



Canine Influenza

April 22, 2015

Causative agent

Canine influenza (CI), or dog flu, is a highly contagious infection caused by an influenza A virus. The causative canine influenza virus (CIV) strains have been classified as H3N8 and H3N2, based on the amino acid composition of the hemagglutinin (H) and neuraminidase (N) glycoproteins in the lipid outer layer of the capsid. These glycoproteins facilitate entry into and release from host cells, and are important targets for antibodies against the virus (generated as a result of infection or response to vaccination). The viruses are 80-120 nanometers (nm) in diameter, and consist of a core of eight separate pieces of single-strand ribonucleic acid (RNA) surrounded by a spiked arrangement of glycoproteins.



H3N2 canine influenza appeared limited to Korea, China and Thailand until 2015, when an [outbreak that started in the Chicago area](#) was determined to be due to an H3N2 strain.

The H3N8 canine influenza virus represents a very rare event in adaptive evolution; the entire genome of the H3N8 equine influenza virus was transferred to dogs, and the virus adapted to the canine species to emerge as a new canine-specific virus.

The canine H3N2 strain, on the other hand, emerged in Asia in 2006-2007 among dogs suffering from respiratory disease. This strain in Asia likely arose through the direct transfer of an avian influenza virus – possibly from among viruses circulating in live bird markets – to dogs. The new canine virus spread widely among dogs in South Korea and in several regions of China, and caused an outbreak of respiratory disease among dogs in Thailand in 2012. In 2015, a canine H3N2 that was genetically almost identical to the Asian strain was detected in the United States. Although

rumors have circulated that the virus was introduced to the U.S. through dogs rescued and imported from Asia, there is no evidence to confirm these rumors.

Canine influenza is a reportable disease in some U.S. states.

Natural distribution

The first recognized outbreak of H3N8 canine influenza occurred in racing greyhounds in January 2004 at a track in Florida. From June to August of 2004, outbreaks of respiratory disease were reported at 14 tracks in 6 states (Florida, Texas, Alabama, Arkansas, West Virginia, and Kansas). Between January and May of 2005, outbreaks occurred at 20 tracks in 11 states (Florida, Texas, Arkansas, Arizona, West Virginia, Kansas, Iowa, Colorado, Rhode Island, and Massachusetts). Since then, the H3N8 canine influenza has been documented in 30 states and Washington, DC. The H3N8 strain of canine influenza virus is endemic in areas of Colorado, Florida, New York, and Pennsylvania.

The [first recognized U.S. outbreak of H3N2 canine influenza](#) occurred in 2015, starting in Chicago and spreading to other Midwestern states.

Outbreaks are more commonly seen in situations where groups of susceptible dogs are in close contact, such as shelters, kennels, dog day care facilities, and boarding facilities.

Transmission

Canine influenza is spread via aerosolized respiratory secretions and contaminated objects (kennel surfaces, food and water bowls, collars and leashes) and people moving between infected and uninfected dogs. The virus can remain viable (alive and able to infect) on surfaces for up to 48 hours, on clothing for 24 hours, and on hands for 12 hours.

The incubation period is usually two to four days from exposure to onset of clinical signs. The highest amounts of viral shedding occur during this time; therefore, dogs are most contagious during this 2-4 day incubation period when they are not exhibiting signs of illness. Virus shedding decreases dramatically during the first 4 days of illness but may continue up to 7 days in most dogs and up to 10 days in some dogs.

Because this is still an emerging pathogen, all dogs, regardless of breed or age, are susceptible to infection and have no naturally acquired or vaccine-induced immunity when first exposed to the virus. If the virus enters a kennel or other closed group, a high percentage of the dogs may become infected, and most of these dogs will be symptomatic. Although most dogs have a milder form of canine influenza and recover without complications, some may develop severe pneumonia. Approximately 20-25% of infected dogs are expected to remain asymptomatic, but can still shed the virus and spread the virus.

Pathology and Clinical Signs

The canine influenza virus infects and replicates inside the cells of the respiratory tract, from the nasal lining to the terminal airways. The inflammatory response results in rhinitis, tracheitis, bronchitis and bronchiolitis. The pathologic process also involves the death of the epithelial cells lining the respiratory tract, resulting in exposure of the underlying basement membrane. This, in turn, predisposes the respiratory tract to secondary bacterial infections that contribute to the nasal discharge and coughing.

Virtually all dogs that are exposed become infected with the virus, but approximately 80% develop clinical signs of disease. The approximately 20% of infected dogs that do not exhibit clinical signs of disease can still shed the virus and can spread the infection.

Like other mammalian influenza viruses, canine influenza virus causes an acute respiratory infection in dogs. However, unlike human influenza, CIV is not a "seasonal" flu – infections can occur year-round. Canine influenza virus infection often resembles the illness associated with canine infectious tracheobronchitis ("kennel cough"), which is caused by one of more bacterial and viral infections (including *Bordetella bronchiseptica*/parainfluenza virus).

The majority of infected dogs exhibit the mild form of canine influenza. In the mild form, the most common clinical sign is a cough that persists for 10 to 21 days despite treatment with antibiotics and cough suppressants. Affected dogs may have a soft, moist cough or a dry cough similar to that induced by kennel cough. Nasal and/or ocular discharge, sneezing, lethargy and anorexia may also be observed. Many dogs develop a purulent nasal discharge and low-grade fever. The nasal discharge is usually caused by secondary bacterial infections, including *Pasteurella multocida* and mycoplasma species.

Some dogs are more severely affected with clinical signs of pneumonia, such as a high-grade fever (104°F to 106°F) and increased respiratory rate and effort. Thoracic radiography (chest x-rays) may reveal consolidation of lung lobes.

During the initial outbreaks in greyhound facilities, severe bronchopneumonia, fibrinous pleuritis, and hemorrhages in the lungs, mediastinum and pleural cavity were observed, as well as acute death. This syndrome has not been reported in pet dogs.

Diagnosis

Canine influenza cannot be diagnosed solely by clinical signs because the clinical signs (coughing, sneezing and nasal discharge) are similar to those associated with all of the other respiratory pathogens and cannot be differentiated from them.

Antibodies to canine influenza virus may be detected in the blood as early as seven days after onset of clinical signs, and the virus may be identified in nasal or pharyngeal swabs during the first 4 days of illness. The most reliable and sensitive method for confirmation of infection is serologic testing. Paired acute serum samples (taken within the first 7 days of illness) and convalescent serum samples (taken 10-14 days later) are necessary for diagnosis of recent infection. If an acute sample is not available, a convalescent sample will indicate whether a dog has been exposed to the virus at some point in the past. A diagnosis of canine influenza is made based on a four-fold increase in antibody titer from the acute to the convalescent sample. Serologic testing is available for both H3N8 and H3N2 canine influenza. For example, when requesting tests through the Cornell University Animal Health Diagnostic Center, veterinarians should request canine influenza HAI; the testing will be done automatically for both H3N8 and H3N2 viruses, and they will get a differential titer.

If a dog has been ill for less than 4 days, nasal and pharyngeal swab submission for Polymerase Chain Reaction (PCR) testing can be performed. Nasal swabs may yield better results than nasopharyngeal swabs. If the PCR indicates a positive result, the dog is most likely infected. Negative PCR results may be falsely negative if the swabs are not collected during the time of peak virus shedding. After 4 days of illness, PCR results are less likely to be reliable. Serology should be performed to confirm infection, especially if the PCR results are negative and the case is highly suspicious for canine influenza infection.

Other diagnostic options applicable to dogs that have died from pneumonia are viral culture and PCR analysis using fresh (not formalin-preserved or frozen) lung and tracheal tissues.

In-house ELISA tests designed to detect influenza types A and B in humans may also be helpful in early diagnosis of CIV.

Treatment

Veterinary expertise is required to establish the best course of treatment or treatment options. As for all viral diseases, treatment is largely supportive. Good husbandry and nutrition may assist dogs in mounting an effective immune response. Most dogs recover from canine influenza within 2-3 weeks. The presence of secondary bacterial infection, pneumonia, dehydration, or other health factors (e.g., pregnancy, pre-existing pulmonary disease, immunosuppression, tracheal collapse, etc.) may warrant additional diagnostic and treatments including, but not limited to:

- Antimicrobials for known or suspected secondary bacterial infections: the selection may be based on results of culture and sensitivity testing of transtracheal aspirate; or broad-spectrum activity if aspirate and culture/sensitivity are not obtained.
- Nonsteroidal anti-inflammatory medications as needed to reduce fever and inflammation.
- Fluids to help correct dehydration or maintain hydration.

Treatment modifications should be made as needed, based on response to treatment, other health factors, and other factors such as compliance and animal care capabilities of the owner/caretaker.

Antiviral drugs are approved for use in humans only, and little is known about their use, efficacy and safety in dogs. Veterinarians who use approved drugs in a manner that is not in accord with approved label directions (e.g., use of an antiviral drug only approved for use in humans) must follow the federal extralabel drug use regulations of the [Animal Medicinal Drug Use Clarification Act \(AMDUCA\)](#).

Morbidity and Mortality

The morbidity rate (the number of exposed animals that develop disease) associated with canine influenza is estimated at 80%. Deaths occur mainly in dogs with the severe form of disease; the mortality rate is low (less than 10%). Higher case fatality rates have been reported in small groups of greyhounds that developed hemorrhagic pneumonia during outbreaks.

Prevention and Control

In veterinary, boarding and shelter facilities, the canine influenza virus appears to be easily killed by disinfectants commonly used in these facilities, such as quaternary ammonium compounds (eg, benzalkonium chloride), aldehydes, phenols and bleach solutions. Protocols should be established for thoroughly cleaning and disinfecting cages, bowls and other surfaces between uses. The virus may persist in the environment for approximately 2 days, and be viable on hands and clothing for up to 24 hours.

Employees should wash their hands with soap and water:

- Upon arriving at the facility
- Before and after handling each dog
- After coming into contact with dogs' saliva, urine, feces, or blood
- After cleaning cages
- Before eating meals, taking breaks, or leaving the facility
- Before and after using the restroom

Isolation protocols should be rigorously applied for dogs showing clinical signs of respiratory disease. Sick or exposed dogs should be isolated for two weeks. Clothing, equipment, surfaces and hands should be cleaned and disinfected after exposure to dogs showing signs of respiratory disease. Dog owners whose dogs are coughing or exhibiting other signs of respiratory disease should not participate in activities or bring their dogs to facilities where other dogs can be exposed to the virus.

There are currently two H3N8 CIV vaccines available, the first of which was approved by the USDA in May 2009; both are labeled as an aid in the control of disease, and contain inactivated whole virus. There is no U.S. commercial vaccine for the H3N2 strain of canine influenza virus, and it is unknown whether the H3N8 vaccines will provide any cross-protection against H3N2.

The canine H3N8 vaccine is intended as an aid in the control of disease associated with canine influenza virus infection. Although the vaccine may not prevent H3N8 infection altogether, efficacy trials have shown that it may significantly reduce the severity and duration of clinical illness, including the incidence and severity of damage to the lungs. In

addition, the vaccine reduces the amount of virus shed and shortens the shedding interval; therefore, vaccinated dogs that become infected develop less severe illness and are less likely to spread the virus to other dogs. These benefits are similar to those provided by influenza vaccines used in other species, including humans.

The canine influenza vaccine is a "lifestyle" vaccine, and is not recommended for every dog. In general, the vaccine is intended for the protection of dogs at risk for exposure to the canine influenza virus, which include those that either participate in activities with many other dogs or are housed in communal facilities, particularly where the virus is prevalent. Dogs that may benefit from canine influenza vaccination include those that receive the kennel cough (*Bordetella/parainfluenza*) vaccine, because the risk groups are similar. Dog owners should consult with their veterinarian to determine whether their dog's lifestyle includes risks for exposure to the canine influenza virus, and if vaccination is appropriate for their dog.

More Information about Canine Influenza

[Canine Influenza resources](#) (Iowa State University Center for Food Security & Public Health)

[Key Facts about Canine Influenza](#) (Centers for Disease Control and Prevention)

[Dog Owners: Canine Influenza FAQ](#) (University of Florida College of Veterinary Medicine)

[Sheltering Organizations: Canine Influenza FAQ](#) (University of Florida College of Veterinary Medicine)

[Canine Influenza Fact Sheet](#) (Iowa State University)

[Canine Influenza](#) (University of California-Davis Shelter Medicine Program)

[Canine Influenza Virus](#) (Cornell University Veterinary Diagnostic Laboratory)

[2015 Canine Influenza Outbreak in Chicago Area](#) (Cornell University Veterinary Diagnostic Laboratory)

References

Meyer M. UF veterinary researchers discover a new disease in dogs. *Explore: Research at the University of Florida*; 2006:11. Available at: <http://www.research.ufl.edu/publications/explore/v11n2/story3.html>. Accessed on April 22, 2015.

Crawford C. Canine influenza: Frequently asked questions from dog owners. *University of Florida*; 2009. Cornell University: College of Veterinary Medicine. Emerging issues - Canine influenza: Test summary for canine influenza virus in dogs not affiliated with greyhound racetracks *Animal Health Diagnostic Center*.

Crawford C. Canine influenza: Frequently asked questions from veterinarians. *University of Florida*; 2009.

Iowa State University. Canine Influenza. Available at: www.cfsph.iastate.edu/Factsheets/pdfs/canine_influenza.pdf. Accessed on August 19, 2009.

Canine Influenza FAQ: Questions, answers, and interim guidelines. *American Veterinary Medical Association*; 2015. Available at: <http://www.avma.org/KB/Resources/FAQs/Pages/Control-of-Canine-Influenza-in-Dogs.aspx>.

Cornell University: College of Veterinary Medicine. Emerging issues - Canine influenza virus. *Animal Health Diagnostic Center*, 2006.

United States Department of Agriculture. Animal and Plant Inspection Service. *Veterinary Services: Center for Veterinary Biologics* Center for Veterinary Biologics Notice No 09 13 Issuance of Licenses 2009 Available at: http://www.aphis.usda.gov/animal_health/vet_biologics/publications/notice_09_13.pdf. Accessed on April 22, 2015

Cole, L. McNally, A. APHIS issues conditional license for canine influenza virus vaccine. *United States Department of Agriculture. Animal and Plant Inspection Service*; 2009.