

Canine and Feline Influenza: Risks, Management, and Prevention

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CORNELL UNIVERSITY

FALL 2017



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**Maddie's Shelter
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Emerging Issues

Evolving viruses

Species jumps

Newer, highly sensitive diagnostic testing methods

Unknown/ unrecognized agents

More animal movement

- Shelters
- Owners

Anti-vaccination movement



By Brett Rains

Deadly disease threatens dogs at Humane Society

Outbreak shuts down adoptions at Sebastian County center

UPDATED 6:29 PM CDT Jun 08, 2016

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Health

Tech

Environment

Society

Quirky

Science News

from research organizations

Canine influenza transmitted to cats in Midwestern shelter

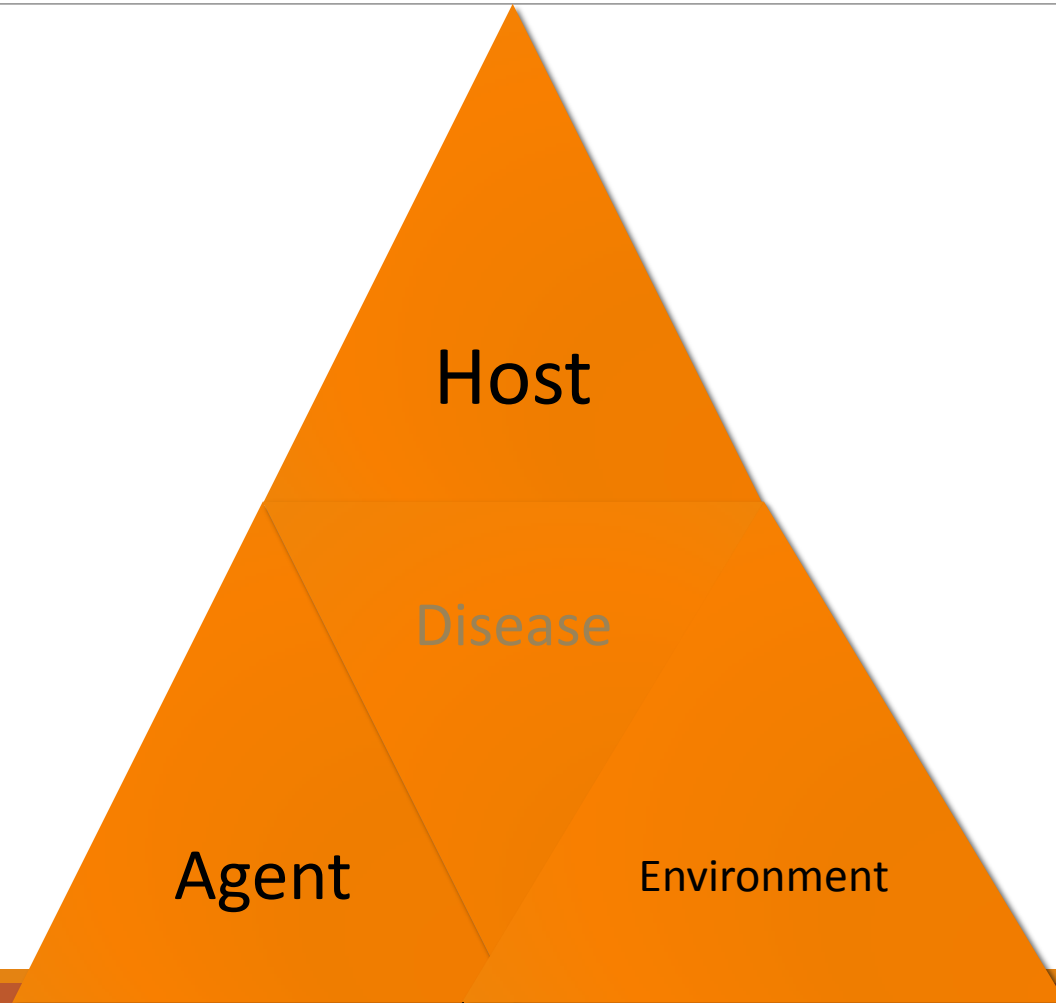
Date: April 1, 2016

Source: University of Wisconsin-Madison

Summary: It may be called canine influenza, but an expert has confirmed that the virus that sickened a large number of dogs in the Midwest last year has now infected a group of cats in the region.

Show

Epidemiologic Triad



- Age
- Concurrent conditions
- Stress!



- Immune status
- Vaccine status
- Nutritional status

- Virulence
- Transmission routes
- Carrier state
- Incubation period
- Shedding
- Vaccine and treatment coverage



- Capacity
- Housing
- Sanitation
- Ventilation
- Staff training and communication

URI Prevention & Management



Canine URI Agents

VIRAL

Classics

- Canine distemper
- Canine parainfluenza (CPiV)
- Canine adenovirus (CAV2)
- Canine respiratory coronavirus (CRCoV)

Emerging

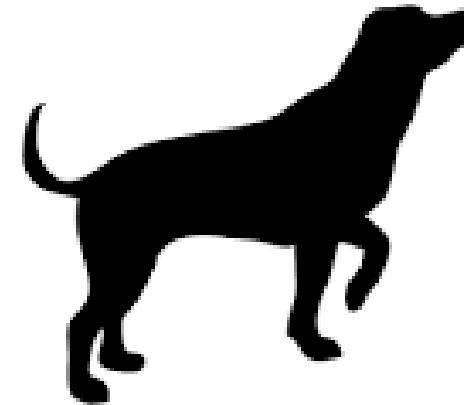
- Canine pneumovirus
- Canine Influenza (CIV)
 - H3N8
 - H3N2

BACTERIAL

Bordetella bronchiseptica

Mycoplasma spp.

Strep zoo



Agents

INCUBATION

Exposure → clinical signs

Most often < 1 week

- Between 2-14 days



Secretions

Clinical
Signs/Shedding

- Shedding variable: some BEFORE CLINICAL SIGNS
- Variable length but most < 2 weeks

Shedding

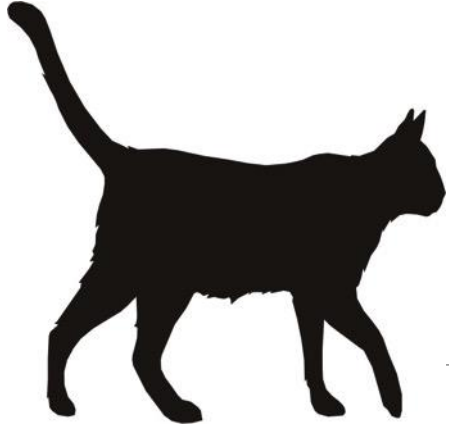
TRANSMISSION

Direct contact: sick → susceptible

Aerosolization

Environmental contamination

- **FOMITES!**



Feline URI Agents

CLASSIC AGENTS

- Viral
 - Feline Herpes Virus (FHV-1)
 - Feline Calicivirus (FCV)
- Bacterial
 - *Bordetella bronchiseptica*
 - *Chlamydophila felis*
 - *Mycoplasma* spp.
 - Others



EMERGING AGENTS

Feline influenza

H5N1

H1N1

H3N2

H7N2

Feline pneumovirus?

Feline URI Agents

INCUBATION

Exposure → clinical signs

Often < 1 week

- Between 2-14 days



Secretions

Shedding

**Clinical
Signs/Shedding**
most efficient
when clinical
signs are present

- Variable length
Weeks to months

TRANSMISSION

Direct contact: sick → susceptible

Droplet

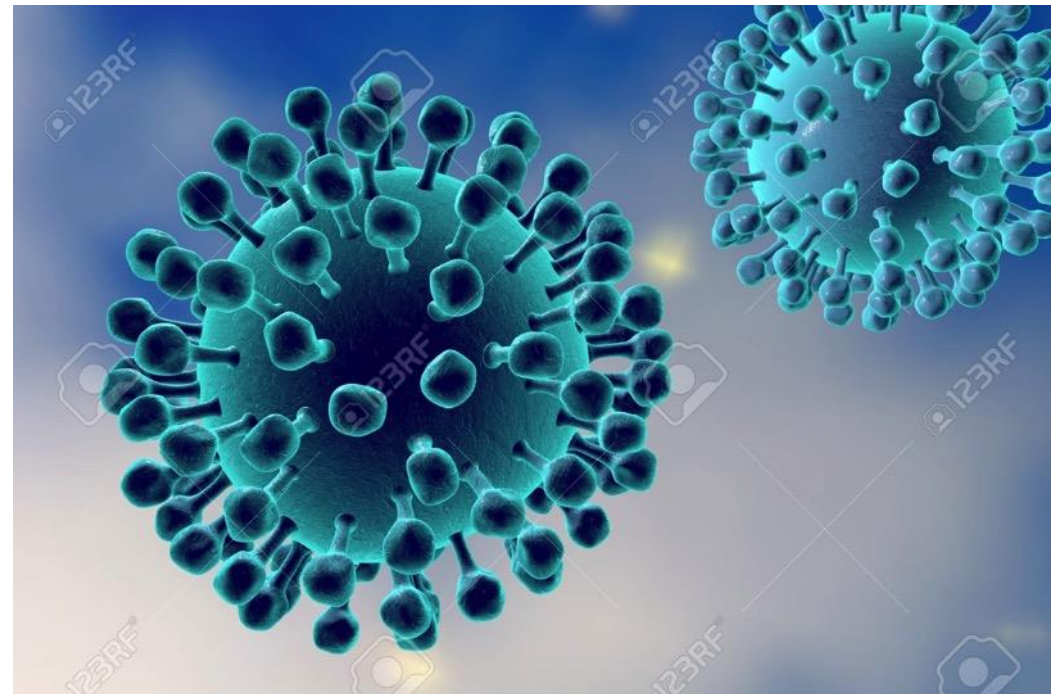
Environmental contamination

- **FOMITES!**

Influenza viruses

Orthomyxovirus

- Enveloped RNA virus
- Three families
 - A – avian, human pandemic, highly virulent and mutable
 - B – humans, seals, ferrets, less mutable
 - C – humans, dogs, pigs; rare
- Influenza A is the one we are most worried about



Influenza A viruses – relevant factors

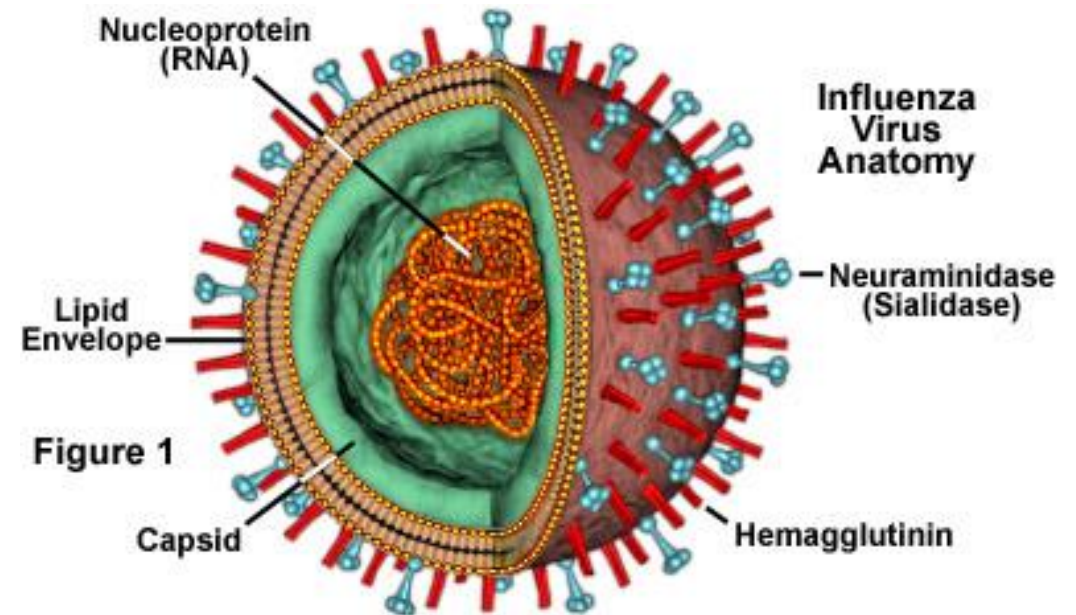
Antigenic protein = classification

- H1-H18 Hemagglutinin receptors
- N1-N11 Neurominidase receptors

H antigen is responsible for viral attachment to host cells

N antigen is responsible for the exit strategy to continue infection

Lots of recombination events, highly mutable



Influenza viruses – relevant factors

Transmission

- Droplet, aerosolization
- Direct contact
- Fomites
- For H5N1, consumption or droppings
- No reports of transmission from dogs/cats to people
- Ferrets are susceptible to H1N1



Canine influenza (H3N8 and H3N2)

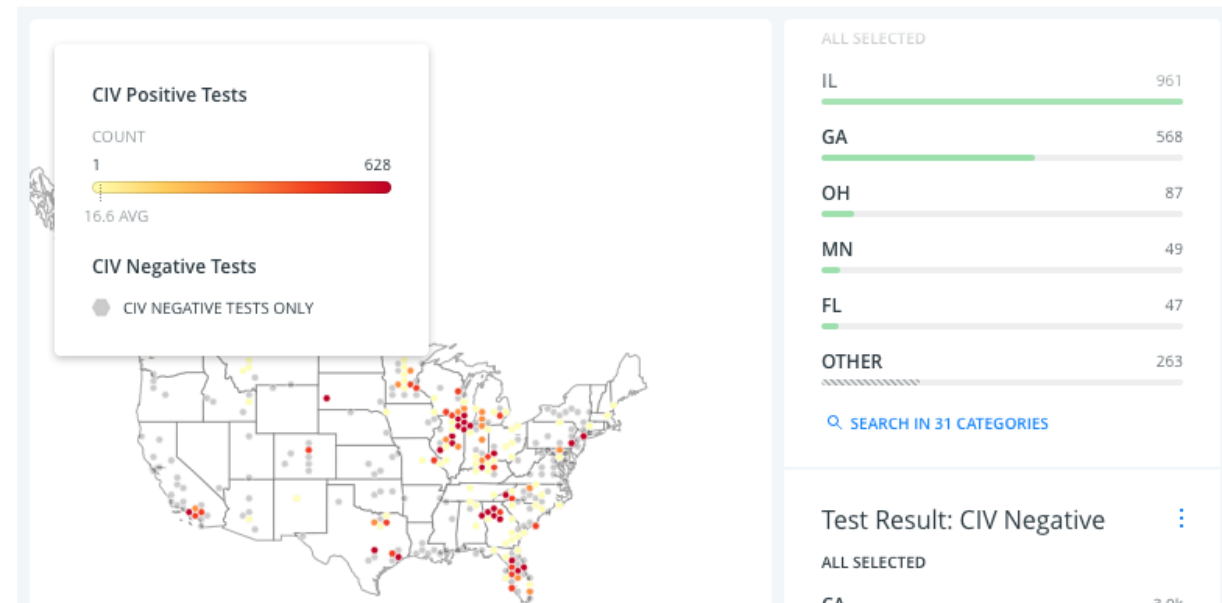
H3N8 (2004)

- Equine to dog
- Periodic outbreaks
 - Endemic areas: NY, PA, CO, FL

H3N2 (2015)

- 2015 Outbreak in Chicago
- Avian to dog transmission
- first reported in owned dogs
- Longer shedding periods (21 days?)
- More severe disease

Canine Influenza Virus Surveillance Network
H3N2 test results from March 2015 to present



Canine Influenza

Mild forms

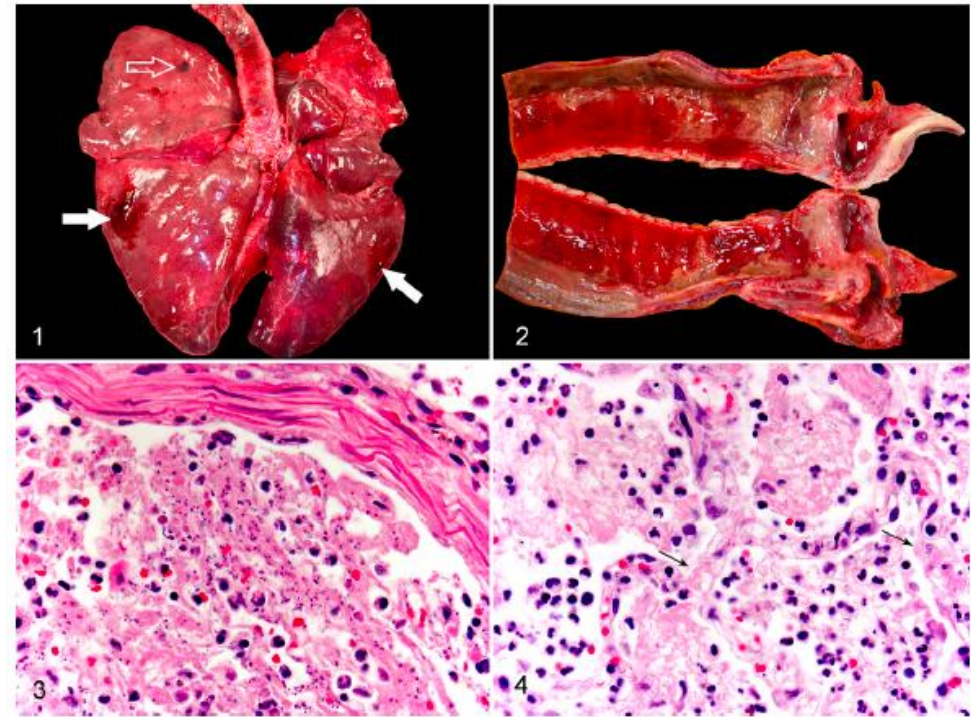
- Soft cough, 10-30 days
- Lethargy, fever, inappetance, nasal discharge

Severe forms

- High fevers
- Pneumonia – secondary agents
- 1 in 5 require hospitalization H3N2

Morbidity: virtually all dogs become infected;
80% show clinical signs

Mortality: low (less than 10%)



Figures 1–4. Influenza, lung dog. **Figure 1.** The lungs fail to collapse and have multiple hemorrhagic foci that range from depressed (open arrow) to raised (closed arrow). **Figure 2.** Fibrinonecrotic tracheitis and laryngitis, dog. A dull brown fibrinonecrotic membrane covers a portion of the mucosal surface, which is diffusely hyperemic and glistening (submucosal hemorrhage and edema). **Figure 3.** The bronchiole has loss of epithelial cells and the lumen contains neutrophils and cellular debris. Hematoxylin and eosin (HE). **Figure 4.** Alveoli contain flocculent to fibrillar eosinophilic material (protein-rich exudate and fibrin), fragmented cellular debris, macrophages, and neutrophils. The alveolar septa are

Feline Influenza

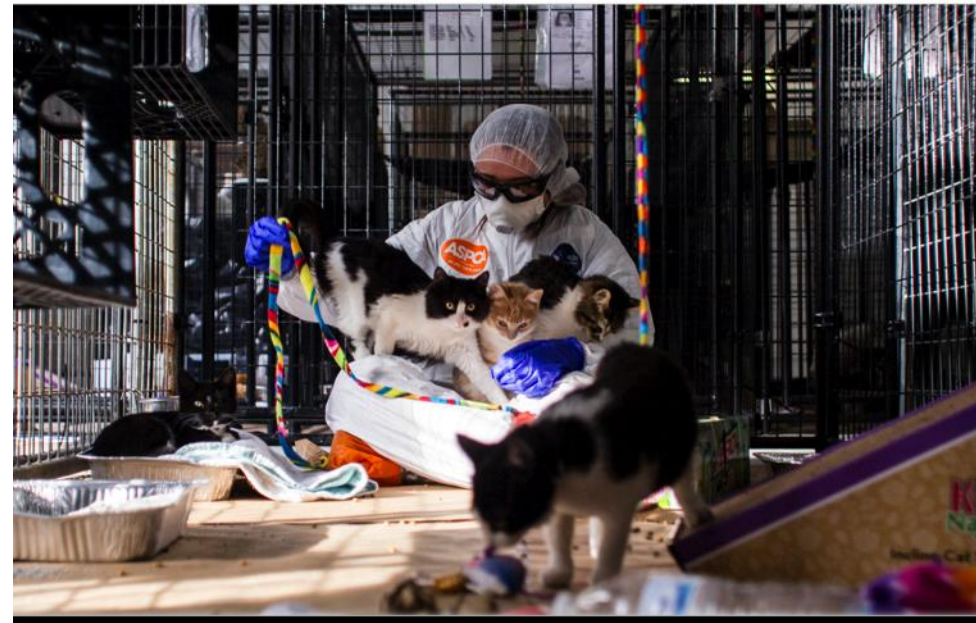
Strains

- H5N1: highly pathogenic avian influenza
- H1N1
 - single cat in 2009, Iowa household members had respiratory disease
- H3N2: Canine flu
 - S Korea in 2006; birds to dogs
 - Dog to dog (US 2015)
 - Dog to Cats
 - Relatively rare
 - Does not affect humans



Feline influenza (H7N2)

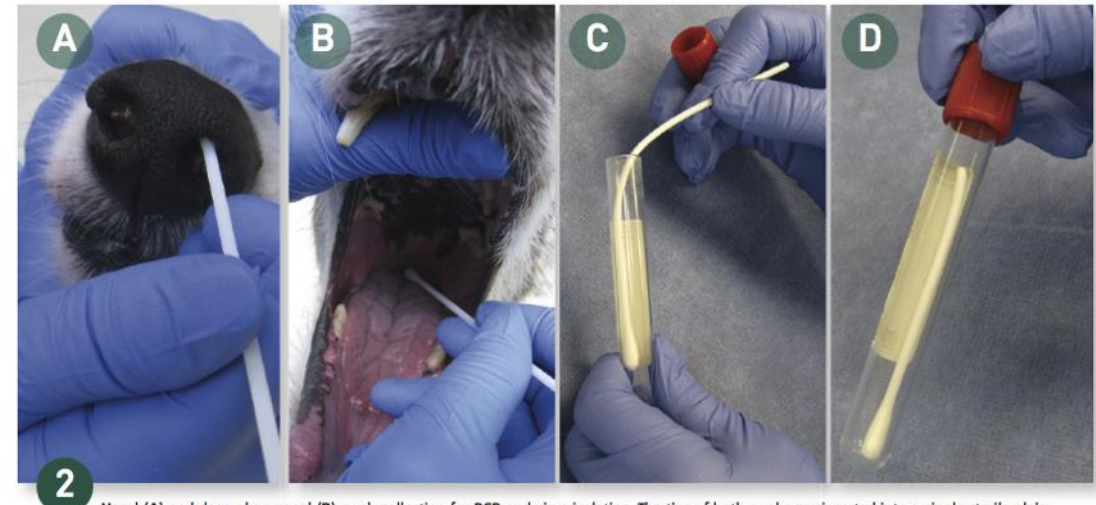
- H7N2: Low Pathogenic Avian Influenza
 - Cats in NYC shelters (2016)
 - Found by accident – sent as a canine sample for PCR (specific to H3N2 and H3N8)
- History
 - Had circulated in NYC live bird markets early 2000s
 - Thought to be eradicated (2006)
- Only 2 previous human cases reported
 - Considered "low risk for transmission"
- 1 investigator tested positive one day, negative the next, but risk was raised



PCR Testing for respiratory disease

Canine and feline respiratory panels

- PCR technology – can identify based on small amounts of agent
- Oropharyngeal and conjunctival swabs – 2-3 per animal, pooled in dry sterile tube
- For complete instructions, see <https://vetmed-maddie.sites.medinfo.ufl.edu/files/2014/10/Collection-of-Swabs-for-Diagnosis-of-Respiratory-Pathogens-by-PCR.pdf>
- Remember short shedding period for H3N8 (7 days); longer for H3N2 (21-28 days)
- Antech/Idexx: H3N8, H3N2
- Cornell AHDC: Testing for Influenza A matrix, then follow with strain details



Nasal (A) and deep pharyngeal (B) swab collection for PCR and virus isolation. The tips of both swabs are inserted into a single sterile plain red-top or similar tube (C), and the plastic handles are snapped (D) to release the tips into the tube.

PCR testing in shelters

Benefits

- Management
- Prognosis

Why not do it on everyone?

How does it change what you do?

Unusual clinical signs: type or severity

Unusual numbers of cases

Disease in vaccinated, healthy animals

Unclear source



ELISA for Influenza A testing in shelters

Human point of care test

Can be used to test dogs with less than 4 days of clinical signs

Influenza A nucleoprotein

False negatives due to low amounts of virus



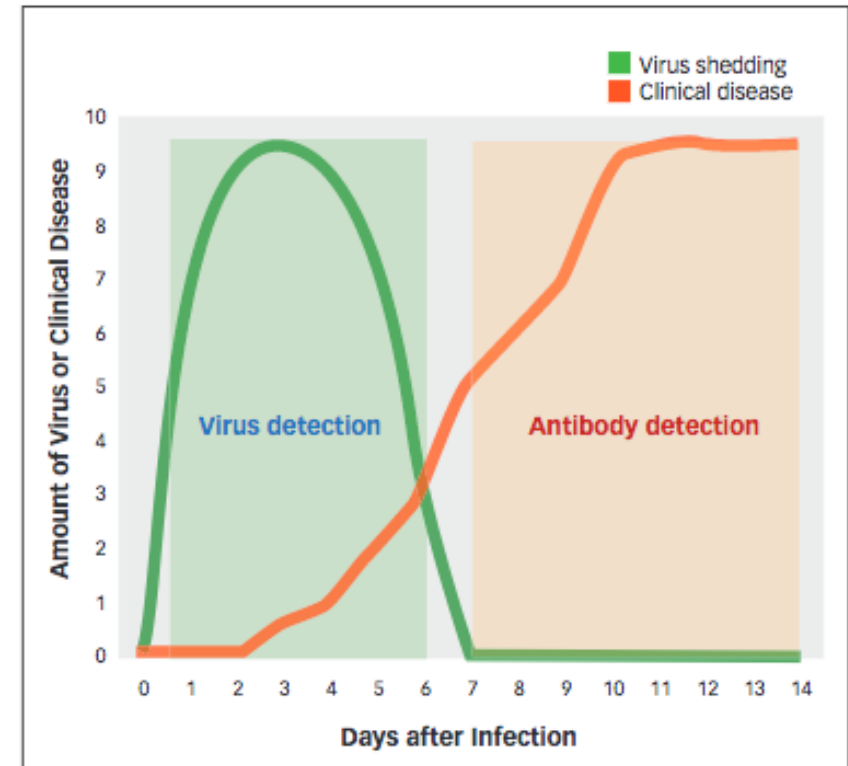
Paired serology is definitive

Acute serum sample < 7 days of signs, followed by another sample 2 weeks later

- Measures IgG levels
- 2 to 4 fold increase verifies acute disease

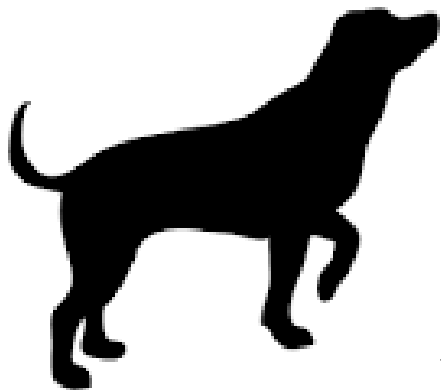
CIV is novel in many settings

- Positive titer at the start can be significant



URI Prevention & Management





VACCINES AVAILABLE?



CLASSICAL AGENTS

- Viral
 - Canine Distemper (CDV)
 - Canine Parainfluenza (CPiV)
 - Canine Adenovirus (CAV2)
 - Canine respiratory coronavirus (CrCoV) No
- Bacterial
 - *Bordetella bronchiseptica*
 - *Mycoplasma* spp. No

EMERGING AGENTS

- Canine pneumovirus - No
- *Strep zoo* - No
- Canine Influenza (CIV)
 - H3N8 (2009)
 - H3N2 (2015)
 - Bivalent 2016
 - Ongoing research

Current research (2017)

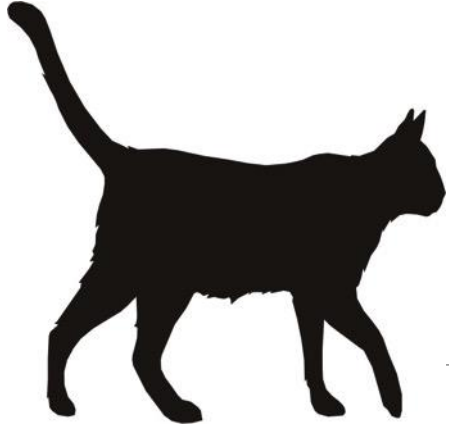
A bivalent live-attenuated influenza vaccine for the control and prevention of H3N8 and H3N2 canine influenza viruses

Laura Rodriguez^a, Aitor Nogales^a, Pablo R. Murcia^b, Colin R. Parrish^c, Luis Martínez-Sobrido^{a,*}

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^c Baker Institute for Animal Health, College of Veterinary Medicine, Cornell University, Ithaca, NY, United States



VACCINES AVAILABLE?

CLASSIC AGENTS

- Viral
 - Feline Herpes Virus (FHV-1)
 - Feline Calicivirus (FCV)
- Bacterial
 - *Bordetella bronchiseptica*
 - *Chlamydophila felis*
 - *Mycoplasma* spp. No
 - Others



EMERGING AGENTS

Feline influenza? No

H5N1

H1N1

H3N2

H7N2

Feline pneumovirus? No

Vaccine principles

Protective

- Canine distemper

vs *partially* protective

- Herpes, calici
- Bordetella
- CIV too

Vast majority of URI, protection is PARTIAL

- Minimize signs, severity, shedding



Vaccine principles in shelters

AT INTAKE

Correct products, modified live agents

- DOGS: DHPP SQ, **Bordetella/Parainfluenza IN (+/-CAV2)**
- CATS: FVRCP SQ, IN?

Limitations of killed products

Benefits of intranasal products for cell mediated immunity

Correct handling of products

- Trained staff
- Refrigeration
- Mixing just prior to use



Table 10.2. Anti-microbial treatment options for URI
Sources: Lappin et al. 2017; Plumb 2015; Sykes 2013

Drug	Dose	Comments
First line antibiotics		Uncomplicated URI
Doxycycline	5mg/kg PO q12 or 10 mg/kg PO q24h	Effective against CIRD associated B bronchiseptica or Mycoplasma spp. Much preferred over other options in shelters.
Minocycline	5mg/kg PO q12h	Similar to doxycycline
Amoxicillin-clavulanate	11 mg/kg PO q12h	Effective against CIRD caused by secondary commensals, including Pasturella, Staphylococcus, and Streptococcus species. Ineffective against beta-lactamase bacteria, including most B. bronchiseptica isolates. Ineffective against Mycoplasma spp.

Table 10.2. Anti-microbial treatment options for URI
Sources: Lappin et al. 2017; Plumb 2015; Sykes 2013

Drug	Dose	Comments
Second line antibiotics		For use in non-responsive or cases progressing to pneumonia. Preferably based on culture and sensitivity of endotracheal wash or bronchoalveolar lavage samples. Culturing nasal swabs not recommended.
Azithromycin	5-10mg/kg PO q 24 h for 3-7 days; 10mg kg PO q 24-72 hours (cats)	Primary bacterial pneumonia including Mycoplasma spp.
Enrofloxacin	5-20mg/kg PO, IM, IV q24h	Effective against most isolates of B. bronchiseptica and Mycoplasma spp
Marbofloxacin	2.7-5.5 mg/kg PO q 24h	Effective for B. bronchiseptica and Mycoplasma spp and many secondary Gram-positive and Gram negative organisms.
Pradofloxacin (cats)	5mg/kg	Only quinolone with effects against anaerobes; good for bacterial rhinitis/osteomyelitis; good for P. multocida, Mycoplasma spp, C. felis.

URI Treatment: Anti-tussives

DOGS

- All extra-label, except Butorphanol (0.55mg/kg q 6-8)
- Can compromise clearance mechanisms
- Options: controlled drug management
 - hydrocodone bitartrate/homatropine MBr (0.2-0.5mg/kg PO q 12 h),
- Maroparitant (0.5mg -1mg/kg q 24 h)
 - cough suppression in cats, dogs and humans through its inhibition of the tachykinin NK1 receptor and Substance P (this is extra-label usage)

Patient selection, not protocol typically

Not recommended with CIV due to risk of pneumonia

Pneumonia in cats

Can. Be. Subtle.

Tachypnea and dyspnea

- Varying degrees, can be missed

Fever

- Only about 50% of the time. Not reliable

Cough

- *Bordetella*, parasites such as lungworm, toxoplasmosis

Tachycardia

- Secondary to hypoxia, sepsis, fever, progression

Crackles and wheezes on auscultation

- Must distinguish from referred upper respiratory sounds



Shelter specific concerns

Must separate ill animals from healthy animals

- “clean break” is ESSENTIAL

Disaster comes when dogs are presumed to have standard kennel cough and left in the population

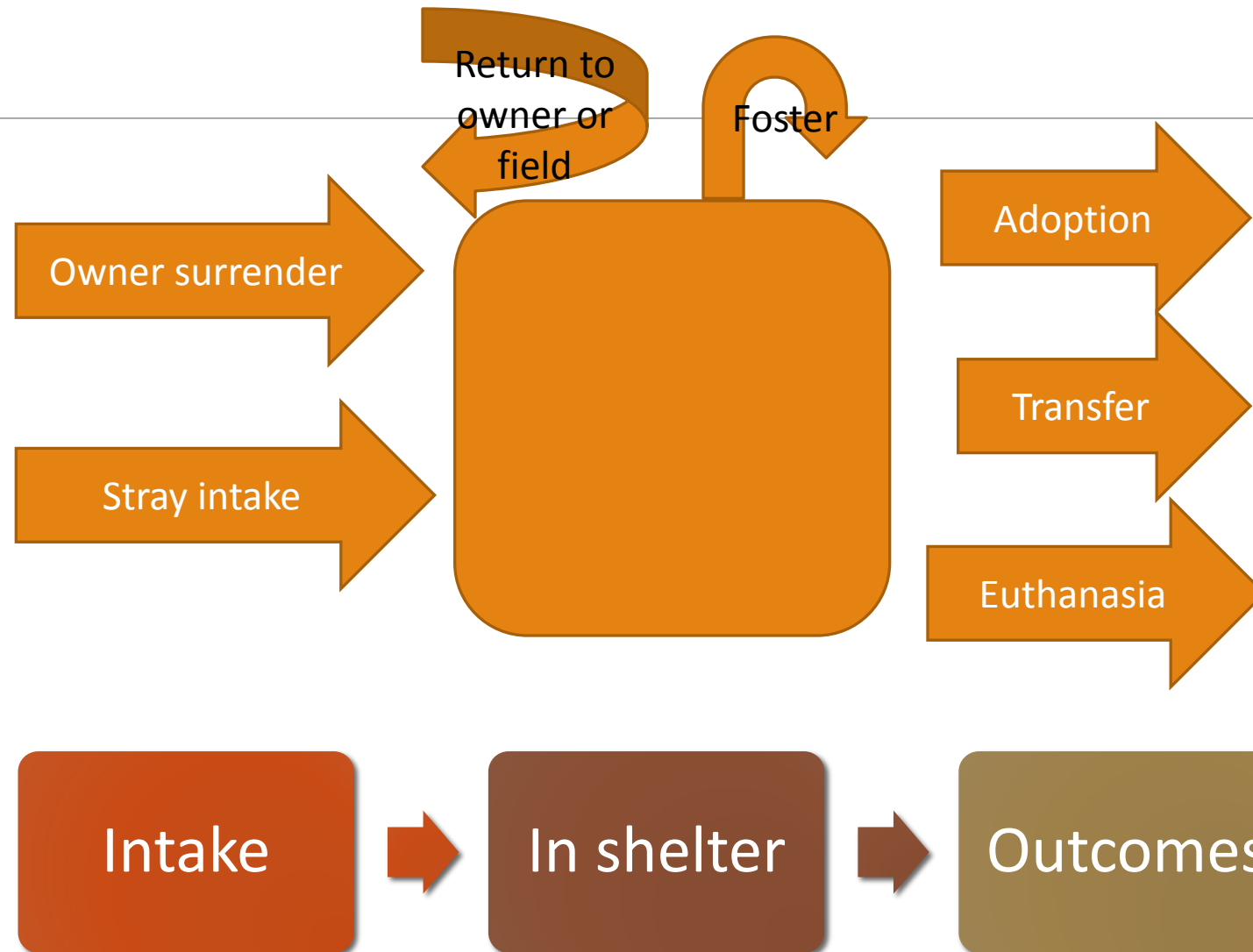
Environmental measures are critical



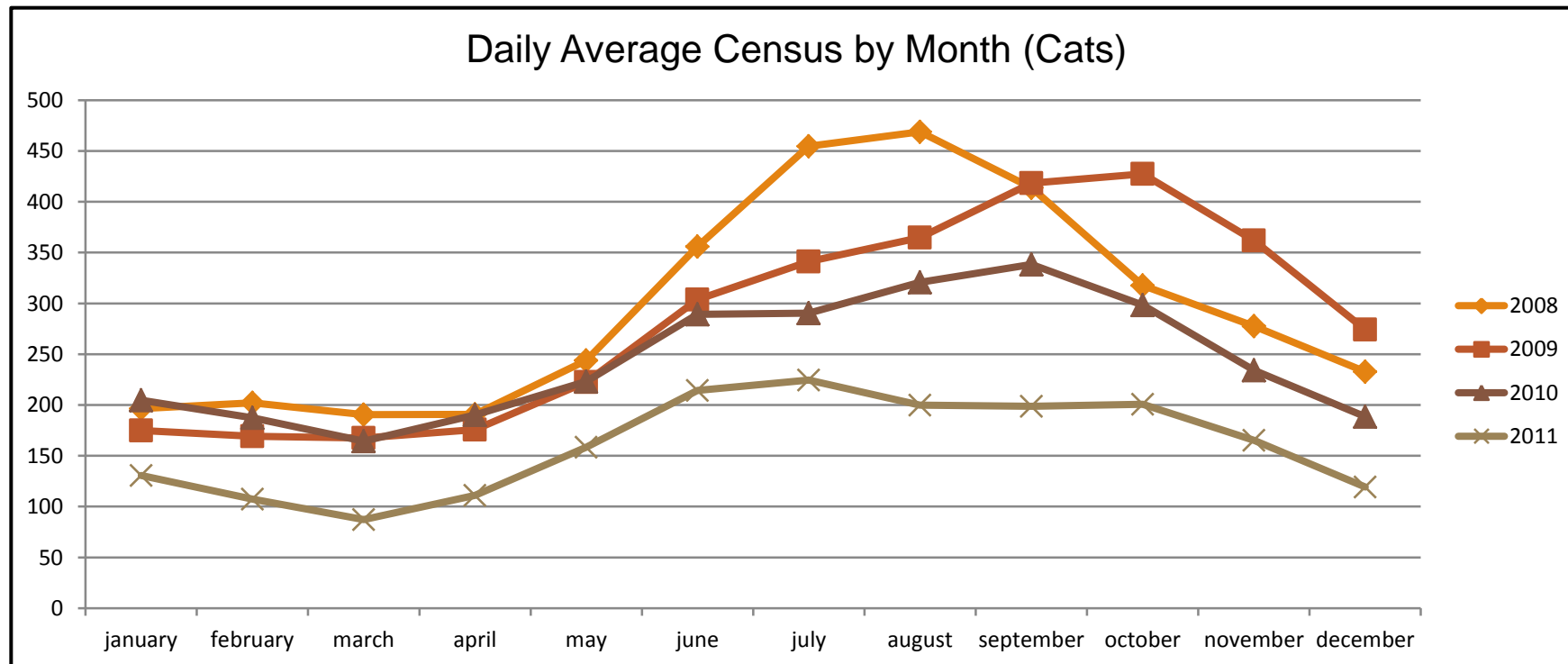
URI Prevention & Management



The Shelter as a System



Capacity for Care = healthy humane care



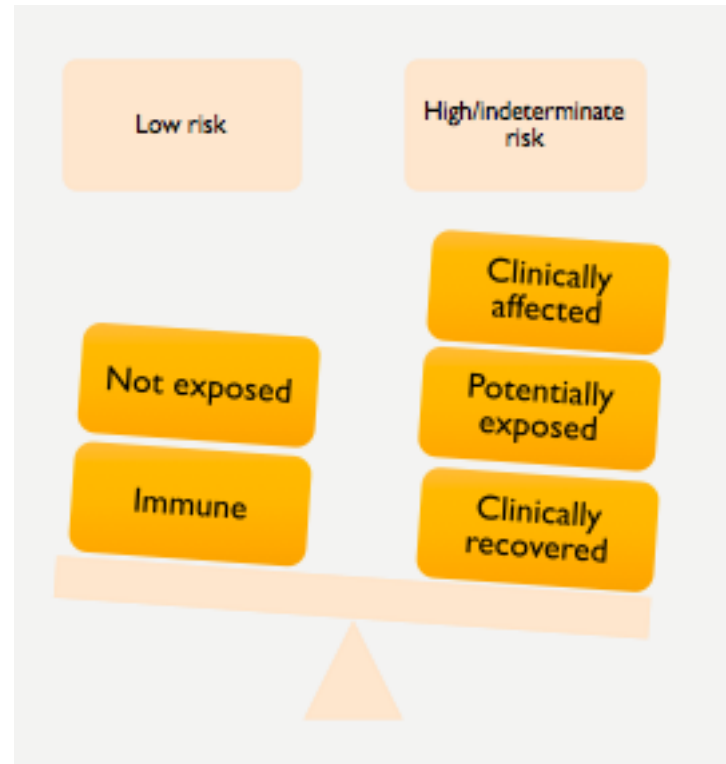
Risk management and Pathway Planning

Farm animal herd health = “all in, all out”

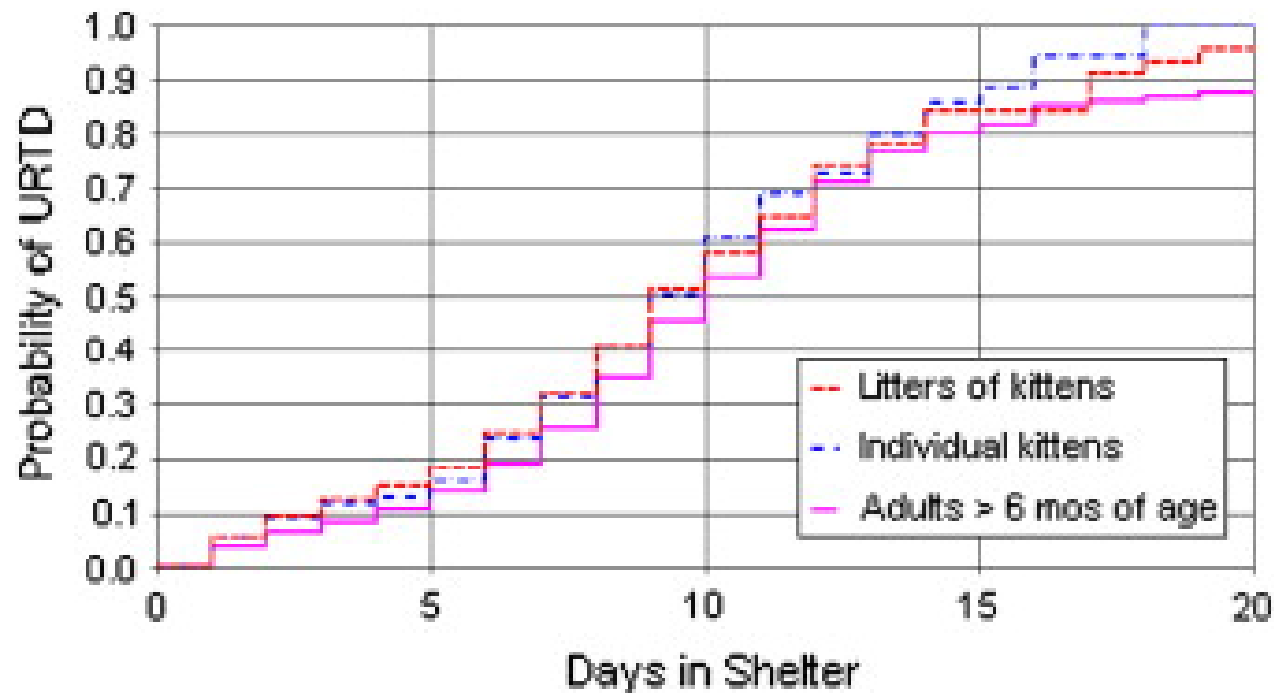
What can we do in shelter medicine?

- Who are at greatest risk for introducing Influenza into our shelters?
- What can we do to minimize the risk?

Should we quarantine everyone for 14 days?



The longer they stay, the greater the risk



Dinnage, JD, Scarlett JM, Richards JR. 2009

Shelter Principles in Herd Health: basics

Assessment on arrival (trained medical staff member)

- Physical exam and behavioral assessment

Vaccinate everyone, and more commonly

- MLV vaccines for common diseases : DHPP, FVRCP, **Bb/CPIV IN**

Treat the treatable

- Anti-parasitics, other potentially infectious diseases

Protect the vulnerable

- Age and species specific housing
- **Risk assessment based on source**

Remove infected animals

- Isolation, foster care, euthanasia

Pathway planning

Biosecurity, surveillance, and humane handling



Controlling CIV Transmission: Fomite control

- On surfaces = 48 hours
- On clothes = 24 hours
- Hands = 12 hours
- Hand hygiene
 - Hand-washing
 - Gloves
 - Hand sanitizer
 - >65% alcohol
- PPE
 - Garments, footwear, gloves



Limit Agent in the Environment

- **Cleaning and disinfection**

- Role of everyone
- Spot cleaning better than daily deep cleaning (*in general*)
- Clean prior to disinfection
- Identify and troubleshoot all fomites!

- **Products:**

- Accelerated hydrogen peroxide (Accel) 😊
- Sodium hypochlorite (Bleach) 😊
 - 1:32 dilution, 10 minutes
- Potassium peroxymonosulfate (Trifectant) 😊
- QUATS (Triple Two, Rocal) ☹️ **for calicivirus**



Controlling Transmission: Early ID of signs

DOGS

Cough

Nasal discharge

Ocular discharge

Retching

Lethargy



CATS

Conjunctivitis

Sneezing

Nasal discharge

Lethargy

Fever



Health Surveillance

Daily monitoring

Staff training

- What to look for, how to report, what to submit

Data collection, recording, access

- Clipboards, software systems, using medical tracking data

Pre-existing protocols

- empower staff to enact isolation, early treatment
- Communicate sooner rather than later



What should we be doing, as shelters,
regarding vaccination for CIV?

Additional Resources

Canine Influenza Updates. Cornell University. <https://ahdc.vet.cornell.edu/news/civchicago.cfm>

Feline Influenza Fact Sheet. University of MN Center for Animal Health and Safety.
https://www.cahfs.umn.edu/sites/cahfs.umn.edu/files/cahfs_website_fs_feline_influenza_may_2016.pdf

Anderson and Crawford. *Diagnosing H3N8 CIV infection*. Clinician's Brief October 2011.

Instructions for best swab collection for testing. <https://vetmed-maddie.sites.medinfo.ufl.edu/files/2014/10/Collection-of-Swabs-for-Diagnosis-of-Respiratory-Pathogens-by-PCR.pdf>

Infectious disease management in animals shelters. Miller et al. 2nd edition in press currently.

ASPCapro Sanitation and Disinfection. <http://aspcapro.org/resource/shelter-health-disease-management/shelter-disinfectant-quick-reference>

Consultation Service, Cornell University Maddie's Shelter Medicine Program

- Consultation hotline 607- 882 – 0179
- Email sheltermedicine@cornell.edu