

Canine Influenza

Canine influenza (CIV) is a highly contagious respiratory disease of concern to boarding facilities, shelters, rescue groups, and anywhere dogs gather or are co-housed. Here's the latest information on the clinical signs to watch out for, diagnostic testing and treatment options, and what to do if you have a suspect case of CIV in your facility.

This Update on Canine Influenza results from a cooperative partnership between the University of Wisconsin Shelter Medicine Program and the UC Davis Koret Shelter Medicine Program.

If you are looking for information about the June, 2019 outbreak in California, please [see the UW Shelter Medicine Program press release](#)

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Introduction

Although influenza viruses may have infected some dog populations prior to 2004, the first recognized outbreak of canine influenza occurred in racing greyhounds in Florida in January 2004^[1]. After its first appearance, canine influenza spread across much of the US, affecting dogs in animal shelters, adoption groups, pet stores, boarding kennels, and veterinary clinics. In general, influenza infections have become less common in recent years with the exception of a small number of shelters and communities in which illness has become endemic. Current information about numbers and locations for confirmed cases have been found for both strains of canine influenza on a state by state basis is available at [Cornell's Animal Health Diagnostic Center website](#).

Previous outbreaks of influenza in the US have been linked to the H3N8 strain which jumped species from an equine origin. In March 2015 a different strain of influenza of avian-origin H3N2 caused a widespread outbreak of respiratory disease in pet dogs and dogs in shelters. This strain was first detected in 2006 in Korea, spread to Thailand and China, and now is in the US.

Since March 2015, the H3N2 strain has been confirmed in hundreds of dogs in the outbreaks in the Chicago area, Atlanta and in other communities across the continental US. Testing confirmed the H3N2 strain infected several dogs in an outbreak at two Northern California shelters in June, 2019.

H3N2 remains uncommon in most areas but since the vast majority of dogs in the US are likely susceptible, shelters should use caution when admitting dogs from affected shelters as well as monitoring for and isolating dogs with clinical signs of respiratory disease. Surveillance testing may help with early detection of the virus in individuals, communities and shelters.

What is canine influenza?

Canine influenza is an enveloped virus with segmented RNA. Dogs are the primary susceptible species.

Canine influenza can affect all ages and all breeds of dogs. Greyhounds in the initial H3N8 outbreak were more severely affected than has been the norm for uncomplicated infections in other dogs including dogs in shelters. Dogs who are otherwise compromised may suffer more severely. Overall mortality rates for canine influenza are very low.

Published reports describe infections with the H3N2 virus in cats in Korea^[2]. In 2016 a small group of cats in an Indiana shelter tested positive for H3N2 canine influenza. The cats exhibited nonspecific signs of upper respiratory infections. All dogs in the shelter were infected or recovering from H3N2 at the time. The cats were not housed with dogs. All cats were quarantined and no spread of H3N2 in cats has been detected beyond the shelter despite surveillance testing and many instances of substantial exposure. In late 2016 a large number of cats in New York City were found to be infected with H7N2 avian influenza which was unrelated to canine influenza and no dogs in the shelter were found to be infected with influenza.

There is no evidence at this time that dogs infected with either H3N8 or H3N2 pose a risk to humans.

Disease course (incubation and recovery)

The incubation period is normally 2-5 days from exposure to onset of clinical signs for infections with H3N8 with peak viral shedding occurring 2-4 days post-exposure. This means that *dogs infected with H3N8 may be at their most infectious prior to showing clinical signs of disease*. In dogs experimentally and naturally infected with H3N8, viral shedding ceases quickly, by 7 days post-infection. This short duration of viral shedding may also make diagnostic testing difficult. Clinical signs would often be the trigger for testing but virus may no longer be detectable once signs are seen.

Although a percentage of dogs may be sub-clinically infected as described below, there is no true carrier state for canine influenza. The short shedding period of H3N8 and absence of a carrier state is helpful for shelters trying to minimize disease spread within the shelter and community – it is unlikely that dogs pose a significant infectious risk a week or more after infection.

Conversely, H3N2 has been shown to have a prolonged shedding time³. Infected dogs have shed viable virus up to 20-24 days past the onset of clinical signs. In some cases, viral shedding may be intermittent with several negatives between positive tests. Because of this, longer isolation periods (21 days) are recommended for infected dogs. Shelters that attempted to reintroduce recovered dogs into their general, healthy population sooner than 21 days after the onset of illness experienced many new infections in dogs exposed to the recovered dogs.

Clinical signs

When canine influenza first strikes a given population, a large percentage of dogs will become infected in a wave like pattern with up to 20% of the population showing no signs of disease. All exposed dogs should be considered an infectious risk, whether or not they are showing signs of respiratory infection. In most dogs, signs of infection are similar to canine infectious respiratory disease (“kennel cough”), and may include:

- Mild low-grade fever
- Soft, moist (productive) or dry, honking cough lasting 10-30 days
- Poor response to antibiotics or antitussives
- +/- thick, purulent/mildly bloody nasal discharge
- Decreased appetite and activity

After the initial onset of coughing, 10-20% of dogs may progress to a more severe form of infection, including:

- High fever (104-106 F)
- Pneumonia
- Death (overall fatality rate varies and is between 1-5%)

The severity of illness is not strain dependent, but depends on overall age and immune status of dog.

Is it flu or something else?

There is no way to distinguish canine influenza from other causes of respiratory disease based on clinical signs alone but rapidly increasing incidence of disease in the population should trigger surveillance testing in shelters. Ultimately, diagnostics are required to confirm canine influenza. Some factors which raise the suspicion of influenza include:

- History of recent introduction of a high risk dog into the shelter population, such as a dog from a canine influenza endemic area or a racing track
- In endemic areas, history of group training, vet clinic visits, daycare, and boarding kennels
- Percentage of dogs affected: In non-endemic areas, no dogs will have immunity when influenza first strikes, and it is likely that large numbers of dogs will be infected. If only a few dogs are sick, even if the clinical signs are consistent with flu, it is probably not canine influenza
- Age: Canine influenza can affect dogs of all ages, while other respiratory infections often affect puppies more severely
- Vaccinated dogs affected: Vaccination provides good protection against canine distemper and moderate protection against other agents of canine respiratory disease. If a high percentage of well-vaccinated dogs are severely affected, influenza is more likely
- Change in character of respiratory signs in a particular shelter – honking cough
- Possibly more severe signs, including fever and pneumonia
- Poor response to antibiotics (however, secondary infections may respond to antibiotics)
- Co-infections are possible: Background disease will continue to occur in concert with canine influenza – so a diagnosis of canine distemper, Bordetella, etc. does not rule out canine influenza infection

Diagnosis

Available tests for H3N8 canine influenza include in-house ELISA test

kits, rRT-PCR, and serology. Serology can confirm infection retrospectively, however, the 3-week delay in confirmatory results limits its usefulness in an active outbreak. As of July 2015, diagnosis of H3N2 can be made by rRT-PCR from Wisconsin Veterinary Diagnostic Lab (WVDL), IDEXX, or Cornell. WVDL and IDEXX both offer pricing discounts to animal shelters. An H3N2-specific serologic test is available through Cornell Animal Health Diagnostic Center. Although a positive test is indicative of infection, canine influenza should not be ruled out based on negative test results.

To receive discounted shelter pricing for influenza testing through the WVDL please contact the UW Shelter Medicine Program:
uwsheltermedicine@vetmed.wisc.edu

Influenza diagnostic test options (as of June 2015):

PCR University of Wisconsin (WVDL), IDEXX, Cornell University and others

For H3N8, positives are most likely before onset of signs in recently exposed dogs. Viral shedding may not persist after onset of signs. Negative results do not necessarily rule out disease.

H3N2 has been well detected in dogs who have recent clinical signs as well as many dogs who have recovered. Shedding may be intermittent so negative results do not necessarily rule out disease.

Testing may be specific for each strain or a broad based assay may be combined with typing. Labs have begun to report positives either for specific strains or for influenza A.

Flu Antigen ELISA [Becton Dickinson, Quidel Quickvue](#)

In-house influenza test designed for humans, may also detect canine influenza H3N2 and H3N8 but has not been validated for dogs. A positive would not distinguish between the two strains. Most sensitive in first 2-3 days of clinical signs. False negatives possible but uncommon. Test kits come in batches of 20, cost comes out to approx. \$10- \$25/ test.

Animal shelters may qualify for assistance with diagnostic testing from Cornell; for more information contact Dr. Crawford in the Department of Small Animal Clinical Sciences at the University of Florida College of

Veterinary Medicine at crawfordc@ufl.edu.

Prevention and control

Transmission

As noted, virus may be excreted for up to three days before clinical signs develop. Once disease is diagnosed, it is necessary to count back several days to determine which dogs may have been exposed.

The virus is shed primarily in respiratory discharge and transmission can be via direct contact, fomites (contaminated objects such as hands, surfaces, clothing, etc.), droplets, and aerosol spread. In a few cases, dog handlers have carried virus home on clothing to infect their own dogs, so a change of clothes between work and home should be routine in any shelter in which canine flu is a concern (as it should be at all times).

Although separate ventilation areas are ideal to control spread, some shelters and veterinary clinics have managed isolation in areas without separate air supply with strict attention to fomite control. See notes on aerosol transmission at the end of this document for further information.

Disinfection

Canine influenza persists less than week (usually 12-24 hours) in the environment. It will be inactivated by most commonly used disinfectants such as accelerated hydrogen peroxide (e.g. Rescue®), isopropyl alcohol, bleach, quaternary ammonium compounds, and potassium peroxymonosulfate (e.g. Trifectant®).

Vaccination

Subcutaneous killed vaccines are available for canine influenza, however, they are currently only known to be effective against H3N8. It is unlikely these vaccines are effective against the H3N2 strain. These vaccines are labeled to reduce the severity of clinical signs and decrease the duration of viral shedding, though like many respiratory vaccines they may not completely prevent infection.

The vaccine is labeled for use in puppies 6 weeks of age and older, and should be given as two injections, 2-4 weeks apart. The requirement for a booster means there is a 4-6 week delay in onset of immunity which limits the usefulness of this vaccine in most shelters, but it should be considered for pet dogs that stay in boarding kennels, attend doggy day care centers, frequent dog parks, or otherwise congregate with other

dogs, especially in areas known to be endemic for canine influenza.

The series of two vaccines should be completed at least two weeks before boarding to allow for optimal immune response. This vaccine may also be useful for shelters in H3N8 endemic areas if dogs frequently stay for a prolonged period, or for shelters transferring dogs from non-endemic to endemic areas (to be administered *prior to transfer* into an endemic area).

Treatment

Although there is no specific treatment for canine influenza viral infection, secondary bacterial infection may play a significant role and antibiotics are often indicated. Broad spectrum antibiotic treatment is indicated for moderate to severe cases. Antibiotics commonly used for treatment of canine infectious respiratory disease complex (“kennel cough”), such as doxycycline, Clavamox, or Baytril, may help to control secondary infections.

Canine respiratory panel testing can help identify co-pathogens and help to rule in or out particularly problematic co-infections, such as Strep. Zooepidemicus or canine distemper virus. In severely ill dogs, thoracic radiographs, trans-tracheal wash and culture and sensitivity testing may be indicated to diagnose pneumonia and determine the best antibiotic choice. Supportive care includes monitoring and supporting nutrition as well as hydration through subcutaneous or IV fluid therapy. Cough suppressants do not tend to be helpful and should be avoided in dogs with a productive cough.

What about Tamiflu?

Oseltamivir (Tamiflu®) is a drug developed for treatment of influenza in humans. This drug should not be used for treatment of canine influenza at this time. There are several reasons for this. We do not currently know the appropriate dose and duration for treatment of dogs. More importantly, Tamiflu® represents a primary line of defense against a human influenza pandemic.

Outbreak management

As with any outbreak, management requires breaking the cycle of transmission between exposed, infected and new incoming dogs. The relatively short period of shedding for H3N8 makes infections more manageable in a population than infections with H3N2, which can have a

prolonged incubation and shedding period up to 20 days.

Breaking the cycle can be very difficult if large numbers of dogs in the community are infected since new intakes may have had community exposure. Because viral shedding occurs so early the course of disease some new intakes may be infectious without or prior to showing obvious clinical signs. Even with cautious evaluation at intake and ongoing monitoring, in regions with an active community outbreak it is very likely that reintroduction may happen.

Still, shelters that have instituted the practices listed below, have been remarkably successful at limiting or controlling spread of the virus within the shelter. Diligent monitoring and very prompt isolation of dogs with known exposure and those who develop clinical signs lowers the infectious dose in the environment lowering the risk for the entire population.

Because susceptibility to either strain is common in dogs, when a first case is identified within the shelter, an assessment of possible exposure to other dogs should be made. Unless an unusually high level of transmission control and separation between wards has been in place, most or all dogs in the shelter should be considered possibly exposed and at risk.

Exposed dogs with no clinical signs should be quarantined for 7 days prior to interacting with or being housed with unexposed dogs. Even if not clinically ill, dogs may pose an infectious risk during this time.

If clinical signs do develop, an isolation period of **7 days past the first clinical signs** is recommended for dogs who have illness associated with **H3N8** infections, while for **H3N2** a **21 day isolation period** is recommended for infected dogs. For H3N2 infections, shedding and infectious potential may persist even following recovery from clinical signs for up to 20-24 days after the first clinical signs.

For H3N8, shelters that can discontinue or divert intake for two weeks (7 day quarantine followed by 7 days of isolation = 14 days), the outbreak may run its course. For H3N2, a 28 day hold on intake would be required (7 days of quarantine followed by 21 days of isolation for dogs who become ill.) However, if exposure is not complete early on but continues throughout the holding period, then the time for the outbreak to run its course may be prolonged for either strain of the virus. When closing to intake is not an option, the following steps can help manage an outbreak:

- **Create a “clean break” - a separate intake ward for un-exposed dogs, ideally with separate ventilation, equipment, and**

caretakers who are dedicated to that “clean” area only. For example, if a shelter has two wards, one for stray and one for adoptable dogs, collect all exposed dogs into the stray ward and take in new strays into the adoptable ward. Dogs in the “clean” area should not share contact with caretakers or environments (e.g. Hallways, play yards, meet and greet rooms, medical areas) from the “exposed” group. Dogs in the “clean” area should be monitored twice daily. Any dog who develops clinical signs of respiratory disease should be immediately removed from the “clean” area.

- **If possible, isolate sick dogs separately from exposed dogs not showing clinical signs.** When a dog begins to show clinical signs remove them promptly to an isolation area for sick animals.
- For shelters with a single ward for all dogs or poor ability to create separation between wards: to avoid depopulation or ongoing disease spread, either **divert new intakes to another facility or send exposed dogs offsite for quarantine.** The most practical way to accomplish this depends on resources in the community:
 - Veterinary hospital or boarding clinic may be used to divert new intakes – owners will need a limited number of places to look for lost pets
 - Foster care with no other dogs in household may be appropriate to hold exposed dogs for a quarantine period – foster parents need to be instructed to keep dogs away from other dogs or environments where other dogs may become exposed.
 - For single ward shelters that are not yet affected by canine flu and rescue groups that would like to support them in the event of an outbreak, this is a great thing to think about beforehand. Muster resources ahead of time if possible.
- Release exposed dogs to responsible adopters and rescue groups willing to complete the quarantine or isolation holding and provide adequate treatment
 - For dogs that are clinically ill, require agreement to quarantine for 20 days if H3N2 is confirmed or suspected and for 7 days if H3N8 is confirmed or suspected. For dogs that are exposed but not clinically affected, isolate for 7 days.
 - Advise reclaiming owners of risk to other dogs and potential for illness to develop

What does adequate isolation look like?

- Only limited, designated staff or volunteers permitted to enter quarantine/isolation areas
- Separate jumpsuits (full clothing coverage), gloves, boots or shoe covers

- Separate cleaning, feeding and treatment supplies
- Separate ventilation (when possible): ideally separate by full wall and door – a designated area within a common air space may not be sufficient but is likely better than no separation / isolation at all

What if it keeps coming back?

Some communities may become “endemic” for canine influenza. In such cases, newly infected dogs may enter the shelter routinely, just as they now do with other infectious diseases. Where canine influenza is a constant, shutting down for two weeks to a month every time a case is identified is not practical or recommended. Under these circumstances, it is nevertheless important to protect incoming dogs, the community and adopter’s other pets.

Recognition of clinical signs and isolation of sick dogs remains essential to help control the spread of disease. When dogs who are at risk of viral shedding or developing illness are placed for adoption, adopters should be clearly advised (verbally and in writing) of the possible risk to other dogs and warned to keep the dog strictly isolated - *including fomite control* - from other dogs until the recommended quarantine and / or isolation period has passed. If veterinary care is necessary, the veterinarian should be advised ahead of time of the risk that the dog may be infected with canine influenza.

Dogs who have been ill and have been held through an isolation period that matches the strain of virus (7 days or 21 days) have a very low likelihood of become ill or infecting other dogs. Since infection likely leaves the dogs with immunity to infection for at least a year or two, these are the dogs are excellent dogs to adopt into the community!

Pro-active communication

Rapid communication can help other shelters and animal facilities get prepared, protect the shelter’s reputation, and gather assistance to manage an outbreak. As in any outbreak, communicate early and often. Target groups to advise of the outbreak include:

- Recent adopters
- Local and state veterinary associations, shelters, and rescue groups
- State veterinarian
- Public health officials
- Media
- Shelter legal counsel

Possible resources to help manage an influenza outbreak include:

- Local veterinarians
- Veterinary schools
- Dr. Sandra Newbury, Director, University of Wisconsin Shelter Medicine Program (H3N2) uwsheltermedicine@vetmed.wisc.edu
- UC Davis Koret Shelter Medicine Program
- Dr. Cynda Crawford, University of Florida at crawfordc@ufl.edu (H3N8)

National shelter support agencies such as the ASPCA, HSUS, AH, NACA, Association of Shelter Veterinarians (ASV).

Preparation: what you can do now to protect your shelter and community

1. Prepare an outbreak management plan

I. Role of community, veterinary clinics, rescue groups, other shelters

II. Chain of communication

2. Educate staff and volunteers about the signs and risk factors for canine influenza

3. Quarantine high risk dogs for 1 week - For communities with active illness

I. Recent history of boarding

II. Recent transfer from high risk area

4. Vaccinate with modified live DHPP and Bordetella on intake. These vaccines will not prevent canine influenza, but will help decrease the incidence and severity of canine respiratory disease for other reasons, decreasing the occurrence of false alarms.

5. Train staff to be alert to signs of respiratory infection, and provide written and oral instructions for all staff members and volunteers letting them know what to do if they notice a dog with signs of respiratory disease (e.g. don't take that dog for a walk, notify medical staff, post a sign on the dog's run)

6. Isolate all dogs showing signs of respiratory infection. As with other respiratory pathogens, mildly affected dogs may transmit severe disease to others. Clean contaminated clothing, hands, equipment and surfaces

after exposure to a dog with respiratory disease.

7. For shelters that have contact with owned pet animals, such as obedience classes or vaccine clinics held at the shelter, make sure areas are cleaned and employees wash hands and change clothing between caring for shelter animals and handling pet animals. Remember, when influenza first arrives in a community, few dogs will be immune, no matter how well vaccinated and cared for.

Information for pet owners

Preparation: what pet owners can do now to protect their dog's health

1. Make sure your pet is following a vaccine schedule as recommended by a veterinarian. Vaccinations decrease the likelihood and severity of several canine respiratory infections. Vaccination against "kennel cough" is generally indicated for dogs at risk for exposure to other dogs, such as at a boarding kennel, doggie day care, agility trials, dog shows, etc. Vaccines should be given at least one week before exposure, and may need to be boosted as often as every six months.
2. If you board your pet, make sure that the kennel is clean and well-maintained, and has a plan for immediately isolating and caring for any dogs that develop signs of "kennel cough" or other disease in a completely separate area (at least 50 feet from healthy dogs or with a separate air supply).
3. Do not take your pet to dog parks or other places with many dogs if he or she has signs of kennel cough or other infectious disease, and for three weeks after recovery.
4. Make sure your pet has current ID tags with your address and phone number clearly displayed. This will ensure that the animal can be returned promptly to you in the event of an escape, and will prevent exposure to respiratory infections in an animal shelter.
5. Keep your pet in overall good health. A strong immune system will be your dog's best defense against infection.

Notes on aerosol transmission

Aerosol transmission may play a significant role in the spread of canine influenza. Spread may be similar to that of other highly contagious canine respiratory infections such as canine distemper, transmission of which has

been observed over distances of up to 20 feet, even from non-coughing dogs (personal communication, Max Appel, Cornell University, 2005).

In a few cases of confirmed canine influenza, severely ill animals have been treated in intensive care units where separate air space was not possible, and no transmission was observed to other dogs in the ward (very strict attention was paid to fomite control). However, the safety of this practice can NOT be assured. Although entirely separate ventilation systems may not be necessary, every effort should be made to keep infected animals in a separate air space, or separated from other animals by at least 50 feet. If dogs must be treated in the same air space as other animals, strict attention to fomite control is still a worthwhile precaution, although it will not eliminate all risk of spread.

Acknowledgements:

Many thanks to the following individuals for their help with preparation of this material:

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Shelter Vet *To Go!*

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