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# Strategies for Managing and Controlling Infectious Diseases in Shelters

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## Overview

Management and control of contagious infectious diseases in dogs and cats continues to be one of the biggest challenges facing shelters. Every shelter is at inherent risk for introduction of infectious agents into their facility on a daily basis with intake of animals from the community, many of which have acquired infections prior to entry. In addition, infected animals may be in the clinically silent incubation period at intake, and thus not recognized as an infectious risk. For these reasons, control and prevention of infectious animals entering the shelter is difficult, especially in open admission municipal shelters. While the risk for introduction of disease cannot be eradicated, there are sound and systematic strategies for minimizing the transmission of contagious infections within the shelter.

Canine and feline parvovirus and respiratory infections are the most common contagious diseases and frequently cause shelter-wide outbreaks, resulting in temporary halting of adoptions or depopulation due to severity of disease or numbers of affected animals. These infections represent a significant and frequent drain on shelter resources, including treatment costs, staff time, and staff morale. Holding animals for treatment and recovery adds to the number of animal care days until adoption, which in turn impacts the holding capacity for the shelter and contributes to potential for crowding. Many shelters do not have adequate isolation areas to house animals with contagious infections, so they are frequently kept in the general population, assuring the transmission and perpetuation of the pathogen so that it becomes an accepted "endemic" problem. These situations not only impact animal health and welfare, but also attract unfavorable scrutiny by the media and community.

This document provides a basic overview of strategies for management and control of parvovirus and respiratory infections in dogs and cats in shelters, but is applicable to other contagious or zoonotic diseases. The key strategies include: 1) population management and stress reduction; 2) vaccination of all dogs and cats on intake; 3) effective cleaning and disinfection; 4) segregation of juveniles from adults; 5) diagnosis; and, 6) removal of infected animals from the population and quarantine of exposed animals. ***The key to effective management and control of infectious diseases in shelters is overall reduction of environmental contamination and support of animal health.***

## Host, pathogen, and husbandry factors

Development of effective management and control strategies for infectious diseases is dependent upon knowledge of host, pathogen, and husbandry factors that contribute to risk for transmission. Many of these factors are shown in the table below. The synergistic interplay between these host, pathogen, and husbandry factors determines risk for infection.

| Host factors | Pathogen factors | Husbandry factors |
|---|---|---|
| Age (juvenile vs. adult) | Virulence | Crowding |
| Immune status | Incubation period | Random co-mingling |

| | | |
|---|---|---|
| Debilitation | Shedding period | Stress |
| Stress | Subclinical infection | Sanitation |
| | Persistent infection (carriers) | Ventilation |
| | Transmission routes | Chronic moisture |
| | Incomplete protection by vaccines | Untrained staff |
| | No vaccines for new pathogens | |

## Host factors

Kittens and puppies are the most susceptible to parvoviral and respiratory infections due to lack of protective immunity from maternally derived antibodies or from ineffective responses to vaccination. They typically enter shelters at an age when maternal immunity has waned to a level that does not protect against infection, but still interferes with responses to vaccination. Unvaccinated adult cats and dogs are also at risk for infection, but the clinical disease may be unapparent or mild. Juveniles and adults that are debilitated by poor nutritional status, parasitism, and stress from entering the shelter environment are more at risk for acquiring infections and may suffer from more severe or prolonged clinical disease..

## Pathogen factors

Inherent properties of pathogens also affect the risk for infection. Virulence, length of incubation period, preclinical shedding, duration of shedding, routes of transmission, and persistence in the environment significantly influence infection risk. The ability to establish subclinical infection or persistent infection increases the infectious dose of the pathogen.

**Parvoviruses:** The primary route of exposure to parvoviruses is nasal or oral contamination with virus-containing feces. The incubation period from time of exposure to onset of clinical disease ranges from 2 to 14 days, but typically is 5 to 7 days. Parvovirus shedding in feces starts within 4 days of exposure, so that healthy-appearing dogs and cats in the incubation period are already contagious ***prior*** *to* onset of clinical signs. Virus shedding continues for 14 days. Animals with subclinical infection or transient symptoms also shed infectious virus in feces. Transmission of parvoviruses occurs by direct contact with an infected animal or feces, by contact with contaminated fomites (cage or kennel surfaces, hands, clothing, food/water bowls, toys, litterboxes), and even by rodents and insects! The infected animal is covered with virus from head to toes, including the fur. Cats are susceptible to infection by canine parvovirus, but not vice versa.

**Canine parvovirus 2c (CPV 2c):** Two studies independently reported in 2007 the identification of CPV-2c in dogs with parvo-like disease in 11 states (AL, AR, AZ, CA, FL, GA, IL, KS, MO, OK, TX).[1,2] The coast-to-coast geographic distribution suggests that the newly emerging CPV-2c strain is probably widespread in the U.S. There is no evidence that CPV-2c is a more serious threat to dogs than CPV-2a or CPV-2b.

**Respiratory pathogens:** Viral pathogens are the more common primary cause of respiratory infections in dogs and cats in shelters. The known viral pathogens that cause canine infectious respiratory disease complex (CIRD) and feline

upper respiratory infections (URI) are shown below. Any one of these pathogens can cause a primary infection, but dogs and cats are often co-infected with more than one virus.

**Dogs**
Distemper virus (CDV)
Parainfluenza virus (CPiV)
Adenovirus type 2 (CAV)
Influenza virus (CIV)
Respiratory coronavirus (CRCoV0

**Cats**
Herpesvirus (FHV)
Calicivirus (FCV)

| Virus | Incubation period | Preclinical shedding | Duration of shedding | Subclinical infection | Persistent infection |
|---|---|---|---|---|---|
| CDV | 1-3 weeks | yes | >1 month | yes | no |
| CPiV | < 1 week | yes | 1 week | yes | no |
| CAV | < 1 week | yes | 1 week | yes | no |
| CRCoV | < 1 week | yes | 2 weeks | yes | no |
| CHV | < 1 week | yes | 2 weeks | yes | no |
| CIV | 2-4 days | yes | 7-10 days | yes | no |
| FHV | 2-6 days | yes | 3 weeks | yes | yes |
| FCV | 1-5 days | yes | >1 month | yes | yes (50%) |

The incubation period for the feline and canine respiratory viruses is <1 week except for CDV, which is typically 1-3 weeks. All have preclinical virus shedding during the incubation period, meaning infected animals are contagious ***before*** they have clinical signs. Most of the canine viruses are shed in respiratory secretions for 7 to 14 days, contributing to feasibility of quarantining exposed/affected dogs for 2 weeks before sending to adoption groups or new owners. CDV, FHV, and FCV are shed for at least a month or much longer, making quarantines unfeasible and too costly, and transfer to other groups too risky. Most of the pathogens cause subclinical infections which increases the number of exposed animals. Dogs and cats with clinical signs shed greater amounts of virus that significantly increases the infectious dose in the environment. None of the canine viruses establish persistent infection. However, most cats are persistently infected with FHV or FCV. Stress reactivates shedding of FHV, while cats infected with FCV are probably persistent shedders. All of the viral respiratory pathogens are transmitted by direct contact with respiratory secretions of infected dogs or cats, and by contact with contaminated fomites. Staff is the most important fomite promoting spread of the pathogens. In addition, the canine viruses (but NOT feline viruses) are effectively spread over distances >20 feet in aerosols generated by sneezing and coughing – this significantly increases the difficulty in stopping rapid transmission throughout the kennel. The feline respiratory viruses can be shed in large droplets, but these droplets travel <4 feet.

Bacteria can also cause respiratory infections, but probably on a less common basis than the viruses. *Bordetella bronchiseptica* can be a primary pathogen in both dogs and cats, as well as a co-infecting pathogen with viruses. *Mycoplasma* species also contribute to respiratory infections in dogs and cats, mostly as a secondary opportunistic pathogen with viruses.

## Husbandry factors

Most husbandry issues stem from ineffective population management and exceeding the housing capacity of the facility and crowding. This causes stress for the animals and staff, hampers effective cleaning and disinfection procedures, and increases the infectious dose of pathogens in the environment. Crowding also decreases ventilation and air quality which increases risk for respiratory infections. Lastly, staff that is not trained to recognize parvoviral or

respiratory infections and to follow a plan for prompt segregation of affected animals contributes to increased pathogen transmission and infectious dose in the environment.

## Strategies for management and control of infectious diseases

### Population management and stress reduction

***Effective population management is the most important strategy for reducing transmission of infectious disease in shelters. This over-arching strategy affects the efficacy of all other strategies, including stress reduction, response to vaccination, segregated housing, cleaning and disinfection, prompt recognition of diseased animals, and space for isolation and quarantine.*** Crowding and the attendant stress is undoubtedly the single greatest risk factor for infectious disease outbreaks. Increased population density leads to a greater risk of disease introduction, higher contact rates for disease transmission, increased doses of infectious agents in the environment, and reduced ventilation and air quality.

Unfortunately, crowding in shelters is common, either due to insufficient facilities to provide even minimal care for the stray hold population, or to well-intended attempts to decrease euthanasia by housing more animals and holding them longer periods of time for potential adoption or transfer. Delays in moving animals through the facility are frequent precursors of disease outbreaks in crowded shelters. Several studies have shown that the risk for respiratory infections in dogs and cats increases significantly with each day in the shelter.[3]

Crowding due to overcapacity necessitates housing of multiple unrelated dogs in a run. This random co-mingling increases stress, promotes fighting between incompatible dogs, and leads to resource guarding by "bully" dogs, preventing access to food and water by other dogs in the run. Crowding hampers effective cleaning and disinfection procedures, which increases the infectious dose of pathogens in the environment. Because of multiple dogs per run and no empty runs to facilitate cleaning/disinfection, cleaning may consist only of spraying kennel floors (and dogs) with water to remove feces and urine. This results in chronic environmental moisture which favors pathogen survival and is stressful to the dogs.

Shelters are not a cat-friendly environment, and common housing practices are very stressful. Particularly stressful is the stuffing of adult cats or entire litters of kittens into a 2' X 2' X 2' cage where there is barely enough floor space for a litterbox and food and water bowls. The cramped space forces adult cats or a litter of kittens to use the litter box as a sleeping area and does not provide enough room for them to move or stretch out. Some fearful cats spend their entire incarceration time hiding under newspaper linings. Because clinical signs and shedding of FHV are activated by stress, stress reduction is crucial to control of feline URI. In addition, stressed cats are not likely to display adoptable behaviors.

The goal of population management is to limit the number of dogs and cats to the housing capacity of the facility. Housing capacity is defined as the number of housing units available for 1 dog per run (or cage) and 1 cat per cage. The daily census should not exceed the housing capacity. Ideally, the daily census should be less than the housing capacity so that empty runs and cages are available to facilitate cleaning and disinfection, for predictable increases in population (e.g. – "kitten season"), and for unpredictable increases in population (e.g. – cruelty/hoarding seizures).

Some key strategies for effective population management and stress reduction include:

- Transfer of puppies and kittens at intake to foster homes, adoption groups, and humane societies that can provide a safer environment. This age group is the most susceptible to infectious disease in the shelter due to incomplete immunity and potential exposure to adults with subclinical infections.
- Diversion of feral cats to a local Trap-Neuter-Return (TNR) program. This reduces the burden on housing capacity for strays and owner relinquished cats that may have better opportunities for adoption, decreases euthanasia, and increases live-release rates. In Feb 2008, NACA issued a policy statement on community cat management that recognized TNR programs for feral cats as an effective alternative management tool and recommended that each animal control agency assess the need within their community.
- Segregated housing of dogs and cats. Exposure to dogs and dog noise (barking) is very stressful to cats. *Bordetella bronchiseptica* can be transmitted between dogs and cats, and cats are susceptible to infection by canine parvovirus.
- Adult dogs should be housed 1 per run or at most, 2 related dogs per run ("planned co-mingling"). Littermate puppies should be limited to 2-3 per run or 2 per large cage. This reduces stress and stress-related behaviors that lead to euthanasia, reduces chance of disease transmission, increases ability to monitor for clinical signs, facilitates proper cleaning and disinfection to reduce the dose of infectious agents in the environment, and improves air quality.
- Housing of cats in bigger cages with planned co-mingling and adding a hiding box significantly reduces stress. Even adding a paper bag as a hiding place in smaller cages can reduce stress. The hiding box also facilitates cleaning and can be used to transport cats to minimize handling. Littermate kittens should be limited to 2 per cage depending on their size.
- Prompt disposition of animals at the end of their stray hold period. If you can't reduce the number of animals coming in, then reduce the number of days they stay beyond the legal holding period. Every day beyond this period adds to the total number of animal care days and decreases housing for new intakes.
- Encourage adoption groups to visit the shelter daily to evaluate dogs and cats during their stray hold period instead of waiting until the period expires. This facilitates prompt disposition and increases live-release rates.

## Segregation of juveniles and adults

***Kittens and puppies are the most susceptible to infectious disease in the shelter due to incomplete immunity and potential exposure to adults with subclinical infections.*** They typically enter shelters at an age when maternal immunity has waned to a level that does not protect against infection, but still interferes with responses to vaccination. Therefore, puppies and kittens should not be housed with adults because of the increased risk for exposure to parvovirus and respiratory pathogens that subclinical or mildly affected adults are shedding. Stress-induced reactivation of FHV in latently infected adults also puts naïve kittens at risk for infection if housed in the same room. Puppies or kittens can be housed together using a planned co-mingling approach where related animals are kept together in very small groups (2-3 per group). Unrelated puppies or kittens that were already living together before admission can also be housed together. Limiting the number per run or cage reduces stress, reduces contact rates, facilitates cleaning and disinfection, and promotes prompt recognition of clinical signs in each animal.

## Vaccination

***Vaccination of all dogs and cats on intake is one of the most effective strategies for prevention and control of infectious diseases in shelters.*** For animals that were not vaccinated *before* exposure, vaccination *after* exposure will have little or no effect on the outcome. Vaccines for feline parvovirus (FPV), canine parvovirus (CPV), and CDV are highly effective in preventing infection. Canine vaccines for *Bordetella*, CPiV, and CAV, and feline vaccines for FHV and FCV, are not as effective in preventing infection, but they can mitigate the frequency, severity, and duration of clinical disease. At this time, there are no vaccines for CIV and CRCoV to help reduce transmission of these respiratory viruses within the shelter.

Since shelters are high risk environments, ***all dogs and cats 4 weeks of age and older should be vaccinated on intake, regardless of intake status (stray, owner surrender, rabies quarantine, cruelty, pregnant, lactating, injured, ill).***[4,5] A delay of even a day can significantly increase the risk for infection. Restricting vaccinations to adoptable animals only creates a large pool of susceptible animals that can make infections an endemic problem, eventually affecting all animals. In a study conducted in one shelter,[6] 431 dogs of all ages and sources were tested for protective antibody titers to CDV and CPV at intake: 57% did not have protective immunity to CDV and 33% did not have protective immunity to CPV. Dogs < 3 years old were significantly more likely to be unprotected against CDV and dogs <1 year old were significantly more likely to be unprotected against CPV. Owner surrendered pets were as likely to be unprotected as stray dogs.

Modified-live multivalent vaccines are the most effective for reliably inducing protective immunity very quickly. Modified-live vaccines administered intranasally or subcutaneously are far superior to vaccines containing killed virus. Studies have proven many times that multivalent vaccines containing modified-live FPV, CPV, or CDV induce protective immunity within 3 days if there is no interference by maternally derived immunity. A multivalent vaccine containing recombinant CDV DNA in a canarypox vector (Merial) has been touted for use in puppies because of greater efficacy in the face of maternal antibody interference. Intranasal vaccination of dogs with a trivalent vaccine containing modified-live *Bordetella*/CPiV/CAV (Schering Plough) provides rapid local immunity (< 7 days) to these 3 respiratory pathogens, even in the face of maternal antibody interference. In one study, intranasal vaccination of dogs against *Bordetella,* CPiV, and CAV on intake significantly reduced the risk of coughing.[7] A modified-live *Bordetella* vaccine for cats is available, but is not recommended except when persistent or recurrent infections are documented by diagnostic testing.

At intake, all dogs should receive a DAPP (CDV, CAV, CPiV, CPV) vaccine SQ and the intranasal *Bordetella*/CPiV/CAV vaccine, and all cats should receive the FVRCP (FHV, FCV, FPV) vaccine SQ. Due to the potential for maternal antibody interference, all puppies and kittens should be re-vaccinated with DAPP or FVRCP ***every 2 weeks*** while in the shelter to successfully induce protective antibody titers. Adult dogs and cats should receive a booster DAPP or FVRCP vaccination 2 weeks after the initial vaccination on intake.

**A note about CPV type 2c**. Recent vaccine trials have demonstrated that currently available commercial CPV vaccines (Fort Dodge, Intervet, Schering Plough, Pfizer, and Merial) provide protective immunity to CPV-2c.[8-10]

## Cleaning and disinfection

***Careful and effective cleaning by well-trained employees is mandatory for control of infectious disease and reducing the dose of infectious agents in the environment.*** Time and money spent on training and supplies for an effective cleaning program will result in decreased costs due to disease. Cleaning/disinfection protocols should include runs, cages, walkways, carriers, doorknobs, exam tables, litterpans, food/water bowls, and animal transport vehicles. The protocols should be applied to all housing areas, intake areas, and any other location in the facility where there is animal contact. Cleaning/disinfection should proceed from the most vulnerable animals to the least vulnerable animals and from the cleanest areas to the most contaminated areas. The recommended order is:

- Kittens and puppies in adoption areas
- Adults in adoption areas
- Kittens and puppies in stray holding areas
- Adults in stray holding areas
- Quarantined kittens and puppies
- Quarantined adults
- Animals in isolation

Separate cleaning supplies should be dedicated to each area and not swapped between areas. To avoid tracking of infectious agents on shoes and clothing between housing areas (incl. intake), dedicated rubber boots and disposable gowns or smocks are recommended for each area. Ideally, hands should be disinfected after handling each dog with sanitizers containing 60-90% ethanol alcohol. All cats, whether healthy or not, should be handled with gloves that are changed between cats. Gloves, gowns, and boots are necessary for cleaning quarantine or isolation areas.

Mop buckets should not be used for cleaning and disinfection of kennel runs because the mop water and mop become heavily contaminated by organic matter and serve as a fomite for transmission of infectious agents. High pressure hoses are preferable for application of disinfectants to dog runs, but should not be used in occupied runs unless the dogs can be separated by a guillotine door while cleaning.

***CPV, FPV, FCV and CAV are only inactivated by bleach or potassium peroxymonosulfate (Virkon® or Trifectant®).*** Therefore, all areas should be disinfected on a daily basis with either of these 2 disinfectants. A 5% solution of household bleach (½ cup per gallon water) should be prepared fresh daily and stored in an opaque container since light exposure inactivates it. Trifectant solution should be prepared according to manufacturer instructions - it is not inactivated by light and is less corrosive to metal and skin than bleach. For both disinfectants, more is *not* better! The more concentrated the solutions, the more irritating and damaging to skin, eyes, and the respiratory tract of animals and staff. Bleach, and to some extent Trifectant, are inactivated by organic matter. For optimum killing activity, environmental surfaces contaminated with feces, urine, vomit, blood, and nasal discharge must first be cleaned with a detergent and rinsed before applying the bleach or Trifectant solution. The minimum required contact time for bleach or Trifectant is 10 minutes. Air drying is preferred if possible, but if an animal needs to be moved into the run or cage, the area should be rinsed after the 10 min contact time, then dried using a squeegee or towel. Moisture favors the survival of pathogens.

There is no effective method to clean and disinfect dog runs and cages if all are occupied. In addition, 100% occupancy does not provide an opportunity to have clean runs ready for new intakes. For shelters with effective population management, there are 2 concepts for cleaning dog runs and cages. For "T" kennels or double-sided runs separated by a guillotine door, the dogs can be confined to one side with the guillotine door while the other side is cleaned, disinfected, and dried. The process is then repeated for the other side of the run. For runs without guillotine doors, the "move down one" concept can be followed. This depends on availability of empty clean runs at the end of each row. The dog next to the empty run is placed in that run, and the vacated run is cleaned, disinfected, and dried. The next dog in line is moved to the cleaned run. The process is repeated until all dogs on a row have been moved down one run, leaving an empty run at the end that is cleaned and disinfected for repeating the process the next day. Cages can also be cleaned and disinfected using the "move down one" procedure. Automatic waterers, water bowls, food pans, and toys should be included in the daily cleaning/disinfection.

Moving from cage to cage for cleaning is very stressful for cats. Cats should kept in the same cage during their stay in the shelter, and their cages "spot cleaned" on a daily basis with replacement of soiled bedding and litterpans. If the cat must be removed for thorough cleaning and disinfection of the cage, it should be placed in its own carrier during the cleaning and returned after the cage is dried. Cages can be thoroughly cleaned and disinfected between residents. Future cat cages will likely be 2-sided like dog runs so that the cat can be safe and comfortable on one side while the other side is cleaned. Food/water bowls and litterpans should be cleaned and disinfected, but not in the same sinks due to the potential for FPV contamination. In addition, they should be made of stainless steel instead of plastic because scratched plastic is difficult to fully disinfect. Disposable litterpans are suitable for cats quarantined due to exposure to FPV. Disposable cardboard carriers are preferable to plastic because plastic carriers are particularly difficult to clean and disinfect unless taken apart. Many instances of exposure to FPV have occurred by improper disinfection of carriers used for multiple cats.

## Diagnosis

***Timely diagnosis substantially impacts how many dogs and cats remain healthy and adoptable. No diagnosis or late diagnosis increases the number of sick and exposed animal due to improper management and ultimately the number of animals euthanized.***

**Parvoviruses:** Not all cases of vomiting or diarrhea in juveniles and adults are due to CPV or FPV, especially in animals that are debilitated, parasitized, co-infected with other pathogens, and stressed from entering the shelter environment. Therefore, parvovirus infection cannot be diagnosed based on the age of the dog or cat and the clinical signs. Since other diseases mimic parvo, diagnostic testing should be performed on all dogs and cats with compatible clinical signs instead of making a decision on a guess, especially if animals suspected of having parvo are euthanized. ***The most common cause of sudden death in kittens and cats in shelters is FPV – these cats should be tested postmortem!*** The point-of-care test kits (IDEXX, Agen, Synbiotics) for detection of parvovirus antigens in feces are a rapid and cost-effective diagnostic tool for dogs and cats. To date, the IDEXX SNAP Parvo test has been shown to reliably detect CPV-2c in fecal samples from infected dogs. All animals with compatible clinical signs should be immediately tested in order to start proper containment strategies. Although it is a common practice, there is no compelling medical reason to use the parvovirus test kits for routine screening of all dogs and cats in the shelter that don't have compatible clinical signs or known exposure – resources would be better allocated for control and preventive strategies.

**Respiratory disease:** All of the canine and feline respiratory pathogens cause similar clinical syndromes, at least during the first week of illness. Therefore, the cause of infection cannot be diagnosed based on clinical signs! Most shelters assume that "kennel cough" in dogs is due to *Bordetella* bacterial infection and treat for several days with doxycycline antibiotic. Accumulating evidence from diagnostic testing indicates that ***most respiratory infections in shelter dogs and cats are viral!*** Shelters should invest in diagnostic testing when the numbers of affected dogs persist or increase despite antibiotic treatment, there is explosive spread through the population over a period of a few days, progression to more severe disease or death, and an increased frequency of new owner and community veterinarian complaints of sick dogs from the shelter. Diagnostic testing of cats with should be considered when the respiratory infections are unusually severe and cats are dying of pneumonia,

The best diagnostic method for acute infections is performance of PCR for pathogen DNA on conjunctival, nasal, or pharyngeal swabs. IDEXX offers a canine respiratory pathogen PCR panel that detects Bordetella, CPiV, CAV-2, CDV, CIV, and CRCoV (http://www.idexx.com/animalhealth/laboratory/realpcr/tests/crd.jsp), and a feline respiratory pathogen panel that detects FHV, FCV, Bordetella, Mycoplasma, and Chlamydophila felis (http://www.idexx.com/animalhealth/laboratory/realpcr/tests/furd.jsp). IDEXX offers a substantial test discount to shelter programs (http://www.sheltermedicine.com/services/idexx_shelter_surveillance.shtml).
Conjunctival, nasal, and pharyngeal swabs should be collected from 5 to 10 dogs with clinical signs for <4 days in order to catch the pathogens in their peak shedding period. Oropharyngeal swabs can be collected from 5 to 10 cats. The more animals tested, the more confident you can be in the diagnostic test results, especially if there is a consistent pattern of results.

## Isolation and quarantine

***Prompt removal of clinically affected dogs and cats is one of the single most effective strategies for controlling spread of infectious disease.*** This significantly reduces the infectious dose in the environment. These animals should be housed in a physically enclosed isolation room pending diagnostic testing. Diagnosis will direct management decisions on treatment and isolation time. CPV, FPV, CDV, FHV, and FCV are generally regarded as non-treatable diseases in a shelter because of severity of disease, duration of virus shedding, staff requirements for care, and treatment costs. In contrast, most dogs recover from *Bordetella* and viral respiratory infections (except CDV), so if

shelters have enough space and staff, sick dogs can be held in isolation for 2 weeks for recovery and cessation of pathogen shedding. The most important consideration is whether the shelter can manage animals with contagious diseases without contaminating the entire facility and putting healthy animals at risk, resulting in outbreaks forcing temporary closure and potential depopulation. If this is not possible, then sick animals should be removed from the facility for treatment or euthanized to relieve suffering and curtail disease transmission. Sick cats and dogs should be housed in separate isolation areas to reduce stress and since some pathogens can be transmitted back and forth. Staff responsible for care of animals in isolation should wear boots, gown, and gloves. If the staff is responsible for care of other animals, they should care for healthy animals first.

Since sick animals shed infectious parvoviruses and respiratory viruses before onset of clinical disease, all others exposed to the sick animals either by direct contact, fomite contact, or aerosol should be quarantined from the general population for 14 days with twice daily monitoring for appearance of clinical signs. Staff should be trained in recognition of clinical signs with prompt reporting to supervisors. If clinical signs occur, the animal should be immediately removed to help reduce the infectious dose of virus in the environment. Staff caring for the quarantined population should also wear boots, gown, and gloves since exposed animals may be in the incubation period with preclinical shedding of pathogen. Handling of dogs and cats in quarantine should be minimized. Staff should always care for healthy animals first, then quarantined animals, then sick animals in isolation.

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## Valuable Resources

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# Association of Shelter Veterinarians Policy Statement on Infectious Disease Outbreak Management

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www.sheltervet.org/

The Board of the Association of Shelter Veterinarians recognizes that sheltering organizations have unique situations and challenges that may warrant differing responses in the event of a disease outbreak. Variables such as facility design, funding, and community sheltering resources can affect the options available for any given situation. While there is no single response policy that is ideal for all situations, the following recommendations should be a part of all outbreak management plans.

Whenever the level or severity of illness in a shelter population rises, identification of the underlying pathogen(s) using appropriate diagnostic tests is essential for the development of specific control strategies. Clinically ill animals should be identified and removed from the general population. Depending on the nature of the disease and available resources for treatment, affected animals can be isolated; placed in foster care; released to rescue, other shelters, or veterinary clinics; or euthanized. If animals are released to private homes or other shelters, appropriate precautions must be taken to prevent additional spread and protect household and community pets and people. A risk assessment should be performed to identify animals that have been exposed and are at meaningfully increased risk of infection. Titer evaluation may assist with this process for some conditions, such as canine distemper and canine and feline parvovirus. At-risk animals should be quarantined and monitored for signs of illness, returning to the general population only after the maximum incubation period has passed in order to minimize risk to animal or human health. To assist in the prevention of new cases, cleaning and disinfection procedures, animal movement and housing, and vaccination protocols should be reviewed for effectiveness against the identified pathogen(s). For outbreaks of vaccine preventable diseases, it is critical that animals entering the facility be vaccinated with an appropriate modified live vaccine on or before entry. Factors that may adversely affect health and increase disease susceptibility such as malnutrition, parasitism, and overcrowding should also be addressed.

Shelters that treat infectious disease on site should ensure that they have a separate isolation area for housing and treating the animals to prevent further disease transmission. Humane conditions and medical care that keep the animal comfortable must be provided throughout the treatment period. Additional protocols should be in place to prevent the spread of disease through the movement of contaminated fomites or staff members within the shelter. Furthermore, shelters must ensure that animals are not returned to the general population until they are clinically cured and are no longer expected to be shedding infectious disease agents.

Fortunately, the need to depopulate a group of animals in a shelter is rare, but it is one option available for disease outbreak intervention. When considering depopulation, many factors including transmission, morbidity, mortality, and public health should be taken into account. Along with shelter administration, board members and staff/community veterinarians, it is recommended that shelter medicine experts or related professionals be contacted for opinions and advice before making a final decision. All other avenues should be fully examined and depopulation viewed as a last resort.