Parvovirus in Shelter Dogs: Parvo 101

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Your Presenter

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Parvovirus Infections

- Highly contagious, easily spread, environmentally resilient virus
- May cause severe, potentially fatal illness in dogs
- Current circulating virus: CPV-2b + 2c

Who gets parvo?

- ANY unvaccinated dog of any age

- Puppies, co-infected dogs more susceptible to severe disease
  - MDA to one strain may provide less robust protection against a different strain
- Breed susceptibility vs. commonly infected breeds
  - Rotties, Dobies, Labs, GSDs thought to be more susceptible
  - Pit bull type dogs – susceptibility vs. exposure

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Is parvo a bigger risk now?

- Concern over new strains, vaccine resistance
- Are we just seeing it more and/or facilitating spread?
  - Transport and animal movement
  - Social contact for dogs:
    - Doggie day care
    - Dog parks
    - Pet store shopping +/- vet hospitals

Prevention, diagnosis, and control remains unchanged

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Parvovirus – Transmission

Virus spread primarily through feces, also through vomit and other bodily excretions

- Dogs can spread through direct contact, fomites, even aerosolization during cleaning!
- Can also be picked up from the environment (common walkways, etc.)

Highly resistant in the environment – persists for up to a year

- Cleaning and disinfection using parvocidal products is critical to preventing transmission!

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CPV Transmission

Particular shelter practices may enhance transmission through a variety of routes:

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- Co-housing and co-mingling, including play groups

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- Housing design
- Inadequate isolation facilities and practices

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- Overcrowding
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- Housing design
- Inadequate isolation
- Cleaning procedures

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- Cleaning procedures
- Common areas and surfaces

CPV Transmission

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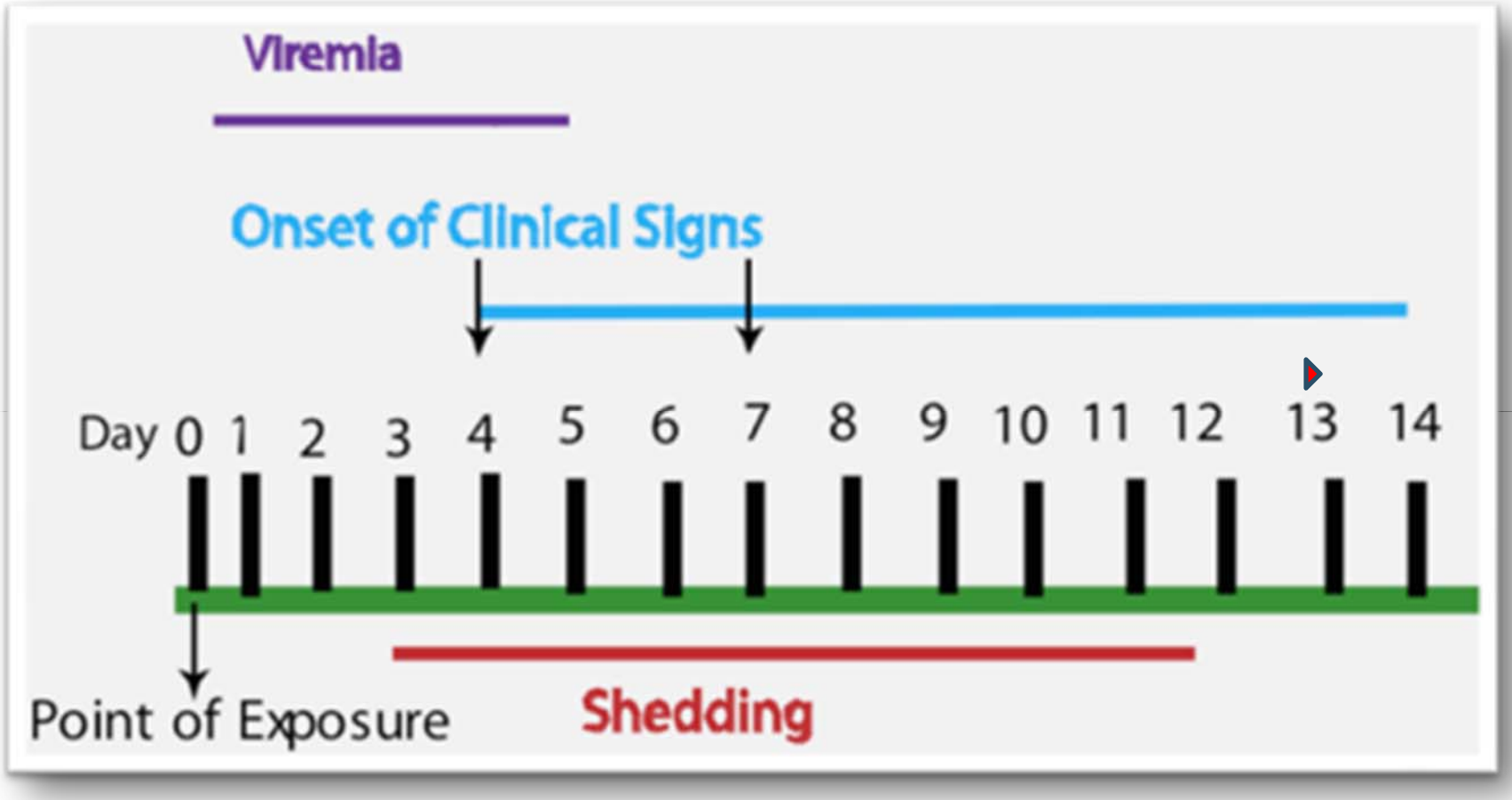
- Inadequate isolation
- Cleaning procedures
- Common areas and surfaces

Parvo Timeline



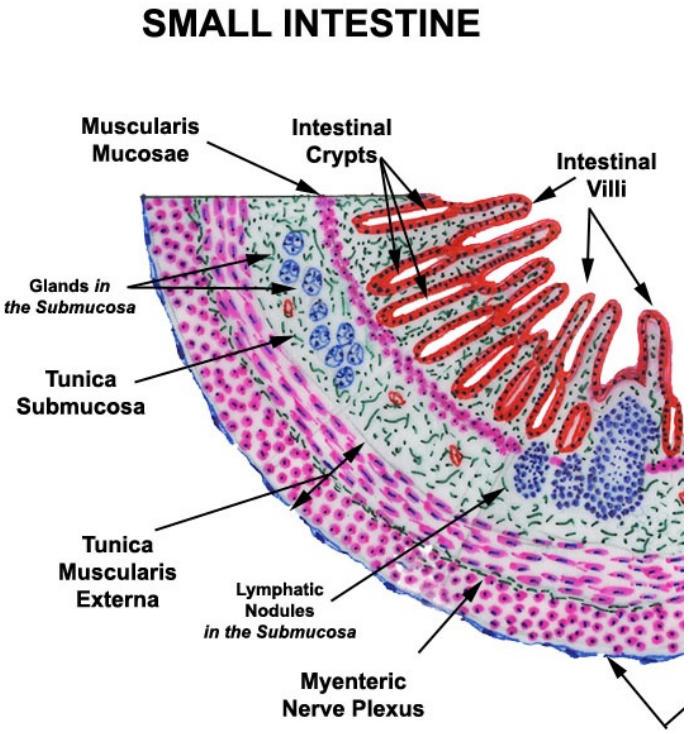
What happens when they get sick?

- Severe, potentially fatal disease

- Virus attacks rapidly dividing cells
  - Destroys the lining of the intestines
    - Vomiting, diarrhea, dehydration, electrolyte problems

- Wipes out bone marrow
  - Decreases in white blood cells hamper immune system's ability to fight infection

- Other serious complications possible – heart problems, intussuceptions, DIC, etc.



Clinical Signs of Parvo Infection

Symptoms usually develop 5-7 days after exposure, but range is 2-14 days:

- Vomiting
- Diarrhea, often bloody
- Inappetance
- Dehydration
- Lethargy, weakness
- Temperature extremes

Management challenge:

- May be contagious before symptoms start and for a period of time after they resolve

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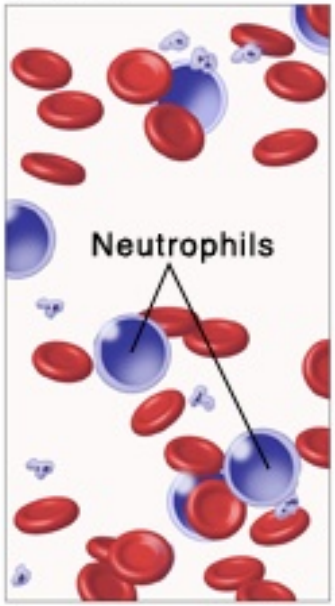
Diagnosis

Consistent symptoms and history

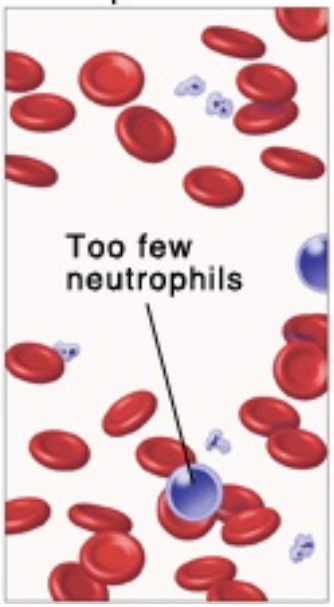
In-house parvo tests

- Look for viral antigen in the feces – all strains
- May get false negative results
- May cross-react with recent MLV vaccination
  - Anecdotally weak positives within a week
  - Not common – safest is to assume infection until confirmed

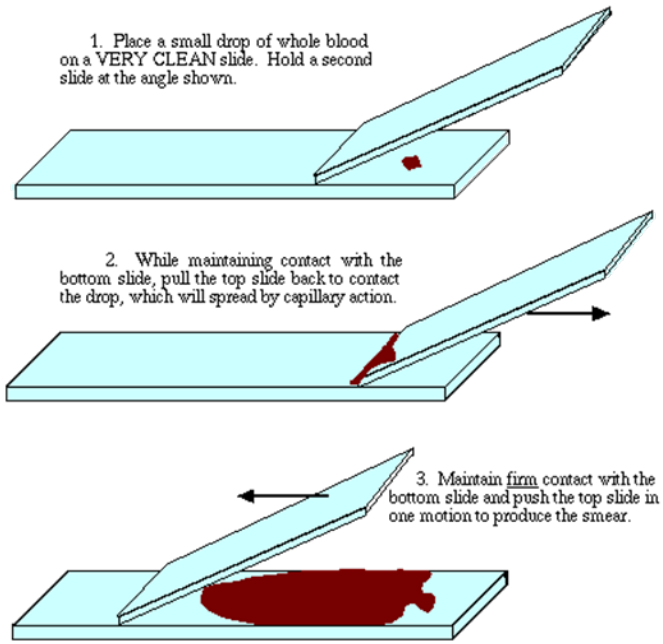
Normal

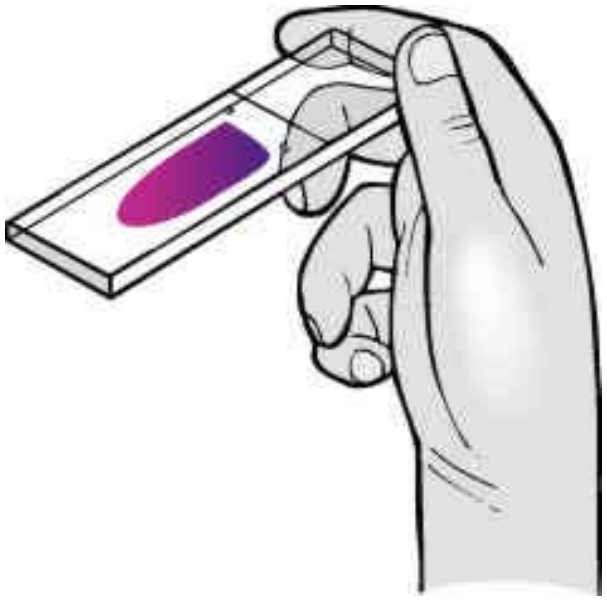


Neutropenia



- Complete blood count (CBC) or smear
  - At 10X → 4-6 WBC per field or less
  - At 40X → 1-3 WBC per field of less





Caveat: timing doesn't always correspond with gastrointestinal signs

Diagnosis

PCR testing is also available

- Need to distinguish recent vaccination vs. natural infection
- Look for quantitative levels
- Available in “diarrhea panels”

Diagnosis

Post-mortem diagnosis:

- Segmental enteritis is classic finding on gross exam
- Parvo test can still be used on GI tract
- Samples for PCR or IFA, IHC tests and histopath
    - Tongue is an excellent sample to collect – very sensitive

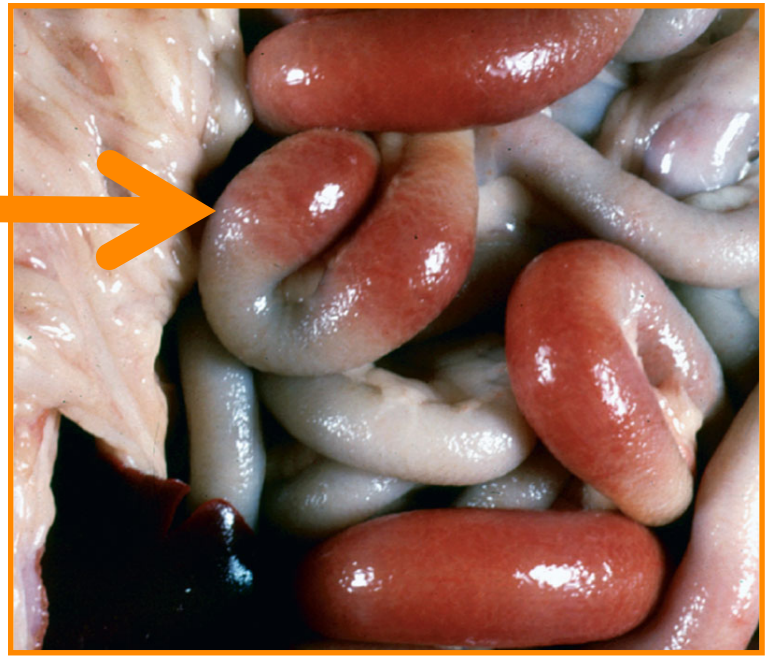


Image from Greene's Infectious Diseases of the Dog and Cat

Diagnosis: Necropsy

- Identify pathogens and their role in disease
- Often the most efficient way to get an accurate diagnosis
- Document initial findings

- Non-fixed samples for bacterial culture, viral isolation, parasitology testing
  - Obtain first
  - Refrigerated for bacteria, frozen for viruses
  - Small and large intestine

Diagnosis: Necropsy

- Tissue samples for histopathology
  - Preserve samples (9:1 ratio formalin: tissue)

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Preventive Strategies

- **Plan A: Prevent exposure**
  - If exposure can't be zero, limit the dose to as little as possible:
    - Avoid overcrowding
    - Reduce length of stay
    - Excellent sanitation
    - Fomite control
    - Adequate isolation +/- quarantine

Preventive Strategies

- **Plan B: Strengthen host defense**
  - Good husbandry, nutrition
  - Treat concurrent infections
  - Vaccination
  - Reduce stress

Preventing Exposure

Avoid overcrowding – stay within your capacity for care

Crowding = major stressor and risk factor for disease outbreaks

- Exacerbates challenges shelters already struggle to manage
- Not inevitable!

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Capacity for Care

- Housing capacity:
  - Not just an open cage, but an appropriate enclosure for that particular animal
  - Ideally below your max capacity
- Staffing capacity
  - Staff and/or volunteers to meet the physical and behavioral needs of that animal
- Additional sufficient resources as needed for that animal
  - Medications, vet care, training

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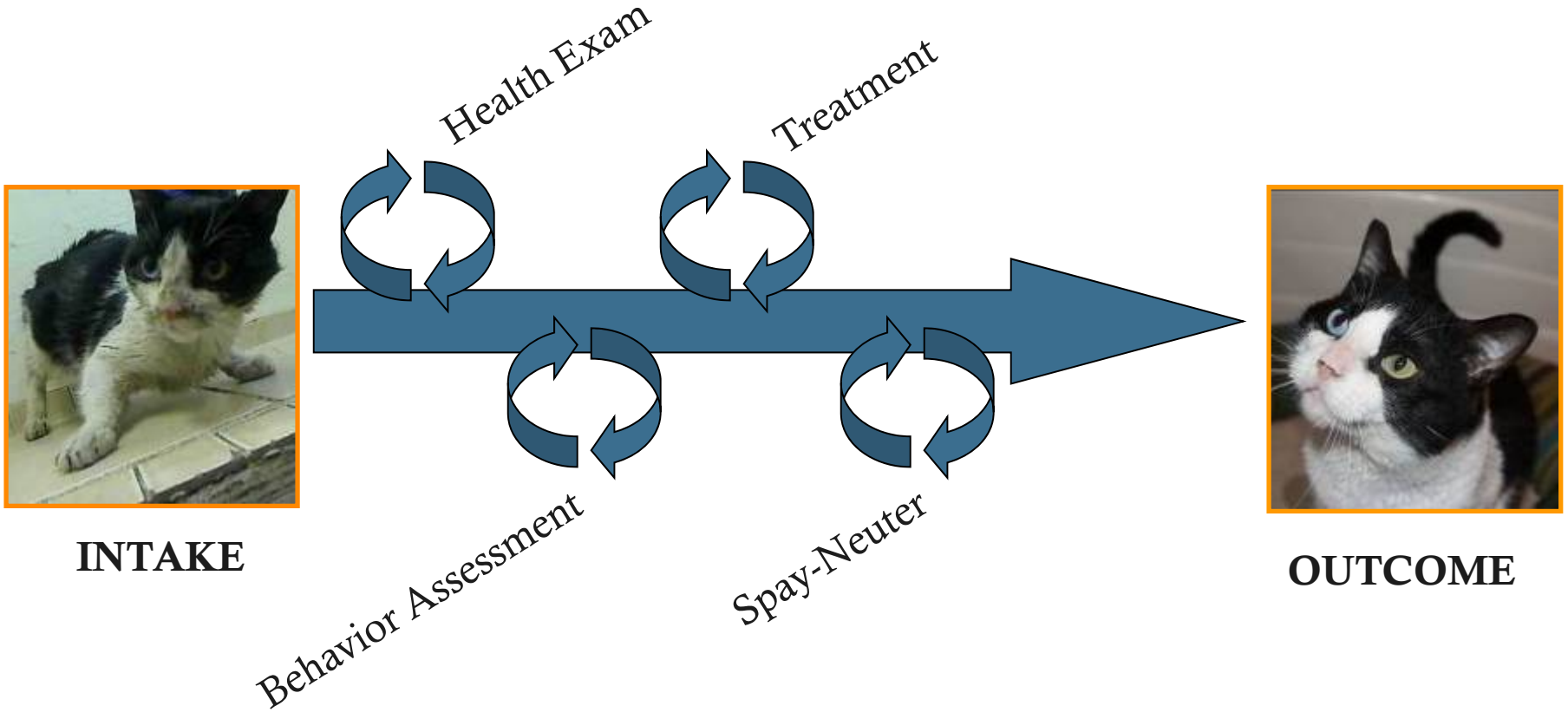
Why Length of Stay (LOS) Matters

- Calculate holding capacity, adoption driven capacity, and amount of time available for animal care

- Knowing capacity for care, LOS, and average shelter populations helps with decision-making
  - Resource allocation
  - Staffing
  - Intake and adoption decisions
  - Cage space

- **Moving animals efficiently through the system is a win-win-win!**



What can we do TODAY to move that animal closer to their final outcome?

- Written SOP and criteria for behavior, medical to determine adoption, transfer, etc
- Eliminate holds and bottle necks – extra staffing, resources, fast track/slow track program, etc.

Daily Rounds

The idea:

- Performed DAILY ☺
- Look at each animal in the building
- Decide where they are going
- Determine what they need to get there
- Figure out how to make happen!

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Daily Rounds

Requires:

- Someone with training, knowledge, and authority
- A commitment by all staff and management to make it a priority

- Accurate data collection and entry
- Process +/- equipment to make it work
- Ideally, a rounds leader or task master with a team

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Preventing Exposure

Excellent sanitation procedures and fomite control

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Cleaning & Sanitation Protocols

- Cleaning & disinfection are actually two different things!
- Step 1 – Clean
  - Remove organic material
    - Detergent and scrubbing
- Step 2 – Disinfect
  - Inactivate pathogens
    - Start with a clean surface
    - Leave on required contact time

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Sanitation Basics

- Sanitation is critical – we can't rely on pathogens going away on their own
- CPV is resistant to many disinfectants
  - Cannot use quats – despite the label ☹
  - Bleach, trifectant, Accel all good choices

- Porous, organic materials are harder or impossible to sanitize
  - Limit contact of animals with surfaces that can't be disinfected – e.g. play yards

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The sad facts about quats…

1. Scott, FW. Virucidal disinfectants and feline viruses. *Am J Vet Res*, 1980. 41(3): p. 410-4.
2. Kennedy, MA et al., Virucidal efficacy of the newer quaternary ammonium compounds. *J Am Anim Hosp Assoc*, 1995. 31(3): p. 254-8.
3. Eleraky NZ, Potgieter LN, Kennedy MA. Virucidal efficacy of four new disinfectants. *J Am Anim Hosp Assoc*, 2002. 38(3): p. 231-4.
4. Eterpi M, McDonnell G, Thomas V. Disinfection efficacy against parvoviruses compared with reference viruses. *J Hosp Infect*, 2009. 73(1): p. 64-70.

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Disinfection Resources

http://www.aspcapro.org/search/index/disinfection

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What does it mean to be clean?

- Kennels
- Cages
- Transport carriers
- Windows and walls
- Lobbies and halls
- Doors and doorknobs
- Play yards
- Vehicles
- Exam tables
- Bedding
- Toys
- Food and water bowls
- Collars and leashes
- Scoops, brushes, mops
- Clothing and Footwear
- Ventilation ducts
- Phones, keyboards, etc.
- HANDS!!!

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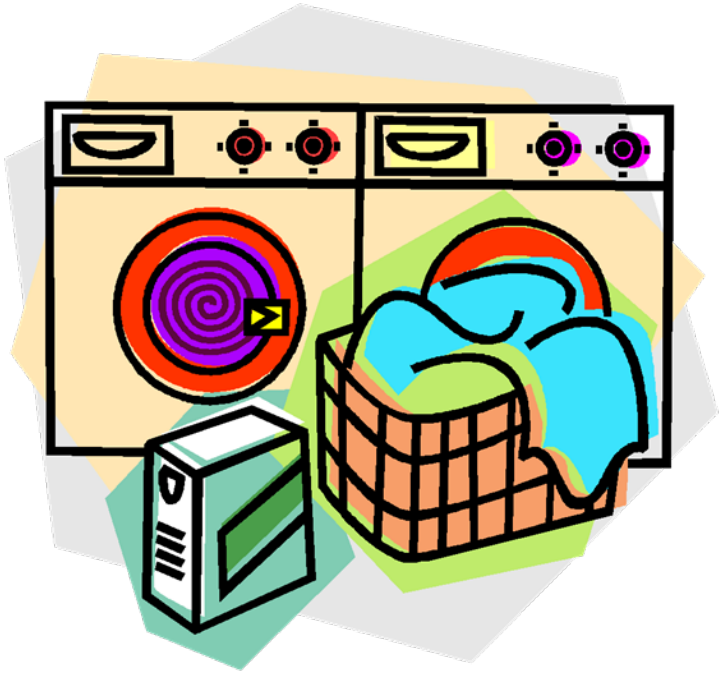
Sanitation Basics

Laundry:



- Hot water, detergent, bleach
- Dry thoroughly!
- Discard if heavily soiled
- Caution in and moving to laundry areas

A Simple, Yet Critical Fix

Wash your hands, change your gloves, wear PPE!!!

- We can be our own worst enemies – minimize fomite spread!

Preventing Exposure

Excellent sanitation procedures and fomite control

- Appropriate use of housing
- Labeled, dedicated equipment
- Dedicated staff
- Appropriate order of cleaning
- Diligent hand sanitation

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Preventing Exposure

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Invest your time where you'll get the most bang for your buck!

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What is “adequate” PPE?

- Hint: It’s not just your hands and scrub top…

How about footbaths?

Stockton, K. A., P. S. Morley, et al. (2006). "Evaluation of the effects of footwear hygiene protocols on nonspecific bacterial contamination of floor surfaces in an equine hospital." J Am Vet Med Assoc 228(7): 1068-1073.

How about footbaths?

- *Not* reliably effective
- Can actually help spread disease

Stockton, K. A., P. S. Morley, et al. (2006). "Evaluation of the effects of footwear hygiene protocols on nonspecific bacterial contamination of floor surfaces in an equine hospital." J Am Vet Med Assoc 228(7): 1068-1073.

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How about footbaths?

Dedicated footwear and/or shoe covers are better choices

Stockton, K. A., P. S. Morley, et al. (2006). "Evaluation of the effects of footwear hygiene protocols on nonspecific bacterial contamination of floor surfaces in an equine hospital." J Am Vet Med Assoc 228(7): 1068-1073.

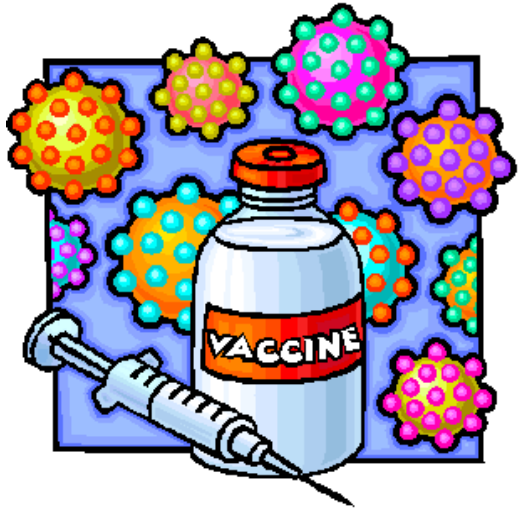
Shouldn't we just leave the kennel open for a while?

- 1, 3, 5, or even 30 days won't help if sanitation was inadequate
- Multiple thorough episodes of cleaning and disinfection can help but are not time dependent

Parvo Vaccination

- Parvo is considered to be a vaccine-preventable disease – “sterile immunity”

- Vaccination reminders:
  - Biologic products that stimulate the immune system
  - Given before exposure
  - Functioning immune system with time to respond



Parvo Vaccination

- Vaccination reminders: MLV vaccines
  - Give as close to time of intake as possible, or before if at all possible
  - Must be kept refrigerated from time of arrival until time of administration
  - Must be mixed up fresh – do not mix and keep in the fridge for later use

Core Vaccination

- DA2PP given at intake for dogs 4-6+ weeks old
  - Repeat q 14 days while in the shelter, stop at 18-20 weeks old
- Vaccination is highly effective for CPV:
  - Clinically relevant protection within hours
- Weigh risk of exposure vs. risk of vaccination
  - Rule of thumb: too sick to vaccinate = too sick to stay in the shelter

http://www.aahanet.org/publicdocuments/caninevaccineguidelines.pdf

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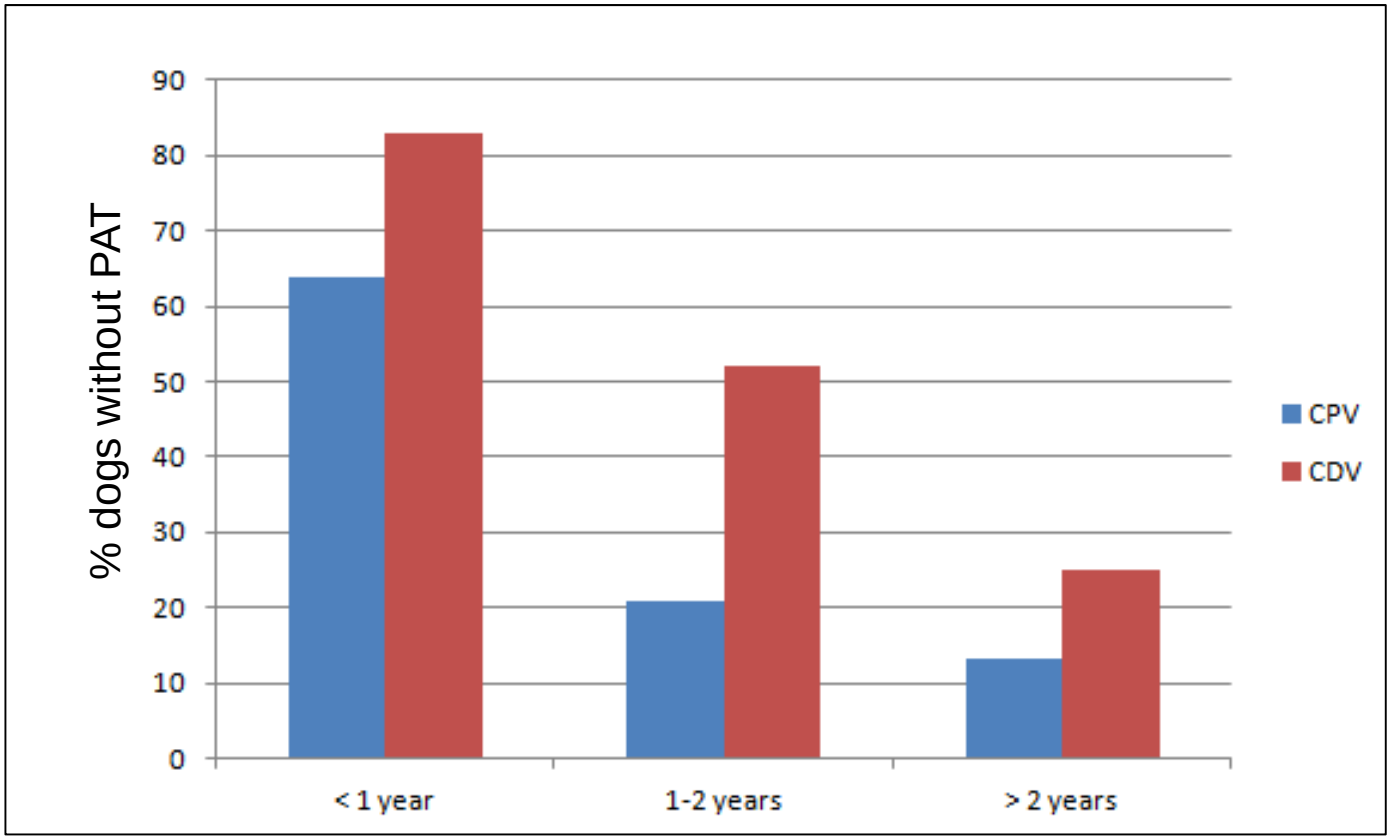
Parvo Vaccination

This is a core vaccine – don't assume they are protected!



Lechner ES et al. Prevalence of protective antibody titers for canine distemper virus and canine parvovirus in dogs entering a Florida shelter. J Am Vet Med Assoc. 2010 Jun 15;236(12):1317-21.

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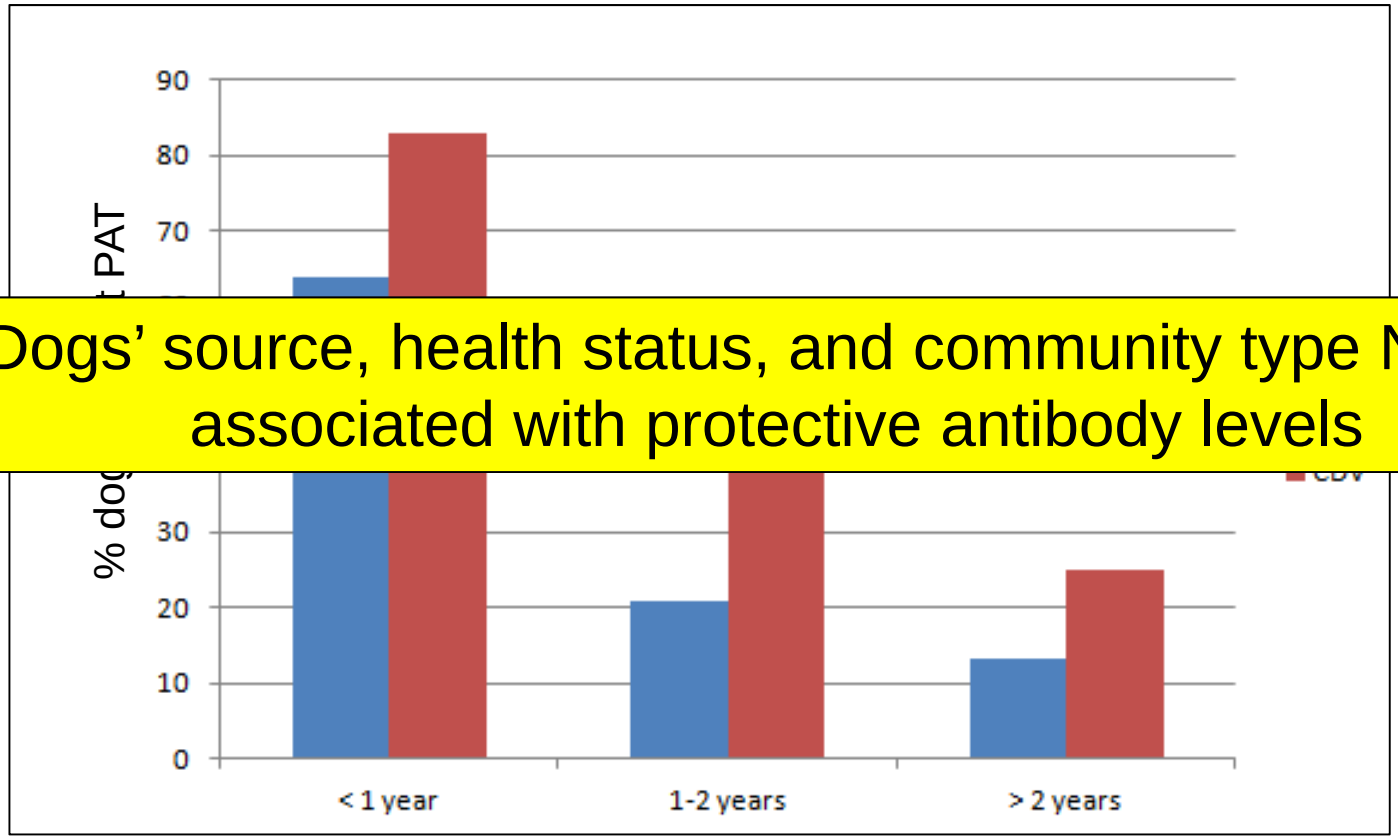

Dogs' source, health status, and community type NOT associated with protective antibody levels

Lechner ES et al. Prevalence of protective antibody titers for canine distemper virus and canine parvovirus in dogs entering a Florida shelter. J Am Vet Med Assoc. 2010 Jun 15;236(12):1317-21.

Good News!

"Dogs vaccinated with modified live canine parvovirus develop high hemagluttination inhibition titers within four days of inoculation and antibody persisted."

Carmichael LE, et al. (1983). "A modified live canine parvovirus vaccine with novel plaque characteristics. 1. Viral attenuation and dog response." Cornell Vet 73(1): 13-29.

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Maternally-derived Antibody Interference

AKA – why puppies need so many vaccines!

Other Core Vaccinations

- Intranasal *Bordetella* AND Parainfluenza at intake for dogs as young as 3-4 weeks of age
  - Dogs < 6 weeks old: repeat once in 14 days
  - Dogs > 6 months old: not necessary
- Caution not to give via parenteral route: severe reactions, including acute hepatic necrosis and death may occur
- Oral *Bordetella* vaccine → effective, but lacks CPiV component

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Physical Health vs. Behavior

Frequency of CPV Infection in Vaccinated Puppies that Attended Puppy Socialization Classes

Meredith E. Stepita, DVM*†, Melissa J. Bain, DVM, DACVB, MS, Philip H. Kass, PhD, DVM, DACVPM

ABSTRACT

Socialization is one method of preventing behavior problems in dogs; however, some oppose socialization before 16 wk of age due to the risk of contracting infectious diseases. The objectives of this study were to determine if puppies that attended puppy socialization classes and were vaccinated by a veterinarian at least once were at an increased risk of confirmed canine parvovirus (CPV) infection compared with puppies that did not attend classes and to determine the frequency of suspected CPV infection in puppies vaccinated at least once that attended classes with trainers. Twenty-one clinics in four cities in the United States provided information regarding demographics, vaccination, CPV diagnosis, and class attendance for puppies ≤ 16 wk of age. In addition, 24 trainers in those same cities collected similar information on puppies that attended their classes. In total, 279 puppies attended socialization classes and none were suspected of or diagnosed with CPV infection. Results indicated that vaccinated puppies attending socialization classes were at no greater risk of CPV infection than vaccinated puppies that did not attend those classes. (*J Am Anim Hosp Assoc* 2013; 49:95–100. DOI 10.5326/JAAHA-MS-5825)

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"Results indicated that vaccinated puppies attending socialization classes were at no greater risk of CPV infection than vaccinated puppies that did not attend those classes."

What if I transfer in puppies?

Know your source!

- Low risk source → consider no quarantine
- High risk source → quarantine, use antibody titers to evaluate risk

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Canine Parvo Titers

- Simultaneous with diagnostics, helps to clarify susceptibility and risk
  - Guidance, not absolutes
- Must limit use for dogs without current or historical clinical signs – distinguish protection vs. infection

- Validated lab, Synbiotics Titerchek or Biogal Vaccicheck
- Can be very cost effective

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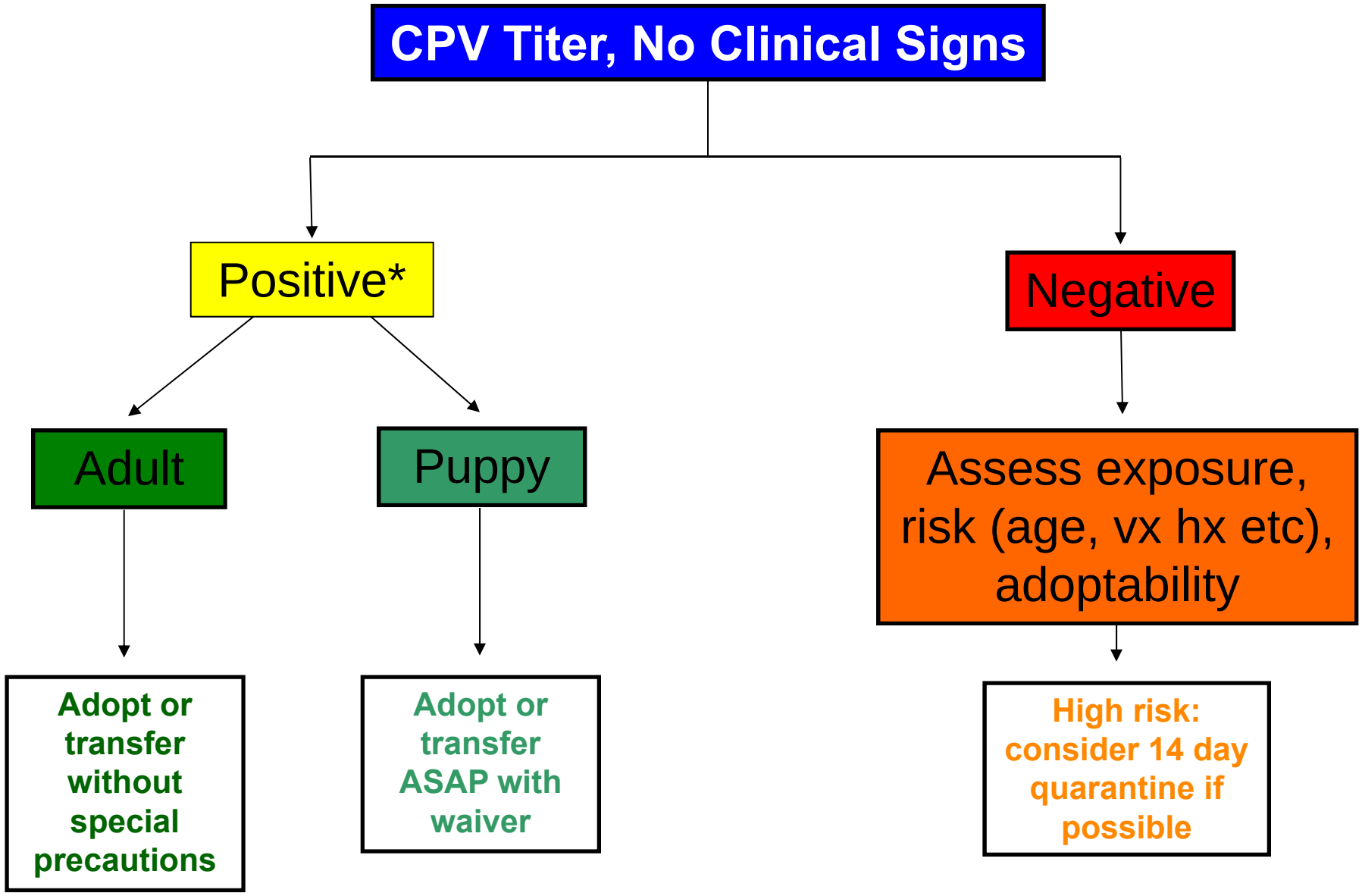

*** Remember that titers may rise faster than development of clinical signs. Low risk ≠ no risk!**

Help! We have Parvo!

- Act promptly to limit spread
  - Stop movement – people, animals, equipment

Assess the risk, make a plan, and act on it – but do not panic.

Help! We have Parvo!

- Act promptly to limit spread
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- Map the cases

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Help! We have Parvo!

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- Map the cases
- Determine animal movement

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- Act promptly to limit spread
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- Map the cases
- Determine animal movement
- Create a timeline
  - Clinical signs vs. onset of shedding

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Help! We have Parvo!

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- Evaluate shelter practices
  - Review sanitation, vaccination SOPs and procedures
  - Risks: crowding, co-mingling, etc.

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Help! We have Parvo!

- Act promptly to limit spread
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- Review individual animal risk
  - Location, age, vaccination
- Evaluate shelter practices
  - Review sanitation, vaccination SOPs and procedures
  - Risks: crowding, co-mingling, etc.
- Make decisions for individual animals:
  - Treatment, quarantine, adoption, euthanasia

Assess the risk, make a plan, and act on it – but do not panic.

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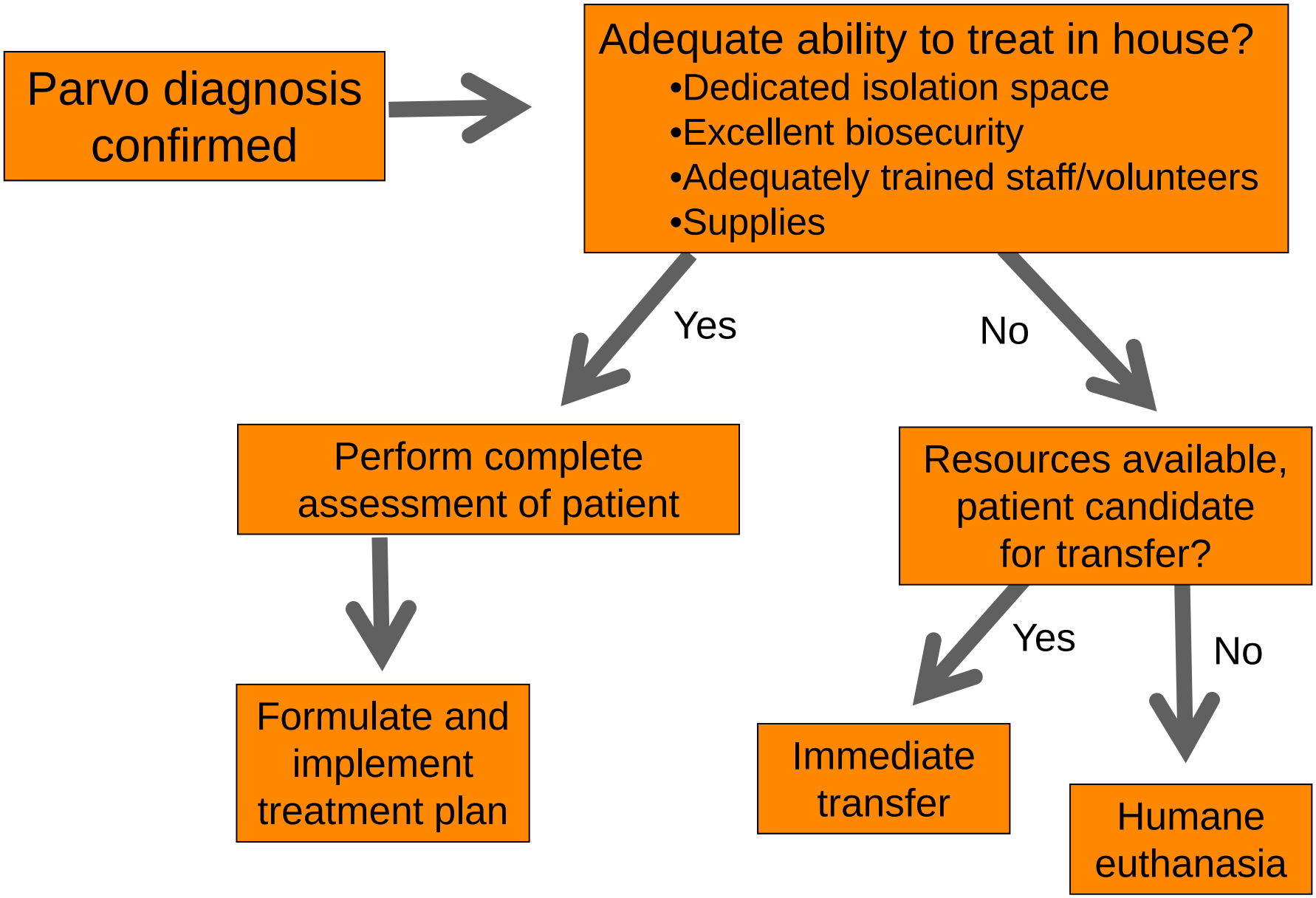
Treatment

Careful consideration necessary when deciding to treat:

- Ability to provide humane level of care
  - Supplies, space/housing, staffing
- Ability to protect the remaining population – strict isolation is mandatory
- Retain focus on prevention
- Variable prognosis depending on severity of symptoms and response

Treatment Considerations



Treatment Considerations

Prompt identification of infected dogs is key:

- Remove from general population early to reduce spread
- Timely treatment helps improve outcome

Written SOPs:

- Description and case definition
- Treatment
  - Do you treat? If so, who?
  - Initiating and administering
    – who, what, where, when, how
- Containment and management steps
- Intervention points and next steps

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Do you have an appropriate isolation space?

- Ideally, physically separate building
- Minimally, separate, easily disinfected area
- Adequate monitoring and sufficient staffing mandatory
- Full body protection, double gloves, footwear, equipment
- No crossover with puppies/new intakes

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Treatment

Treatment remains largely supportive:

- Correct dehydration, hypoglycemia, electrolyte imbalances
- Address hypoproteinemia
- Prevent sepsis
- Stop vomiting
- Early nutritional support
- Alleviate pain and discomfort

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Address Hydration and Electrolytes

Severity of dehydration will determine volume and route of fluids:

- Balanced electrolyte solution vs. colloids
- Typically IV or IP
- SQ may be ok for adequately perfused, more stable patients
- K+, glucose supplementation

Estimating Percent Dehydration

% dehydration	skin tenting	dry, tacky gums	sunken eyes
5-6	mild	none/mild	no
7-8	moderate	mild/moderate	no
9-10	severe	Severe	yes

Relieve nausea and feed them!

Cerenia (Maropitant) commonly needed to control vomiting and nausea

- 1 mg/kg SQ q24hr

- Encourage oral intake of small amounts of food ASAP (syringe feed AD)

- May need to place NE tube for nutritional support

Mohr AJ, Leisewitz AL, et al. Effect of early enteral nutrition on intestinal permeability, intestinal protein loss, and outcome in dogs with severe parvoviral enteritis J Vet Intern Med. 2003 Nov-Dec;17(6):791-8.

Parasite Control

Co-infections exacerbate clinical illness from CPV

- Increases GI cell turnover, viral replication

Treat orally as soon as possible

- Fenbendazole (i.e. Panacur), ponazuril

Antimicrobial Therapy

- Antibiotics indicated due to neutropenia
- Variety of factors to consider in selection:
  - Time dependent vs. concentration dependent
  - Efficacy against pathogens likely to be of concern
  - Severity and progression of symptoms
  - Route of administration and absorption
- Common protocol:
  - Injectable penicillin with fluoroquinolone or aminoglycoside
  - Convenia for out-patient tx
- Remember: will not help with primary viral infection

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Influenza Treatment for Parvo?

- Oseltamivir phosphate (i.e. Tamiflu) – neuraminidase inhibitor
- Anecdotal reports promising but not backed up:
  - Dogs gained weight and didn't drop WBC, but no difference in clinical signs or survival

- Not recommended for treatment of parvo infected dogs:

  - Pharmacokinetic studies lacking

  - Public health concerns, legal restrictions coming?

Savigny, M. R. and D. K. Macintire (2010). "Use of oseltamivir in the treatment of canine parvoviral enteritis." J Vet Emerg Crit Care (San Antonio) **20**(1): 132-142.

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Treatment

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New Protocol Gives Parvo Puppies a Fighting Chance When Owners Can't Afford Hospitalization

Canine parvovirus is a serious and often fatal viral illness that most commonly affects puppies, though unvaccinated adult dogs can be infected as well. While treatment for parvovirus is available, it can be cost prohibitive for many families. Now, a new protocol developed at the Colorado State University Veterinary Teaching Hospital may help save "parvo puppies" and give their families a chance to give their dogs a healthy life.

"Parvovirus is one of the most common and deadliest viruses that unvaccinated dogs tend to get," said Dr. Lauren Sullivan, an Assistant Professor in the Department of Clinical Sciences and a veterinarian with the Critical Care Unit at the Veterinary Teaching Hospital. "While a vaccine is available, puppies can be exposed to the disease before their vaccinations are complete, or if they haven't received puppy wellness care due to their owner's financial limitations."

Parvovirus, which is spread through exposure to feces from infected dogs, has a wide range of symptoms including lethargy, vomiting, fever, and diarrhea. It primarily impacts the gastrointestinal tract and the circulatory system, where it suppresses the bone marrow and causes the white blood cell count to drop. Veterinary care focuses on supporting the puppy with IV fluids and antibiotics, and close monitoring, while the puppy weathers the viral storm. Without intensive veterinary intervention, parvovirus is almost always fatal due to dehydration and/or a severely compromised immune system.

Intervention, while effective, requires inpatient care ranging from $1,500 to $3,000 – a cost some owners simply can't afford. Euthanasia often becomes the only other option for severely affected dogs.

http://csu-cvmbs.colostate.edu/pages/parvo-puppies-new-protocal.aspx

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CSU Parvo Outpatient Protocol

- 40 parvo cases
- Randomized clinical study – if owners declined IV in patient therapy, then they were offered participation in the study

- In-patient vs. out-patient treatment
  - Small difference in survival – 90% IP vs. 80% OP

Evaluation of an Outpatient Protocol in the Treatment of Canine Parvoviral Gastroenteritis. Preisner K, Sullivan L, Boscan P, Twedt D. Colorado State University, ACVIM abstract, 2013.

CSU OP Protocol

- Initial fluids by IV catheter
- Volume replacement + electrolytes and glucose based on labs
- SQ fluids at twice maintenance divided TID
- Convenia 8 mg/kg SQ once
- Cerenia 1 mg/kg SQ q 24 hrs
    - Additional meds used if needed
- Syringe feed A/D (1 ml/kg) q 6 hrs as tolerated
- Buprenorphine as needed for pain
- Oral supplementation – Karo syrup and Tumil K
- Worsening signs → transferred to IP group (only 5%)

Evaluation of an Outpatient Protocol in the Treatment of Canine Parvoviral Gastroenteritis. Preisner K, Sullivan L, Boscan P, Twedt D. Colorado State University, ACVIM abstract, 2013.

Treatment Parameters

- Must retain ability to provide humane care
- Regular monitoring is key – status can change rapidly

What requires revision of the plan?

- Options for further treatment
- Changing meds
- More aggressive therapy care
- Transfer for care?

- What are “stopping points” for your shelter?

After Treatment…

- Pups generally recover after 3-10 days of treatment…(5-7 typical)
- Viral shedding stops within 2 weeks (occasionally intermittent to 3 weeks)
- Once clinically recovered, SNAP test (or PCR)
- Bathe and dry thoroughly!!!
- Vaccinate as usual!
- Rehome ASAP!

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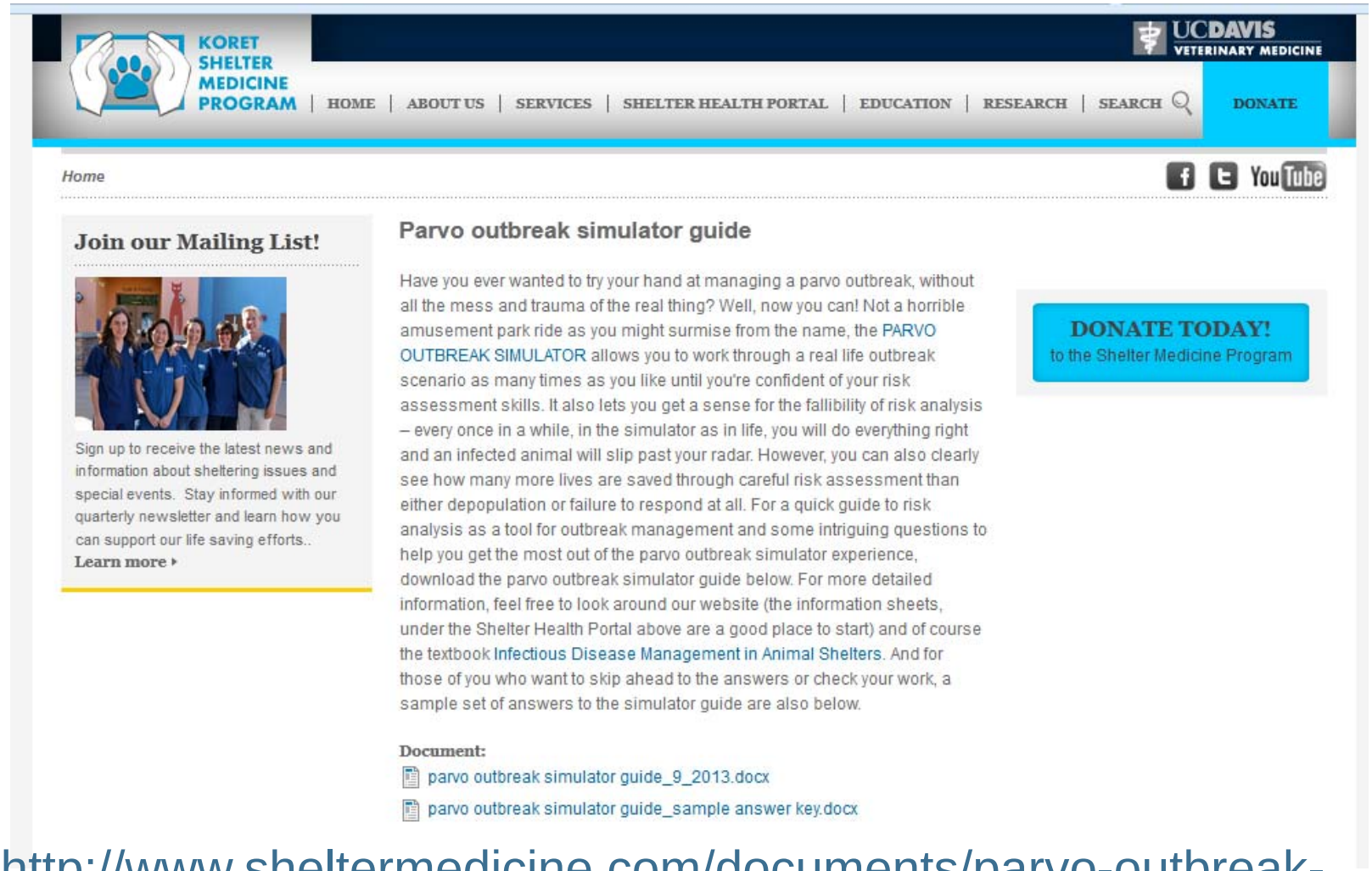
Practice, Practice, Practice



http://www.sheltermedicine.com/documents/parvo-outbreak-simulator-guide