Potential risks for zoonotic disease

Pets have become intimate partners in the lives of families. As this bond has strengthened, so has the potential for exposure to vectors of disease and sharing pathogens and parasites. Because of the proximity of Pets and owners in the household, potential risk for zoonotic disease has increased as well as the potential for exposure to shared vectors for disease. In this article, DataSavant examines the prevalence, geography and monthly distribution of selected canine and feline parasite infections, as well as vector-borne disease. With this information, veterinarians can help clients understand how Pets serve as a sentinel for vector-borne diseases and the importance of good wellness care and preventive practices, like deworming and vaccination, as well as the consistent use of approved products for flea and tick control (see *Identifying tick-borne diseases*, page 24).

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Methods of analysis

For our study population, we selected two case series (feline and canine) of in-patients in 2006 that had a positive laboratory diagnosis (fecal flotation, ELISA, SNAP, PCR) for the following parasites or disease organisms:

- Coccidia
- Heartworms

Evidence-Based Medicine Toolkit

Zoonoses: The World Health Organization defines zoonoses as "those diseases and infections which are naturally transmitted between vertebrate animals and man."

CDC website:
http://www.cdc.gov/ncidod/dpd/animals.htm

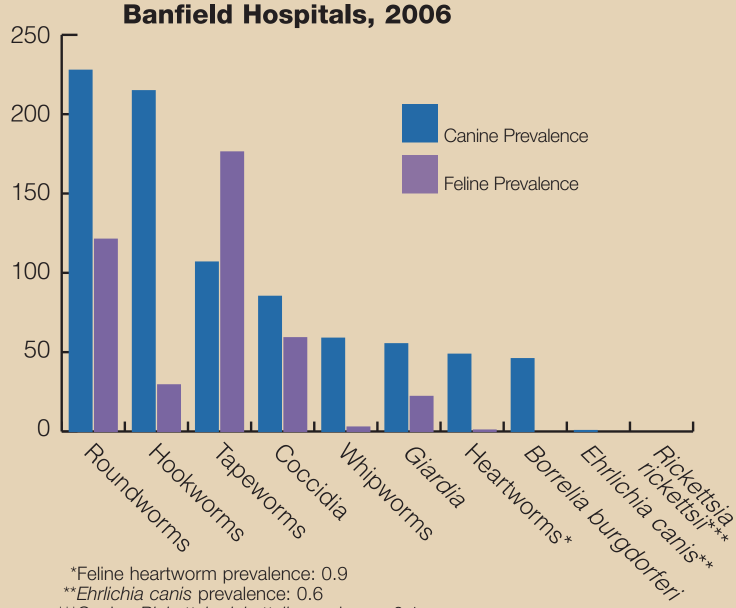
Odds ratio: A measure of the degree of association (also known as a cross-product ratio or relative odds); for example, the odds of exposure among the cases compared with the odds of exposure among the controls.

Confounding: Confounding occurs when one risk factor for a disease is also associated with the risk factor being studied. Age, breed, gender are often confounding risk factors, *e.g.*, age is related to both neuter status and to risk for disease.

Pretest probability: Pretest probability is defined as the probability of the disease diagnosis before the diagnostic test result is known.

DataSavant's mission is to:
- Explore the health and well-being of Pet populations
- Evaluate new clinical treatments
- Monitor Pets as sentinels of zoonotic disease in family environments
- Transform Pet medical data into knowledge, *i.e.*, open new windows into Pet health care using the Banfield medical caseload and database.

Table 1: Prevalence per 10,000 Pets: Banfield Hospitals, 2006



*Feline heartworm prevalence: 0.9
***Ehrlichia canis* prevalence: 0.6
***Canine *Rickettsia rickettsii* prevalence: 0.1

- *Giardia*
- Hookworms
- Roundworms
- Tapeworms
- Whipworms
- *Ehrlichia canis*
- *Borrelia burgdorferi*
- *Rickettsia rickettsii*

Overall prevalence for these diseases was generated from the Banfield in-patient population seen in 2006. Additionally, for canine Lyme disease and feline roundworm infestation, we compared an affected (case) and unaffected (control) population to determine whether age, gender and breed were risk factors for disease. Our control or reference populations were selected randomly from the 2006 canine and feline in-patients that did *not* have a positive laboratory test for any of the above parasites or organisms.

Prevalence is simply the proportion of Pets affected by a disease (newly diagnosed or existing) in a population. Prevalence is also referred to as the pretest probability, the likelihood of disease in a population before the results of any diagnostic tests are known. Pretest probability can also be used to quantify the likelihood of disease in a group of Pets with specific clinical signs, for example, the prevalence of renal disease in a population of cats older than 10 years old that present with anorexia. For Lyme disease, we generated three different prevalence estimates to demonstrate the differences between the population results.

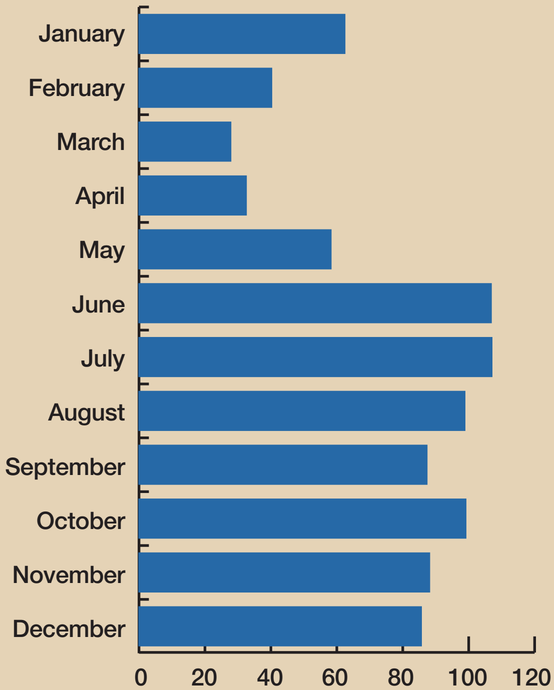
To quantitate risk, we estimated the relative risk (RR) using the odds ratio (OR) for the association between age, breed, gender and the disease of interest. A relative risk greater than one suggests a positive association between an outcome and a factor, whereas a relative risk equal to one reflects no association. A relative risk less than one suggests an inverse relationship between a factor under study and a disease outcome.

Results

There were 292,593 in-patient cats and 1,189,862 in-patient dogs identified from the encounters in U.S. Banfield hospitals during 2006. The overall prevalence for the diseases of interest are listed in *Table 1*. Roundworms (ascarids) were the most common canine parasite in the Banfield population with a prevalence of 2.3 percent (227 per 10,000); Lyme disease was the most common canine tick-borne disease with a prevalence of 0.5 percent (45 per 10,000). The most common parasite affecting cats was tapeworms with a prevalence of 1.8 percent (176 per 10,000).

In the analysis of feline roundworm infection, overall U.S. prevalence was 1.2 percent (122 per 10,000) of in-patient cats, and the prevalence was greatest in June, July and August (*Table 2*, page 20). States with the highest rates (two to three times average) of feline roundworm infection, in decreasing order of prevalence, are: Delaware, Alabama, Rhode Island, Tennessee, Iowa, Ohio, North Carolina, DataSavant

Table 2: Prevalence of Roundworms in Cats by Month for 2006*

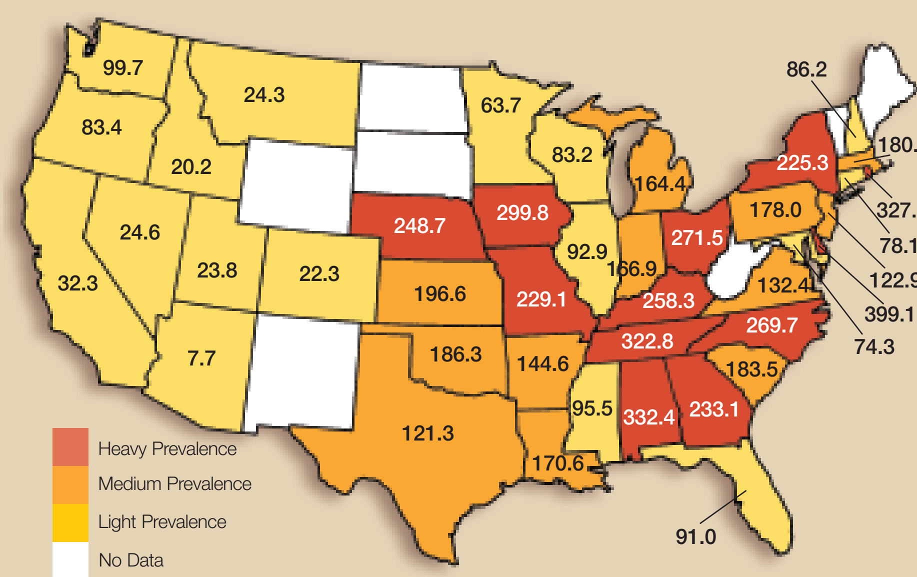


*Rate per 10,000 cats

Kentucky, Nebraska, Georgia, Missouri and New York (*Figure 1*). Younger cats and kittens were most likely to be affected; the mean age was 9 months (versus 4.4 years for the control population). At increased risk for roundworms was the Domestic Shorthair (OR=1.5). Domestic Longhair, Domestic Mediumhair, Siamese, Russian Blue, Manx, Maine Coon, Himalayan and Persian were all less likely to have roundworms compared with the control population. Intact males (RR=4.8) and females (RR=4.3) were at increased risk for roundworms as well. Roundworm positive cats were also positive for other parasites, including tapeworms (13.1 percent), Coccidia (12.9 percent), hookworms (9.6 percent), *Giardia* (2.3 percent) and whipworms (1.2 percent). Other concurrent diagnoses of roundworm cases included colitis (1.0 percent), enteritis (0.7 percent) and gastroenteritis (0.8 percent). Concurrent physical examination findings and clinical signs for cats with roundworms included diarrhea, vomiting or excess gas (14.5 percent); diarrhea alone (12.6 percent); distended abdomen (6.5 percent); vomiting (3.7 percent) and blood in diarrhea (2.2 percent).

Lyme disease prevalence in the total canine population was 0.5 percent, or one out of every 200 canine in-patients

Figure 1: Prevalence of Roundworms in Cats by State for 2006



of any age seen at a Banfield hospital was positive for the disease. The prevalence for canine adults (n=865,168) was slightly higher, 0.6 percent, or one out of every 170 canine in-patients that were one year of age or older was positive for the disease. Testing prevalence (*i.e.*, the proportion of dogs that were positive out of the total population of dogs that were tested) was 1.1 percent, or one out of every 90 canine in-patients tested was positive for Lyme disease.

The analysis of Lyme disease by month revealed June as having the highest positivity rate (*Table 3*). The states with the highest infection rates (two to 12 times the average) in decreasing order of prevalence are: Massachusetts, New York, New Hampshire, Delaware, Connecticut, Rhode Island, Pennsylvania, Maryland, Minnesota, Wisconsin, New Jersey and Virginia (*Figure 2*). Dogs testing positive for Lyme disease were, on average, older than dogs in the general, unaffected population: 5.9 vs. 3.6 years. Spayed females (RR=1.4) and neutered males (RR=1.8) were at risk compared with intact Pets. Among the most popular breeds, the following breeds (RR) were at greatest risk: Golden Retriever (2.1), German Shepherd Dog (1.9), Chow Chow (1.7), Labrador Retriever (1.7), Beagle (1.5) and Mixed Breed (1.2). Ticks were diagnosed concurrently

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Table 3: Prevalence of Canine Lyme Disease by Month for 2006*

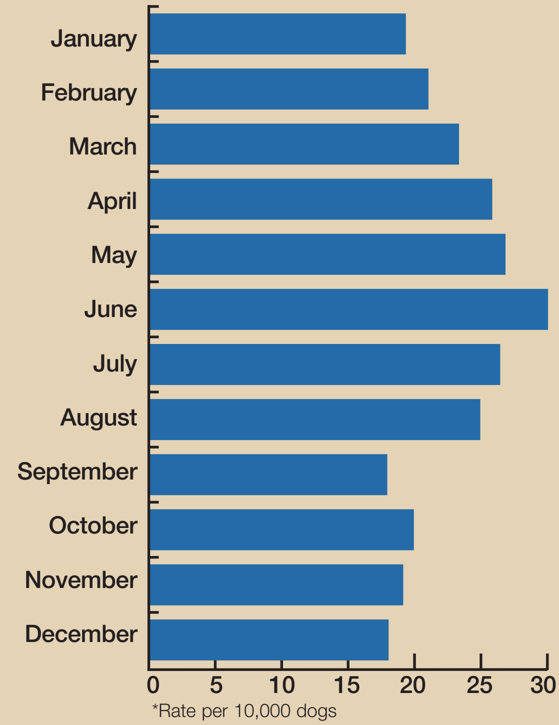
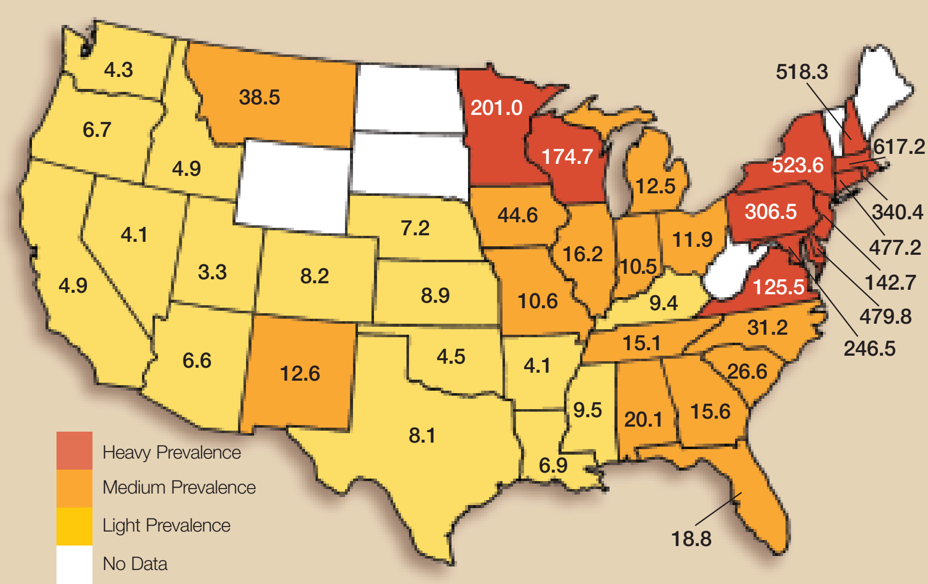


Figure 2: Canine Lyme Disease Prevalence by State for 2006



in 1.1 percent of the cases. Concurrent physical examination findings and clinical signs in dogs testing positive for exposure to Lyme disease included lameness (10.1 percent); musculoskeletal lumps or pain (4.5 percent); decreased appetite (1.6 percent); neurologic signs–fits, seizures, head tilt–or problems walking (1.6 percent) and fever (0.8 percent).

Discussion

Roundworms were the most common canine parasite and tapeworms the most common feline parasite detected in the 2006 Banfield population. Lyme disease was the most common canine tick-borne disease. The rates of selected parasitic and vector-borne diseases varied by time of the year and state. In the analysis of canine Lyme disease and roundworm infection in cats, significant associations were found between intact gender status and roundworm infection in cats and spayed or neutered status and canine Lyme disease. These associations are consistent with confounding between age and the outcome (*e.g.*, young cats with roundworms are more likely to be intact at the time they are diagnosed).

Different estimates of prevalence for Lyme disease were reported from this analysis to provide an example of how prevalence as a probability can help a veterinarian communicate with clients, make a decision about further diagnostic testing or develop a plan to initiate therapy. Although a small percentage of cats and kittens were symptomatic for gastrointestinal disease, the majority were not symptomatic based on our analysis. Roundworms (*Toxocara* spp.) that infect cats and dogs can potentially infect people, causing visceral larval migration through accidental ingestion of infective eggs in the environment. The dog ascarid, *T. canis*, has been a more likely source of migrans syndromes in children; however, the cat ascarid, *T. cati*, can also cause disease in people. Because of this zoonotic potential, the dialogue with clients about the importance of routine fecal examinations and deworming, especially for young Pets, as part of an annual wellness visit is critical. The risk potential is high, while the preventive intervention is simple and straightforward.

In the analysis of U.S. Banfield hospitals, Lyme disease was diagnosed in 42 states and not confined to the northeast region, where it was originally discovered. This is likely the result of the changing epidemiology of the disease and the mobility of the Pet-owning population. Although some Lyme-positive dogs were symptomatic, the majority were not. Likewise, ticks were found on a very small percentage of the cases found in 2006 from Banfield hospitals. Vaccination for Lyme disease and consistent use of approved tick control products to prevent tick bites in outdoor environments are the best ways to reduce the potential for transmission of *Borrelia burgdorferi* to Pets and the subsequent development of Lyme disease. And as with annual fecal testing and routine prophylactic deworming, these recommendations should be a critical component of client communication regarding proper wellness care and prevention.

With consistent and timely communication about the risks for zoonotic and vector-borne disease, veterinarians can help to ensure that families and Pets continue to share a strong bond and not the anguish of easily preventable diseases.

Elizabeth Lund, DVM, MPH, PhD, joined Banfield in 2006 as senior director of research for Data-Savant. As an epidemiologist, Dr. Lund's professional experience over the last 18 years has included research in academia, industry and public health. She also has a master's degree in public health and a PhD in epidemiology/informatics. Dr. Lund and her husband, Jim, have four children (Jessica, Alyssa, Will and Nick) and four Pets.