MANAGING PARVOVIRUS: PREVENTION AND MANAGEMENT IN THE SHELTER SETTING

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OVERVIEW

- Overview of managing an outbreak
- Canine and feline parvovirus
- Brief immunology review
- Diagnostics and their applications in a shelter setting
- Other progressive methods of prevention
- Questions that remain . . .

TBREAK
ENTIFICATION AND
VESTIGATION

DEFINITION OF AN *OUTBREAK*

Disease incidence in excess of what is *usually* present

VETERINARIANS

What my friends think I do

What my parents think I do

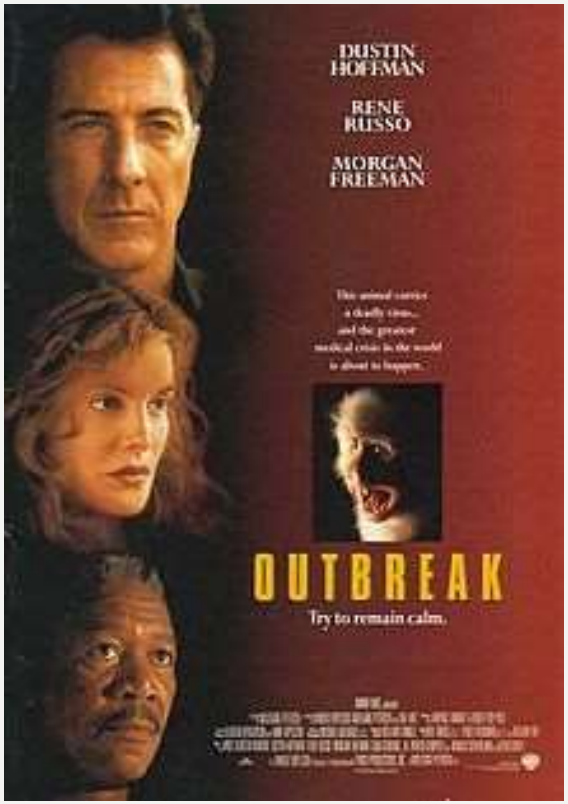
What my patients think I do

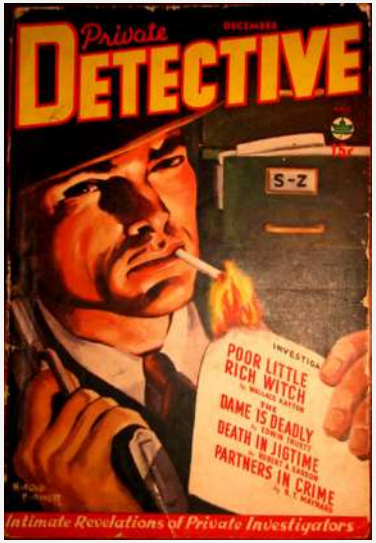
What my clients think I do

What I think I do

What I really do

Here's what people think you to do …





What you *think* you do

"OH NO, I'M FREAKING OUT . . .

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WHAT YOU ACTUALLY DO, RIGHT?

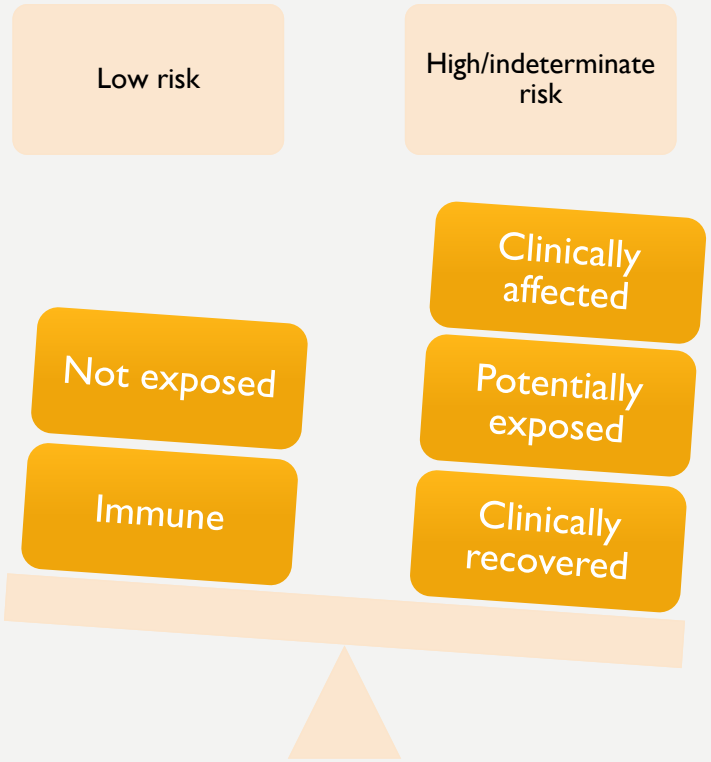
Steps	Outbreak Investigation in a multi-animal setting
1	**Recognition, case definition, diagnosis**
2	**Identification and management of affected and at risk animals**
3	**Limit intake of new animals, or new exposures of additional animals**
4	**Environmental decontamination**
5	**Communication**
6	**Review and revisions to current methods and protocols**

BEING PREPARED MEANS PRE-EXISTING PROTOCOLS

- Do
  - Segregate clinically ill animals immediately
  - Invest in diagnostics
  - Strictly adhere to cleaning protocols
  - Establish rationale traffic patterns
    - Healthy to vulnerable
    - Young to old
    - Clinically ill with their own staff whenever possible

- Consider
  - Restricting entry of new animals
  - Open communication early to the public and volunteers
  - Enlisting help
  - Worst case scenario
  - Best case scenario

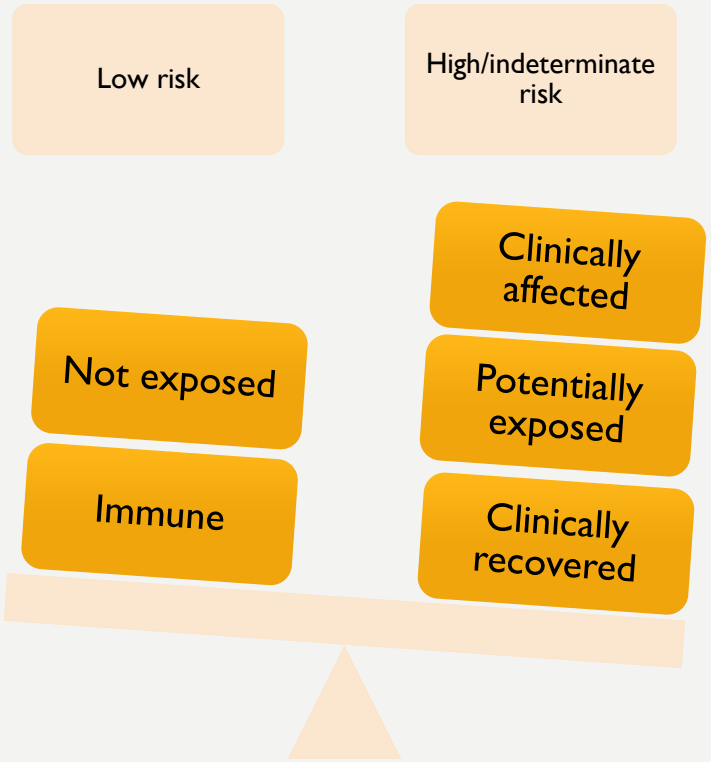
PERFORMING A RISK ASSESSMENT



PREVENTION AND CONTROL MEASURES

Risk Group	Prevention and Control Measure
Not exposed	Segregate and adopt
Immune	Segregate and adopt
Clinically ill	Isolate
Potentially exposed	Quarantine, monitor
Clinically recovered	Move to adoption, but when

PERFORMING A RISK ASSESSMENT



CANINE AND FELINE PARVOVIRUS

PARVOVIRUS: THE BASICS

Clinical signs:

- Gastrointestinal (vomiting, diarrhea)
- Lethargy, anorexia, fever, non-specific signs
- Leukopenia
- Sudden death
- Puppies: Related to rapidly dividing cells – myocarditis
- Kittens: central nervous system/ cerebellum

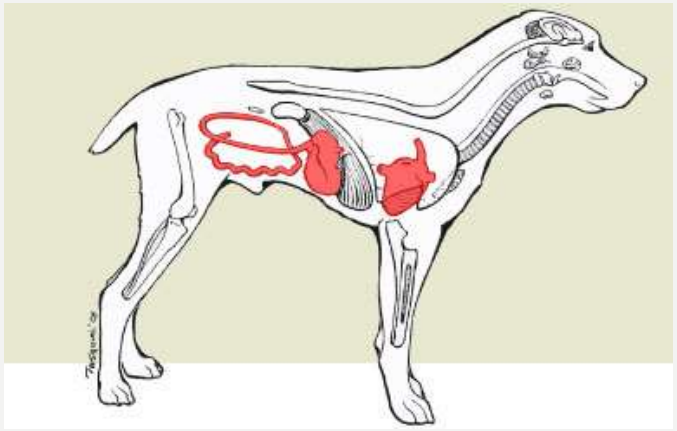
In the environment : Non-enveloped virus, very tough to kill

Dose dependent disease

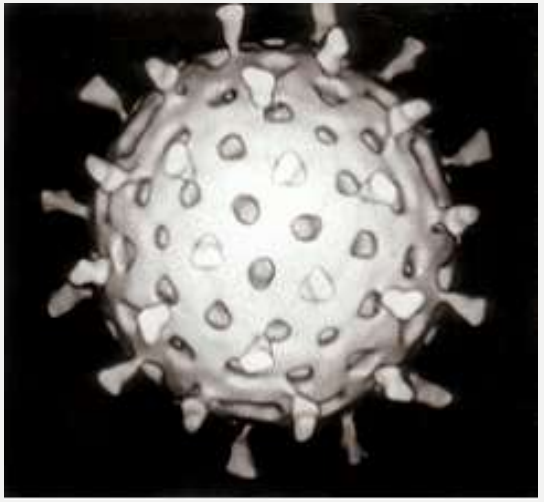
- Preventive care: Antigenically stable, so vaccines are reliable. And unlike some other diseases, vaccination protects against getting the disease.

CANINE PARVOVIRUS (CPV2)

- Transmission
  - Direct contact
  - Fecal/oral
  - Fomites
- Incubation
  - 2 to 14 days, most commonly 3-7
- Shedding
  - two days "prior to signs"
  - 14 days after recovery



FELINE PANLEUKOPENIA



- Transmission
  - direct contact,
  - fomite,
  - transplacentally
- Incubation period
  - 2 to 10 days
- Shedding
  - can occur up to 6 weeks after recovery (Grace 2006, Sturgess 2003)
  - 3 weeks is thought to be more common

CHALLENGES IN DIAGNOSIS AND TESTING FOR THESE DISEASES

- Signs are non-specific
- The cost of a missed diagnosis is HIGH
- Testing can be confounded by vaccination
- Affected animals can be shedding prior to showing signs, or even without showing signs

CANINE PARVOVIRUS ELISA TESTS

(IDEXX SNAP, SYNBIOTICS ASSURE)

Antigen test

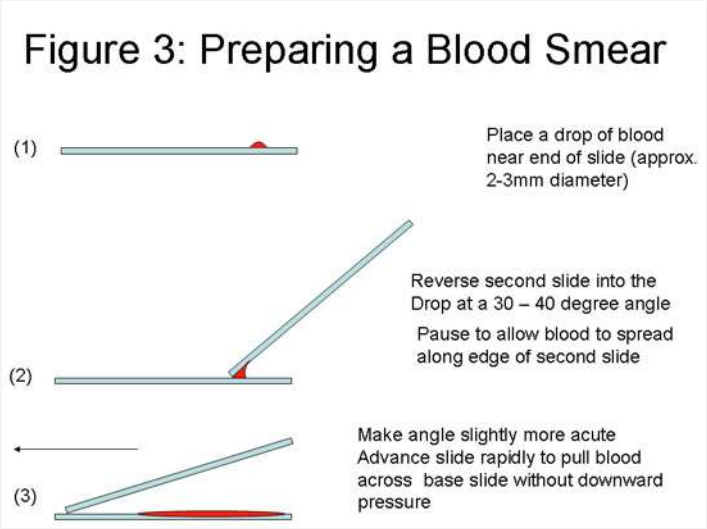
- Testing for viral particles in the feces
  - DIRECT rectal swabs more sensitive
- Controversy: Do "light" positives occur in response to vaccination?
  - No with IDEXX (Schultz 2008)
  - Sometimes (Larson 2007)
    - Thought to be within 5 – 7 days
    - Judge based on clinical signs
    - When in doubt, isolate from the rest of the population
- Can be used for FPLV as well as CPV
  - Questionable specificity
  - positives occur post vaccination

CPV/ FPLV PCR

- Much more sensitive
  - Can detect small amounts of the viral DNA in a fecal sample
- Quantitative tests can distinguish positives due to vaccination
- Delay
- Expensive

TESTING IS ONLY ONE PIECE OF THE PUZZLE

- Judge based on clinical signs
- When in doubt, isolate from the rest of the population
- Patient-side confirmation
  - Blood smear or CBC
    - Neutropenia, pancytopenia



REMEMBER

Now what?

- An ELISA parvo antigen test
  - Is NOT a economical screening test on *healthy* animals
  - Low prevalence means low PPV
- It is a *diagnostic* test on clinically ill animals

IMMUNOLOGY 101

The Good: Both CPV and FPLV vaccines are extremely effective at preventing disease. Modified Live Vaccinations are more successful in a much shorter time frame, and should be used in shelters.

- The Bad: The prevalence of protective antibodies in animals against the diseases can vary, especially in animals entering shelters.

- The Ugly: In young animals (<16 weeks) maternal antibodies can interfere with the vaccination, making these vaccinated animals susceptible to disease.

THE GOOD: MODIFIED LIVE VACCINATIONS

- CPV MLV is effective
  - Protective immunity develops within days
  - With no MDA in play, in a challenge study verified immunity in 98 to 99% of dogs after one dose of MLV vaccine (Schultz 2006)

- FPLV MLV is effective
  - Protection was demonstrated within 1-2 days through the introduction of positive cats to just vaccinated cats (Brun 1979)
  - In another study, detectable serum antibodies were present in 5 to 7 days, but protection occurs even earlier (Ford 2004)

- Thus, for both of these diseases we have seen the move to triennial vaccination in private practice and for vaccination on intake in shelters

THE BAD: SHELTER ANIMALS MAY NOT HAVE EQUAL PROTECTION AGAINST PARVOVIRUS

- Dogs to CPV:
  - Large study of 1441 owned dogs entering vet hospitals
    - 95.1% had a PAT against CPV (Twark 2000)
  - Study in Florida of 431 dogs admitted to a municipal shelter
    - 57% of dogs had a PAT against CPV (Lechner 2010)

PREVALENCE OF PATS TO FPLV IN CATS IS WORSE

Serological survey of cats entering shelters

- Approximately 50% of cats were naïve to FPLV (Schultz, unpublished data, 2007)

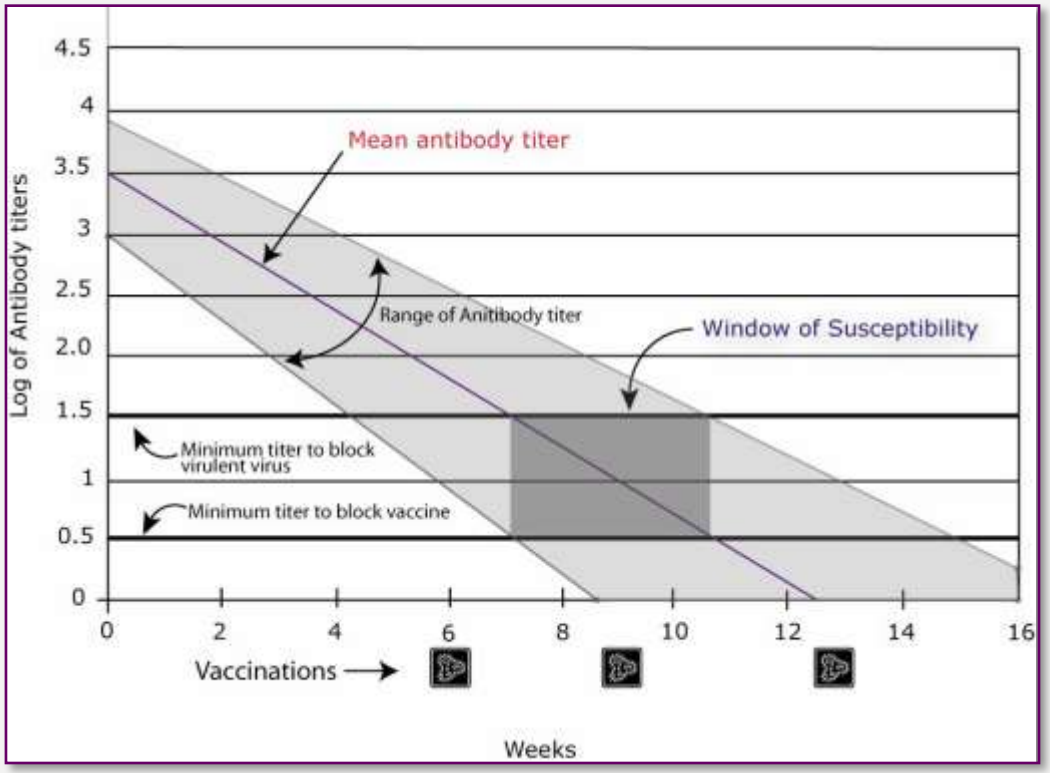
More recent study of 356 cats and kittens entering three Florida shelters

- 41% had PATs against FPLV (DiGangi 2011)

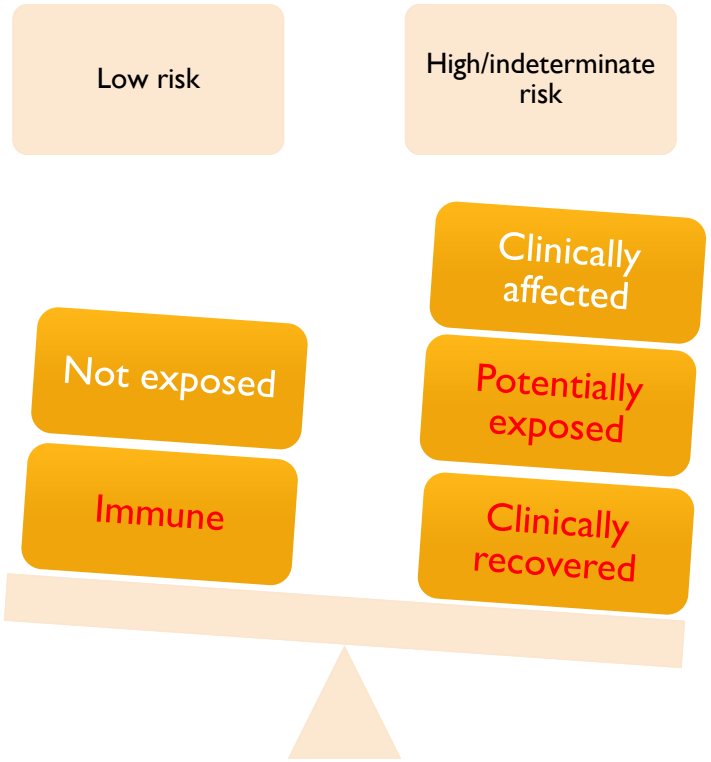
- Similar study of 61 feral cats in Florida
  - 33% had PATs to FPLV (Fischer 2007)

- Overall, not surprisingly, cats are less protected than dogs against parvovirus.

THE UGLY: MATERNAL ANTIBODIES ARE A BLESSING AND A CURSE



PERFORMING A RISK ASSESSMENT



RISK ASSESSMENT BY SIGNALMENT

- Very low risk: adult, fully vaccinated dogs = IMMUNE
- Low risk: adults and puppies greater than 4-5 months old with vaccine on board at least one week = often IMMUNE
- Moderate risk: vaccinated puppies under 4 months of age
- High risk: ALL unvaccinated puppies and dogs
- Extreme risk: littermates of affected puppies

PROTECTIVE ANTIBODY TITER TESTING

First and foremost:

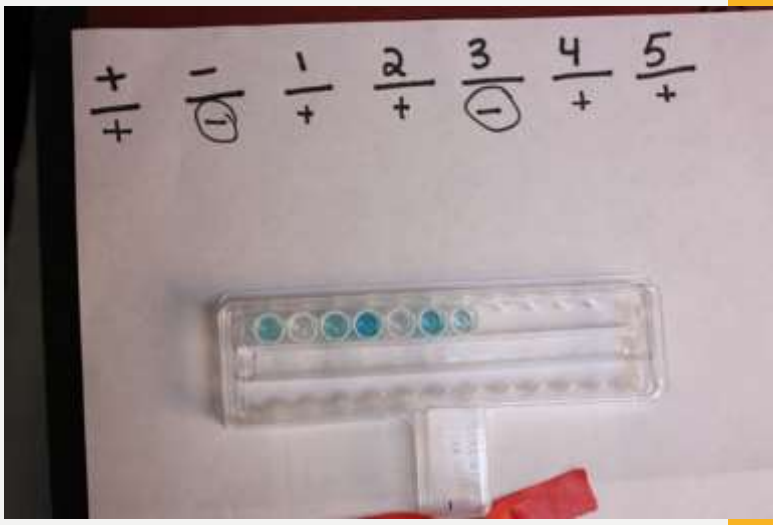
- When it comes to Protective Antibody Titer testing, A POSITIVE result is GOOD

Sensitivity: when high, you "minimize false negatives"

- So a negative test means the animal is at risk of contracting the disease

Specificity: when high, "minimize false positives"

- So a positive test can be trusted, and those animals are protected.



RISK ASSESSMENT : PROTECTIVE ANTIBODY TESTING FOR DOGS

- Synbiotics *TiterCHEK* CDV/CPV ELISA, San Diego CA
  - Specificity CDV 95%, CPV 98%
  - Sensitivity CDV 88%, CPV 98%
- Biogal Canine *VacciCheck*
    - First studied in 1996 at Baker institute and found to be reliable

- These CANINE tests are NOT appropriate for testing for FPLV
  - sensitivity was 28%, with overall accuracy 33% (DiGangi 2011)

CAGE-SIDE FPV TESTING

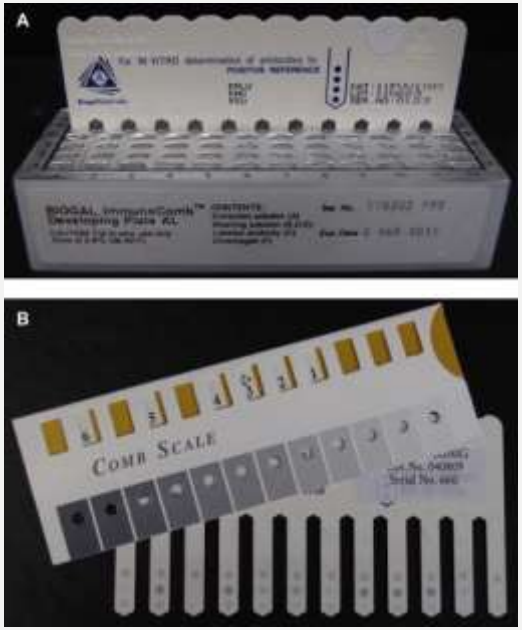
- Biogal's FPV/FCV/FHV Immunocomb VacciCheck test
  - Low *sensitivity (49%* (DiGangi 2011; 78%Mendes)Increased numbers of false negative test results
    - Interpretation: truly protected cats will be perceived as NOT being protected
    - Application: protected cats being quarantined, or even euthanized when considered at risk
  - High *specificity* (99% DiGangi; 89% Mendes)
    - Low numbers of false positive results
    - Interpretation: Cats that test positive for protective antibodies are almost assured protection
    - Application: Cats that were exposed but test positive can move along safely through the shelter.

RISK ASSESSMENT : PROTECTIVE ANTIBODY TESTING FOR CATS

- Biogal Feline *VacciCheck FPV/FCV/FHV-1*

- Better at identifying cats who have immunity, but going to miss about half of the cats who are immune
  - So what is the outcome decision made with these results?

COST OF TESTING



- Cost ranges from $10 – 14 per test if batched
- Labor intensive, especially initially while training staff
  - 20-30 minutes per batch
  - Color-metric reading can be tricky
  - Software is sold to aid in interpretation
  - See Maddie's Institute Resource on *Saving Lives Through Antibody Testing*, which has great "how to" videos from Ron Schultz
- Likely to be cheaper than quarantining all exposed populations

HOW GOOD ARE THESE TESTS WHEN COMPARED TO LABORATORY TESTS?

- *Titercheck* vs IFA commercial laboratory test (Gray 2012)
  - 431 dogs on day of admission to shelter in Florida
  - Samples submitted to criterion-referenced diagnostic lab, commerical lab for IFA, and used in microwell Titercheck
  - Higher specificity for CPV (98%) than IFA (82%)
    - Lower number of false positives
  - Similar sensitivity (98%) to IFA (97%)
    - Low numbers of false negatives

- 25% of the laboratory cost, but greater labor investment requiring a proficient technician
- However, results were within 30 minutes, so decision making could start right away!

RISK ASSESSMENT BY TITERS

High risk	Intermediate risk	Low risk
• negative titer • any age	• positive titer • less than 5 months of age	• positive titer • adult

BUT WHAT DO WE DO THEN?

PAT findings	Strategy in the shelter
Positive fPAT	Bathe and move along to adoption
Negative fPAT	Confirm vaccination/ vaccinate/ revaccinate Quarantine for 7 – 14 days Daily monitoring for signs Vigilance is key Prevent new exposure to disease Off-site housing? Cleaning and disinfection Control of staff and fomites Bathe before introduction to shelter
Affected animals	Strict isolation, removal from population
Recovered animals	Isolation til shedding period is complete ELISA antigen test may help with this Bathe and move along to adoption

HOW SHOULD WE USE THE TESTING?

- In an outbreak situation, the clearest answer:
  - *Titercheck* all dogs over 4 months of age with potential and known exposure and segregate by findings.
- Puppy titers (< 4 months of age) not reliable for protection
  - Can not distinguish between maternal and induced antibodies
- Having said this, is there a place for testing puppies as well?
  - If titers are high/positive, likely that they are more protected than another puppy with a low titer?
  - Quarantine for shorter period after removal from environment and bathing?
  - Low/negative titer: vaccinate and be optimistic for early protection?

TREATING PARVOVIRUS

- Colorado State University study (DOGS)
  - Gold standard treatment 90% survival
  - Outpatient protocol 80% survival

Parvo Puppy ICU

About the parvo puppy ICU

The first of its kind in the nation, Austin Pets Alive!'s Parvo Puppy ICU provides shelters an alternative to euthanasia for puppies that contract parvovirus.

By placing puppies that contract parvo in quarantine, maintaining cross-contamination protocol and providing consistent care and treatment to

CSU PROTOCOL STILL HAS PRETTY HIGH LEVEL OF CARE, AND COST

- Initial stabilization
  - Initial electrolyte assessment
  - Intravenous fluid bolus and correction of electrolytes+/- dextrose
  - Convenia injection
- Outpatient care, with daily vet assessment (was also in hospital)
  - Subcutaneous fluids daily to twice daily
  - Cerenia SQ daily
  - Electrolytes and glucose checked daily (vet visit)
  - Syringe feeding and glucose supplementation
  - +/- opioids (buprenorpine to 20%), +/- anti-emetic (ondansetron to 20%), +/- potassium supplementation

Venn et al. 2017

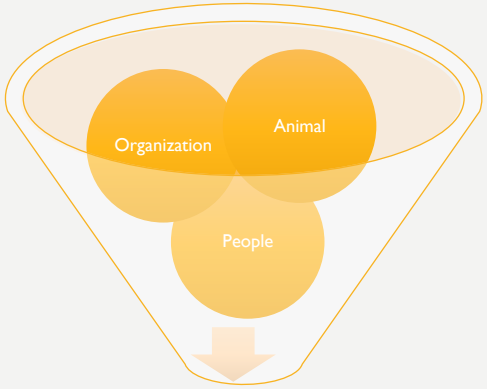
"OUTPATIENT" CARE

- PSPCA, UPenn collaboration
- PSPCA DVM supervised
  - Students provided care
- Dedicated clinic space, isolation
- Basics
  - Diagnostics: PCV/TP, vitals, hydration
  - SQ fluids and injectable cerenia and famotidine, amp/amoxi

- Average LOS in treatment 6.84 days
- High rate of owner compliance
- Extensive monitoring and logging
- 9 week clinic: 84% survival

PATIENT SELECTION AND ANIMAL WELFARE

- Poor prognostic indicators
  - Degree of obvious illness
  - Length of time to diagnosis
  - Low PCV/TP
  - Third spacing of fluids
  - Low body temperature
- Ability of your organization to treat effectively
- Adoptability of the patient in the long run



The Five Freedoms	
Freedom from hunger and thirst	By ready access to fresh water and a diet to maintain full health and vigor
Freedom from discomfort	By providing an appropriate environment including shelter and a comfortable resting area
Freedom from pain, injury, or disease	By prevention or rapid diagnosis and treatment
Freedom to express normal behaviour	By providing sufficient space, proper facilities and company of the animal's own kind
Freedom from fear and distress	By ensuring conditions and treatment which avoid mental suffering

(Farm animal welfare council 2009; reprint ASV Shelter Standards 2010)

THE AFTERMATH: CLEANING UP PARVOVIRUS

- Mechanical removal
  - Environment, patient, self
- Potassium Peroxymonosulfate
  - Trifectant or Virkon
- Accelerated hydrogen peroxide
  - More expensive (>$2/gallon as compared to $0.08)
  - Read the label carefully: various formulations!!! Concentratio n some table sprays!
- Dilute bleach, AFTER cleaning
  - 1:32 dilution
  - Protect from light
  - Make fresh daily, or even twice daily
  - For a handy bleach calculator, see ASPCA pro at http://www.aspcapro.org/shelter-sanitatio

Disinfectant	5.25% Household Bleach (Sodium Hypochlorite)	Quaternary Ammonium (Quats)	Accelerated Hydrogen Peroxide	Potassium Peroxymonosulfate
Common names	(Clorox, many others)	Roccal, KennelSol, A33, Parvosol, D256	Accel TB	Trifectant, Virkon-S
Effective Against Parvovirus?	Yes Dilute 1:32	Not reliably	Yes	Yes
Effective Against Panleukopenia?	Yes Dilute 1:32	Not reliably	Yes	Yes
Effective Against Ringworm?	Yes Dilute 1:10	No	Labeled as effective but not confirmed with independent studies	Not reliably
Effective Against Calicivirus?	Yes Dilute 1:32	No	Yes	Yes
Inactivated by Organic Material?	Yes	Mildly inactivated	No	Less inactivation than bleach or quats
Stability When Prepared	24 hours if protected from light	24 hours	Ready to use 0.5% solution has a 3 year shelf life	7 days when mixed from powder
Minimum Contact Time	10 minutes	10 minutes	1-5 minutes (bacteria, virus) 10 minutes (ringworm)	10 minutes
Detergent Activity?	No	Mild but rinsing is critical	Yes	Yes
Rinse Required?	Yes	Yes	No	No
Cost Comparison	Cheap	More expensive than Bleach	Most expensive	More expensive than Bleach or Quats
Notes	Highly corrosive to metal		Ready to use liquid can be applied in a variety of ways	

Prepare and use all disinfectants as directed on the product packaging. Products may not be effective if prepared or used incorrectly. Do not combine disinfectant products or combine disinfectants with soap and detergents in a single solution.

A ROLE FOR DISEASE SURVEILLANCE?

- Infectious disease surveillance in companion animals has mostly taken the form of ad hoc surveys
- No centralized system

- In Australia, *Disease WatchDog* was launched in 2010
  - Prospective, national disease reporting for companion animals veterinarians
  - Registrants gain access to disease maps and information
  - In 10 months, 31% of practices reported over 1300 cases
  - (Ward 2011)

- Is there a role for this in the animal shelter community?
- Could we benefit from an online, efficient reporting system for our most serious infectious diseases?
- How do we ensure accuracy in reporting?

A ROLE FOR PROACTIVE, PREVENTIVE MEASURES IN YOUR COMMUNITY?

- Zipcode / GIS mapping to determine where parvovirus and panleukopenia are coming from in your neighborhood

- Vaccination clinics, subsidized preventive care, education?

IN CONCLUSION

- Have solid preventive measures in place
  - Biosecurity
  - Risk management
  - Outbreak plan
  - Treatment plan
- Patient side titer tests may have a place in your shelter
  - Outbreaks
  - Transport/ transfer program
- Knowledgeable Interpretation is important
  - FPLV PAT tests
  - low sensitivity
  - depends on interpretation and application
- Is there a place for preventive disease surveillance in your community, and proactive prevention such as vaccination clinics?

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