Canine Infectious Respiratory Disease Complex

What is it, and what can be done?

Prepared for the Animal Welfare Section
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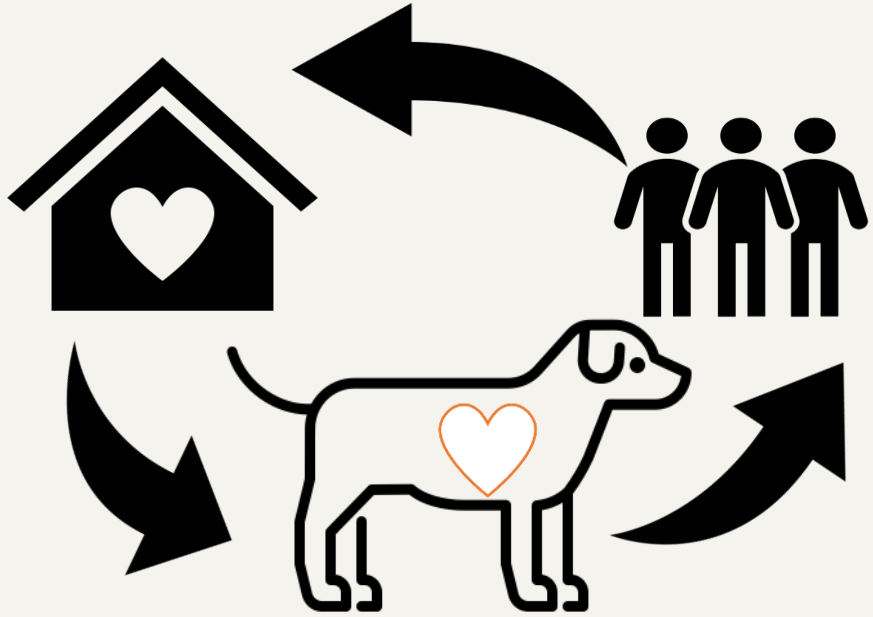
Kennel Cough is not just Bordetella

The new term is Canine Infectious Respiratory Disease Complex (CIRDC)

CIRDC results from a complex interaction between dogs, their environment, and the people who take care of them



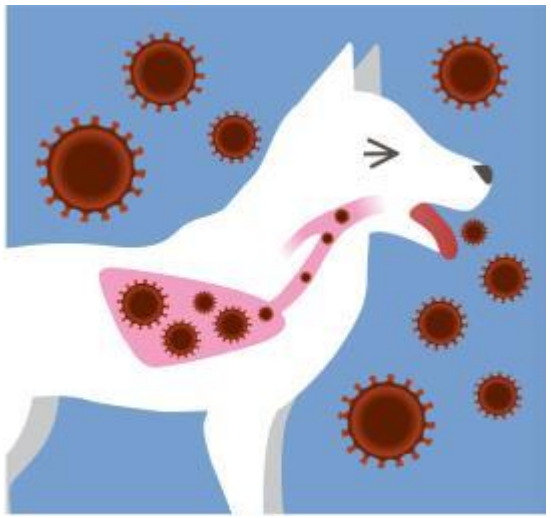
The Pathogens

- **There are currently 11 identified pathogens that play a role in CIRDC.**
- **Dogs with symptoms of CIRDC are often infected with two or three pathogens at once. Many of these pathogens may also live normally in healthy dogs.**

 **Viruses**	**Bacteria** 
• Canine distemper virus (CDV)* • Canine influenza virus (CIV) • Canine adenovirus type 2* (CAV2) • Canine herpes virus-1 (CHV-1) • Canine respiratory coronavirus (CRoCV) • Canine parainfluenza virus* (CPiV) • Canine pneumovirus (CnPnV)	• Bordetella * (Bb) • Mycoplasma (M. cynos, M. canis) • Strep. zooepidemicus (strep. zoo)

*Vaccines are available

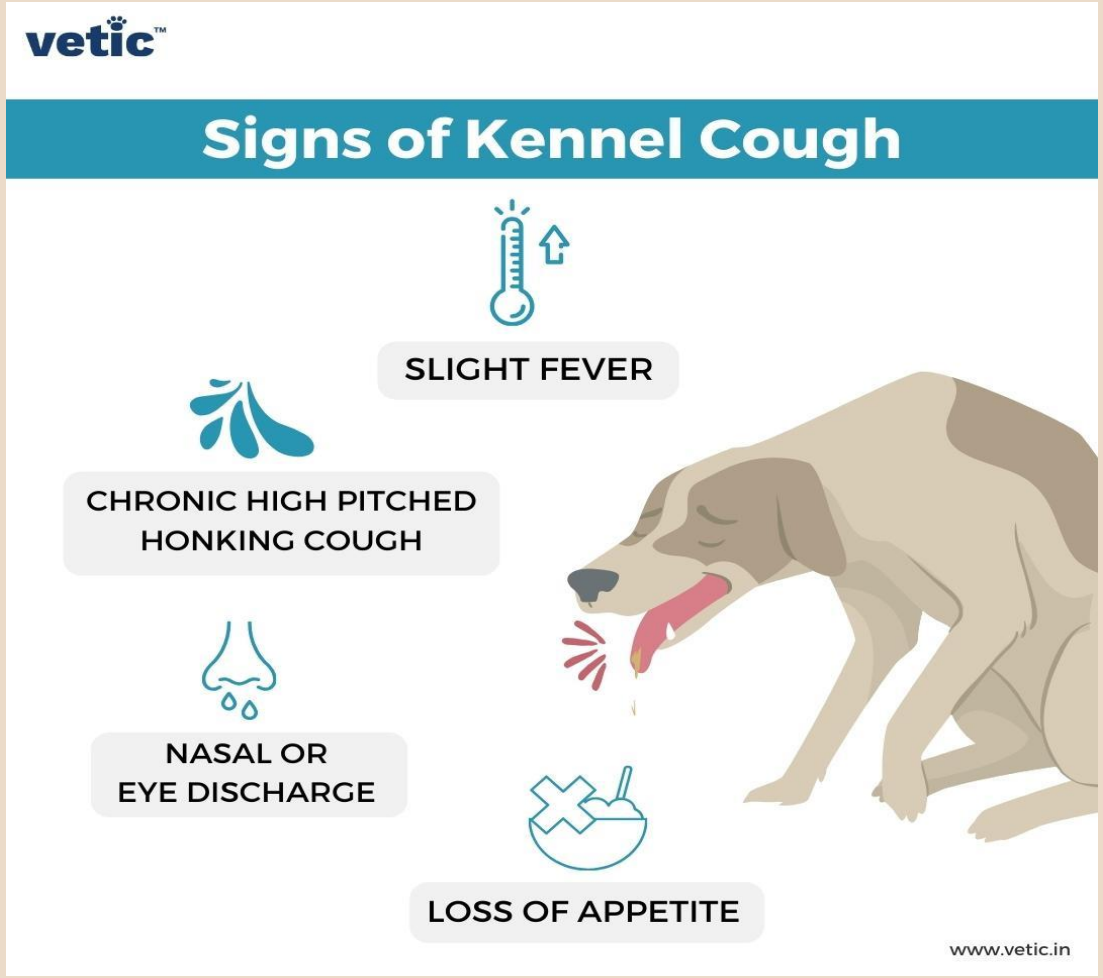
How Is It Transmitted?



- Dogs inhale pathogens from an infected dog's sneeze or cough
- *Germs are often transmitted from dried secretions on dishes, toys, hoses, cleaning supplies, employee's hands, feet and clothes
- Dogs can be infectious to other dogs 2 days *before* they show symptoms
- Some microbes can travel up to 30 feet in the air and hang as a mist
- Some microbes can persist in the environment for months, especially in a moist environment

Symptoms

- Most diseases start the same way:
  - Mild clinical symptoms
  - Usually run their course without treatment within 10 days.
- Most common symptoms:
  - Coughing
  - Sneezing
  - Clear or mucous discharge from the eyes or nose
  - +/- lethargy or low-grade fever.



Incubation and Shedding

- Most pathogens have a 7-day or less incubation period *
- Dogs are infectious for ~14 days*
  - Exceptions:
    - Canine distemper can remain infectious for weeks or months
    - H3N2 canine influenza can be shed for up to 28 days.
- Untreated bacterial infections can remain contagious for weeks if not properly treated

(*Distemper has a two-week incubation)

CIRDC pathogens

Organism	Incubation period	Shedding period	Clinical Symptoms	Vaccinations available
B. Bronchiseptica	2–6 days	≤ 3 months (without antibiotic treatment)	Variable ranging from asymptomatic to mild upper- respiratory signs to severe bronchopneumonia	Parenteral inactivated; attenuated live intranasal, mucosal vaccine
Mycoplasma cynos	3–10 days	weeks (without antibiotic treatment)	Clinical syndrome not completely described; Isolated as a single agent from dogs with pneumonia	None
Strep. zoo	Probably days	weeks (without antibiotic treatment)	mild upper respiratory signs or subclinical infections (Although may cause severe, rapidly progressing hemorrhagic pneumonia in overcrowded environments)	None
Canine adenovirus 2	3–6 days	≤ 2 weeks	Mild upper-respiratory signs and harsh cough of 2-wk duration	Attenuated live parenteral and mucosal vaccines; cross-protection for CAV-1
Canine distemper virus	3–6 days	Weeks to months	Respiratory signs in combination with lethargy, ocular discharge, fever; rapidly progressive and can include GI and central nervous system signs	Parenteral attenuated live and recombinant vaccines; core vaccines
Canine herpesvirus 1	6–10 days	≤ 2 weeks	Subclinical or mild respiratory signs in adults; moderate to severe ocular changes; severe disease in neonates	None
Canine influenza virus (H3N2)	2–4 days	3 weeks	Variable, ranging from subclinical to severe clinical disease with secondary bacterial infection	Parenteral inactivated vaccines for H3N2, H3N8, or both
Canine parainfluenza virus	3–10 days	≤ 2 weeks	Highly contagious; upper respiratory signs lasting up to 10 d	Attenuated live parenteral and mucosal vaccines
Canine respiratory coronavirus	Probably days	≤ 2 weeks	Variable; subclinical to mild upper respiratory signs	None (no cross- protection afforded by the CCoV vaccine)

Diagnosis

- Diagnosing pathogens cannot be done by clinical signs alone*
- Diagnostics are usually not necessary since most pathogens cause self-limiting mild clinical symptoms

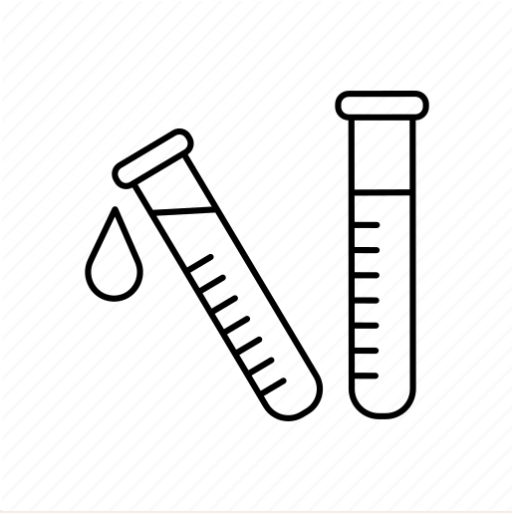
***Exceptions:**

- *Canine influenza and canine pneumonitis
  - These cause explosive epidemics in shelters, causing disease in most dogs at once, and compared to other viruses, higher fever with possible pneumonia.
- *Strep. zoo. can also cause rapid epidemic progression.
  - Symptoms:
    - Bloody nasal discharge
    - Respiratory distress
    - Death (Employees may find previously unaffected dogs dead in their cage in the morning).

Diagnosis (cont.)

When are diagnostics recommended?

- When symptoms and numbers are beyond the typical amount for the shelter
- Signs are severe, or not responding as expected to treatment
- In the face of suspected zoonotic outbreak



How should testing be performed?

- Test 10-30% (or a minimum of 5-10 dogs) of the population
- **Choose acutely** symptomatic dogs when using PCR multiplex testing.
- The human point-of-care flu test may be used to rule out canine influenza
  - Although these tests may be falsely negative, a positive test is enough to begin flu precautions (isolating symptomatic dogs and quarantining all contacts).
  - All positive and questionable negative human tests should be confirmed by the lab.

Risk Factors

- We now know that the **kennel or shelter environment** plays an important role in the average number of coughing dogs
- Anything that adds stress for dogs will increase their likelihood and severity of CIRDC

  - **Behavioral Causes**

    - Crowding
    - Loud barking
    - Intermixing with unfamiliar dogs
    - Increased length of stay
    - Decreased enrichment activities

  - **Medical Causes**

    - Old age or young age
    - Pre-existing disease
    - Unvaccinated dogs

  - **Facility Causes**

    - Lack of proper cleaning and sanitation
    - Lack of employee hand-hygiene
    - Increased humidity
    - Lack of proper ventilation and air flow
    - Lack of a proper isolation area
    - Improper traffic flow within the facility
    - Improper planning for disease outbreaks
    - Lack of proper traffic flow for staff and dogs

So, What Can We Do?

Control & Prevention!

Address All of the Following Risk Factors

- Physical
- Procedural
- Population Management
- Facility Management
- Lack of community involvement and support

Facility Design

- **Separate housing is ideal and should provide for one-way traffic flow**
  - Young healthy puppies or incompletely vaccinated younger dogs* and/or immunocompromised, geriatric dogs
    *young puppies are ideally fostered outside shelters with either community volunteers or rescue organization
  - Quarantine for new intakes
  - Quarantine for exposed dogs
  - Isolation for sick dogs, ideally with separate ventilation and exit
- **Guillotine or two-compartment kennels**
  - Preferred for enclosures
  - Ideally allow dogs to spend time outdoors
  - Allow for proper cleaning and sanitizing without removing dogs from their kennel
  - Natural behavior for most dogs includes separate areas for sleeping and elimination.
- **Kennel drains**
  - Preferred for wastewater removal and are preferable to mop usage.
  - Individual kennels should each have separate drains which empty into communal trenches.
  - Trenches should be outside the runs and slant toward a floor drain away from floor traffic.

Improvements for Existing Facilities

- All surfaces should be covered with impervious material
  - Floors and walls should be sealed, not painted.
- Dishes, hammocks, and toys:
  - Should not have rough or chewed surfaces that harbor germs
  - Should be disinfected between uses
  - Kept in covered storage when not in use.
- Hoses can be hung from the ceiling, with separate hoses in each section to decrease pathogen spread from dragging hoses.
- Regular maintenance should involve HVAC filter changes biweekly or monthly
- Creating and following simple sanitary protocols and traffic flow are often effective

Sanitation

There are four steps included for proper sanitation

*Ensure cleaning supplies, such as brushes and hoses, are designated for each area (general population, new intakes, young dogs, isolated and/or quarantined dogs) to avoid spreading pathogens between areas of the shelter

Step 1= Cleaning

- Remove waste and clean at least twice daily and throughout the day as needed to keep dogs away from waste
- Can occur with the dog in the kennel
- Prior to cleaning, tidying also involves removing all items such as dishes, bedding, and toys from the kennel

Sanitation (cont.)

Step 2= Cleaning

- Use hot water (180 degrees F), a scrubbing device, and a detergent such as Dawn
- Dogs should never remain within the enclosure during this step
- Some disinfectants have cleaning activity listed on the label. However, it's best to remove all solid waste prior to using these products
- The only disinfectants with combined cleaning activity are accelerated hydrogen peroxides (ex: Accel™) and Potassium Peroxymonosulfates (ex: Trifectant™). These sanitizer label claims don't require rinsing after appropriate contact time, although residues may form when they're not rinsed
    - **North Carolina Animal Welfare Act rules require complete rinsing after cleaning with any sanitizer/disinfectant to remove all residual chemicals**
- Attempts should be made to minimize extra water and overspray
    - Spraying may spread pathogens
    - Excess puddling of water on floors increases humidity, encourages pathogen growth, and increases the likelihood of dogs or employees walking on wet surfaces which will contaminate other areas
- Allow proper drying of kennels after washing and prior to sanitation

Sanitation (cont.)

Step 3= Sanitation

- Enclosures should be sanitized at least **once weekly**, or any time a new animal is introduced into a previously occupied enclosure
  - Food and water receptacles should be sanitized **daily** with a disinfectant following cleaning with hot water and detergent
- In general, disinfectants require at least a **10-minute contact time** before rinsing
- Sanitation protocols should should include directions for hand-hygiene, traffic flow, sanitizer dilution strengths and duration of dilution stabilities as easy-to-follow directions
- Print protocols in employee handbooks and hang over sinks or wash stations
- Repeat and reinforce protocols during staff continuing education activities
- Hoses should be fitted with foamer tips with built-in dilution settings to decrease water spraying, puddling and dilution errors
- Dogs should not be allowed entrance back into damp enclosures
- Mops should be washed and dried between rooms and uses, and each area should have its own dedicated mop and cleaning supplies

Step 4 = Drying

- Use a squeegee or towel to mop up excess water. **Complete air drying after sanitation is required prior to returning dogs to enclosures**

Sanitizing Outdoor Areas

When cleaning or sanitizing indoor or outdoor artificial turf:

- **Only Rescue™ with the foamer tip is labeled for this use.**
- **All other sanitizers are labeled for non-porous materials only.**
- **Although enzymatic formulas are labeled for odor control on artificial turf, they do not disinfect or clean.**

- **Most disinfectants, (including bleach, Wysiwash™, KennelSol™, Parvosol™, & Roccal-D™), are inactivated by organic material such as urine, feces, and dirt.**

Common Disinfectants

	Accelerated hydrogen peroxide	Potassium peroxymonosulfate	Quaternary ammonium compounds	Calcium hypochlorite	Sodium hypochlorite	Sodium dichloriosocyanurate
Common names	Rescue® (formerly named Accel®)	Trifectant®, Virkon®	KennelSol® Parvosol® Roccal-D®	Wysiwash®	Household bleach	Bruclean®
Effective against non-enveloped viruses?	Yes at 1:16 dilution	Yes at 1%	No	No	Yes, dilute to 1:32 (1 cup/gallon)	Yes
Inactivated by organic material?	No	Slightly less than bleach or quats	Yes	Yes	Yes	Yes
Detergent ability?	Good	Some	Variable	No	No	Some (if tablet form is used)
Requires separate step for cleaning prior to use?	No only pre-clean heavily soiled surfaces	No only pre-clean heavily soiled surfaces	Yes requires some pre-cleaning and all surfaces must be rinsed of detergent prior to using	Yes always requires extensive pre-cleaning, surfaces does not need to be rinsed after detergent	Yes always requires extensive pre-cleaning	Yes recommend pre-cleaning
Stability when diluted	90 days	7 days	Varies	24 hours	24 hours (Inactivated by light)	24 hours
Contact time	10 min.-1:32 dilution 5 min.-1:16 dilution	10 min.	10 min.	10 min.	10 min.	10 min.
Rinse required after use?	No	No	Yes	Yes	Yes	No
Cautions	Residual disinfectant may feel greasy at higher concentration	May leave residue or cause damage on some surfaces	Potentially toxic to cats if diluted incorrectly	Disconnect and rinse hose-end applicator after each use	Corrosive to metal, a respiratory irritant	Less corrosive to metal, less irritating than bleach

Veterinary involvement

!Vaccination is imperative!

A veterinarian familiar with shelter/population medicine should help each facility design separate vaccination, sanitation, disease, and outbreak protocols.

- AAHA, Maddie's Shelter Medicine Program, and the Association of Shelter Veterinarians recommend **ALL** dogs > 4 weeks of age (including pregnant dogs and bite quarantines) entering a shelter be vaccinated with an injectable MLV DHPP multivalent product AND intranasal Bordetella with parainfluenza +/-adenovirus administered in accordance with the vaccine manufacturer's recommendations

  Puppies < 16 weeks should be boostered every two weeks
  Dogs > 16 weeks should be boostered once in 4 weeks)

  - In communities where canine influenza is encountered, vaccination is recommended with the bivalent flu shot
  - This should be given as two doses, 2-4 weeks apart and will impart immunity 2 weeks after the final dose has been given. (This vaccine may not be useful in high-turnover shelters for this reason)

- All kennels should require updated documentation regarding their veterinarian's recommended vaccine protocol

Veterinary Involvement (cont.)

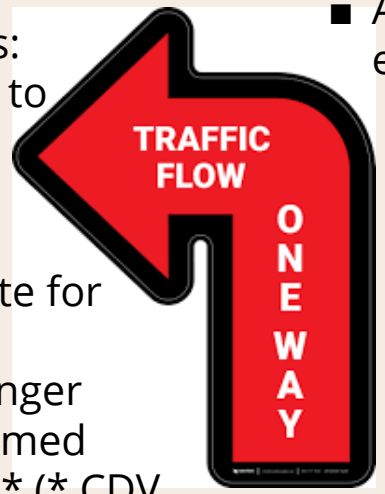
Rapid isolation of clinically affected dogs is one of the most effective strategies for decreasing the spread of respiratory pathogens

Disease and Outbreak Protocol Development

- Generalized Protocol vs. Individual
  - A generalized disease outbreak protocol is acceptable for basic procedures
  - Some outbreaks (influenza, distemper, pneumovirus, strep.zoo) require swift isolation of infected dogs and quarantine of exposed dogs, so **individual protocols are recommended**
- Clear, menu-driven protocols allow well-educated employees to quickly move identified dogs without first requiring approval
- Protocols should be regularly reviewed and revised
- Daily rounds should be made to identify dogs with developing clinical signs
- **Educate employees and empower them with the ability to make rapid isolation decisions**

Isolation and Quarantine

- **Quarantine for exposed dogs is essential**
  - Dogs may be infective 2 days prior to the onset of symptoms
  - Duration is usually for 7 days
  - If a quarantined dog shows clinical signs:
    - They should be promptly removed to isolation
    - The quarantine clock is restarted
- **Isolation times for sick dogs may vary**
  - However, 14 days is considered adequate for most pathogens
  - If space is limited, recovered dogs no longer showing clinical symptoms may be assumed safe to return to the general population* (* CDV and CIV are exceptions)
- Isolated and quarantined dogs should be taken care of **last** or with dedicated staff
  - Employees caring for sick or exposed dogs should wear proper PPE
    - Complete hair cover, gowns, gloves, and boots



- Dedicated cleaning supplies should be kept in isolation rooms within easy reach
- A pathway of traffic flow should be developed for employees and visitors
  - Begin in the clean areas and proceed through quarantine
  - Isolation is last before leaving the building
  - No traffic should go in the opposite direction
  - Clients should only be allowed in clean areas and should have access to sinks or hand sanitizing stations before entering and leaving the facility
- Staff should be educated in hand-hygiene, and sinks (ideally) or hand sanitizing stations should be available and easily reachable throughout the facility

Population Management

Factors that increase a dog's stress can also result in decreased air quality, ventilation, and the inability to properly clean enclosures

- Noise
- Crowding
- Random co-mingling of dogs
- Increased length of stay

Population Management (cont.)

Each day that a dog stays in the shelter increases the likelihood of CIRDC disease development

What to do?

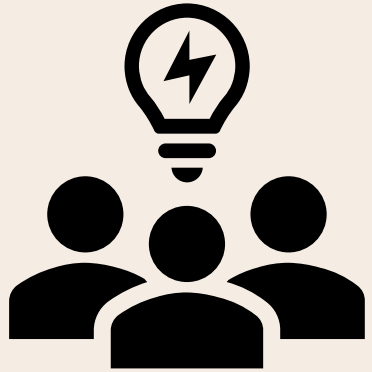
- Decrease the length of stay (LOS) for dogs in shelters
  - Use of fosters (community volunteers or rescue organizations)
  - Use of social media to advertise dogs in quarantine or isolation as adoptable
  - Minimally affected quarantined or isolated dogs may be released to rescues or fosters with proper instructions and legal wording to continue their isolation periods outside the shelter
- Enrichment activities increase quality of life and decrease stress for sheltered and long-term stays for kenneled dogs
- One-on-one human contact, time with an interactive toy, or a walk outside with a volunteer are examples of enrichment activities

Facility Management (cont.)

Factors that hinder effective operation & result in the increased costs & loss of business

- Understaffing
- Overcrowding
- Lack of ongoing employee education, training, and cooperative involvement

Lack of supportive and responsive management interferes with competent and engaged employees making decisions based on their day-to-day observations



Community Involvement

Who should be involved?

Involving the community with adoption and fostering benefits everyone

1. Dogs get a change of routine and a better chance of adoption
2. The shelter and staff will have less crowding and more space and time for effective cleaning and other duties
3. Volunteers have the satisfaction of knowing they're helping the animals and the community
4. Volunteers increase social media dispersion of adoptable dogs and may influence community leaders who influence shelter budgets

What about when there is a flu outbreak?

Rapid, proactive communication with stakeholders helps others and protects the shelter's reputation.

Who are the stakeholders?

1. Recent adopters
2. Other shelters
3. Local and state veterinary associations
4. State veterinarian
5. Public health officials
6. Media
7. Legal counsel

In summary, change what you can, and conditions will improve!

1. Create and follow a vet-approved vaccination protocol
2. Create and follow an effective and consistent sanitation protocol
3. Create a disease control protocol involving proper traffic flow, PPE, and guidelines for quarantine and isolation timelines and procedures
4. Control puddling of water after cleaning
5. Decrease intermixing and crowding
6. Increase enrichment, especially for dogs staying for longer periods
7. Decrease lengths of stay
8. Support active, ongoing employee education, training, and involvement
9. Maintain adequate staffing and control overpopulation
10. Maintain a supportive and responsive management philosophy
11. Increase community involvement and support

Available Shelter Resources

- National Support agencies for shelter medicine
  - American Society for the Prevention of Cruelty to Animals (ASPCA)
  - Humane Society of the United States (HSUS)
  - American Humane Association (AH)
  - National Animal Care & Control Association (NACA)
  - Association of Shelter Veterinarians (ASV)
- Excellent handout on disease outbreak management in shelters https://sheltermedicine.vetmed.ufl.edu/wordpress/files/2020/08/Disease-Outbreak-Management-in-Shelters.2021.pdf
- Sample disease and outbreak protocols and shelter outbreak consultation https://sheltermedicine.vetmed.ufl.edu/shelter-services/disease-management/
- Shelter outbreak consultation (FREE email support)

  https://www.vet.cornell.edu/hospitals/maddies-shelter-medicine-program
- Dr. Sandra Newbury, Director, University of Wisconsin Shelter Medicine Program (H3N2)
  - Email: uwsheltermedicine@vetmed.wisc.edu
- UC Davis Koret Shelter Medicine Program
- Dr. Cynda Crawford, University of Florida (H3N8) at crawfordc@ufl.edu

References

American Animal Hospital Association (AAHA) AAHA Canine Vaccination Guidelines. (2022). https://www.aaha.org/aaha-guidelines/2022-aaha-canine-vaccination-guidelines/home/

American Society for the Prevention of Cruelty to Animals (2023). Shelter disinfectant quick reference. ASPCApro. https://www.aspcapro.org/resource/shelter-disinfectant-quick-reference

Berliner, E. A. (2021). Canine infectious respiratory disease (CIRD). In Miller, L., Janeczko, S., Hurley, K. (Eds), Infectious Disease Management in Animal Shelters. (Vol.1, pp. 221-255). Wiley Online Library. https://doi.org/10.1002/9781119294382.ch10

Crawford, C. (2021). Canine respiratory infections in shelters. Maddie's Shelter Medicine Program. https://sheltermedicine.vetmed.ufl.edu/wordpress/files/2021/05/Canine-Respiratory-Infections-in-Shelters.

O'Quin, J. (2021). Outbreak Management. In Miller, L. Janeczko, S., Hurley, K. (Eds.), Infectious Disease Management in Animal Shelters. (Vol. 1, pp. 113-142). Wiley Online Library. https://doi.org/10.1002/9781119294382.ch6

Reagan, K. L., & Sykes, J. E. (2020). Canine infectious respiratory disease. Vet Clin North Am Small Animal Practice. 50(2), 405-418. https://doi.org/10.1016/j.cvsm.2019.10.009

Smith-Blackmore, M. (2021). Cleaning and disinfection in shelter medicine. Merk Veterinary Manual. https://www.merckvetmanual.com/special-subjects/shelter-medicine/cleaning-and-disinfection-in-shelter-medicine

The Guidelines for Standards of Care in Animal Shelters (JSMCAH). Second edition. (2022). Journal of Shelter Medicine and Community Animal Health. https://doi.org/10.56771/asvguidelines.2022

University of Wisconsin Shelter Medicine *(2015)*. Canine influenza. https://sheltermedicine.wisc.edu/library/resources/canine-influenza