century. 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> Based on his pioneering thought, smallpox vaccine saved millions of lives that would have been lost to smallpox epidemics. For centuries, vaccination has been saving lives, and today's vaccines are significantly improved over a pus sample!<sup>1,2</sup>

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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 vaccination, 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





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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.

Usually, 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.

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### Further Reading:

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, England: Sampson Low; 1798:4

# How Vaccines Work



Dr. Courtney Campbell

**Plasma is liquid gold. Plasma received that distinctive moniker in some medical communities because of the incredible potential it harnesses.** Blood plasma has been used for a host of medical conditions, including blood transfusions, inflammation of the pancreas, and low protein conditions, among many other conditions. Plasma is the liquid part of the blood and makes up about half of the volume of blood. It's devoid of cells but it contains antibodies and other important proteins. Antibodies are the essential gears behind the incredibly complex vaccine mechanism.

Vaccines are some of the most powerful weapons that medicine has against infectious disease.

Vaccines prime the immune system's army, making it better able to fight infectious disease. In a general sense, vaccines are made by weakening

**There are three main methods for weakening an organism so a vaccine can be made.**

1. The first method is to kill the organism whether it is a virus or bacteria. To make a killed vaccine, a dead pathogen is injected into the patient. The immune system detects these dead particles, leading to stimulation of the immune system.
2. A second method is to use a live pathogen that has been modified so it does not result in illness. The live pathogen is able to travel through the body, setting off alarm bells in the immune system in a similar fashion to the natural disease. The result is an immunity created to that disease that is similar to one that would be created by a real infection.
3. A third method is to modify the pathogen's DNA out of the organism and put it into a live virus. This type of vaccine is called a recombinant vaccine.

Without a doubt, vaccines have helped prevent illness and death. Fortunately, they are widely available and inexpensive. This is good news, because many of the conditions for which we vaccinate are highly contagious and often fatal diseases. There continue to be outbreaks of these deleterious diseases throughout the United States and worldwide.

an infectious organism in some way (attenuation) and then adding that weakened organism to a cell. Once the damaged organism is debilitated to the point of not being able to cause infection, it is then used as a vaccine.

ability to recognize a foreign substance. If the body breaks down the foreign substance and removes it too quickly, the viral proteins will not be present long enough to generate an immune response. Adjuvants help stabilize the virus so that the

Sometimes when learning as a new student, you need a tutor. The tutor is there to provide help while you learn a new subject. The immune system is no different. To help the immune system "learn" faster, an adjuvant is used like it is a "tutor". An adjuvant is a material added to a killed vaccine to boost the immune system's

immune system can detect it and mount a more robust response.

A live virus vaccine is generally preferred and, in terms of an immune response, a live virus vaccine will provide a very strong immune response. However, there are some circumstances where a killed virus vaccine is better. A killed virus vaccine can never revert to virulence, which means there are no circumstances under which the vaccine can produce the disease it's trying to prevent. If the virus in question is particularly deadly (such as rabies), it is not worth taking any chances with a live virus vaccine, even for a superior immune response.

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Puppies are born with immature immune systems. Their immune systems are not ready for the daily (and hourly) barrage of infectious agents that are seeking to invade their body. For this reason, they have help from their mothers. Besides being nurturing and providing food, the mother provides colostrum, which contains antibodies that she has in her mature immune system. By drinking this special substance that is only available for a few days at the beginning of birth, puppies are essentially "gifted" their mother's immunity. Newly born puppies and kittens are under pressure to suckle well. Not only is colostrum available for a limited time only, but a puppy's intestines undergo "closure," which means that they can no longer absorb externally produced antibodies.

Maternal antibodies are a finicky bunch. Their presence in a new puppy or kitten is highly individualized and depends on many factors. Whether or not a newborn is fully protected can depend on the birth order, who was the first to nurse, who suckled the strongest, and the vaccination status of the mother, among many other factors. To compound matters even further, antibodies against different diseases wear off after different times.

The gift of a mother's immune system comes with an expiration date. The antibodies that the newborn has received in the colostrum have usually completely dissipated from the body by 14-20 weeks of age. After this point, a puppy is left unprotected.



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Vaccines must be given with the impeccable timing of a double-dutch jump roper. The vaccine has to be given at the gap between the waning maternal antibodies and dangerous vulnerability. Give a vaccine too early, and mother's "borrowed" antibodies will inactivate the virus (i.e. a jumper gets tangled up in the rope). Vaccines will not be able to "take" until maternal antibody has sufficiently dropped. If the vaccine is given too late, there's a large window of vulnerability in which the newborn is unprotected from the dangers of infectious disease (i.e. jumper jumps too late and trips on the rope). This is why timing is of utmost importance when deciding when to give a vaccine.

By 14-20 weeks of age, maternal antibodies are mostly gone and the newborn must be able to survive with its own immune system. To give newborns the best chance of responding to vaccination, vaccines are given starting at 6-8 weeks, and then intermittently every 2-4 weeks in hopes of gaining some early protection.

If you are welcoming a slightly older dog into your home and vaccines are being given for the first time, it is usually best to give at least two vaccinations 2-4 weeks apart. This is because the second vaccination will produce a much greater (logarithmically greater) response if it is following an initial vaccine.

People recognize a vaccine's potential to confer lifelong immunity in human beings. So naturally, pet parents are curious as to why pets would need vaccines annually. The basis for annual vaccination is based partly on biology and partly on certification. If a vaccine is licensed by the USDA for annual use, this means it has been tested and found to be protective for the majority of the vaccinated animals a year after they have been vaccinated. Some vaccines have only been certified for 1 year and others for 3 years. As a general rule, viral diseases that have a widespread effect on the

body (i.e. parvovirus, distemper, etc.) have vaccines that last a long time (i.e. 3 years or longer). Other diseases, particularly if bacterial in nature (i.e. *Bordetella* or *Leptospira*), need to be prevented with more frequent booster vaccines.

In school, many of us lived through a set of courses that are considered basic and essential for future class work and graduation. We were strongly encouraged to learn these subjects because they were considered the foundation for continued learning. Collectively, these courses were designated as part of the Core Curriculum. When training the immune system, the same philosophy applies. The immune system needs to be trained with some essentials to help the newborn survive. The vaccines that provide these essentials are called Core vaccines. These vaccines include canine distemper, adenovirus type 2, canine parvovirus, and rabies. Non-Core vaccines are essentially vaccines that are recommended by your veterinarian based on your pet's location, age, social activity, outdoor activity, and lifestyle.

Some pet parents are concerned with the safety of vaccines. There is a small chance of your pet having mild side effects like swelling or soreness at the vaccination site, lack of appetite, or fever. There



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are definitely cases of severe allergic reactions in some dogs. This type of reaction is rare and can occur immediately (or within hours). If this type of reaction is observed in your dog, then your veterinarian should be contacted immediately. Generally speaking, the chances of an adverse reaction to a vaccine are lower than the harm a disease can cause. In short, the benefits of vaccines far outweigh the risks.

A vaccinated pet may still get sick even with the most diligent vaccine regimen, and some vaccines are not designed to be 100% protective. They are designed specifically to mitigate the signs and the duration of the illness. Moreover, every immune system is just as unique as the pet, and not every pet will be able to mount a robust immune response to a vaccine. This is due to the individual characteristics of their immune system. In terms of vaccination, some immune systems respond like students in honors programs, while others respond like students who fail the class the first time and need a second chance. This is called vaccine failure. It's extremely rare but it is possible. This may be why some pets may still get sick after vaccination.

The dreaded report card. Every new student has felt the butterflies in their stomach knowing that there will be a full report on how well they have done on their tests at the end of the semester. Well, the immune system doesn't experience that academic anxiety, but it essentially has a "report card". That report card is called a titer. A titer measures antibody levels in the blood. There are specific titers for specific diseases. The titer functions as a "report card" for how well your

immune system has "learned" from the vaccine. If your immune system has "learned" well, the the titer number will be high and your pet should be protected. If the titer is low, that means the immune system no longer has a healthy amount of that particular antibody and needs to be vaccinated. However, some feel that the immune system is too complex to be reduced to simple titer levels. Antibody levels are only a small piece of the protection puzzle, and it may not be correct to say that a certain antibody level "equals" protection.

There has been much discussion about "overvaccination" in pets. There are some who have postulated that administering too many vaccines to your pet can result in various conditions in the kidneys, cancer, and immune conditions. So far, there's no evidence. There are no clear and objective studies to support that a sensible vaccination regimen has increased the incidence of any specific health problems.

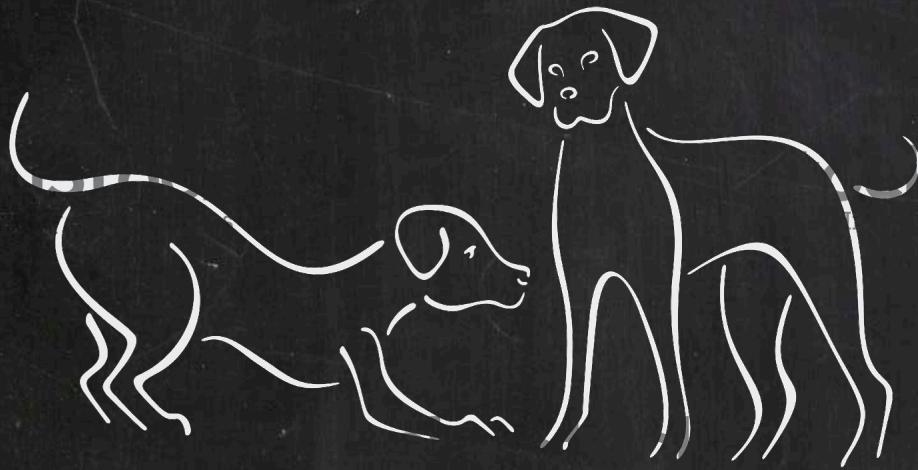
Infectious agents are ubiquitous. Every day of your pet's life, they are exposed to bacteria and viruses, but fortunately, most pets stay healthy. That health can be credited to an outstanding immune system that has been "taught", primed, and trained to battle infectious agents through a good vaccine curriculum. This preparation results in a mature immune system than can fight infectious agents and prevent disease transmission. Adequately timed, personalized vaccine regimens are the cornerstones of infectious disease prevention. Make sure you have an in-depth conversation with your veterinarian about what is the best vaccine protocol for your pet.

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### Further Reading:

1. Schultz RD. Considerations in designing effective and safe vaccination programs for dogs. In: Carmichael LE, ed. *Recent Advances in Canine Infectious Diseases*. Ithaca, NY: International Veterinary Information Service; 2000.
2. 2017 American Animal Hospital Association (AAHA) Vaccination Guidelines.

# Vaccine Strategy for Social Dogs



Dr. Courtney Campbell



**We love our pets.** We want the absolute best for them, and pet parents take this responsibility very seriously – we want our pets to be well-nourished, safe, and, most of all, healthy.

For some pet parents, working from home would be a dream. Not only could they luxuriate in the comfort of their home, but they could keep a watchful eye over their pets. But that quixotic musing is quickly tempered by having to brave the morning commute. As they leave to go to work, many are faced with the decision of whether to leave their dog alone or allow them to enjoy the day socializing with other dogs.

**Dogs are social beings. Sure, there are some dogs that prefer to be alone, but the majority of dogs enjoy playing, wrestling, and spending time with others. For pet parents, the decision on where to socialize their pet can be daunting. Safety and health are at the top of the list when deciding where and when to socialize your pet.**

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If that sounds at all like you and your dog, then you are not alone. But that sociability can come at a cost.

Preventing the spread of infectious disease is difficult. Viruses and bacteria are extremely crafty and constantly evolving. Despite rigorous efforts and novel design strategies aimed at eradicating disease, infectious agents still can be opportunistic invaders in the absence of diligent prevention strategies. Part of what makes fighting these organisms so challenging is the complexity of each infectious agent, their movement (transmission mode), their ability to jump from pet to pet (infectivity), and their ability to cause serious illness (pathogenicity and virulence). Individual, population, and environmental variability between pets makes the fight against

these diseases more difficult. Importantly, some of these bacteria and viruses can cause illness in people, which only further highlights the importance of vigilance and protection.

One of the pillars of infectious disease prevention is vaccination.

Fortunately, some of the most virulent enemies (i.e. parvovirus, etc.) can be effectively neutralized with vaccination alone. However, the battle against infectious disease also includes more than just vaccination. Insect and wildlife control, disinfection, and hygiene (among others) are equally as important as an immunization.

Pet parents shouldn't have to play infectious disease roulette with their pets when dropping them off at a boarding facility. When the goal is to



do all you possibly can to ensure their safety, you start with vaccination.

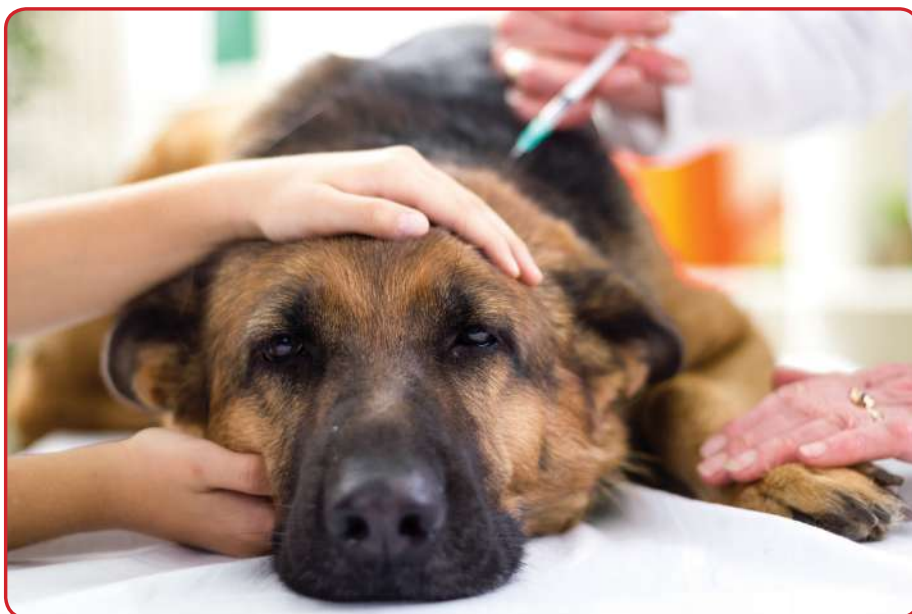
**Dogs should be up-to-date on the Core vaccinations.** The term Core in this sense signifies the central or most important part of the vaccination schedule. Diseases that are included in the Core vaccine category are distemper, adenovirus, parvovirus, and rabies. Puppies are vaccinated beginning at age 6-8 weeks and then every 2 to 4 weeks thereafter until age 16 weeks. The next vaccine is given one year later. After that, subsequent vaccination

boosters are given every 1 to 3 years. (Please see Chapter on DA2P)

Although vaccines outside of those 4 are considered “lifestyle” or non-Core vaccines, every dog that goes to a boarding facility is considered part of the “social lifestyle”. This means that vaccination with those 4 Core vaccines, in addition to *Bordetella*, parainfluenza, and dog flu (canine influenza), should be a priority. Some of these vaccines are given in the nose (intranasal) so they can provide rapid protection. Some intranasal vaccines can be used in puppies as young as 3 weeks of age (maternal antibodies won't interfere at the site of the vaccine), and only a single-nostril dose may be needed. These intranasal vaccines provide rapid protection beginning as early as 48 hours post-vaccination and, depending on how the

vaccine is labeled, it will provide a 1-year duration of immunity.

Dog flu has resulted in several large outbreaks among dogs associated with race tracks, shelters, and boarding facilities. Regular vaccination against the flu virus will help reduce these outbreaks. If your dog may be exposed in the future (i.e.



boarding, kennel, day care, grooming, obedience class, dog park, etc.), then vaccination is of utmost importance. There are two strains of the canine flu virus that have caused illness in dogs: H3N8 and H3N2.

Vaccinating against one strain does not protect your dog from the other. Ask your vet about a bivalent vaccine that will protect your pet from both strains of the virus simultaneously. Two doses of the vaccine should be given 2-4 weeks apart, and then annually thereafter.

In 2012, there were 7,249 reported cases of Lyme disease in California; in Connecticut, there were 58,957. So when it comes to certain diseases like Lyme disease (and leptospirosis), vaccination should be based on how common that disease is in your region and according to your dog's lifestyle. Considering these two factors will enable you and your veterinarian to “calculate” the risk posed to your dog and then ultimately make the best decision regarding vaccination.

The immune system is like a student; it needs to learn. Vaccines are the tutors that help the immune cells to learn faster. Despite excellent vaccines, some of the “students” of the immune system may fail when challenged by a vaccine. Vaccine failure is rare, but it does occur. This is why it’s important for your pet to be vaccinated in case they encounter a dog who has failed their vaccination. Conversely, it’s important for the other dogs in the community to be vaccinated in case it’s your dog that has failed a vaccine. There are also dogs that can’t receive vaccines for health reasons or pet parents who “opt out” of the vaccine schedule. If enough pet parents vaccinate their pets, then those that aren’t vaccinated will be protected as well. That’s called herd immunity and it’s a beautiful phenomenon, but it will only work with everyone committed to a diligent and regular vaccination schedule.

In summary, make sure your furry loved ones are protected against the “worst of the worst”: parvovirus, adenovirus, distemper, and rabies (Core vaccines). If your dog is going to a boarding facility, kennel, daycare, grooming facility, dog park, or any other social meeting place for dogs, then vaccination against parainfluenza, canine influenza, *Bordetella*, and adenovirus type 2 must be considered.

Being a pet parent is fun and rewarding. One of the greatest joys when spending time with your dog is watching them play and make new friends. Having them protected from some of the world’s microscopic dangers will not only keep your pet healthy, but it will allow you to spend less time worrying and more time snuggling.



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## Further Reading:

1. Greene CE, et al. Immunoprophylaxis and immunotherapy. In: Greene CE, ed. *Infectious Diseases of the Dog and Cat*, 3rd ed. Philadelphia: W.B. Saunders Co.; 2006.
2. Pardo MC, et al. Protection of dogs against canine distemper by vaccination with a canarypox virus recombinant expressing canine distemper virus fusion and hemagglutinin glycoproteins. *Am J Vet Res*. 1997;58(8):833-836.
3. Horzinek MC, et al. General description of vaccines. In: Pastoret PP, et al., eds. *Veterinary Vaccinology*. Amsterdam: Elsevier; 1997.
4. Roth JA, et al. New technology for improved vaccine safety and efficacy. *Vet Clin North Am Food Anim Pract*. 2001;17(3):585-597, vii.
5. Edelman R. Vaccine adjuvants: Preparation methods and research protocols. In: O'Hagan DT, ed. Clifton, NJ: Humana Press; 2000.
6. Spickler AR, et al. Adjuvants in veterinary vaccines: Modes of action and adverse effects. *J Vet Intern Med*. 2003;17(3):273-281.
7. Roth JA. Mechanistic bases for adverse vaccine reactions and vaccine failures. In: Schultz RD, ed. *Advances in Veterinary Medicine 41: Veterinary Vaccines and Diagnostics*. San Diego: Academic Press; 1999.
8. Dodds WJ. More bumps on the vaccine road. In: Schultz RD, ed. *Advances in Veterinary Medicine 41: Veterinary Vaccines and Diagnostics*. San Diego: Academic Press; 1999.
9. Hogenesch H, et al. Vaccine induced autoimmunity in the dog. In: Schultz RD, ed. *Advances in Veterinary Medicine 41: Veterinary Vaccines and Diagnostics*. San Diego: Academic Press; 1999.
10. Greene CE, et al. Canine vaccination. *Vet Clin North Am Small Anim Pract*. 2001;31(3):473-492, v-vi.
11. Ford RB, et al. Vaccines and vaccination programs for the 21st century. In: Bonagura JD, ed. *Kirk's Current Veterinary Therapy XIII*. Philadelphia: W.B. Saunders Co.; 2000.
12. Frana TS, et al. Summary of adverse event reports for veterinary biologic products received by the USDA from 1999 through 2005. *J Am Vet Med Assoc*. 2006;229(7):1100-1102.
13. Frana TS, et al. Postmarketing surveillance of rabies vaccines for dogs to evaluate safety and efficacy. *J Am Vet Med Assoc*. 2008;232(7):1000-1002.
14. Schultz RD. Considerations in designing effective and safe vaccination programs for dogs. In: Carmichael LE, ed. *Recent Advances in Canine Infectious Diseases*. International Veterinary Information Service; 2000. Available at: <http://www.ivis.org/>. Accessed August 2011.
15. Martinod S. In: Pastoret P, et al., eds. *Adverse Effects of Vaccination in Veterinary Vaccinology*. Amsterdam: Elsevier; 1997.
16. Meyer EK. Vaccine-associated adverse events. *Vet Clin North Am Small Anim Pract*. 2001;31(3):493-514.
17. Phillips TR, et al. Effects of vaccines on the canine immune system. *Can J Vet Res*. 1989;53(2):154-160.
18. Moore GE, et al. Postmarketing surveillance for dog and cat vaccines: new resources in changing times. *J Am Vet Med Assoc*. 2005;227(7):1066-1069.
19. Carmichael LE. Vaccines for dogs. In: Pastoret P, et al., eds. *Veterinary Vaccinology*. Amsterdam: Elsevier; 1997.
20. Carmichael LE. Canine viral vaccines at a turning point—a personal perspective. In: Schultz RD, ed. *Advances in Veterinary Medicine 41: Veterinary Vaccines and Diagnostics*. San Diego: Academic Press; 1999.
21. Schultz RD, et al. Canine vaccines and immunity. In: Kirk RW, ed. *Current Veterinary Therapy VI*. Philadelphia: W.B. Saunders Co.; 1977.
22. Schultz RD. Theory and practice of immunization. In: Kirk RW, ed. *Current 285 Veterinary Therapy VII*. Philadelphia: W.B. Saunders Co.; 1980.

# About the Authors and Editor





**Kathryn Primm, DVM**, is the owner and founder of Applebrook Animal Hospital in Ooltewah, Tennessee. She also enjoys writing, 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. She is a host of two pet shows on Pet Life Radio.

Dr. Primm was also the nation's first Fear Free<sup>sm</sup> Certified Professional and is the Module Chair for a second level of certification for Fear Free. She spoke nationwide in 2017 about implementing strategies to help pets feel safer and more comfortable at the vet hospital, and continues with speaking engagements at conferences in 2018.

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 under way, with more stories about the animals that Dr. Primm treats and the people who love them.



**Courtney Campbell, DVM**, is a graduate of Tuskegee University School of Veterinary Medicine. He currently works at VetSurg, a surgical specialty center in Ventura, California. Dr. Campbell has been involved in a variety of national media endeavors, including becoming a regular guest on programs such as *The Doctors*, *Home and Family*, *The Real*, *Dueling Doctors*, and *The Boris and Nicole Show*, and was the featured veterinarian on The Pet Collective's YouTube channel *Ask a Vet*. He is now the co-host of *Pet Talk*, a first-of-its-kind talk show dedicated to the wonderful world of pets. He launched his podcast, *The Dr. Courtney Show*, on Pet Life Radio in 2017.



**Steve Dale, CABC** (Certified Animal Behavior Consultant), is the author of a popular blog, [www.stevedalepetworld.com](http://www.stevedalepetworld.com). He is host of two national radio shows and is heard on WGN Radio, Chicago. Among his books are the ebooks "Good Dog!" and "Good Cat!" He's a co-editor of "Decoding Your Dog," authored by the American College of Veterinary Behaviorists. He's a contributor to "The Cat: Clinical Medicine and Management." He's contributed to dozens of books and publications and is a columnist for Catster and Veterinary Practice News. His multiple awards include Nobivac Gold Paw Journalist of the Year Award and the AVMA Humane Award, and he's an inductee in the Dog Writer's Hall of Fame.



**Madeleine Stahl, DVM**, holds a Doctor of Veterinary Medicine degree from Purdue University College of Veterinary Medicine, as well as a Bachelor of Science in Biology from Purdue University. After graduation, she practiced small animal medicine in New Jersey and Virginia, as well as held several positions in sales, training, and technical services within the animal health industry. She is currently an Associate Director of Scientific Marketing Affairs in Merck Animal Health's companion animal business unit and has a special interest in canine and feline infectious diseases and endocrine disorders.

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