Simplifying Case Management with Advancements in Vector Borne Disease Diagnostics

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IDEXX

Financial Disclosure

I have a direct relationship with IDEXX. Because of the nature of the relationship, it **will** influence my presentation.

Learning Objectives

1. **Learn about diagnostic options to help simplify vector borne disease dilemmas.**
2. **Understand how to interpret diagnostic results to make effective treatment plans**
3. **Review case management options for timely diagnosis utilizing real case examples.**

Zoonotic Vector Borne Diseases

Lyme disease gets all the press…

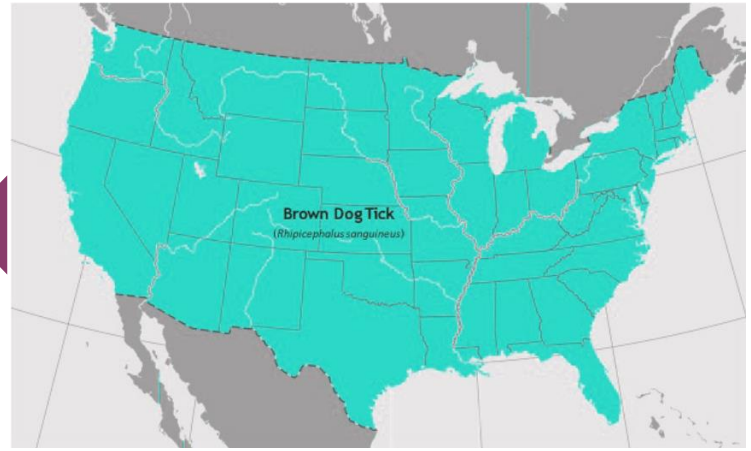
Zoonotic Risk

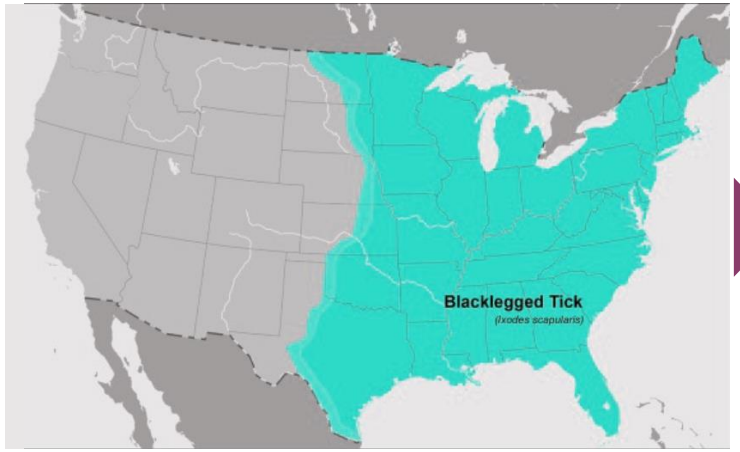
In the strict sense, zoonoses are defined as infectious diseases naturally transmitted from living animals to humans

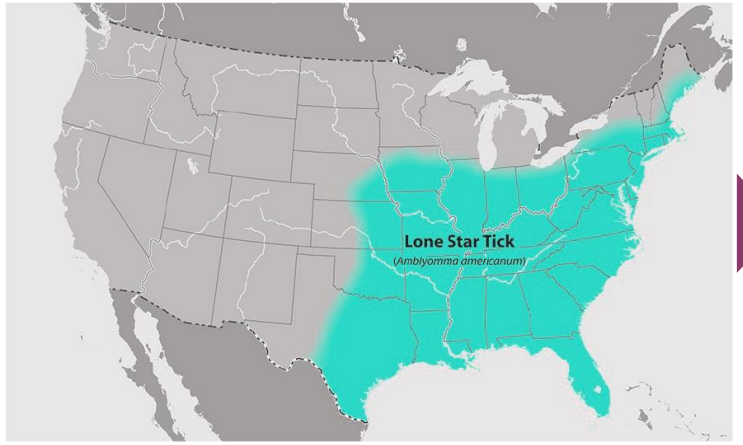
Based on the animal reservoir hosts, zoonoses can be synanthropic with an urban or domestic animal cycle, or exoanthropic with a feral or wild animal cycle.

Greene's Infectious Diseases of the Dog and Cat, 3rd Edition

Distribution of common ticks in the United States

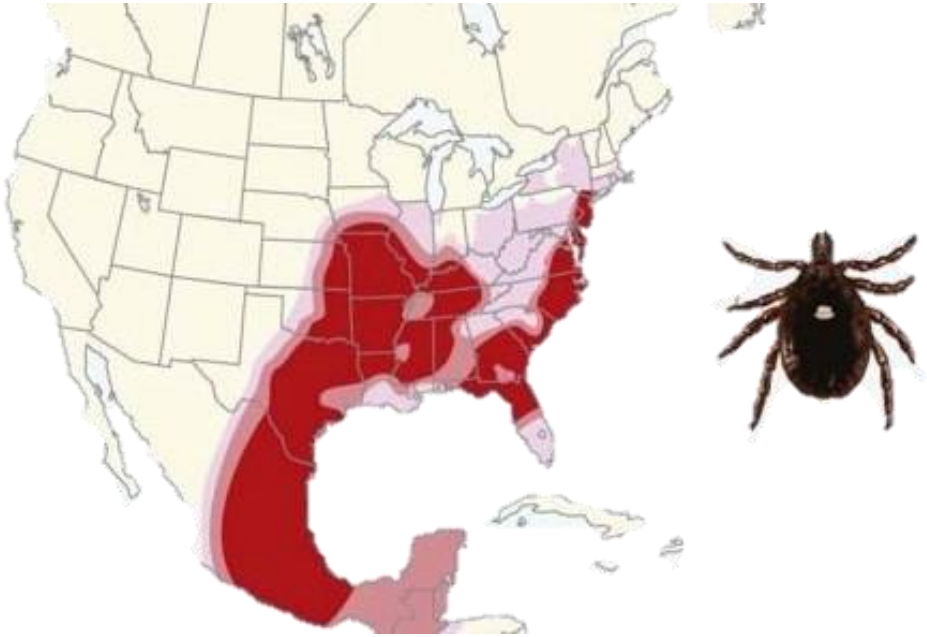




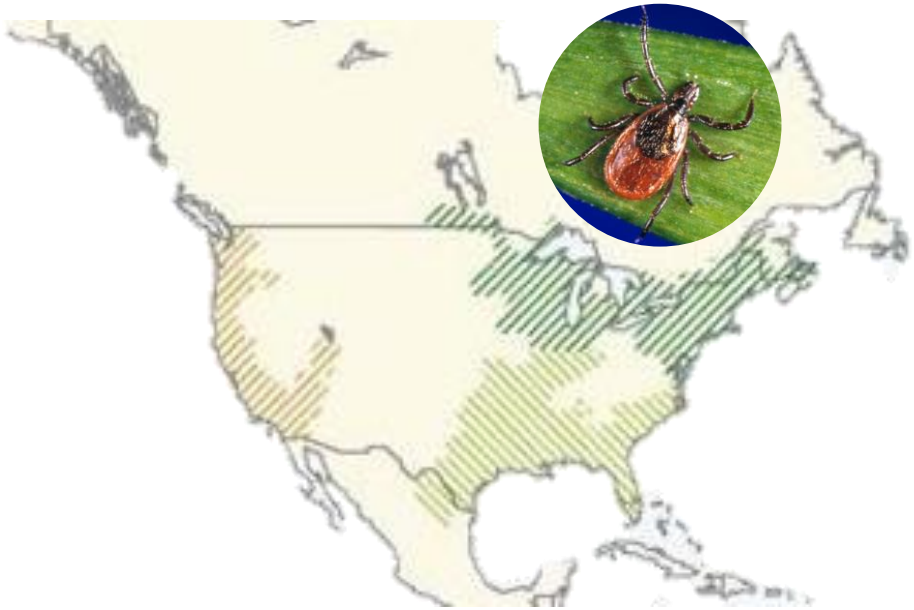


Source: Centers for Disease Control and Prevention. Geographic distribution of ticks that bite humans. CDC website. https://www.cdc.gov/ticks/geographic_distribution.html. Updated May 27, 2021. Accessed January 6, 2022.

Ticks may be closer than you realize…



Map shows the approximate distribution of *Amblyomma americanum*, or lone star tick.
Darkening shades of red indicate increasing prevalence.



- Ixodes scapularis N.
- Ixodes scapularis S.
- Ixodes pacificus

Image by William C. “Kipp” Carter. Image courtesy of The University of Georgia—College of Veterinary Medicine. © 2010 University of Georgia Research Foundation, Inc. (Used with permission)

How do we get infected?

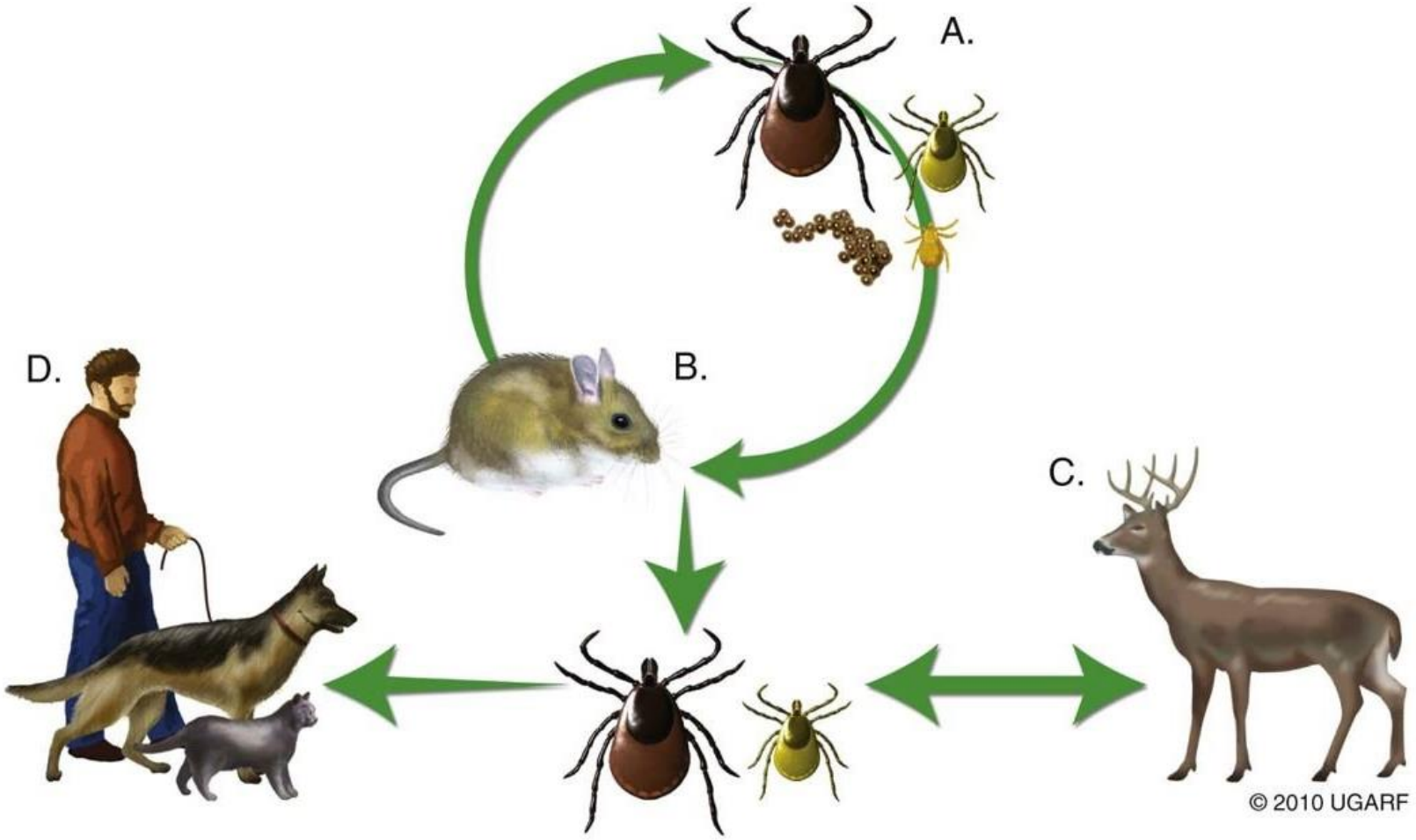


Image by William C. “Kipp” Carter. Image courtesy of The University of Georgia—College of Veterinary Medicine.

And with what?

Agent	*Anaplasma* phagocytophilum			*E. ewingii* and *E. chaffeenis*
Tick distribution				
A. Tick vector: primary reservoir host	 *Ixodes scapularis*	 *I. pacificus*, *I. spinipalpis*	 *I. ricinus*, *I. persulcatus*, *I. trainguliceps*	 *Amblyomma americanum*
B. Primary reservoir host	 *Peromyscus leucopus* (white-footed mouse)	 *Neotoma fuscipes* (dusky-footed woodrat)	 *Apodemus sylvaticus* (wood mouse)	 *Odocoileus virginianus* (white-tailed deer)
C. Wildlife host	 *O. virginianus* (white-tailed deer)	 *O. hemionus columbianus* (black-tailed deer), *Cervus elaphys* (elk)	 *Capreolus capreolus* (Roe deer), *Cervus elaphus* (red deer)	 *O. virginianus* (white-tailed deer), foxes, coyotes, etc.
D. Domestic host	Human, dog, horse, cat	Human, dog, horse, cat	Human, dog, horse, cat	Human, dog

Image by William C. “Kipp” Carter. Image courtesy of The University of Georgia—College of Veterinary Medicine.

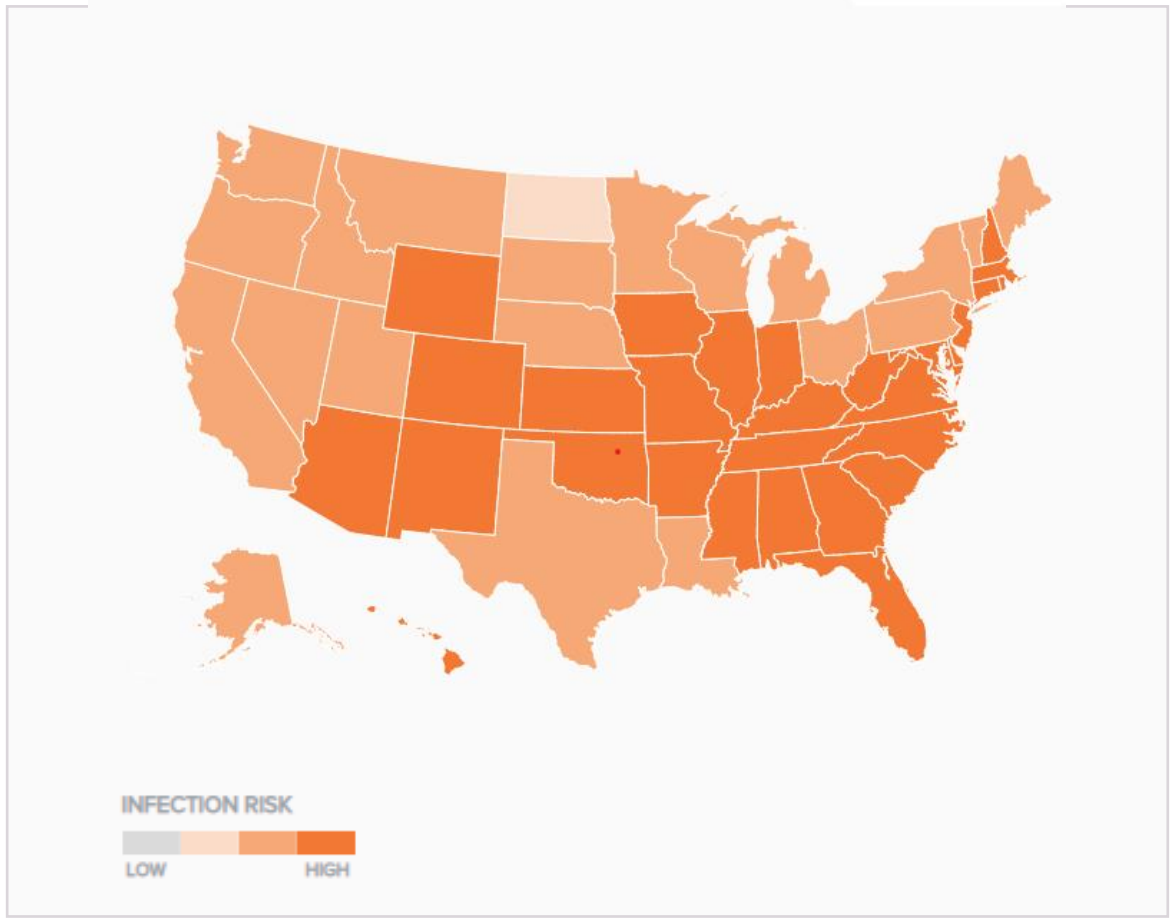
Ticks can transmit more than one pathogen

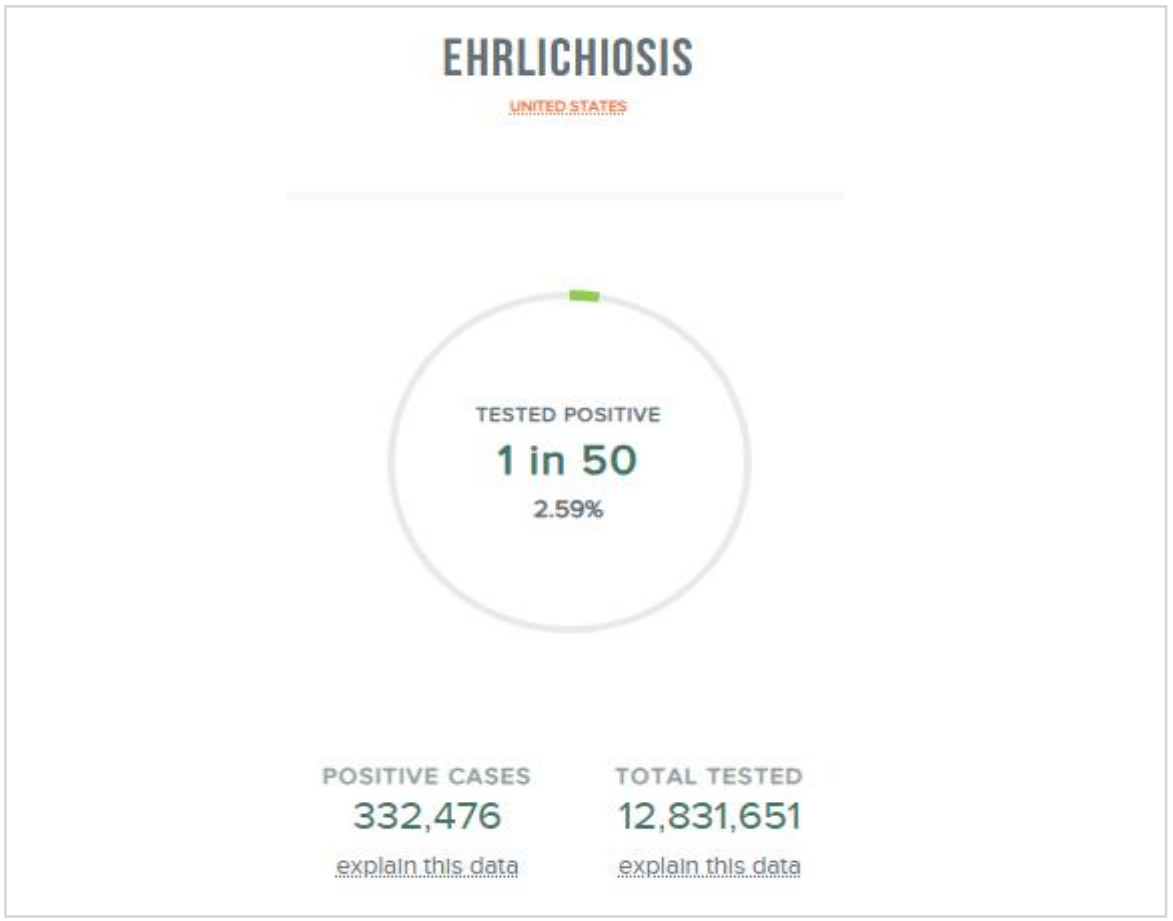
When you use a test as a screening tool, you may…

detect antibodies to these pathogens	carried by these ticks	that may also transmit other infections to dogs and people
Ehrlichia ewingii	Lone star tick *Amblyomma americanum*	*Ehrlichia chaffeensis* Tularemia Rocky Mountain spotted fever STARI
Anaplasma phagocytophilum *Borrelia burgdoferi* (*Lyme* disease)	Black-legged tick *Ixodes scapularis* *Ixodes pacificus*	*Bartonella* spp. *Babesia* spp.
Ehrlichia canis *Anaplasma platys*	Brown dog tick *Rhipicephalus sanguineus*	*Babesia* spp. Rocky Mountain spotted fever
Ehrlichia canis	American dog tick *Dermacentor variabilis*	Rocky Mountain spotted fever Tularemia

Source: Beall MJ, Chandrashekar R, Eberts MD, et al. Serological and molecular prevalence of Borrelia burgdorferi, Anaplasma phagocytophilum, and Ehrlichia species in dogs from Minnesota. Vector-Borne Zoonot. 2008;8(4):455–464.

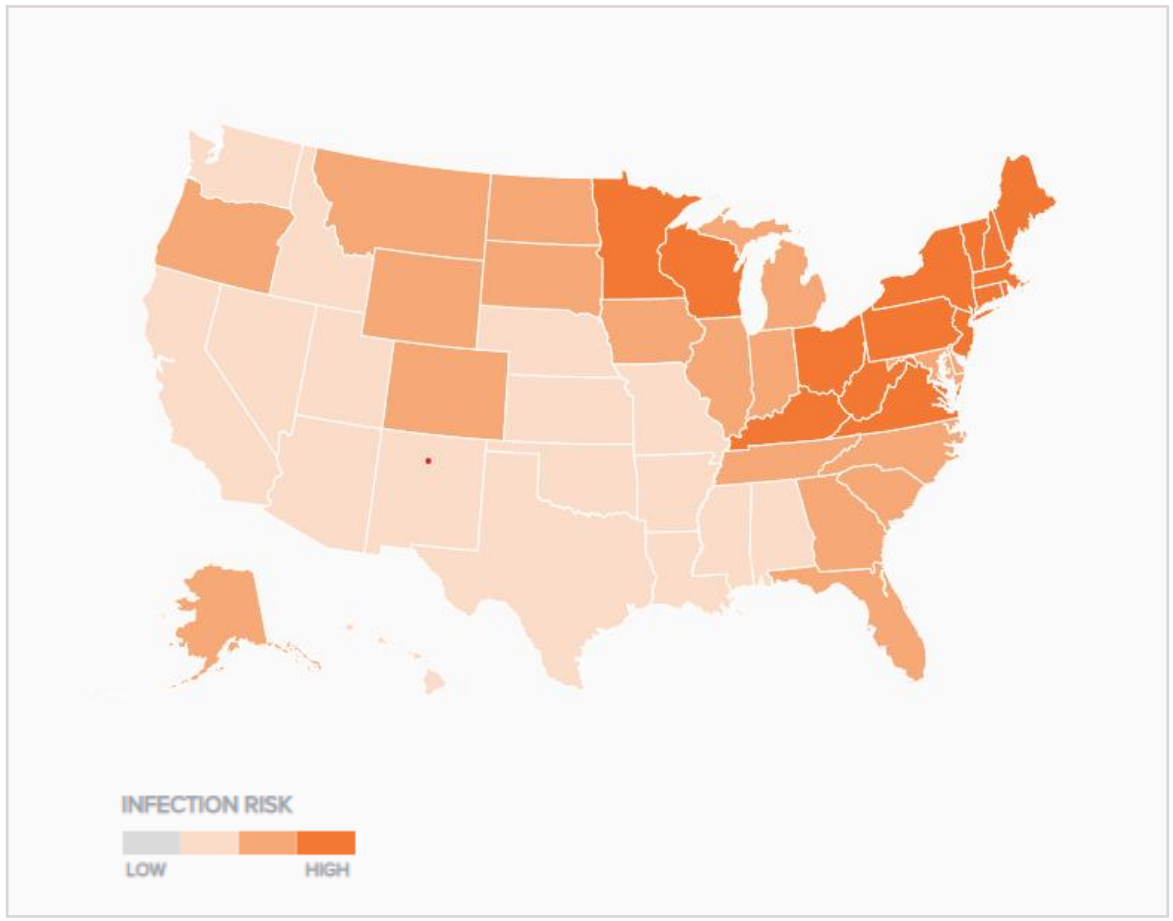
2025 CAPC *Ehrlichia* prevalence map: Dogs





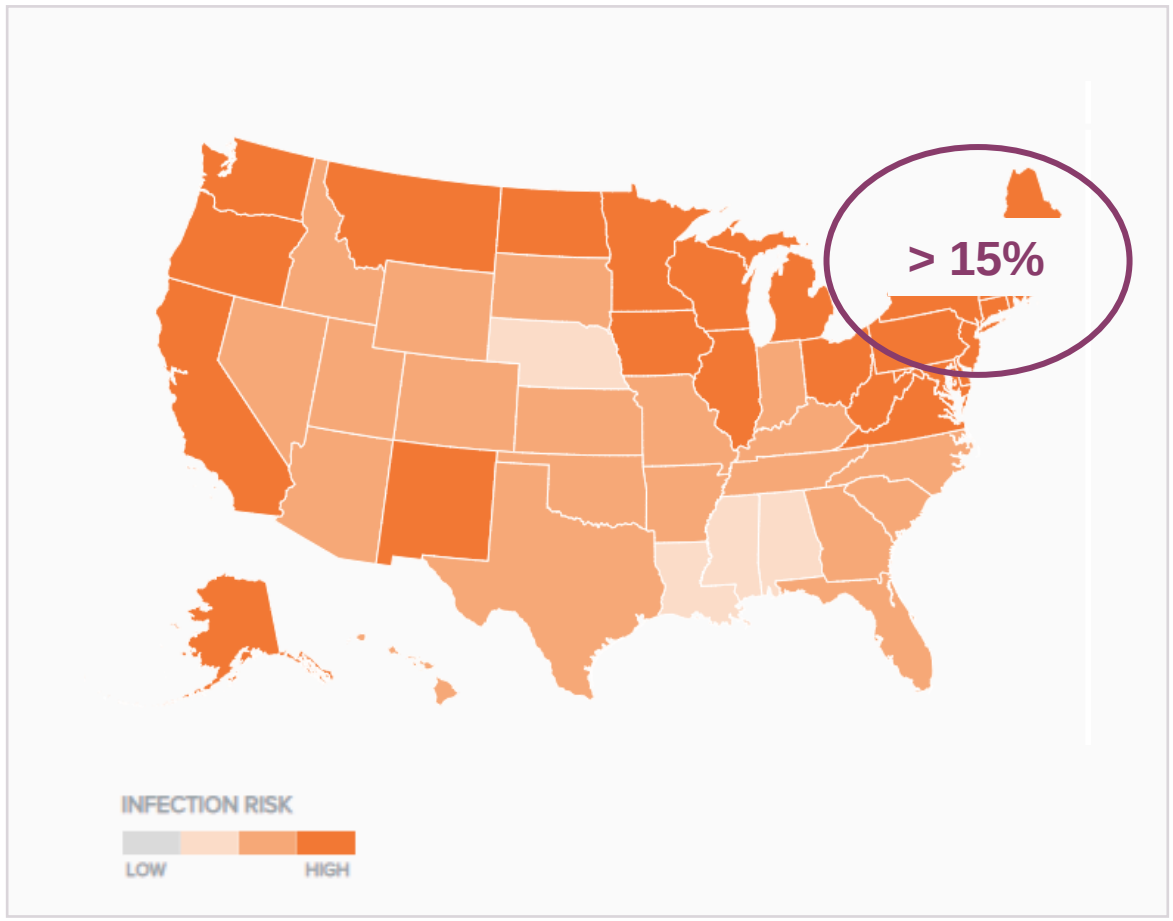
Source: Companion Animal Parasite Council. Tick borne disease agents: Ehrlichia—dog. CAPC website. https://capcvet.org/maps/#/2025/all-year/ehrlichiosis/dog/united-states . Accessed 1/09/2026

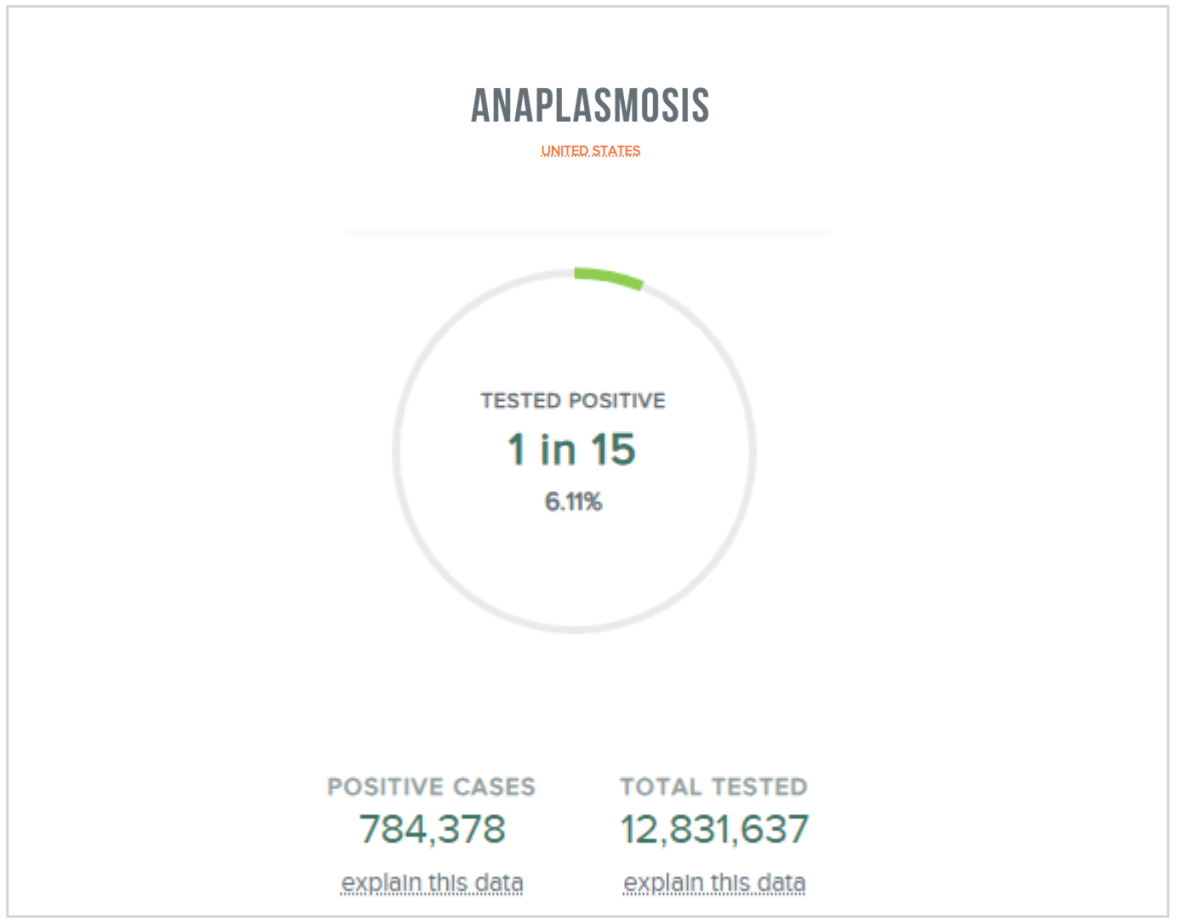
2025 CAPC Lyme prevalence map: Dogs



Source: Companion Animal Parasite Council. Lyme disease prevalence map—dogs. CAPC website. https://capcvet.org/maps/#/2025/all-year/lyme-disease/dog/united-states. Accessed 1/09/2026

2025 CAPC *Anaplasma* prevalence map: Dogs





Source: Companion Animal Parasite Council. Tick borne disease agents: anaplasmosis—dog. CAPC website. https://capcvet.org/maps/#/2025/all-year/anaplasmosis/dog/united-states Accessed 1/09/2026

Why test?

- Sentinel of infected ticks in your area
- Improve tick control
- Public health benefits
- Treatment
- Coinfections

Accuracy matters

- Consistent and accurate performance of point of care and other screening tests is important
- Results impact clinical decisions
- Accuracy in diagnosis is critical in providing the best care for patients, reliable results for pet owners, and peace of mind for veterinarians
- If you can’t trust the result, why run the test?

Screening dogs for tick-borne diseases is important

- Lyme disease, anaplasmosis, and canine granulocytic ehrlichiosis are caused by organisms that also infect people.
- Dogs are sentinels for the presence of tick-borne disease in a community.
- You want to know about what is happening in your community.

Research confirms the importance of comprehensive annual screening

A single tick can transmit multiple infectious agents that can cause serious illnesses.

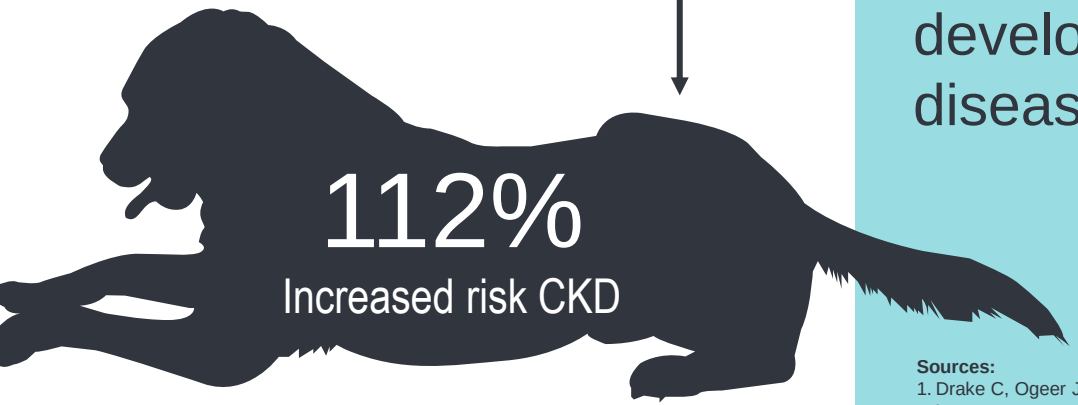
2 studies demonstrate exposure to diseases carried by ticks is associated with increased risk of kidney disease [1,2] .

1. Drake C, Ogeer JS, Beall MJ, et al. Investigation of the association between Lyme seroreactivity and chronic kidney disease in dogs [ACVIM Abstract ID08]. *J Vet Intern Med*. 2018;32(6):2264.
2. Burton W, Drake C, Ogeer J, et al. Association between exposure to *Ehrlichia* spp. and risk of developing chronic kidney disease in dogs. *J Am Anim Hosp Assoc*. 2020;56:159–164.

Studies link exposure to Lyme disease and *Ehrlichia* with increased risk of kidney disease

Exposure to *Ehrlichia*[2]

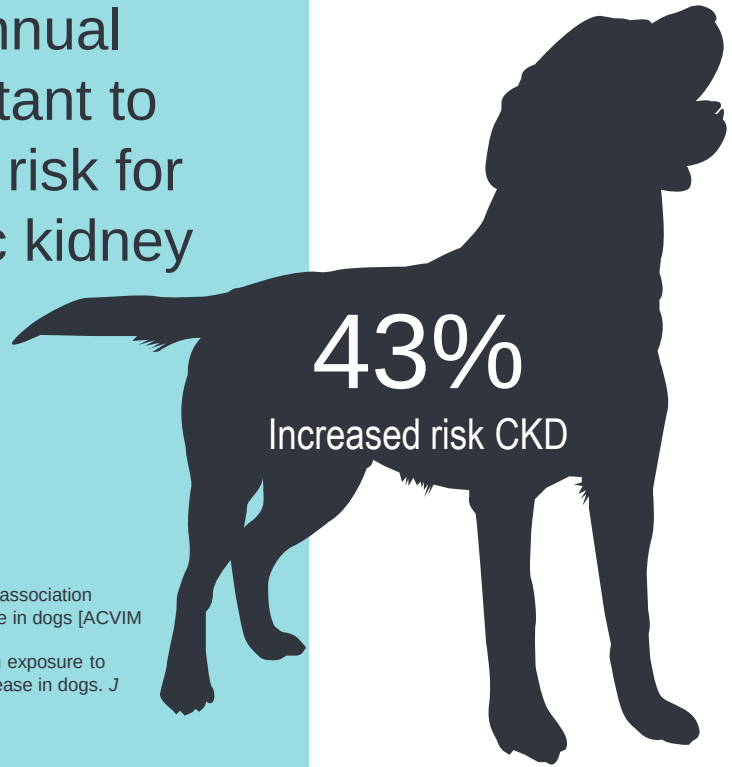
n = 22,440



Exposure to tick-borne diseases increases the risk of kidney disease. Comprehensive annual screening is important to identify patients at risk for developing chronic kidney disease.

Exposure to Lyme[1]

n = 322,145



Sources:

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IDEXX

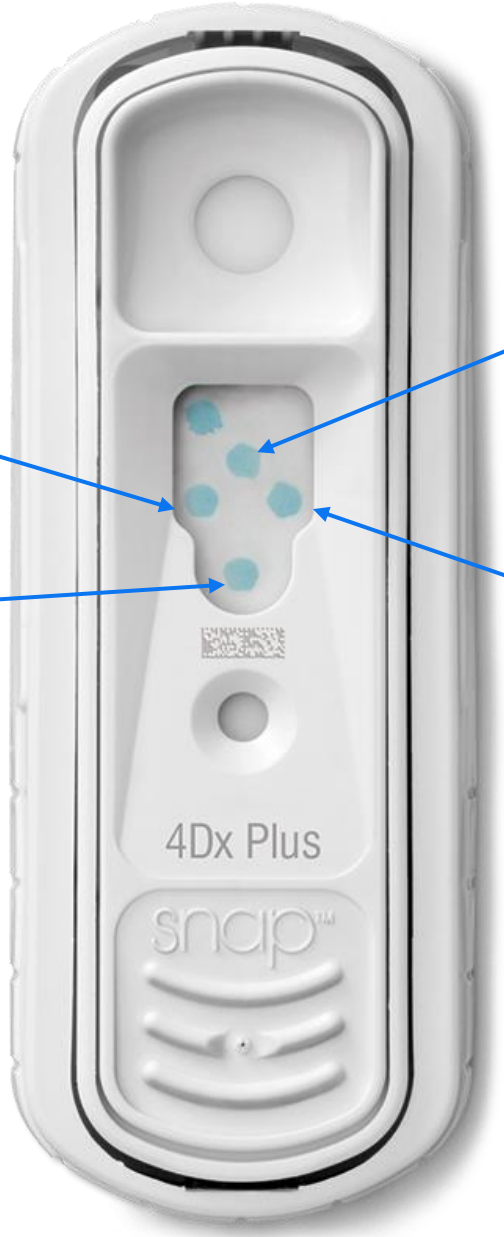
Diagnostic Options for Tick Borne Disease

How do we uncover clinical disease?

What does the blue dot mean?

E. canis/E. ewingii Antibody

B. burgdorferi C6 Antibody



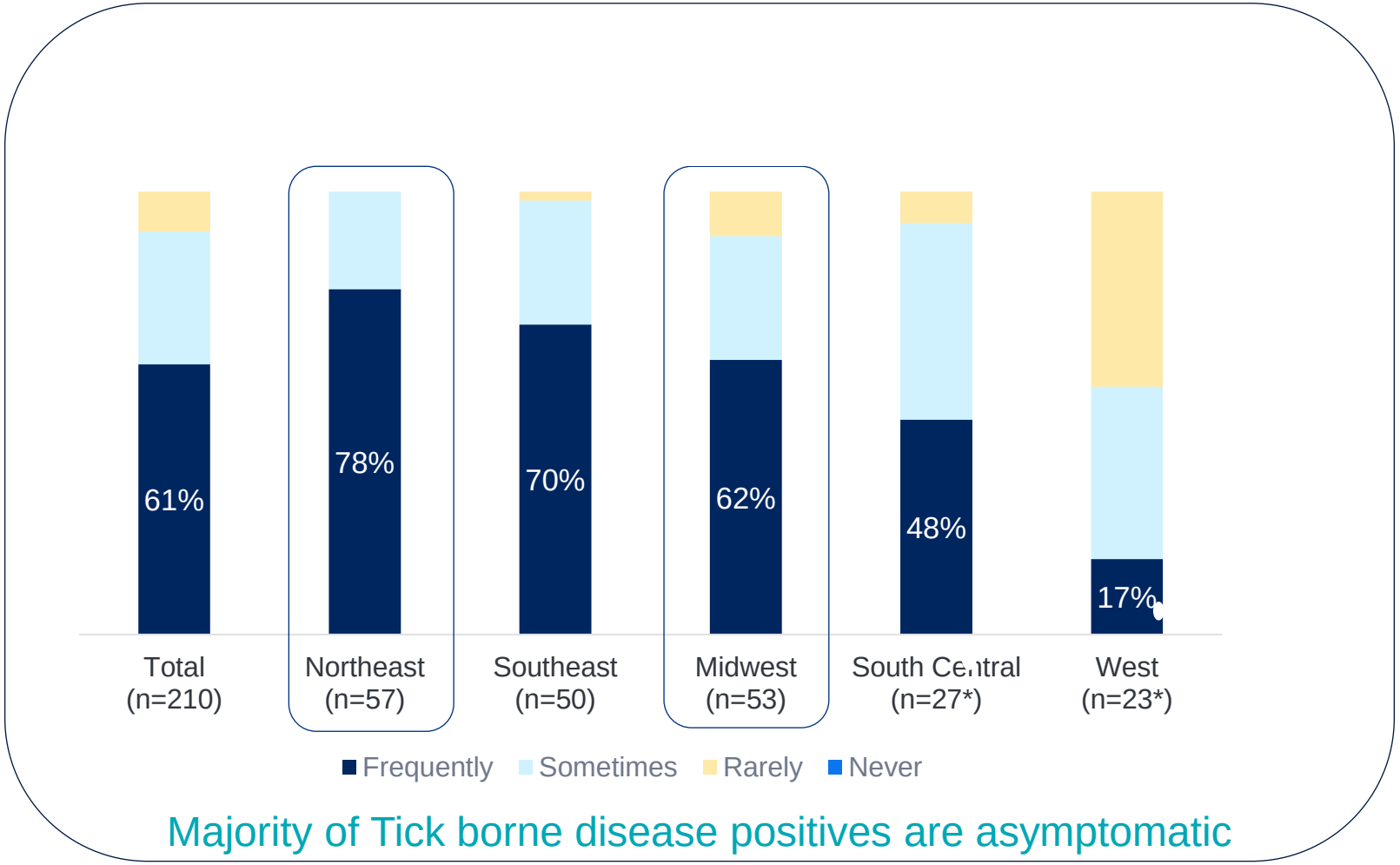
A. phagocytophilum/A. platys Antibody

D. Immitis Antigen

What does the blue dot mean?

- Lyme C_6 antibodies are specific to infection and are not a result of Lyme vaccination.
- Antibodies to *Anaplasma* and *Ehrlichia* indicate the dog was bitten by an infected tick.
- *D. immitis* antigen indicates the dog is infected with adult heartworms

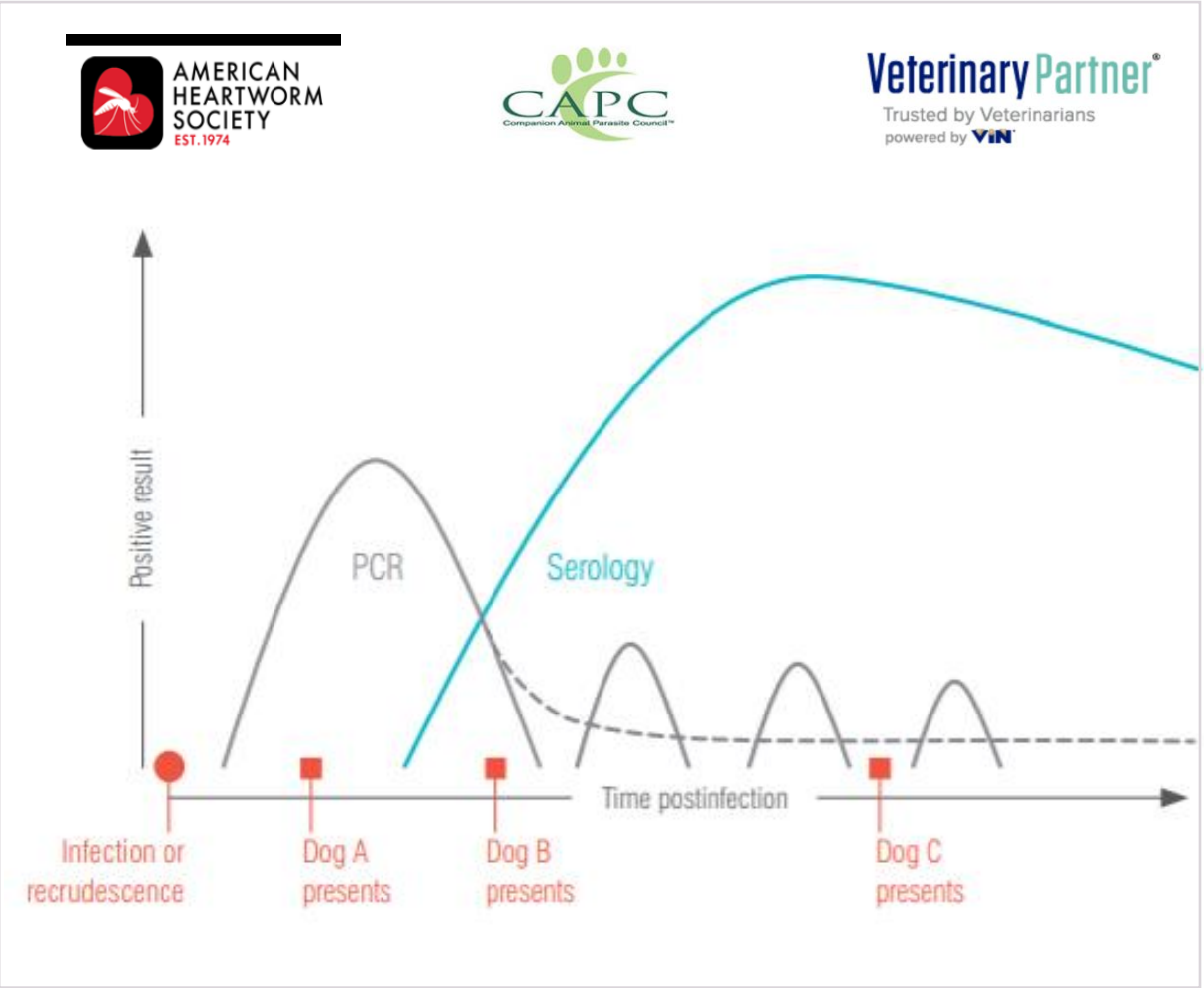
Positive asymptomatic patients can be frustrating



Majority of Tick borne disease positives are asymptomatic

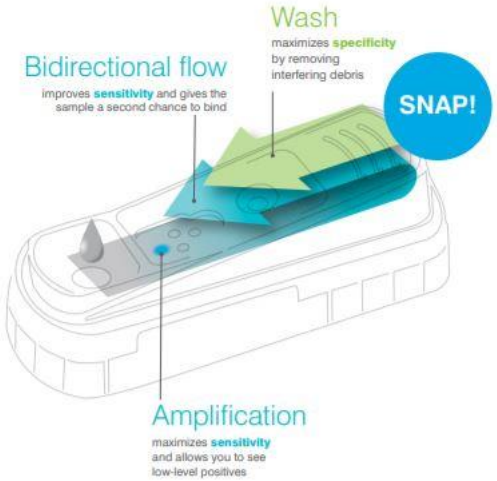
Source: IDEXX Insight Testing, August 2019, n = 210 veterinarians surveyed. Data on file at IDEXX Laboratories, Inc. Westbrook, Maine USA.

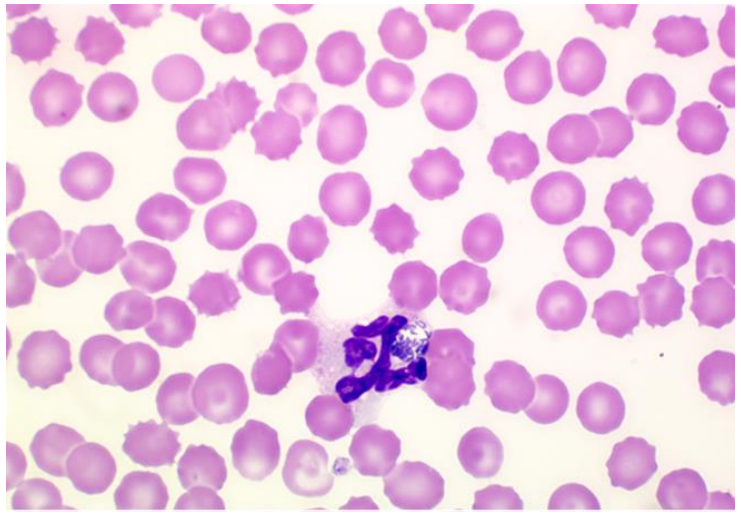
How do we uncover clinical disease?

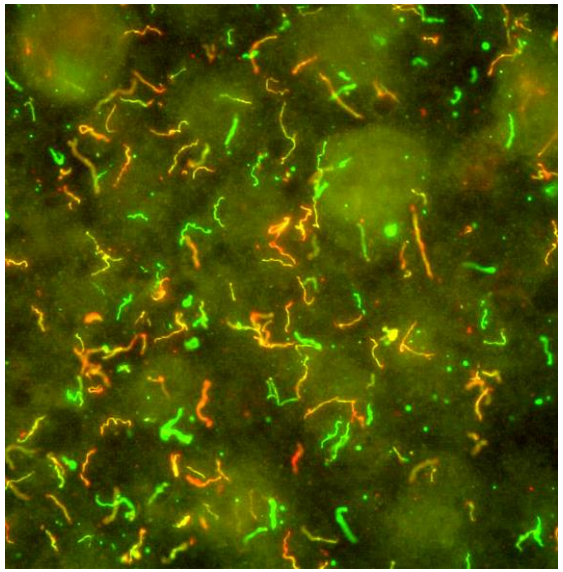


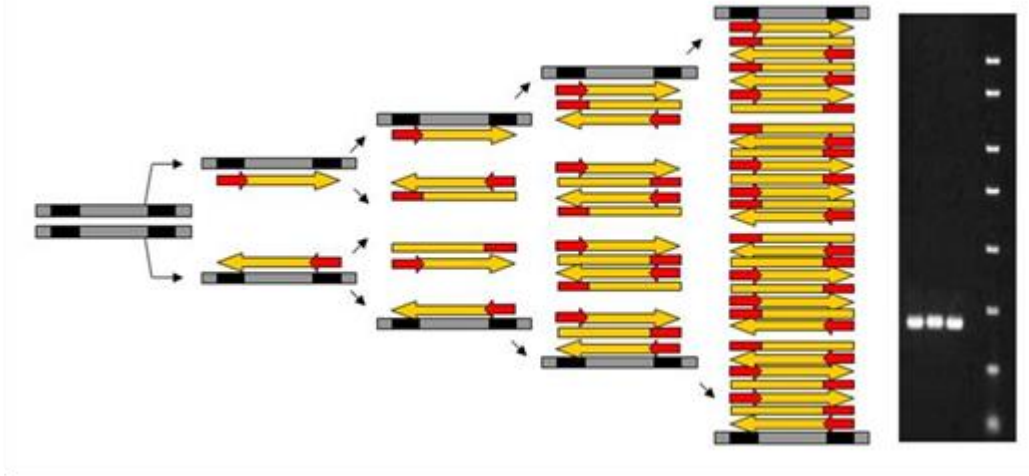
- What is my next step? (textbooks, VIN, colleagues, published journals)
- Do I recommend further testing?
- Which ones (CBC, PCR, UA/UPC, QC6)
- Do I treat all positives?
- Let pet owner decide to treat or test further?
- Antimicrobial resistance?
- Ignore it
  - probably “exposure”
  - Is it a “re-infection”?

Vector-borne disease testing methodology





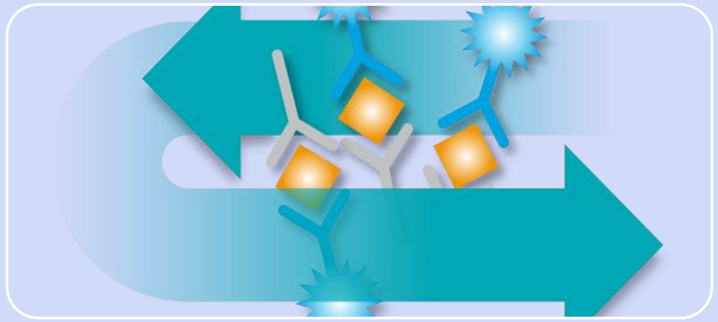




Serology and PCR

- In-clinic:
  - Point-of-care assays
    - SNAP® 4Dx® Plus Test
    - Lateral flow tests
  - Blood film
- Reference labs:
  - Lab 4Dx® Plus Test
  - AccuPlex®4
  - Immunofluorescence assay (IFA)
  - Polymerase chain reaction (PCR)
  - Blood film

What makes the SNAP® 4Dx® Plus Test an accurate screening tool?

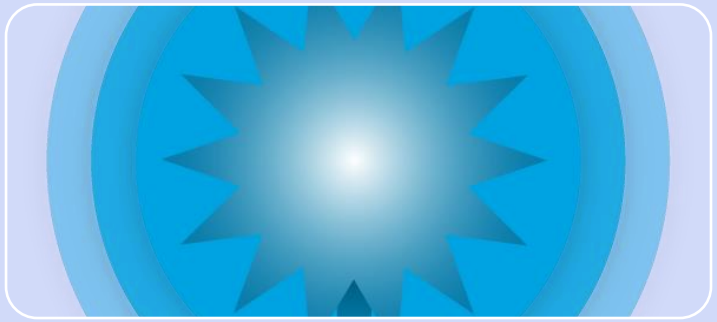


Bidirectional flow

- Sample-conjugate mixture passes capture reagents on the test spots.
- Activating device forces the sample mixture back across the capture reagents.
- Provides additional opportunity for binding.

Integrated wash

- Initiated by activating device.
- Wash buffer removes unbound sample and conjugate from surface.
- Produces clean, white background for easier results interpretation.



Amplification

- Upon binding, sample-conjugate mixture undergoes enzymatic reaction with the substrate to enhance the spot color.
- Helps maximize the signal from even low-level positive samples.

IDEXX

PCR—polymerase chain reaction

- PCR is useful for detection of infection prior to seroconversion, especially in clinically sick animals.
- PCR enables the production of unlimited copies of genetic material in the laboratory:
  - Copy and amplification of a single pathogen's DNA or RNA from a patient specimen
- Highly specific for the exact DNA or RNA marker:
  - Can be detected before antibody response
  - High sensitivity—negative result does not rule out the infection

What's a veterinarian to do for the seropositive "healthy" pet?

- Pursue further diagnostics
- Review parasite control measures
- Explore treatment options (dependent on the organism)
- Find out where the pet was exposed

Source: Birkenheuer A. The "blue dot dilemma" aka what do I do with positive SNAP tests (Proceedings). dvm360 website. http://veterinarycalendar.dvm360.com/blue-dot-dilemma-aka-what-do-i-do-with-positive-snap-tests-proceedings. Published August 1, 2011. Accessed July 18, 2019.

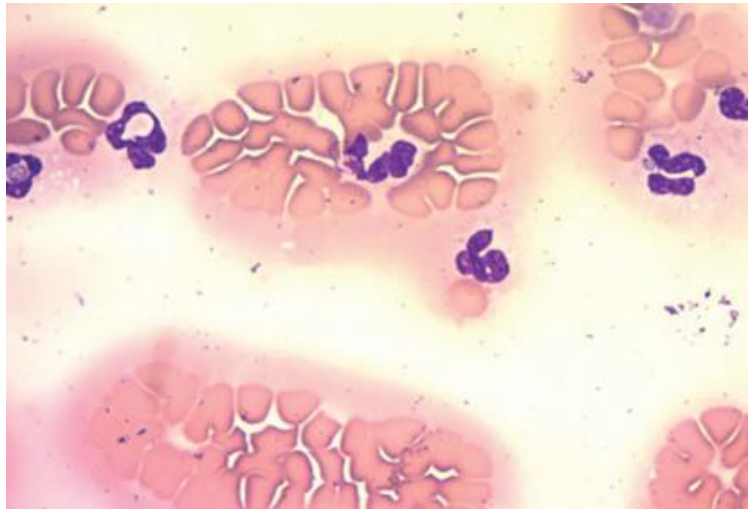
What are the Key Diagnostics?

Anaplasmosis

- CBC with blood film
  - Thrombocytopenia
  - Anemia
  - +/- Neutrophilia & Monocytosis

Lyme

- Urinalysis with UPC
  - Proteinuria stable or rapidly progressive
- Quant C6 Antibody
  - C6 antibody level elevated with active infection

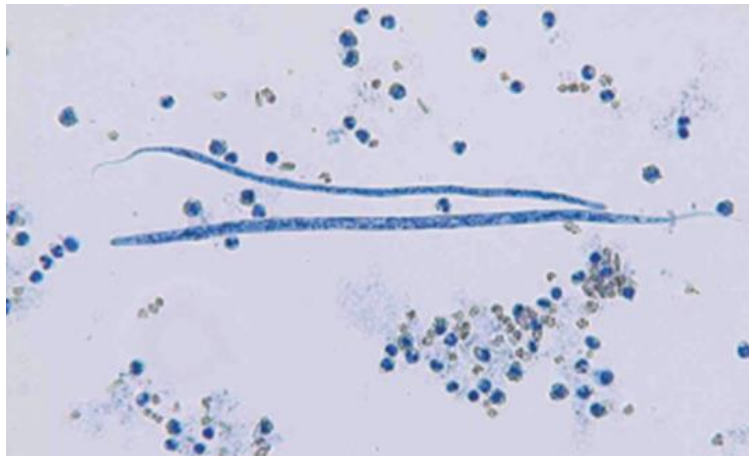


Ehrlichiosis

- CBC with blood film
  - Thrombocytopenia
  - Anemia
  - +/- Pancytopenia

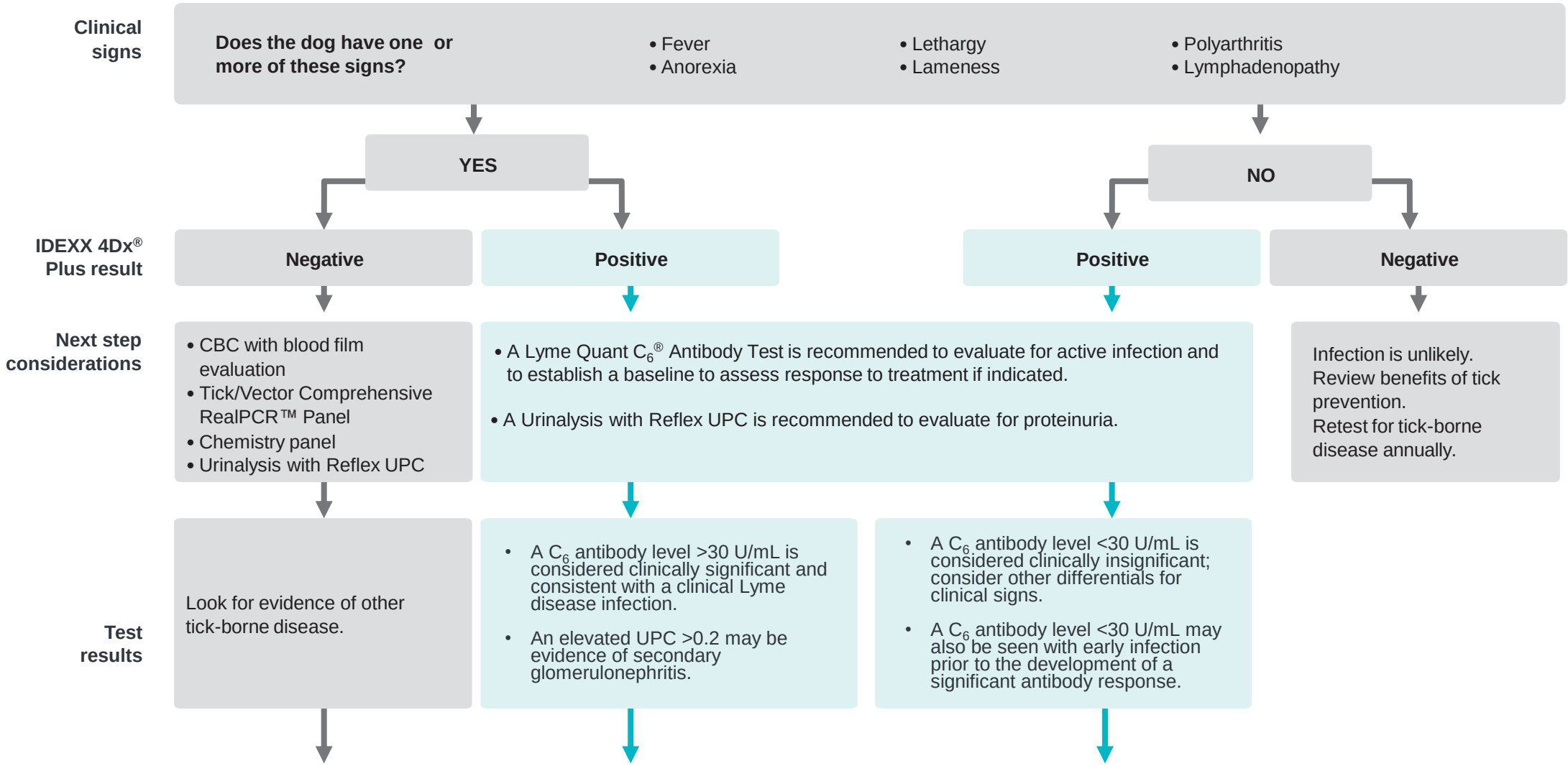
Heartworms

- Repeat HW Antigen
- Microfilaria
- Thoracic imaging

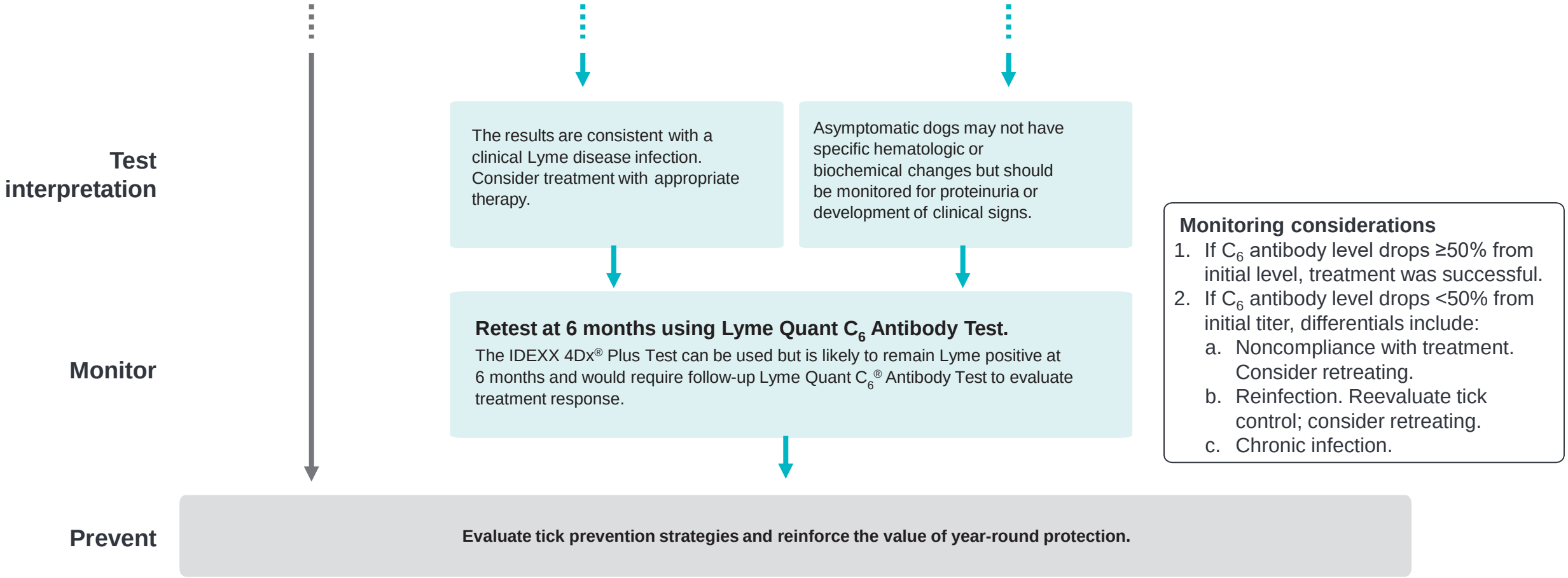


Interpreting Diagnostic Results

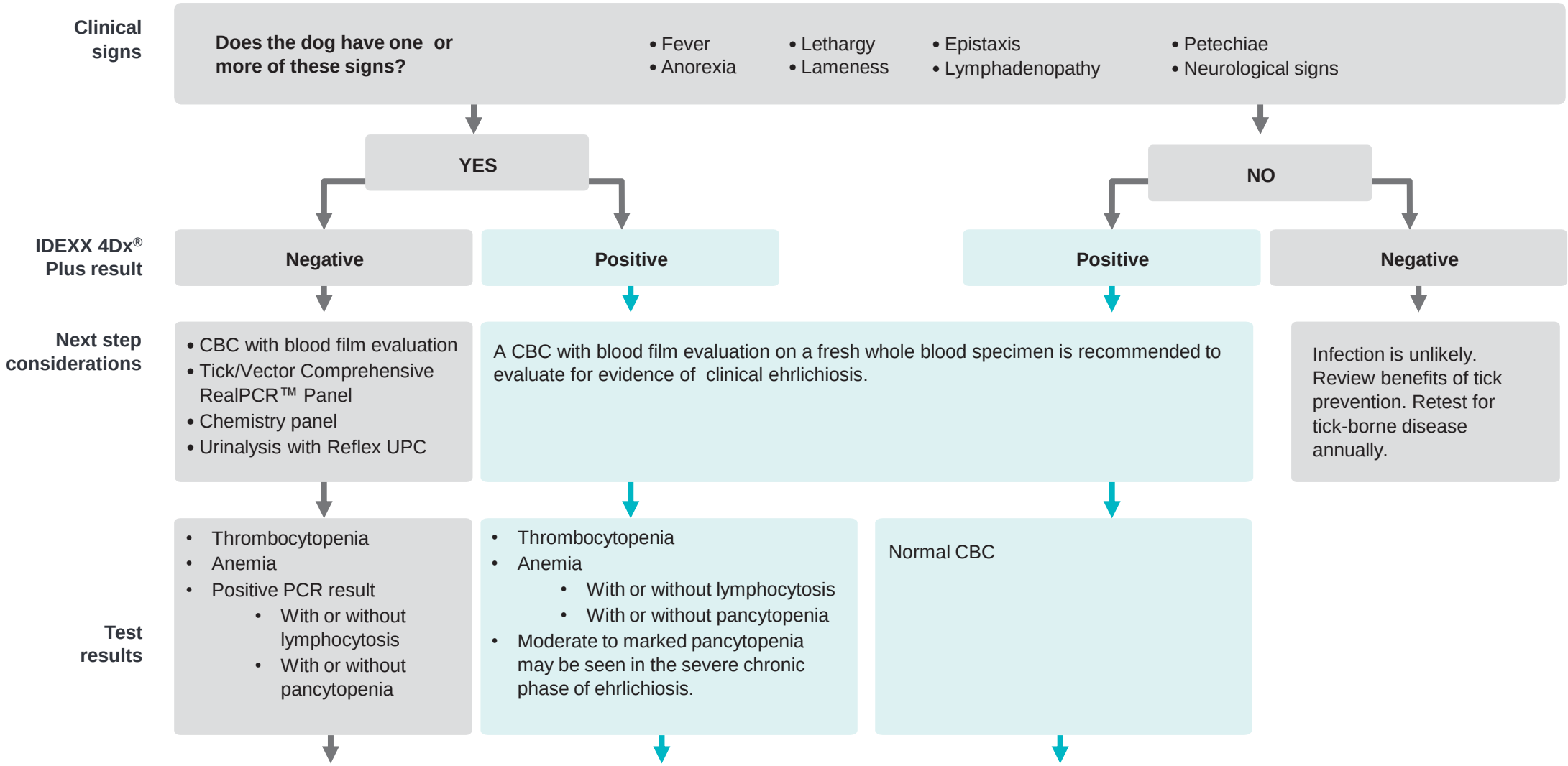
Lyme disease: Next steps to interpret results



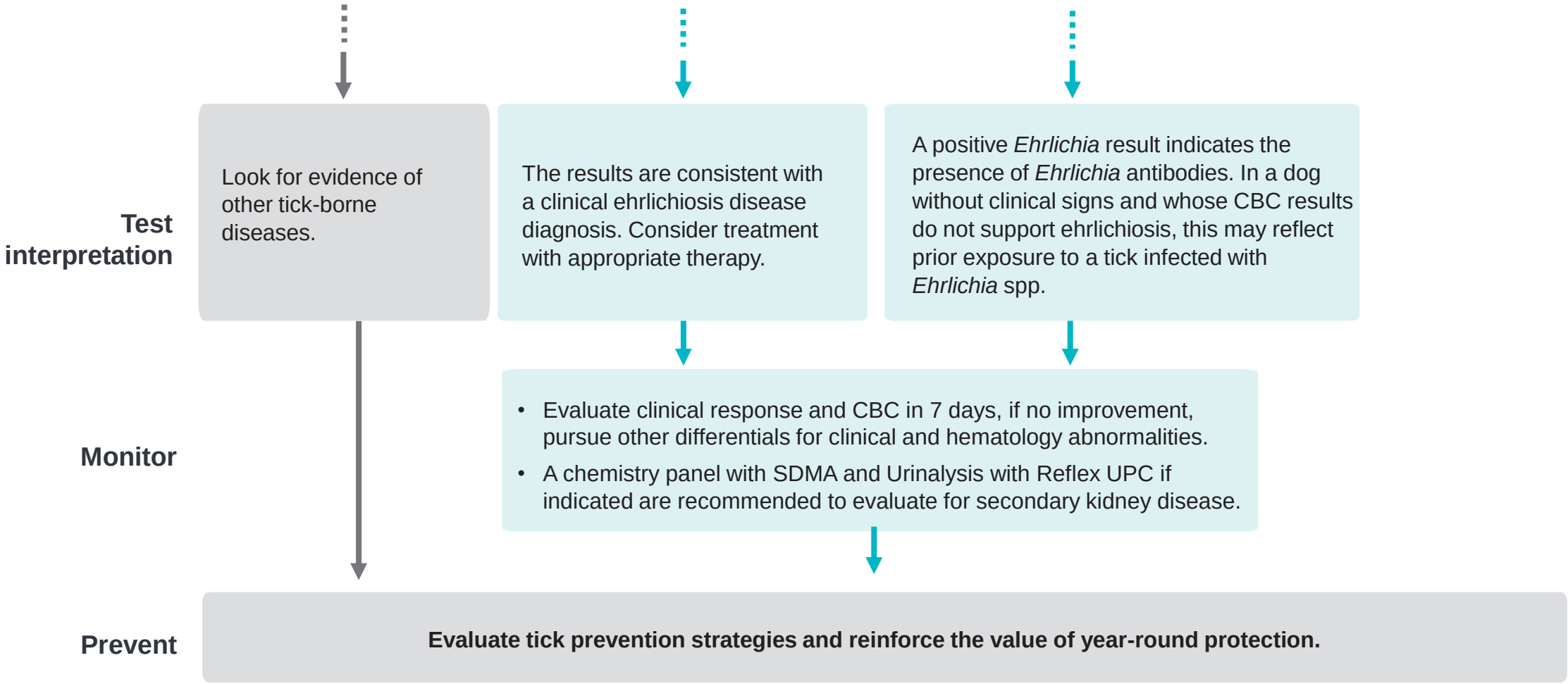
Lyme disease: Next steps to interpret results



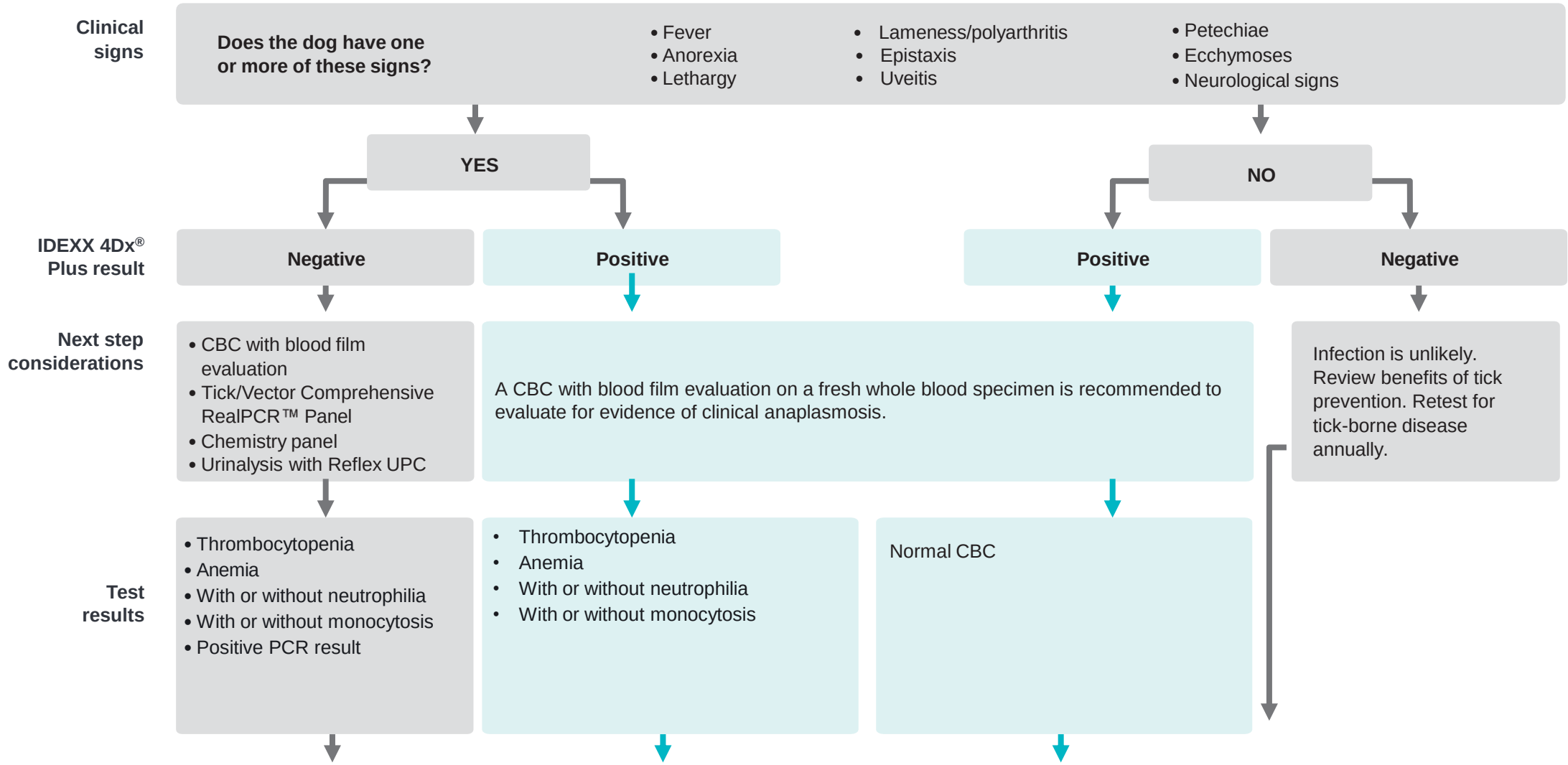
Canine ehrlichiosis: Next steps to interpret results



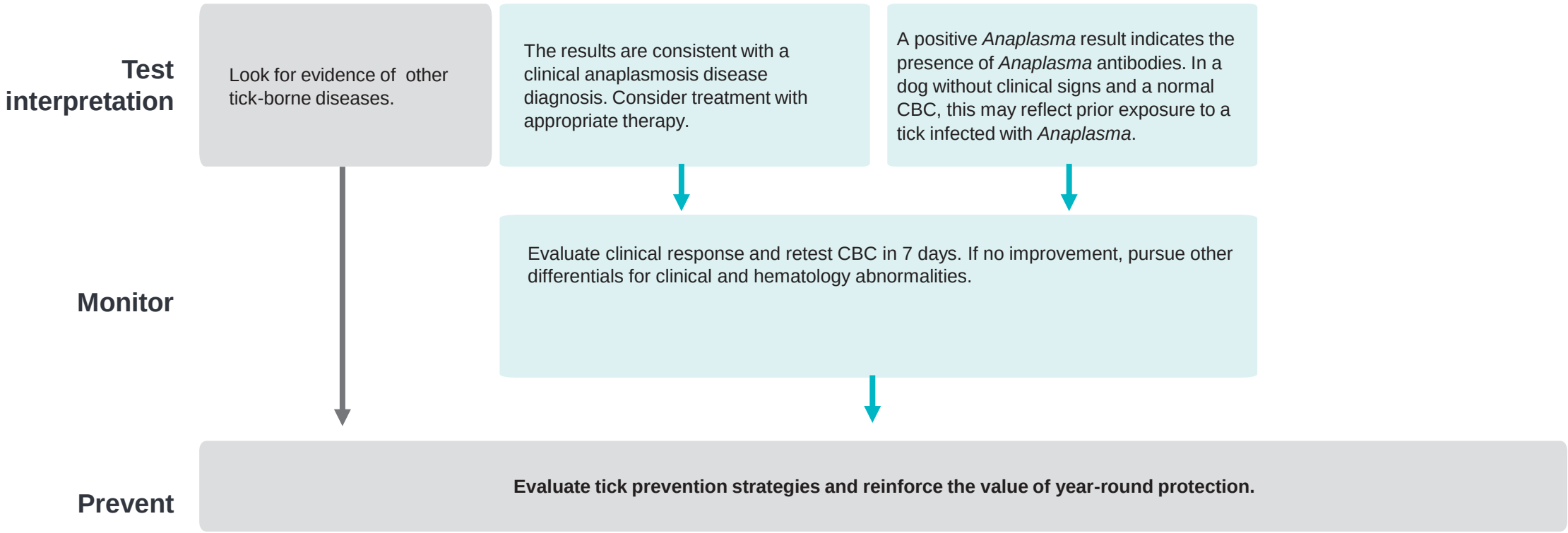
Canine ehrlichiosis: Next steps to interpret results



Canine Anaplasmosis: Next steps to interpret results



Canine Anaplasmosis: Next steps to interpret results



How does this work with clinical cases?

Anaplasmosis case study: Victor

5-year-old, neutered male Maltese

- Presenting Reason:
  - 2-3 days of Anorexia
  - Lethargic
  - Owner observed quivering/shaking
  - Owner had recently taken him hiking
  - Current on some vaccinations
  - One year overdue for Lyme Vaccine
- Physical Exam:
  - Lethargic
  - Notably warm to the touch
  - Temperature: 103.8F
  - Heartrate: 180bpm

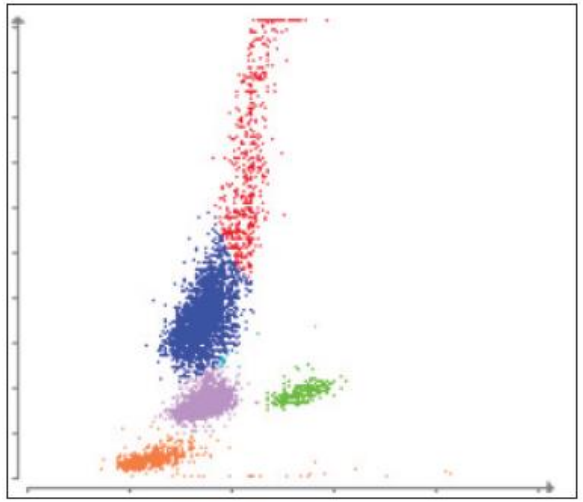
Anaplasmosis case study: Victor

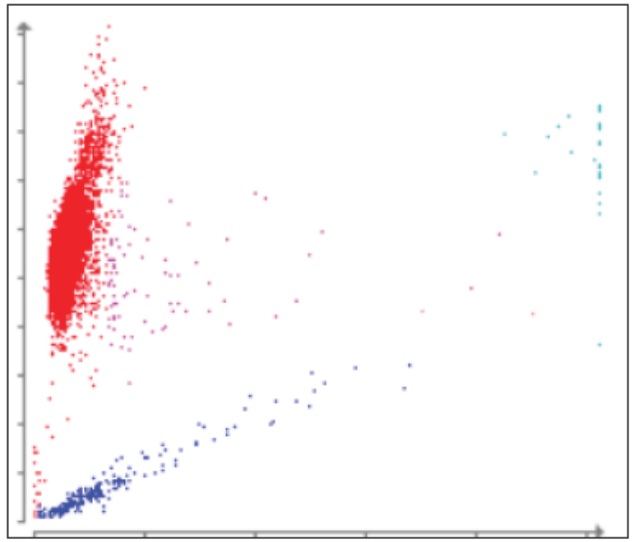
- Diagnostic Plan:
  - Complete blood count (CBC)
  - Chemistry 15 panel, including electrolytes
  - SNAP® 4Dx® Plus Test
  - SNAP ® cPL
  - Fecal Dx Profile with *Giardia*
  - Abdominal Radiographs

Anaplasmosis case study: Victor

+ CBC showed a leukopenia with lymphopenia, thrombocytopenia, and decreased retic hemoglobin and plateletcrit.
+ Chem 15 and electrolytes were all within normal limits.
+ The SNAP 4Dx Plus Test results were negative.
+ SNAP cPL Test was normal.
+ Fecal Dx® Profile with *Giardia* results were all negative.

After the negative results on the SNAP® 4Dx® Plus Test, the veterinarian sent a blood film to IDEXX Reference Laboratories for pathologist review.

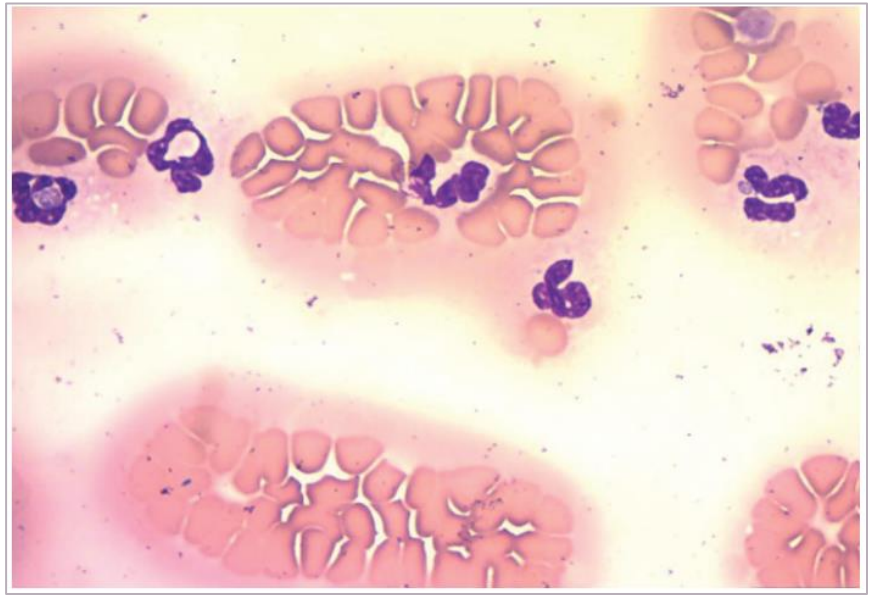




Anaplasmosis case study: Victor

Pathologist Review:

- Low numbers of neutrophils contain a morula of coccoid bacteria that resemble *Anaplasma phagocytophilum* or *Ehrlichia ewingii*, both of which infect granulocytes. Infection with A. phagocytophilum can result in neutropenia, thrombocytopenia, lymphopenia, and a mild anemia.
- Approximately 3 platelets are found per high-power field in the monolayer of the blood film, consistent with a platelet estimate of 45,000/µL. The thrombocytopenia is suspected to be due to tick-borne infection.



Anaplasmosis case study: Victor

- Diagnosis & Treatment
  - Initial Treatment started while waiting on blood film results:
    - Hospitalized and started on IV antibiotics, prednisone and doxycycline orally
  - The veterinarian made a presumptive diagnosis of anaplasmosis based on clinical signs and morulae since they live in an area endemic for *A. phagocytophilum*
- Additional Testing:
  - Tick/Vector Comprehensive RealPCR™ Panel was positive for *Anaplasma* spp.
  - Further testing using the **improved SNAP® 4Dx® Plus Test** launched in 2022 was performed on the sample collected on Victor's initial presentation. The SNAP 4Dx Plus Test now has additional markers that increase the sensitivity for the detection of *Anaplasma*, and this test's results was **positive for *Anaplasma* spp.**

Meet Hadley

3-year-old, female spayed Akita mix

Presenting complaint and history

+ Annual wellness examination and vaccinations.
+ The client had no concerns about Hadley and believed she was in good health.
+ There was no history of illness.
+ Vaccines had been administered previously at appropriate intervals and vector-borne disease tests had been consistently negative.

Hadley

Diagnostic plan

+ Wellness profile sent to IDEXX Reference Laboratories
  + CBC
  + Chemistry profile
  + Complete urinalysis
  + Fecal Dx® Profile
+ A SNAP® 4Dx® Plus Test was performed on the SNAP Pro Analyzer in-house

Diagnostic results

✓ Hematology, chemistry, and urinalysis results were unremarkable and within the reference ranges

✓ The Fecal Dx Profile did not detect the presence of any intestinal parasites

✓ The SNAP 4Dx Plus Test was positive for both *Anaplasma* and Lyme

Serology 12/12/21 12:49 PM

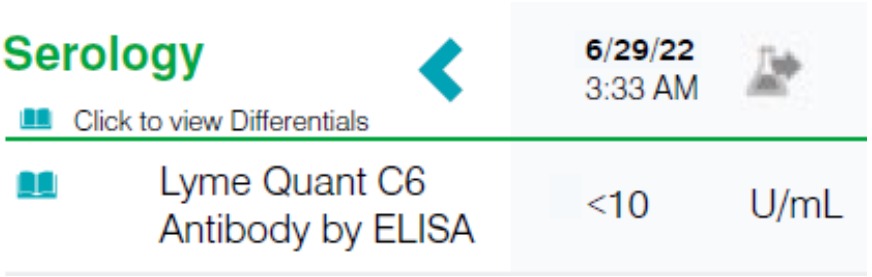
Click to view Differentials

Heartworm Antigen	Negative
Ehrlichia canis / ewingii	Negative
Lyme (Borrelia burgdorferi)	Positive
Anaplasma phagocytophilum / platys	Positive

Hadley

Patient outcome

- No reported clinical signs of anaplasmosis or Lyme disease.
- Because the Lyme Quant C_6 Antibody Test was ≥30, doxycycline was prescribed 10 mg/kg to be administered twice daily for 30 days.
- She was scheduled to be retested in 6 months:



- Because this value is less than 50% of the value at the time of diagnosis, treatment was considered successful.

Conclusion

More than *Lyme* disease should be a concern….*Anaplasma* and *Ehrlichia* are important zoonotic tick-borne diseases with One Health implications too.

Dogs are sentinels for the presence of tick-borne disease in a community.

Consistent and accurate performance of point of care and other diagnostic tests is important because results impact clinical decisions