Knowledge, Attitudes and Practices of Licensed Dog Breeders in Kansas Regarding Canine Brucellosis

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Kansas Department of Health and Environment (KDHE)

- Health and Environmental Laboratories
- Environment
- Health Care Finance
- Public Health
  - Bureau of Epidemiology and Public Health Informatics (BEPHI)
    - Infectious disease epidemiology and response
      - Disease investigations
      - Investigative reports
      - Statistics

Source: www.kdheks.gov

Field Experience

- Knowledge, Attitudes and Practices Survey
- Brucellosis Reporting in Humans
- Brucellosis Reporting in Dogs

BACKGROUND

Canine Brucellosis

- Infectious reproductive disease of dogs
- Clinical Signs
  - Males – prostatitis, epididymitis, infertility
  - Females – abortion, stillbirth, infertility
- Zoonotic
  - Causes flu-like illness in humans
  - Fever, weakness, night sweats, fatigue, headache, painful joints, unexplained weight loss

Brucella species

- Gram (-) aerobic coccobacilli
- Intracellular
- Smooth or rough colony morphology

Bacterial Species	Preferred Host
Brucella abortus	Cattle
Brucella melitensis	Sheep and Goats
Brucella suis	Swine
Brucella ovis	Sheep
Brucella canis	Dogs

Transmission

- Direct contact with an infected dog
  - Bacteria can be found in most bodily secretions
  - Highest bacterial load in aborted fetus and vaginal discharge
- Passed from mother to puppies
  - Transplacental
  - Ingestion of birthing fluids
  - Ingestion of milk

Source: puppymilk.org/nursing.htm

- Environmental exposure
  - Can survive for months in the environment
  - High humidity, low temperature, no sunlight
- No evidence of human-to-human transmission

Diagnosis in Dogs

- Serology tests
  - Rapid slide agglutination test (RSAT)
  - Modified RSAT with 2-mercaptoethanol
  - National Veterinary Services Laboratory (NVSL)
- Confirmatory tests
  - Blood culture
  - PCR
  - Kansas State Veterinary Diagnostic Lab (KSVDL)

Photo source: http://www.vet.k-state.edu/depts/dmp/service/

Diagnosis in Humans

- Human serologic tests use smooth coated antigen
  - Brucella canis has a rough coat
  - False negative
- Blood culture can also be unreliable
  - Fastidious organism
  - Empiric antibiotic treatment
- Indirect ELISA??

Treatment

- Dogs – often unrewarding
  - Antibiotic therapy
  - Sterilization
  - Euthanasia
  - No vaccine
- Humans – good prognosis
  - Antibiotic therapy
  - Low mortality

Notification – Human Cases

Reportable!

- Kansas Department of Health and Environment
  - Suspect or confirmed cases are to be reported to KDHE within 7 days
- Local health department
  - KDHE assigns the case to the local jurisdiction
  - Brucellosis Disease Investigation Guidelines
- Centers for Disease Control and Prevention (CDC)
  - State health departments report cases to CDC

Disease Investigation Guidelines

1. Use current case definition to confirm diagnosis with medical provider
2. Conduct a case investigation to identify potential source of infection
3. Conduct contact investigation to identify additional cases
4. Identify whether the source of infection is a major public health concern
5. Initiate control and prevention measures to prevent spread of disease
6. Complete and report all information requested via the state electronic surveillance system (EpiTrax)
7. Use the disease fact sheet to educate individuals or groups

Notification – Dog Cases

Reportable!

- Kansas Department of Agriculture (KDA)
  - Animal Health Division (KDA-AHD)
  - Receives cases from veterinarians or laboratories
- Disease management
  - KDA-AHD, attending veterinarian and owner collaborate
  - Regulations outlined in Kansas Statutes
    - KSA 47-610 to KSA 47-635

Canine Brucellosis in Humans

- Centers for Disease Control and Prevention
  - 100+ cases of all *Brucella* species in the U.S. per year
  - 50 cases total of *Brucella canis* in the U.S. since 1973
- Seroprevalence rates in humans unknown
  - Estimated to account for 1% of all *Brucella* cases
  - Wide range of estimates from serology surveys
    - 13% in hospital patients in Mexico
    - 0.4% in US military population
    - 0.6% in Florida residents

Canine Brucellosis in Dogs

- Little data is available on prevalence
  - Estimated 1 – 8% of U.S. dog population is infected
  - More prevalent in stray dogs and shelter dogs
- KDA-AHD receives 6 – 12 cases/year in Kansas

Objectives

1. Knowledge, Attitudes and Practices Survey
   - Determine licensed dog breeders' knowledge, attitudes and practices regarding *Brucella canis* infection in dogs and humans
   - Screen licensed dog breeders for a history of symptoms that could suggest human cases of canine brucellosis
2. Brucellosis Reporting in Humans
   - Assess the human burden of *Brucella* infection in Kansas
3. Brucellosis Reporting in Dogs
   - Current case investigation guidelines in place for investigating canine brucellosis cases in breeding facilities

METHODS

KAP Survey

- 44 multiple choice and free text questions
- Sent to all 294 licensed breeders in Kansas
  - Physical addresses provided by KDA-AHD
  - One wave of surveys mailed; no follow-up actions
- Covered various aspects of canine brucellosis
  - Knowledge of disease in dogs and humans
  - Attitudes toward testing dogs for canine brucellosis
  - Personal protective behaviors to reduce transmission
  - History of symptoms of disease in respondents

Licensed Breeders

- Hobby
  - Sells 3-5 litters a year
- Animal Breeder
  - Sells 6+ litters a year, primarily for wholesale
- Retail Breeder
  - Sells 6+ litters a year, primarily at retail
- Animal Breeder and Distributor

Brucellosis Reporting in Humans

- Searched for reported *Brucella* cases in Kansas using the electronic surveillance systems maintained by KDHE
- Kansas Electronic Disease Surveillance System (KS-EDSS)
  - Used from 1997 – 2012
- EpiTrax databases
  - New reporting system implemented in 2012

Case Definition

Case Classification for *Brucella* Infection	
Confirmed	Clinically compatible illness Definitive laboratory evidence of *Brucella* infection
Probable	Clinical compatible illness with at least one of the following - Epidemiologically linked to a confirmed human or animal brucellosis case - Presumptive laboratory evidence
Suspect	Laboratory results only No clinical information

Source: http://wwwn.cdc.gov/NNDSS/script/casedef.aspx?CondYrID=625&DatePub=1/1/2010%2012:00:00%20AM

Brucellosis Reporting in Dogs

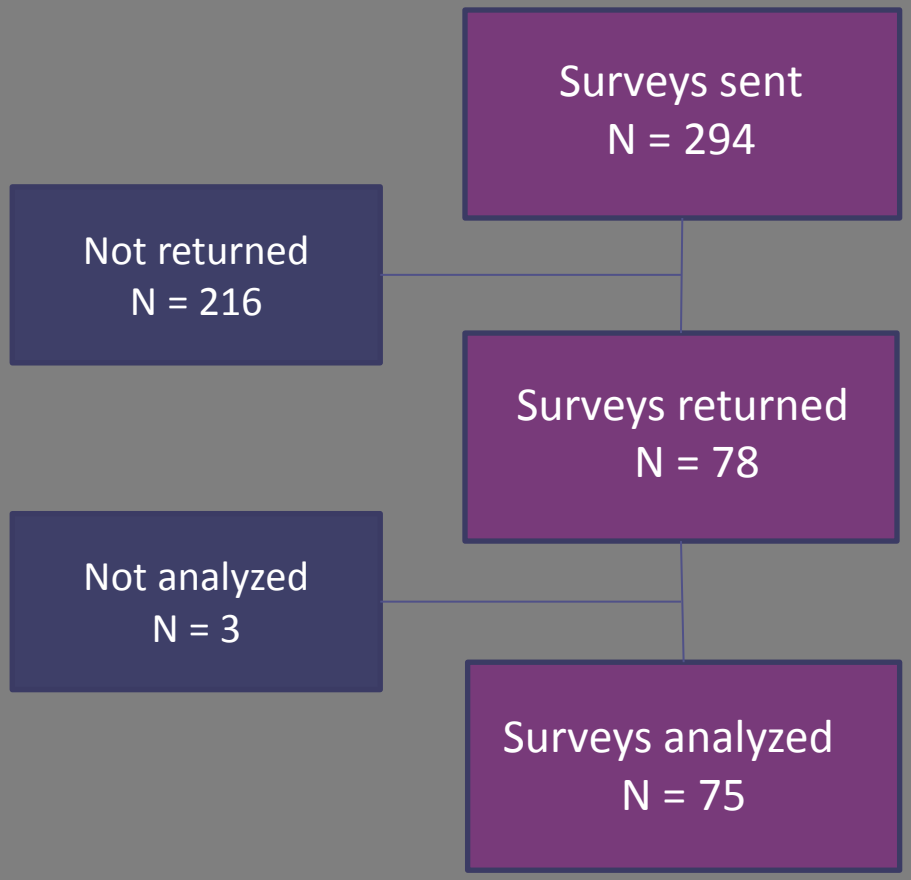
- Spoke with KDA-AHD about brucellosis reporting
  - Dr. Paul Grosdidier
  - Dr. James Crawford
- Performed a search for specific laws governing the regulatory authority of KDA-AHD with regard to reportable infectious diseases
  - Kansas Statutes Annotated (KSA)
  - Kansas Pet Animal Act

Statistical Analysis

- Data grouped into 2x2 contingency tables
- Fisher's exact two-tailed tests were performed
- Significance of associations was determined
  - $P < 0.05$ was considered significant

RESULTS

Response Rate



Response Rate = 25.5%

Breeder Demographics

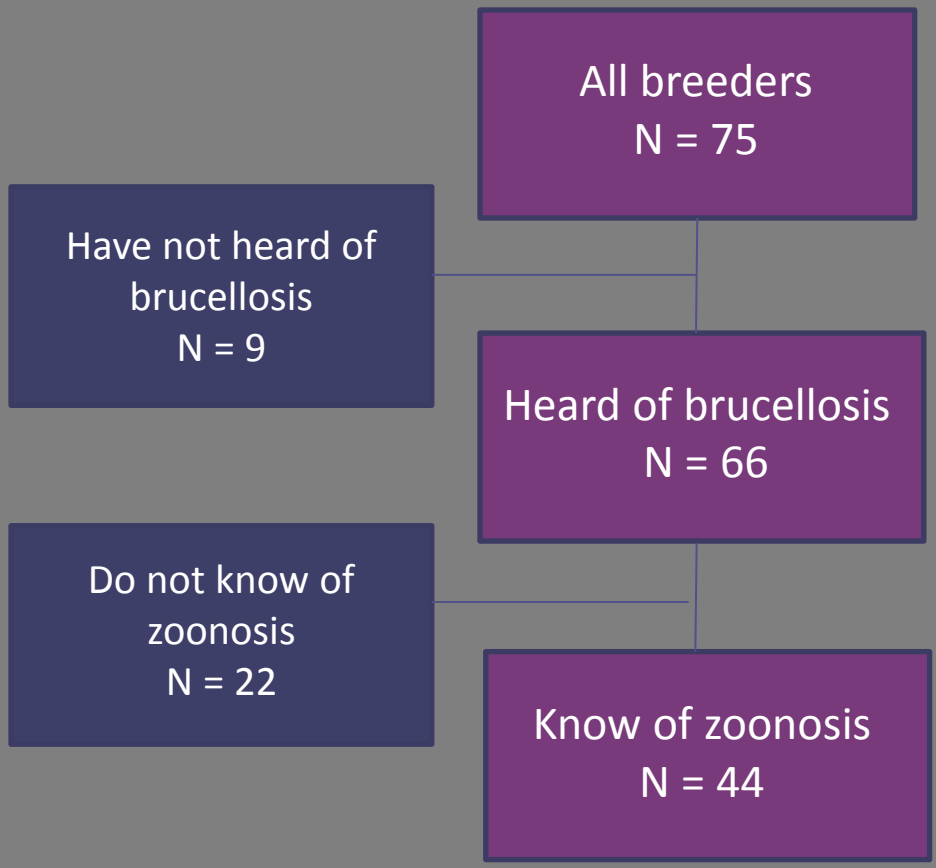
- Age: 57.3% below 60; 42.7% above 60
- Sex: 17.1% male; 80.5% female
- Education: 45.1% completed high school only; 54.9% completed some level of higher education
- Income: 37.8% below $50,000; 30.5% above $50,000; 30.5% prefer not to answer

Breeding Facilities

Size of Breeding Facilities Operated by Breeders

	Median	Minimum	Maximum
Breeding females	15	2	624
Breeding males	6	0	175
Litters produced per year	10	2	250

Knowledge of Disease



88% of breeders have heard of canine brucellosis

66.7% of breeders know that canine brucellosis is zoonotic

Zoonosis vs Education

Breeders who know that canine brucellosis is zoonotic, stratified by highest level of education completed

		Knew of Zoonosis		
		Yes	*No*	Total
Level of Education	*College*	26	5	31
	High School	16	14	30
	Total	42	19	61

Fisher's exact test (two tailed): 0.0134

Prevalence ratio: 1.57

Knowledge of Disease Transmission in Dogs

In what ways can canine brucellosis be spread from dog to dog?

Mode of Transmission	Number of Respondents
Contact with vaginal discharge or products of abortion from an infected bitch	52 (78.8%)
Contact with urine from an infected male	37 (56.1%)
Shared food and water bowls	15 (22.7%)
Infection passed from infected mother to puppies during pregnancy or whelping	39 (59.1%)
Tick bite	4 (6.1%)
Sexual contact during natural breeding	59 (89.4%)
Use of artificial insemination	26 (39.4%)
Not sure	5 (7.6%)

Knowledge of Disease Transmission in Humans

How can humans become infected by canine brucellosis?

Mode of Transmission	Number of Respondents
Petting or touching a dog's fur	7 (15.2%)
Breathing in the bacteria by nose or mouth	9 (19.6%)
Getting licked on the face or mouth by an infected dog	11 (23.9%)
Direct contact with abortion material or vaginal discharge from an infected dog	40 (87.0%)
Not sure	6 (13.0%)

Knowledge of Disease in Dogs

Can dogs that are spayed or neutered get infected with canine brucellosis?

Yes	No	Not sure
★ 37 (56.1%)	11 (16.7%)	18 (27.3%)

Is it possible for dogs that have never been bred to have canine brucellosis?

Yes	No	Not sure
★ 51 (77.3%)	7 (10.6%)	7 (13.7%)

Can canine brucellosis in dogs be cured?

Yes	No	Not sure
10 (15.2%)	★ 44 (66.7%)	11 (16.7%)

Knowledge of Disease in Humans

Can canine brucellosis be spread from person to person?

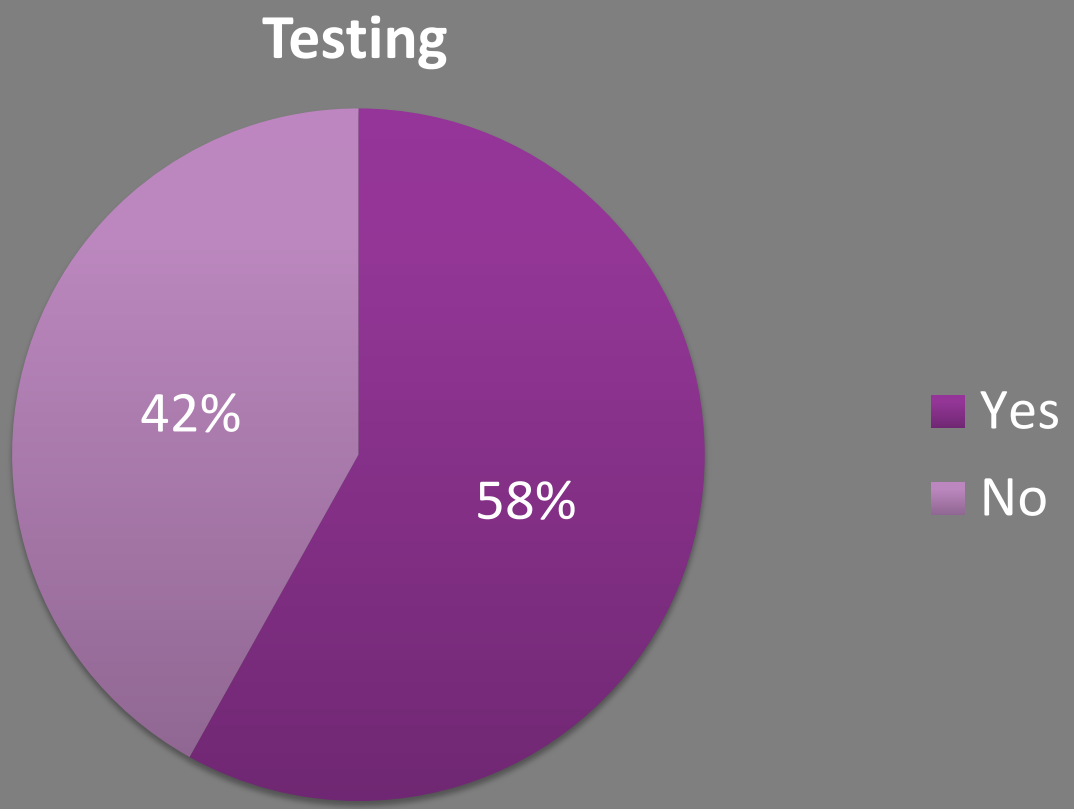
Yes	No	Not sure
10 (21.7%)	★ 11 (23.9%)	24 (52.2%)

Can canine brucellosis in humans be cured?

Yes	No	Not sure
★ 15 (32.6%)	8 (17.4%)	22 (47.8%)

Brucellosis Testing

Do you test dogs in your kennel for canine brucellosis?



Reasons for Testing Dogs

When do you test your dogs for brucellosis?

Reasons for Testing	Number of Respondents
Test dogs that have fertility problems	17 (37.0%)
Test dogs on a veterinarian's recommendation	12 (26.1%)
Test all breeding stock once a year	0 (0.0%)
Test dogs prior to each breeding event	2 (4.3%)
Test new animals before co-mingling	36 (78.3%)
Other	7 (15.2%)

Reasons for Not Testing Dogs

What reasons made you decide not to test your dogs?

Reason for Not Testing	Number of Respondents
Did not know about the disease	7 (21.2%)
Do not consider my dogs at risk of getting the disease	15 (45.5%)
No fertility problems in my kennel	15 (45.5%)
Do not want to know if dog is positive	0 (0.0%)
Testing takes too much time and effort	0 (0.0%)
Testing is too expensive	5 (15.2%)
Other	9 (27.3%)

Testing vs History of Infertility

Breeders who test dogs, stratified by history of infertility

		Perform testing		
		Yes	*No*	Total
History of Infertility	*Yes*	18	6	24
	No	24	24	48
	Total	42	30	72

Fisher's exact test (two tailed): 0.0478

Prevalence Ratio: 1.50

Number of Tests Performed

Number of tests performed and number of dogs diagnosed with brucellosis

Past 5 years		
Total tests	Test (+) dogs	Diagnosed dogs
2086	63	63

Past 12 Months		
Total Tests	Test (+) dogs	Diagnosed dogs
697	18	18

A total of seven breeders reported having positive dogs

Sources of Breeding Dogs

Source	Number of Respondents
Buy dogs from other breeders	52 (69.3%)
Buy dogs from auction events	16 (21.3%)
Keep some of own puppies to breed	72 (96.0%)
Buy semen and use AI	5 (6.7%)
Other	4 (5.3%)

Auctions vs Positive Dogs

Breeders who buy dogs from auctions, stratified by breeders with brucellosis-positive dogs

		Positive Dog(s)		
		Yes	*No*	Total
Purchase dogs from auctions	*Yes*	5	11	16
	No	2	57	59
	Total	7	68	75

Fisher's Exact test (two tailed): 0.0040

Prevalence Ratio: 9.20

Practicing Personal Protection

Do you wear gloves when performing the following activities?

Activity	Do Wear Gloves
Routine cleaning of cages/runs	35 (46.7%)
Assisting in whelping puppies	37 (49.3%)
Cleaning the area after whelping	35 (46.7%)

Symptoms of Human Disease

Within two months of any stillbirth or abortion in your kennel, did you notice any of the following symptoms in yourself?

Fever
Headache
Night sweats
Fatigue
Painful joints
Weakness
Weight loss
Arthritis/back pain

Response	Number of Respondents
We have never had a stillbirth or abortion in the kennel	22 (29.7%)
I had none of these symptoms	46 (62.2%)
Fatigue	1 (1.4%)
No response	5 (6.8%)

Brucellosis Reporting in Humans

Brucellosis cases in Kansas, 1997-2012

Case Classification	Number of cases
Confirmed	11
Probable	16
Suspect	28

Total = 55 cases

Only five confirmed cases listed a specific *Brucella* species

- Four cases reported *B. melitensis* as the causative agent
- One case reported *B. abortus* as the causative agent

Brucellosis Reporting in Dogs

- KDA-AHD does not currently have a written protocol guiding case investigation upon report of a brucellosis-positive dog in a breeding facility

- Regulatory actions for all reportable infectious diseases are outlined in the Kansas Statutes Annotated (KSA) and Kansas Administrative Regulations (KAR)

KAR 9-27-1

Includes “all species of brucellosis” in the list of diseases that “shall be designated as reportable infectious or contagious animal diseases and shall be reported in accordance with KSA 47-622.”

KSA 47-622

It is the duty of “any person who discovers the existence of any such contagious or infectious disease among the domestic animals of any person to immediately report this information to the animal health commissioner.”

KSA 47-610

"[The] state animal health commissioner is directed to protect the health of domestic animals of the state from all contagious and infectious diseases and for this purpose is hereby authorized and empowered to establish, maintain and enforce such quarantine, sanitary and other regulations as necessary."

KSA 47-634

The state animal health commissioner can impose mandatory “disinfection of the premises where a disease animal or animals” have been housed.

KSA 47-614

"When in the opinion of the commissioner it shall be necessary to prevent the spread of any contagious or infectious diseases among the domestic animals of this state, to destroy animals affected with or which have been exposed to any such disease, or which are unconfined in violation of any quarantine order, he shall determine what animals shall be killed and cause the same to be killed and the carcasses disposed of as in his judgment will best protect the health of the domestic animals of the locality."

CONCLUSIONS AND DISCUSSION

Conclusions

- Licensed dog breeders in Kansas are more knowledgeable about canine brucellosis in dogs than in humans
- While breeders know that canine brucellosis is zoonotic, this knowledge does not translate into the performance of appropriate protective behaviors such as wearing gloves when in contact with potentially infected dogs
- Attitudes toward testing are more favorable regarding newly purchased dogs than currently owned dogs
- No breeders reporting symptoms of disease

Limitations

- Small study size
  - Response rate = 25.5%
  - Comparison of respondents vs non-respondents
    - Based on region of KS where breeder was located
    - Not statistically different
- Power of study
  - Limited ability to find significant associations
  - Limited ability to find a breeder with symptoms of disease

Limitations

- Recall bias
  - Many responses based on memory of past events
  - Symptoms of disease in humans are non-specific
  - Events of interest (ex – abortion) may have happened years previously

Limitations

- Each of the seven respondents reporting positive dogs in their facility wrote the same number for dogs that "tested positive" and dogs that were "diagnosed"
  - Respondents indicated confusion in the distinction between the two terms
- Questions were intended to differentiate dogs that tested positive on a screening test (not 100% specific) and those that were ultimately diagnosed
- These data should not be used alone to assess disease burden in this population

Discussion

- Knowledge of disease
  - Breeders know much more about canine brucellosis in dogs than in humans
  - Knowledge of the zoonotic potential does not translate into personal protective practices such as wearing gloves
  - Low perceived risk of infection

Discussion

- Attitudes toward testing
  - Breeders commonly test newly purchased dogs before introducing them into the kennel (81%)
  - Breeders are much less likely to test dogs that are already in the facility, even if they develop fertility problems (41%)
  - Reluctance to test could be due to regulatory implications of having a positive dog

Discussion

- Reasons for not finding any human cases
  - Small sample size with a rare disease
  - Symptoms are non-specific and may be mild
  - Under-reporting

Discussion

- Why estimates of human disease burden of canine brucellosis may be falsely low
  - Non-specific clinical signs
  - False negative serologic tests
    - Standard brucellosis tests do not detect *Brucella canis*
  - Doctors may not consider *B. canis* as a differential
  - CDC does not require that the etiologic species of *Brucella* be included in case reports

Recommendations

- KDHE and KDA-AHD
  - Develop a joint protocol to follow-up on reported cases of canine brucellosis that may have resulted in human exposure
  - Create a fact sheet to provide to breeders
    - Incubation period and length of symptom watch
    - What symptoms may develop
    - What to do if you develop symptoms
  - Include the specific causative agent of *Brucella* in any case reported entered into EpiTrax

Recommendations

- Further study
  - Serosurveillance
    - More accurate assessment of prior exposure
    - Determine risk factors for those with seroconversion
  - Education
    - Outreach to breeders to increase knowledge
    - Encourage proper protective behaviors

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Questions?

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