Disease Outbreak Management in Shelters

Overview

Management 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 contagious diseases into their facility with intake of animals from the community, many of which have acquired infections prior to entry. Infected animals may be in the pre-symptomatic incubation period on admission and thus not recognized as an infectious risk. If the shelter population contains large numbers of susceptible animals, particularly puppies and kittens, then widespread transmission of disease will ensue from exposure to the infected animal. Disease outbreaks not only impact the life-saving capacity of shelters, but also destroy the shelter's reputation with adoption partners, local veterinarians, and the entire community, especially when such outbreaks are publicized by local and national media sources. This contributes to paralyzed adoptions, low staff morale, and perpetuation of the vicious cycle of crowding. In addition to the tangible losses associated with the financial costs of a disease outbreak, there are the intangible but far more costly losses of life and community support.

This document provides an overview of the common causes of disease outbreaks in shelters and the strategic steps for successfully managing these outbreaks while maximizing the saving of lives.

Risk Factors for Disease Outbreaks

Risk factors for disease outbreaks include crowding, which increases animal contact and stress and decreases care capacity; random co-mingling of animals in a run or cage; ineffective sanitation; suboptimal vaccination policies, especially for puppies and kittens; and failure to promptly remove sick animals from the general population. 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 perpetual transmission of the pathogen so that it becomes an accepted "endemic" problem. ***Of all the risk factors, crowding is the most important and common since it directly impacts all other facets of animal care and exponentially increases the stress level for both the animals and the staff.***

Common Causes of Disease Outbreaks

Canine parvovirus, feline panleukopenia, canine and feline viral respiratory pathogens, and feline ringworm are the most common causes of disease outbreaks in shelters. Outbreaks of feline panleukopenia, feline viral respiratory infections, and ringworm occur most frequently during "kitten season" when shelters are inundated with large numbers of kittens. Canine respiratory disease outbreaks are usually due to canine distemper virus, canine pneumovirus, and canine influenza virus.

The following tables list the pathogens that most commonly cause disease outbreaks in shelters and their properties important to disease management and resolution.

Canine Pathogens

CDV = canine distemper virus
H3N2 CIV = H3N2 canine influenza virus
CnPnV = canine pneumovirus
CPV = canine parvovirus
Strep zoo = *Streptococcus zooepidemicus*

	CDV	H3N2 CIV	CnPnV	CPV	Strep zoo
Incubation period	2 wks	≤1 wk	≤1 wk	≤10 days	≤1 wk
Shedding period	wks to mos	3 wks	<2 wk	2 wks	weeks w/o antibiotics
Persistence in environment	no	no	no	yes	no

Feline Pathogens

FHV = feline herpes virus
FCV = feline calicivirus
FPV = feline parvovirus (panleukopenia virus)
M. canis = *Microsporum canis* (feline ringworm)

	FHV	FCV	FPV	M. canis
Incubation period	≤1 wk	≤1 wk	≤10 days	≤2 wk
Shedding period	≤1 mo	1 to 3 mo	2 wks	weeks w/o treatment
Persistence in environment	no	yes	yes	yes

Persistence in the environment refers to whether the pathogens remain viable and infectious in the environment for weeks to months unless inactivated by special disinfectants.

All of these pathogens are shed before the dog or cat shows clinical signs. In addition, they can cause subclinical infections where the animal does not display clinical disease, yet is shedding the pathogen.

Life-saving Strategy for Managing Disease Outbreaks

Successful life-saving strategies for managing disease outbreaks include the following basic steps.

Steps for Management of Disease Outbreaks

1. Diagnosis of the disease
2. Isolation of sick animals

3. Quarantine of exposed asymptomatic animals
4. Assessment of infection risk in exposed animals
5. Create a clean break to prevent exposure of more animals
6. Biosecurity and environmental decontamination
7. Documentation
8. Communication

Please note that while these are listed as steps, the responses occur simultaneously. ***The overarching goal of the management strategy is to create an effective break between the infected/exposed population and the unexposed population without resorting to mass depopulation via euthanasia***. This strategy is effective in minimizing in-shelter transmission of infection. The success is totally dependent on staff adherence to the necessary steps involved. Staff that disregard or "make exceptions" to the decisions required for each step will undermine any success by assuring continual transmission of disease, prolonged resolution, increased financial burden, public scrutiny, and ultimately the loss of more lives than was necessary.

Diagnosis

Diagnosis is essential for successful control and resolution of disease outbreaks. ***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 animals due to improper management and ultimately the number of animals euthanized.***

Why diagnosis is important:

- Proper treatment of each animal
- Prognosis for recovery and average time to recovery
- Incubation period for the pathogen
- Duration of pathogen shedding (contagious period)
- Transmission routes for the pathogen
- Disinfectants required for pathogen inactivation
- Best strategy for preventing recurrence

Even shelters with tight budgets should invest in diagnostic testing since this is the key to management and prevention strategies. It is far more costly to base these core strategies on guesswork and trial by error, both in terms of the financial burden as well as the suffering of the animals and the shelter's reputation.

Diagnostic testing should be conducted on sick animals and asymptomatic exposed animals. Diagnostic test accuracy is dependent upon the timing of sample collection with the periods when the suspected pathogens are shed in highest amount. For parvoviruses and respiratory pathogens, the largest amounts of shedding occur during the preclinical incubation period (asymptomatic exposed animals) and the acute phase of illness (sick for ≤4 days). At least 5 to10 cases of the combined sick and exposed population should be tested in order to identify a pattern and improve the accuracy and reliability of the results.

Not all diagnostic tests are created equal with regard to accuracy. Shelter personnel should consult with infectious disease experts when deciding on what diagnostic tests are most appropriate and reliable and provide the quickest turnaround time for results. In general, diagnostic tests that actually detect the pathogen in some body secretion or excretion are more desirable than those that detect antibodies to the pathogen since this approach is easily confounded by prior vaccinations or exposures. For parvoviruses, the point-of-care CPV/FPV antigen kits for testing fecal samples are most reliable if conducted during the acute virus shedding period. For respiratory infections, PCR testing of swabs from the upper respiratory tract for pathogen nucleic acid is the best diagnostic approach. For ringworm, a combination of Wood's Lamp exam, trichogram, and ringworm PCR is the best diagnostic approach. The most valuable diagnostic test frequently overlooked by shelters is necropsy - animals that die or are euthanized due to illness yield the most clues for solving the diagnostic puzzle.

Isolation of Sick Animals

Prompt removal of sick animals from the general population is the single most important step in controlling a communicable disease outbreak. This significantly decreases opportunities for transmission to other animals and reduces the infectious dose in the environment. Leaving sick animals in the general population guarantees the spread of infection to others and perpetuation of the outbreak. A common and dangerous belief is that mildly ill animals are not as contagious as those that are sicker - this is a myth because the severity of the illness is more dependent on the individual animal's response to the pathogen. Transmission of severe and even fatal infections by mildly ill animals occurs quite commonly with pathogens such as CPV, FPV, CDV, CIV, and FCV.

Ideally, the animals should be housed in a physically separated and enclosed room for full containment of the pathogens. This is particularly important for the parvoviruses, canine respiratory viruses, and ringworm. Cats infected with FHV and FCV can be isolated in-cage in a regular ward if they can be cared for without fomite contamination of other cats. A cover over the front of the cage contains droplet fomites and reduces stress for these cats.

Infected animals should be isolated for the duration of pathogen shedding. Confirmation of shedding cessation can be determined by testing for the pathogen in the same manner as for the initial diagnosis. This may allow for faster release from isolation for many animals.

If the shelter cannot provide adequate isolation for the entire contagious period or do not have enough staff and medical resources to provide proper care, then the sick animals should not be kept in the shelter. In some cases, the sick animals can be transferred off-site to veterinary clinics, foster homes, or adoption groups with greater resources. However, foster homes and adoption groups are not the best candidates for highly contagious diseases that pose a threat to other pets in the homes, diseases requiring extensive treatment modalities other than oral medications, diseases requiring continual or frequent veterinary assessment, and pathogens that are difficult to remove from the environment.

Quarantine of Exposed Animals

The benefit of isolating sick animals for disease containment is undermined if asymptomatic exposed animals remain in the general population. Exposed animals may not yet be ill because they are in the preclinical incubation period, they have a subclinical infection, or they are immune to infection. ***All***

exposed animals should be considered an infectious risk regardless of vaccine status and quarantined to protect other animals from exposure. Ideally, the exposed animals should be consolidated to one ward that is physically separated from other wards where unexposed animals are housed.

The quarantine time is equal to the pathogen's maximum incubation period. Quarantined animals should be monitored twice daily for clinical signs. Sick animals should be promptly removed to isolation and the quarantine clock re-started for the remaining animals since there was a new exposure. Effective quarantine of exposed animals can save lives and increase staff morale.

Assessment of Infection Risk in Quarantined Animals

Quarantined animals can be assessed for their risk of infection. This provides a humane and cost-effective strategy for quickly moving animals out of quarantine, thereby relieving the strain created by utilizing housing for quarantine. The risk assessment is based on 2 approaches:

1. Tests for pre-existing protective antibody titers to the pathogen
2. Tests for the pathogen itself

Although no risk assessment is 100% accurate, when used and interpreted appropriately these approaches can predict in most cases which animals are safe to release and which animals are at risk.

Due to the availability of point-of-care kits (Zoetis Titerchek and Biogal Vaccicheck), animals exposed to CDV, CPV, or FPV can be tested for protective levels of antibodies to these pathogens. Animals that are free of clinical signs and have protective antibody titers are considered ***low risk*** for infection and can be moved out of quarantine. *An important caveat is that the antibody titers are determined as close to the time of exposure as possible instead of 10-14 days after exposure when the titers could represent an immune response to infection instead of pre-existing immunity*. Animals that do not have protective antibody titers are at ***high risk*** for acquiring infection from exposure and should be held in quarantine at the shelter or transferred to foster homes for completion of the quarantine period.

Quarantined animals can also be assessed using the same test that was used to diagnose the pathogen in the sick animals. For the canine and feline respiratory pathogens, PCR on swabs from the upper respiratory tract is the most accurate and timely test. Animals that are PCR-negative are ***low risk*** and can be moved out of quarantine. Those that are PCR-positive are shedding the pathogen and should be moved to isolation, while the quarantine clock for the remaining animals is re-started.

The point-of-care CPV/FPV antigen tests require a large amount of virus for detection and are not very accurate for screening asymptomatic animals for infection. Animals shedding amounts of virus that are too low for detection will have false negative results. PCR testing of feces for CPV or FPV is very sensitive and will detect small amounts of virus, but PCR also detects CPV and FPV vaccine strains shed in feces for up to 2 weeks post-vaccination, causing false positive test results. However, a negative PCR result means the animal is not shedding virus and may be ***low risk***, especially if it also has protective antibody titers to CPV/FPV.

Quarantined cats exposed to ringworm can be assessed by performing a Wood's Lamp exam and trichogram. Cats with no skin lesions and negative Wood's Lamp and trichogram results are ***low risk*** and

can be dipped once in lime sulfur as a precautionary measure, then moved out of quarantine. Some cats test false positive with a Wood's lamp exam and/or trichogram due to *M canis* carriage on their fur from contact with an infected animal or exposure to a contaminated environment. These "fomite" or "dust mop" cats are not truly infected and do not have any skin lesions. They should also be dipped once in lime sulfur and moved out of quarantine.

The "Clean Break"

The cornerstone for prevention of further spread of infection is creation of a clean break. This is defined as protection of unexposed animals and new arrivals from exposed or infected animals by housing them in a physically contained clean room. Ideally, no new animals should be admitted until the outbreak is resolved. This is feasible for private, nonprofit shelters with controlled admissions. This is not feasible for municipal shelters with animal control contracts that must take in sick and injured animals, dangerous animals, and animals from cruelty investigations. However, these shelters can temporarily discontinue admission of owned pets, transfers from other shelters, and healthy free-roaming animals that are not a public health threat. The pet owners and finders of stray animals can be diverted to other groups or shelters, or asked to keep the animals until the outbreak is resolved. During this time, these animals can be vaccinated to establish immunity while awaiting surrender to the shelter.

There are other ingenious solutions for diverting new admissions from shelters during disease outbreaks:

- Partner with other shelters that agree to receive intakes pending resolution of an outbreak
- Arrange for temporary off-site housing such as empty commercial warehouses for new admissions
- Utilize housing resources provided by local or national emergency/disaster response groups. These groups have mobile tractor trailers containing temporary housing units and even provide staffing to assist with care of the animals.

In conjunction with intake diversion, population management strategies should focus on moving the clean animals out of the shelter as quickly as possible to keep the shelter from getting crowded. Litters of puppies and kittens should be placed for adoption or transferred to rescue groups and foster homes immediately at intake to reduce the number of vulnerable animals on-site.

Vaccination of all incoming animals immediately at intake or before becomes more critical in the face of an outbreak, especially since some of the pathogens that commonly cause more deadly outbreaks are "vaccine preventable" [CPV, FPV, CDV].

Biosecurity and Environmental Decontamination

Biosecurity and effective sanitation should be practiced at all times, but is paramount during a disease outbreak. Signage should be placed on entrances to the isolation room, quarantine room, and clean rooms indicating what animals are in the room, no movement of animals in or out, and what staff can enter. Visibility is enhanced by color-coding the rooms: red = isolation, yellow = quarantine and green = clean. All animal care supplies can be similarly color-coded and dedicated to each area with no movement of supplies between rooms.

Ideally, dedicated staff should be assigned to each room and can wear color-coded badges to match their room assignment to ensure accountability. If there is not enough staff for assignment to specific rooms, then staff should care for animals in the clean rooms first, followed by quarantine, then isolation last. When caring for animals in quarantine and isolation, staff must wear PPE consisting of full-length gowns or scrubs that completely cover arms and legs, hair cover for long hair, rubber boots, and gloves. Street shoes with shoe covers are incompletely covered and become contaminated. Staff should never enter quarantine or isolation without PPE, and the PPE should never be worn outside the room.

Effective sanitation reduces infectious doses of pathogens in the environment. Disinfectants that kill the parvoviruses and feline calicivirus should be used in all housing areas - household bleach, Wysiwash, Trifectant, and Accel/Rescue are the only 4 reliable disinfectants. Contact times for these disinfectants should be adhered to. Spot-cleaning should be used for cats to foster little to no handling of cats and gloves changed between cages. These disinfectants should also be used for dishes, litterpans, animal transport or animal control vehicles, transport cages, animal handling equipment (leashes, muzzles, catchpoles, catnabbers) and hallways.

Documentation

Several disease outbreak parameters should be documented to aid in diagnosis, to determine whether the infection was contracted outside of the shelter or acquired in the shelter, for containment strategy planning, to assess the effectiveness of the strategy, and identification of the weakness in the system that enabled the outbreak. These parameters include:

- Dates of illness for each animal
- Clinical signs observed
- Duration of illness for each animal
- Number of sick animals
- Number of exposed animals
- Age of sick and exposed cases
- Vaccination status of sick and exposed cases
- Housing location of sick and exposed animals
- Cases confirmed by diagnostic testing
- Suspect cases not confirmed by diagnostic testing
- Where did the first sick animals come from and where were they initially housed

A trace-back method can be used to identify animals that may have been exposed to the initial cases during the preclinical shedding period. The trace-back time frame is the incubation period of the diagnosed pathogen - simply count back the number of days from the first identified sick animal. If any of the potentially exposed animals were released to adopters and pet placement partner agencies during this time, they should be notified and provided a written statement explaining what to do if infection is suspected or diagnosed, including who to contact at the shelter and whether the shelter is accepting animals back or assuming financial responsibility for veterinary treatment.

Protocols for intake processing, vaccination, sanitation, daily monitoring of animal health, and isolation of sick animals should be evaluated and updated to include best practices. Responsible staff should be

trained, supervised, and held accountable for the practices. To mitigate risk for recurrent outbreaks, a daily disease surveillance and monitoring protocol should be implemented for prompt identification and isolation of sick animals followed by examination and diagnostic testing to determine cause.

Tracking the origin of affected animals can be helpful in determining if the disease consistently originates from certain locations in the community so that extra precautions can be followed for admission of animals from these locations. Educational outreach and vaccination clinics can be targeted to these locations to increase community awareness and population immunity. Preventing the disease at the source is more effective than responding to recurrent outbreaks.

Communication

Proactive transparent communication about a disease outbreak within the shelter and the control strategy being used provides an opportunity to disseminate accurate information to shelter staff as well as community stakeholders such as adopters, rescue groups, and veterinarians. Proactive communication averts spread of rumors and false information, improves the shelter's image, and enlists public support and trust.

A written statement describing the disease, what animals are at risk, and the transmission modes should be provided to all shelter staff, including managers, directors, and public information officers. A written protocol detailing the management strategy should also be provided to each staff member, regardless of whether they are directly tasked with implementing the protocol or not.

A press release containing pertinent facts about the disease, the number of affected and exposed animals in the shelter, number of deaths, diagnostic testing to identify the pathogen, strategy for control and elimination, and what expertise has been enlisted should be released to media sources, community veterinarians, and pet placement partners. Community support for the shelter can usually be maintained if the shelter is transparent about the problem and provides information on the pursuit of diagnostic testing, plans for containment of the disease, numbers of affected animals, what agencies are providing expertise and help, etc.

Consulting with infectious disease experts is another important component of communication, especially when dealing with an outbreak that cannot be diagnosed with routine testing, outbreaks with high morbidity/mortality, and outbreaks with unusual clinical signs. Reaching out for help should be done before deciding on drastic measures such as depopulation. Asking for help early in the course of an outbreak favors a more positive and successful outcome and saves lives.

When is the Disease Outbreak Over?

By convention, a disease outbreak is declared over when a period of twice the incubation period of the pathogen has elapsed without identification of any new cases. However, for pathogens with short incubation periods of ≤7 days, a period of three times the incubation period is preferred.

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