

CANINE DISTEMPER OUTBREAKS..... what you need to know to save lives



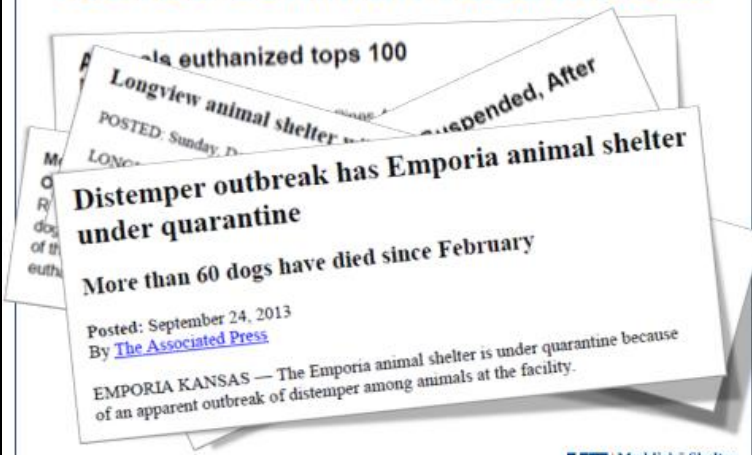
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MADDIE'S
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ALL TOO COMMON HEADLINES.....



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WHY ARE SHELTERS AT RISK ?

- Are there certain practices that put shelters at risk for a distemper outbreak?

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CASE #1

Kentucky shelter euthanizes more than 200 dogs after distemper outbreak

By The Associated Press

Posted July 25, 2012 at 1:02 p.m.

HAZARD, Ky. — An eastern Kentucky animal shelter has euthanized nearly 200 dogs after a distemper outbreak.

Tom Caudill, manager of the Kentucky River Regional Animal Shelter in Hazard, said 198 of the 211 dogs at the shelter have been put down. The remaining 13 dogs are being quarantined and were retested for the highly contagious virus on Tuesday.



KY SHELTER 2012

- Nonprofit shelter serving 4 rural counties
- 3 employees
- Multiple unrelated dogs housed in chain link runs
 - Dogs constantly removed and added
 - Runs never empty
 - Puppies housed in same area as adults
 - Multiple litters housed together in a run
- No vaccination because of budget restraints
- Rescue groups transport dogs to other shelters and adoption facilities in the Midwest



KY SHELTER 2012

- June 2012
 - Many dogs in shelter with respiratory/GI disease
 - Dogs dying in runs
 - Dogs transported to local and Midwest rescue groups on 6/9/12 developed pneumonia, diarrhea, and seizures
 - CDV confirmed by postmortem testing of rescue group dogs on 6/29/12
- Shelter closed 6/29/12 for 2 months
 - 211 dogs on-site
 - 198 infected dogs died or were euthanized due to disease



CASE #2

Distemper reported at Melbourne animal shelter

FLORIDA TODAY • FEBRUARY 17, 2009

The dog-adoption program at the county-run shelters in Melbourne and Titusville has been temporarily suspended after canine distemper was diagnosed by the Maddie's Shelter Medicine Program at the University of Florida College of Veterinary Medicine.

The outbreak was discovered when a veterinarian noticed persistent coughing among some dogs at the South Animal Care Center at 5110 W. Eau Gallie Blvd. in Melbourne.

The virus killed 15 dogs at the shelter, said Bobby Bowen, Brevard County Animal Services and Enforcement interim director.

Between 250 and 300 dogs are housed in the south shelter in Melbourne. The north shelter in Titusville can accommodate up to 100 canines.



FL SHELTER 2009

- Open admission municipal shelter
 - 15,000 animals/yr
- ~250 dogs on-site daily
 - Daily census >300% housing capacity
 - Random co-mingling [some in – some out]
 - No segregation of puppies from adults
 - Dogs with URI remain in general population for treatment



FL SHELTER 2009

- Dogs moved to different runs on a daily basis to facilitate sanitation
- Vaccination of dogs selected for adoption only [>5 days after intake]
- No biosecurity policies
- No structured plan for disease surveillance



FL SHELTER 2009

- Jan/Feb 2009
 - Admission of a puppy in January with URI that progressed to pneumonia with neurological signs
 - 34 dogs developed severe URI ± myoclonus in early Feb – clinical signs appeared within 9 to 13 days after admission
 - CDV infection confirmed
 - Shelter closed for 2 months
 - 68 infected dogs euthanized



CASE #3

Dog Disease Forces Animal Shelter Shut Down

By Jeff Burnside and Todd Wright
Mar 25, 2011

There's a crisis at the Miami-Dade Animal Services shelter. The lives of hundreds of dogs and puppies hang in the balance, after the outbreak of a particularly deadly distemper virus. Currently, there are about 500 dogs and puppies at the shelter.

"Miami-Dade County's Animal Services is temporarily suspending selected services due to an infectious disease problem among dogs and puppies," a statement read Thursday. "Distemper, in particular, has become endemic in the shelter and all dogs and puppies are considered exposed and at risk."



FL SHELTER 2011

- Open admission municipal shelter
 - 37,000 animals/yr
- 350-400 dogs on-site daily
 - Daily census ≥200% housing capacity
 - Random co-mingling [some in-some out]
 - No segregation of puppies from adults
 - Policy to house dogs with URI in a separate area



FL SHELTER 2011

- Dogs put in wire crates on the floor or tied outside of runs during sanitation
 - Crates not disinfected between dogs
 - Close contact between tied out dogs



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FL SHELTER 2011

- Not all dogs vaccinated at intake
 - ~80% vaccinated at intake
 - ~10% vaccinated days later
 - ~10% not vaccinated at all
- No biosecurity
- No structured plan for disease surveillance

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FL SHELTER 2011

- March 2011
 - 70 dogs with respiratory disease and/or diarrhea
 - 19 sick dogs were in the URI isolation
 - 51 sick dogs found throughout rest of shelter
- 45 dogs tested for CDV
 - 30 (67%) infected
 - Infected dogs housed in 2 different buildings containing about 200 dogs each
- Shelter closed for 2 months

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RISK FACTORS FOR CDV OUTBREAKS

- Crowding
- Random co-mingling (some in – some out)
- Mixing of puppies w/ adults
- No or inadequate vaccination
- Poor sanitation practices
- Failure to isolate sick animals
- Inadequate biosecurity
- Inadequate disease surveillance



OTHER PREDISPOSING FACTORS?

- How many dogs enter shelters with no immunity to CDV?
- Does vaccination at intake provide rapid protection from infection?



CDV IMMUNITY AT INTAKE

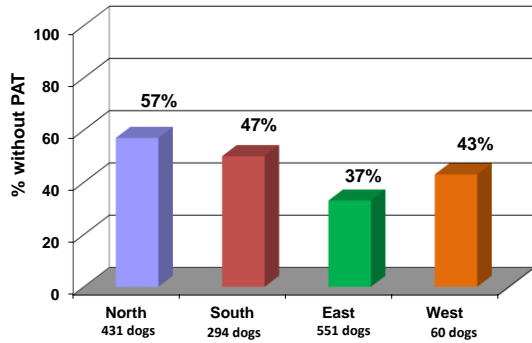
- UF MSMP study to determine the CDV immunity status of dogs entering Florida shelters
 - Blood samples from 1336 dogs on entry into shelters in various regions of Florida
 - CDV antibody titers measured to determine number of dogs with protective antibody titers (PAT)

—Lechner. JAVMA 2010; 236:1317-1321



CDV IMMUNITY AT INTAKE

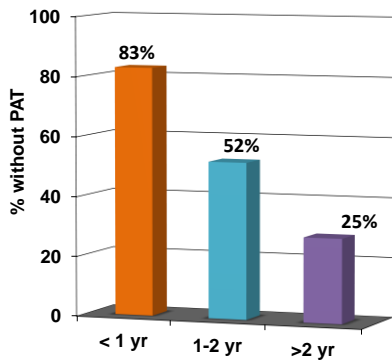
- 1 of every 2-3 dogs did not have CDV PAT at intake



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CDV IMMUNITY AT INTAKE

- Most juvenile dogs did not have CDV PAT at intake



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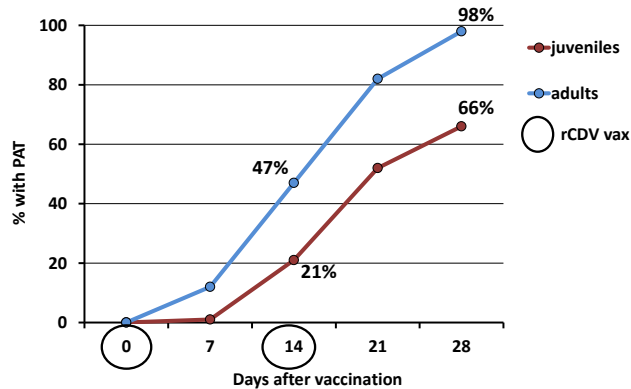
RESPONSE TO CDV VACCINATION

- UF MSMP study to determine how long it takes shelter dogs to develop CDV PAT after vaccination
 - 204 dogs with no CDV antibody at intake
 - 86 juveniles <6 mo old
 - 118 adults ≥6 mo old
 - Vaccinated with Merial rCDV combo vaccine at intake and 2 weeks later
 - CDV antibody titers measured weekly

—Fabian. *ACVIM Forum*. June 2013

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RESPONSE TO CDV VACCINATION



RESPONSE TO CDV VACCINATION

- Time-to-immunity from rCDV vaccination is 14-28 days
 - 50% of adults protected by 14 days and 100% by 28 days
 - 21% of juveniles protected by 14 days and <100% by 28 days
- More than 1 vaccination is necessary for immunity
 - Many dogs ≥ 6 mo old need 2 vaccinations (intake and 2 weeks later)
 - Most puppies <6 mo old need multiple vaccinations at 2-week intervals



VACCINE PROTECTION

- Is the time-to-immunity after rCDV vaccination too long for dogs in high-risk situations such as shelters?
- One study evaluated whether rCDV and MLV CDV vaccines can provide rapid protection of puppies (Larson. *Vet Ther* 2006)
 - Exposed to CDV hours to 7 days after vaccination
 - Puppies did not get sick
 - Did not determine infection status
 - Very few puppies in the study

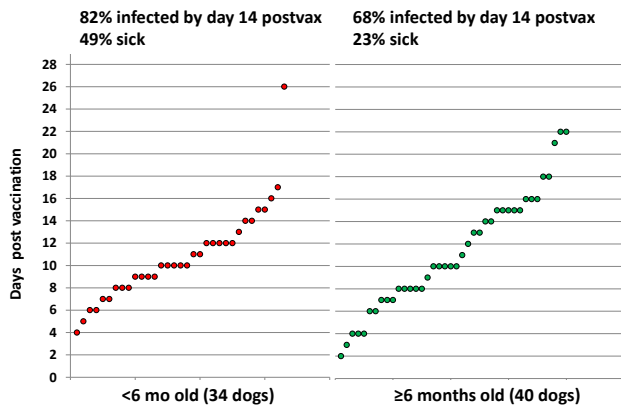


VACCINE PROTECTION

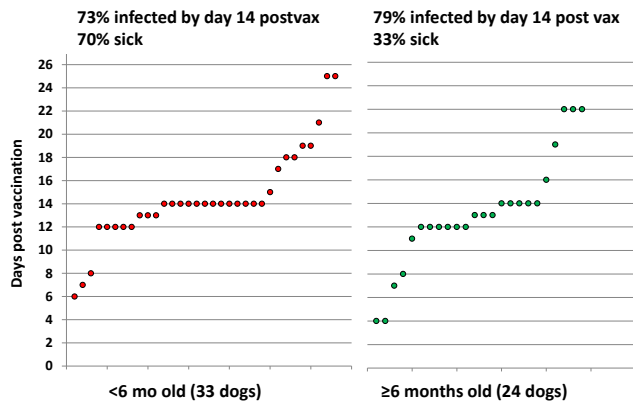
- UF MSMP tested vaccinated dogs for infection during CDV outbreaks in shelters
 - 186 dogs in 4 shelters with outbreaks
 - 156 dogs vaccinated at intake with rCDV
 - 30 dogs vaccinated at intake with MLV CDV
 - Infection status determined by CDV PCR testing of swabs from the upper respiratory tract

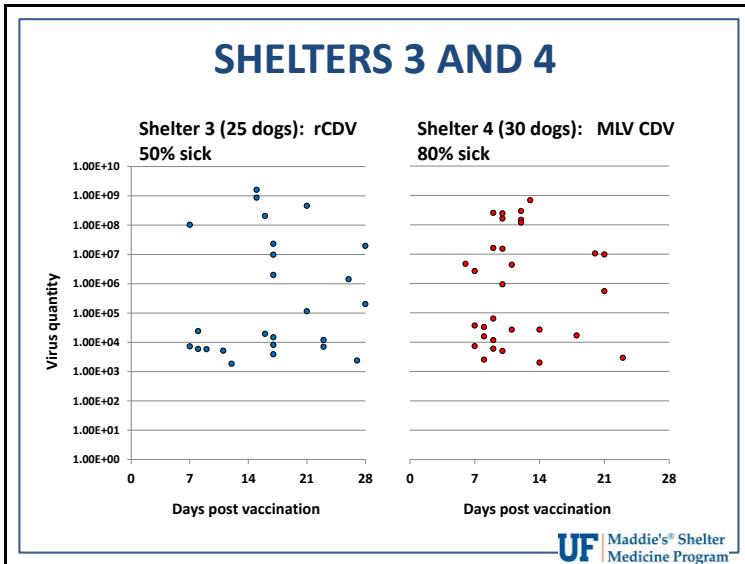


SHELTER 1 [RECOMBINANT CDV VACCINE]



SHELTER 2 [RECOMBINANT CDV VACCINE]





CONCLUSIONS

- Dogs were infected within 28 days of vaccination with rCDV or MLV CDV at intake
 - Most were infected within first 2 weeks
 - Correlates with time of vulnerability from delayed antibody response
- Infected puppies <6 mo old were more likely to get sick than adults
 - Adults may have acquired partial immunity

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WHY ARE SHELTERS SO VULNERABLE?

- Large numbers of dogs enter shelters without protective immunity to CDV
- Slow immune response to CDV vaccination creates a pool of susceptible dogs
- Once introduced into the shelter, CDV is efficiently spread to susceptible dogs with inadequate vaccine responses
- Vaccination is vital to increasing population immunity in a shelter, but the slow response time requires additional strategies to protect at-risk dogs

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DISTEMPER IMPACTS ON SHELTERS

- Death of large numbers of dogs
- Adoption paralysis
- Financial costs
- Resource reallocation
- Low staff morale
- Spread of disease into pet homes and pet placement partners
- Negative perception by community stakeholders
- **Overall impact: decreased life-saving capacity**



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LIFESAVING STRATEGIES FOR CDV OUTBREAKS IN SHELTERS

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GOALS

- Create a clean break between infected/exposed dogs and unexposed dogs without resorting to depopulation
- Save lives by
 - Considering treatment options for sick dogs
 - Assessing risk for infection of exposed dogs

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INTERVENTION STRATEGY

- Diagnosis
- Isolation of sick dogs
- Quarantine of exposed asymptomatic dogs
 - Assessment of exposed dogs for infection risk
- Protection of unexposed dogs
- Biosecurity
- Environmental decontamination



DIAGNOSIS



THE MANY FACES OF DISTEMPER

- CDV causes a systemic infection
 - Respiratory tract
 - Ocular tract
 - GI tract
 - Urinary tract
 - Bones
 - Skin
 - CNS
 - Transplacental
- Infection of multiple systems confounds recognition and causes frequent misdiagnosis
- Cannot diagnose by clinical signs alone



DIAGNOSIS

- Best antemortem test is PCR on swabs from the upper respiratory tract
 - PCR detects viral DNA
 - Very sensitive and specific
 - Rapid turnaround time for results (2-3 days) – timely patient and population management
 - Moderate cost: \$45/sample dependent on diagnostic lab and shelter discounts



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VACCINE INTERFERENCE?

- PCR detection of modified-live CDV vaccine strains
 - Detection in <20% healthy dogs during 1st 2 weeks postvax (Leutenegger, Crawford, Levy. 2011 ACVIM Forum)
- Will not detect rCDV in the Merial canarypox DAPP vaccine
- Quantitative CDV PCR test (Idexx) – developed to differentiate between MLV vaccine and wild type strains using virus quantity
Vaccine cutoff = 1.00 E+05 virus particles/sample

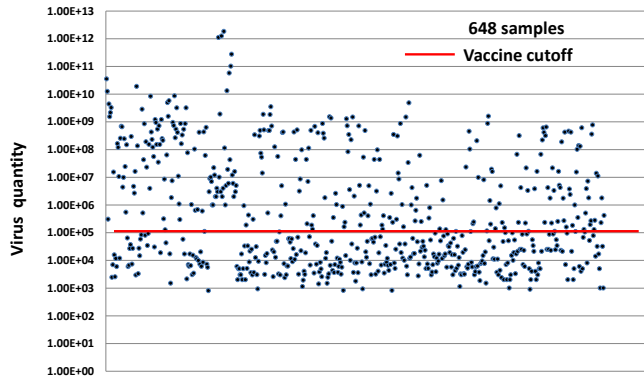
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VACCINE INTERFERENCE?

- UF MSMP evaluated CDV quantity in 648 samples collected from dogs exposed to CDV during distemper outbreaks from 2010-2013
 - Sick and asymptomatic dogs
 - Newly infected and recovered dogs
- Tested 48 infected dogs every 1 to 2 weeks until virus shedding stopped

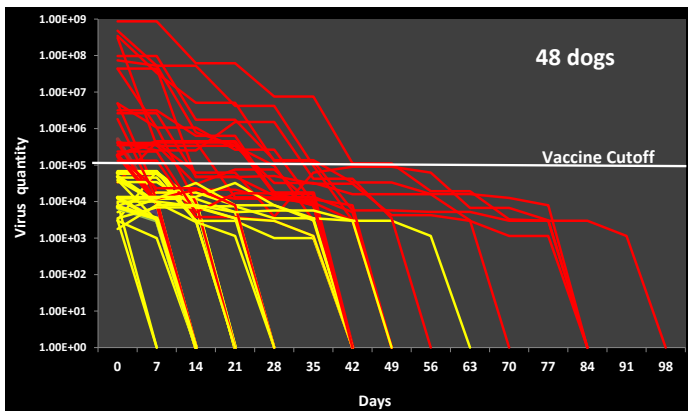
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VIRUS QUANTITY IN INFECTED DOGS



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VIRUS SHEDDING



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CONCLUSION

- Virus amounts < vaccine cutoff can represent the early and recovery phases of wild type infection
- Dogs with low virus counts in high-risk environments should be considered infected until proven otherwise
 - Could be early or waning infection
 - May be an infectious risk to susceptible dogs
 - Isolate and repeat test 1 week later

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ISOLATION



ISOLATION OF SICK DOGS

- Single most important step
 - Reduces virus transmission in shelter
- Evaluate options for treatment based on resources in the shelter and community
- Euthanasia may be the only humane option if no on-site or off-site isolation options for treatment



TREATMENT OF SICK DOGS

- Puppies can have more severe and prolonged disease
 - Waxing and waning course of disease over 1 to 2 mo
- Adult dogs with partial immunity have milder disease with recovery in days
 - Usually have transient respiratory ± GI signs



TREATMENT OF SICK DOGS

- Treatment in the shelter is resource- and time-intensive with inherent risk for virus spillover to susceptible dogs
 - Requires excellent containment for 1-3 mo
 - Strict biosecurity protocols
 - Dedicated staffing
 - Sufficient medical support
 - Funding
- Must develop end points for treatment based on resources and quality of life



TREATMENT OF SICK DOGS

- An alternative is to send infected dogs to a safe foster home or rescue group for care
 - Medical foster homes without susceptible pets
 - Reduces risk for exposure of more dogs and contamination of the shelter
 - Addresses welfare concerns such as socialization and enrichment
 - Insure that the medical care is supervised by a veterinarian

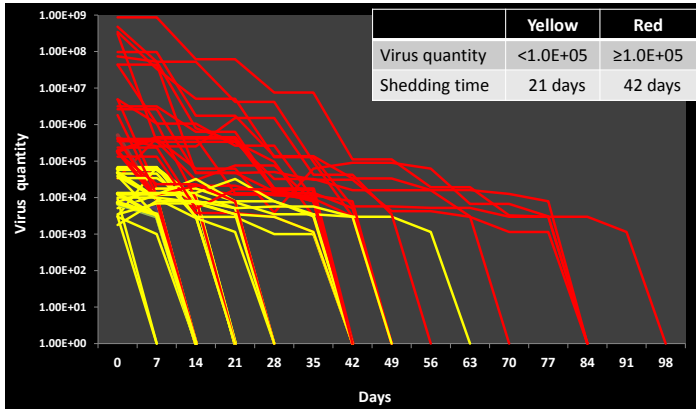


RELEASE FROM ISOLATION

- Infected dogs should be isolated from non-immune dogs until virus shedding stops
- Virus shedding continues for variable periods of time after clinical recovery
- UF MSMP tested 71 infected dogs in shelter outbreaks with CDV qPCR every 1-2 weeks to determine duration of virus shedding

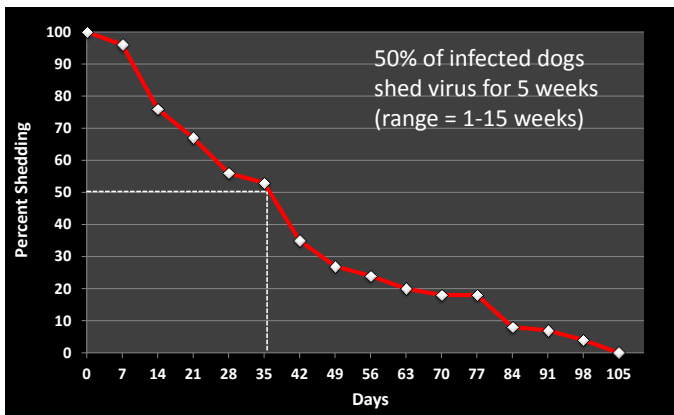


VIRUS SHEDDING



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VIRUS SHEDDING



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RELEASE FROM ISOLATION

- Perform CDV qPCR test after clinical recovery to determine if virus shedding has stopped
- OR
- House with well-vaccinated dogs after recovery

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QUARANTINE OF EXPOSED DOGS

- No clinical disease – why?
 - Infected but in incubation period
 - Subclinical infection
 - Not infected due to immunity
- All exposed animals should be considered an infectious risk pending assessment
 - Implement strict biosecurity practices
- Quarantine for full incubation period of the pathogen (4 weeks for CDV)



QUARANTINE CHALLENGES

- Strain on housing capacity
 - Quarantine period can extend for weeks to months
 - Need separate housing for unexposed animals in the shelter and for animals that must be admitted
- Strain on capacity for care
 - Staff is spread thin between care for segregated populations while adhering to strict biosecurity measures
- Concerns for deterioration of the behavioral health and welfare for dogs held in shelter quarantine for long periods of time



RISK ASSESSMENT

- Determine risk of infection for quarantined animals
 - Humane and cost-effective method for quickly moving animals out of quarantine
 - Relieves strain on housing capacity, capacity for care, and meeting quality of life concerns
- Three approaches
 - Test for CDV immunity
 - Test for CDV infection
 - No testing – use other criteria



TEST FOR IMMUNITY

- Test all exposed *asymptomatic* dogs for CDV PAT
- CDV PAT
 - Low risk for infection
 - Release from quarantine
- No CDV PAT
 - High risk for infection
 - Stay in quarantine or move to a foster home
 - Repeat CDV vaccination



CDV PAT TESTS

- Point-of-care ELISA kits for determining CDV PAT
 - Synbiotics CDV/CPV Titerchek
 - Biogal Canine VacciChek
 - Accuracy is comparable to gold standard tests performed by reference labs
(Gray. JAVMA 2012; Litster. Vet J 2012; Butler. ACVIM Forum 2013)
 - Require very small amounts of serum
 - All needed reagents and supplies in the kit
 - Rapid results in 20 minutes
 - Easily performed by technicians
 - ~\$11-13/dog



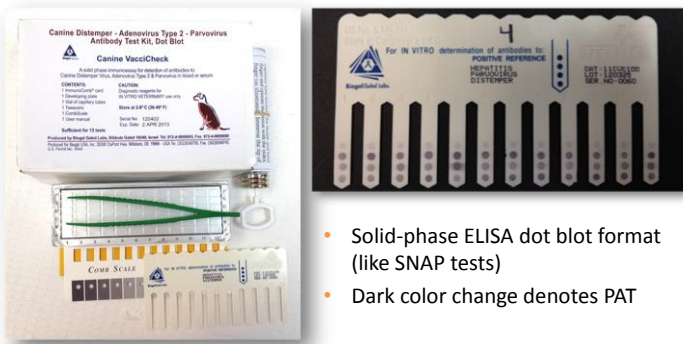
SYNBIOTICS CDV/CPV TITERCHEK



- Liquid-phase ELISA
- Microtiter well format
- Blue color change denotes PAT



BIOGAL CANINE VACCICHECK



- Solid-phase ELISA dot blot format (like SNAP tests)
- Dark color change denotes PAT



TEST RELIABILITY

- Is presence of PAT a good predictor for low risk of infection in the face of CDV exposure?
 - Does the test differentiate between PAT due to vaccination vs. infection?
 - How predictive is the test for puppies that may have transient maternal CDV antibody?
- Can CDV PAT status alone be used or should CDV PCR testing be done?
 - CDV PAT cost: \$11-13/dog
 - CDV PCR cost: \$45/dog



CASE #1

- CDV outbreak in a shelter housing 221 dogs from 3 weeks to 3 years old
 - Intervention strategy started *within 2 weeks* of first cases
- 111 asymptomatic exposed dogs in quarantine
 - 60 dogs ≥4 mo old
 - 51 dogs <4 mo old
 - CDV PAT testing on day 1 to assess risk for infection
 - CDV qPCR on day 1 and day 10 to confirm infection status



CASE #2

No. dogs	Day 1 PAT	Risk for CDV	Day 1 PCR	Day 14 PCR	Outcome
55	no	high	neg	49% pos	sick
10	yes	low	neg	30% pos	healthy

- Presence of CDV PAT was 70% accurate in predicting low risk for infection

CASE #3

- CDV outbreak in a municipal shelter
 - Intervention strategy started *1 month after* first cases
- 139 exposed asymptomatic dogs ≥4 mo old in quarantine
 - CDV PAT and CDV PCR testing on day 1

CASE #3

No. dogs	Day 1 PAT	Risk for CDV	Day 1 PCR	Outcome
53	no	high	100% pos	100% disease
86	yes	low	100% pos	97% disease

- Presence of CDV PAT did not correlate with low risk for infection when testing performed after 1 month of potential exposure
- All dogs with CDV PAT were already infected and had seroconverted

RISK ASSESSMENT USING CDV PAT

- CDV PAT is a good, but not perfect, indicator of protection from infection
 - More reliable when the exposure period is 2 weeks or less
 - Not reliable for puppies
 - Dogs with subclinical or preclinical infection will test “false positive” due to seroconversion from infection
- Safe practice to release exposed dogs with CDV PAT to housing with well-vaccinated dogs



RISK ASSESSMENT USING CDV PCR

- CDV PCR is the best indicator of true infection status
 - Cost prohibitive for most shelters
- Can perform CDV PCR on samples pooled from several dogs to reduce costs
 - PCR is very sensitive and virus detection not likely to be affected by dilution
 - Positive result triggers re-testing of each dog in the pool
 - Group dogs into pools based on age and time since last vaccine



ALTERNATIVE TO TESTING?

- Triage dogs based on age, vaccination status, and available housing
- Puppies <6 mo old: *high risk* regardless of vaccine status
 - Most have no immunity at admission
 - Slow response to vaccination (>2 weeks)
 - Highest risk for infection and clinical disease
 - Need biosecure housing



ALTERNATIVE TO TESTING?

- Dogs ≥ 6 mo old exposed within 2 weeks of intake vaccination: *moderate risk*
 - 50% enter the shelter with no immunity
 - Response to intake vaccine may take 2 weeks
 - May have subclinical infection
 - House with adult dogs that have immunity
- Dogs ≥ 6 mo old with 2 or more vaccinations are at *low risk*
 - Highest probability of protective immunity
 - House with adult dogs that have immunity



EVALUATION SURVEY

[HTTPS://WWW.SURVEYMONKEY.COM/S/5D73CN2](https://www.surveymonkey.com/s/5D73CN2)