Prevalence of *Giardia* in Symptomatic Dogs and Cats throughout the United States as Determined by the IDEXX SNAP *Giardia* Test*

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CLINICAL RELEVANCE

National prevalence of *Giardia* infection in dogs and cats presenting to clinics with gastrointestinal signs was examined using the IDEXX SNAP *Giardia* Test (IDEXX Laboratories). Veterinary practices across the United States were asked to use the test on fecal samples from cats and dogs identified as having diarrhea and/or vomiting. Results from 16,114 dogs and 4,978 cats were submitted. Analysis of the data showed a *Giardia* prevalence of 15.6% among tested dogs and 10.8% among tested cats. The results of this study show that *Giardia* is a common enteric agent among dogs and cats with gastrointestinal signs.

INTRODUCTION

Correct diagnosis of *Giardia* spp is a challenge for many veterinary clinics because the cysts are small and are shed intermittently and staff members are often suboptimally trained to identify them. In addition, the larger and motile trophozoite stage is typically found only in fresh diarrhea. Sugar flotation solutions often preclude accurate diagnosis of *Giardia* because the high specific gravity of the solution distorts the *Giardia* cysts.\(^1\) To increase the recovery of *Giardia* cysts, many laboratories use zinc sulfate as their flotation medium\(^1\); however, the cysts remain difficult to detect by inexperienced in-
of soluble antigen from any *Giardia* species. A fresh fecal sample is collected on a reagent swab that also houses a conjugate-bound antibody solution. The feces and conjugate are mixed within the reagent swab. If *Giardia* antigen is present, the conjugate-bound antibody binds with it. The fecal–reagent solution is then placed on the test device, which contains a membrane coated with secondary antibody; as the solution flows over the membrane, the conjugated antigen is bound by the secondary antibody. Two waves of suspensions then flow: a wash that removes unbound material followed by a substrate.
solution; if the substrate solution encounters the conjugated antibody, a blue color that denotes a positive sample is generated.

The objective of our study was to use the SNAP Giardia Test (IDEXX Laboratories) to determine the prevalence of Giardia spp in dogs and cats in the United States presenting to clinics with clinical signs of gastrointestinal (GI) disease; study parameters defined GI signs as vomiting and/or diarrhea.

**MATERIALS AND METHODS**

An invitation letter was mailed to 21,788 veterinary clinics that are part of the IDEXX mailing list (two mailings; one in 2004 and one in 2005) requesting that veterinarians evaluate all canine and feline patients presenting with clinical signs of GI disease (vomiting and/or diarrhea) for Giardia infection using the SNAP Giardia Test. In return, the clinics received a rebate on the cost of the test for each data point submitted. Data were submitted on standard forms, indicating the species, clinical signs, test date, and test results for each animal. The data were entered into an Excel spreadsheet (Microsoft, Redmond, WA) and analyzed.
with the statistical package Statistix (Analytical Software, Tallahassee, FL).

Prevalence estimates were obtained by dividing the number of positive samples by the number of samples submitted. Estimates were categorized by species, clinic, state, and geographic region; the regions were Northeast, Southeast, Midwest, and West (including Alaska and Hawaii) as characterized by Blagburn et al. Statistical comparisons were made between

**TABLE 1. Prevalence of *Giardia* spp in Dogs by Region of the United States**

<table>
<thead>
<tr>
<th>Region</th>
<th>Total Sample</th>
<th>Percentage Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northeast</td>
<td>3,291</td>
<td>19.2%</td>
</tr>
<tr>
<td>Midwest</td>
<td>5,193</td>
<td>15.6%</td>
</tr>
<tr>
<td>West</td>
<td>3,185</td>
<td>15.7%</td>
</tr>
<tr>
<td>Southeast</td>
<td>4,395</td>
<td>12.9%</td>
</tr>
</tbody>
</table>

**Figure 3.** Percentage of canine fecal samples from each state testing positive for *Giardia* using the IDEXX SNAP *Giardia* Test.
species and among regions using the chi-square test of independence, with $P < .001$ considered significant. Geographic estimates were plotted and displayed using the software package MapViewer (Golden Software, Golden, CO).

### RESULTS

A total of 21,041 test results were reported: 941 clinics submitted results for 16,064 dogs, and 871 clinics submitted results for 4,977 cats. Most of the canine samples tested came

**TABLE 2. Prevalence of *Giardia* spp in Cats by Region of the United States**

<table>
<thead>
<tr>
<th>Region</th>
<th>Total Sample</th>
<th>Percentage Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northeast</td>
<td>1,035</td>
<td>11.2%</td>
</tr>
<tr>
<td>Midwest</td>
<td>1,659</td>
<td>10.3%</td>
</tr>
<tr>
<td>West</td>
<td>977</td>
<td>10.3%</td>
</tr>
<tr>
<td>Southeast</td>
<td>1,306</td>
<td>9.7%</td>
</tr>
</tbody>
</table>
from some of the most populated states in the country, including California, Texas, and Florida; New York, however, which ranks 10th in state population,5 supplied the most results (Figure 1). Supplied cat data predominantly came from many of the same states as the dog data, with New York again being the top contributor of samples (Figure 2).

Overall prevalence for dogs was 15.6%. Regional prevalence values for dogs are shown in Table 1; individual state prevalence data are shown in Figure 3. Except in terms of Midwest versus West, prevalence calculations in all regions were significantly different from one another. The state with the highest prevalence of Giardia among dogs was New Hampshire at 30.6% (37/121). Other states ranking among those with the highest prevalence rates were Connecticut (30.2%; 91/301) and New Jersey (27.7%; 94/340) in the Northeast and Idaho (26.8%; 11/41) and Nevada (25%; 8/32) in the West.

Overall prevalence for cats was 10.3%. There was a significant difference in the overall prevalence (15.6% versus 10.3%) between the two species (P < .001). Regional prevalence values for cats are shown in Table 2; individual state prevalence data are shown in Figure 4. Regional differences were not significant for cats. Tennessee had the highest prevalence of Giardia-infected cats at 24.7% (18/73), followed more distantly by five states in multiple regions with values in the 16% to 20% range (Maine, Nebraska, New Jersey, Oklahoma, and Vermont).

DISCUSSION

Based on the IDEXX SNAP Giardia Test, Giardia is very common in dogs and cats presenting with GI disease as defined by the presence of vomiting and/or diarrhea. The only previous national survey for canine parasites found an overall prevalence of 0.62% in shelter dogs based on centrifugal sucrose flotation, and the authors of that study stated that they believed that their number substantially underestimated true prevalence because sucrose solution is considered an insensitive diagnostic.2 A recent study in pet cats in Banfield hospitals found an overall prevalence of 0.58% based on zinc fecal flotation and/or direct smear.3 The much higher percentages we found may have been partially related to the fact that only symptomatic dogs and cats were examined, but also because the SNAP Giardia Test is likely to be more sensitive than flotation methods in most practice situations.1 The test produces few false-positive or false-negative results: Compared with ELISA microplate results, the sensitivity of the SNAP Giardia Test is 92% and the specificity is 99.8%.6

Other sources of bias are possible. For example, the ages of animals sampled or the severity of their disease may have varied across participating clinics, potentially influencing the prevalence estimates. Also, the responding clinics may have been motivated to participate because they had previously identified (or suspected) a high rate of Giardia among animals presented to them (potentially leading to biased prevalence estimates). As is true of all epidemi-
ologic studies, the results require replication by other investigators in other populations.

As the maps show, *Giardia* infection is most common in dogs in New England and the western Midwest. Among cats, infection also predominates in New England and the western Midwest, as well as some of the more northern south-central states, such as Oklahoma, Arkansas, Mississippi, and Tennessee (although the differences were not significant). Causative reasons for differences in prevalence have not been studied here.

No attempt was made during data collection to correlate the SNAP *Giardia* Test results with those of other fecal analyses, but this presents an interesting area of research. It would also be interesting to correlate test results with clinical signs in symptomatic cats and dogs.

This study looked at the prevalence of *Giardia* among dogs and cats with signs referable to GI disease among animals presented to veterinary clinics. The results pertain only to animals similar to those sampled, and the study did not examine whether *Giardia* was the cause of the signs or simply an incidental finding.\(^7\) Infection in adult dogs and cats is usually asymptomatic, with immature animals being more susceptible to disease.\(^8\) Human data suggest that although infection may be either clinical or subclinical, ostensibly asymptomatic children may yet have stunted growth rates. The role of giardiasis in nutrient deprivation and its contribution to co-infective states offers an important area of further research.

One recent study compared the diagnostic efficacy of sugar flotation, zinc sulfate flotation, and the SNAP *Giardia* test in the hands of practicing veterinarians.\(^1\) The results found that while only six of 27 participants could identify *Giardia* cysts on flotation techniques in a known positive sample, all 27 participants were able to correctly diagnose the samples using the SNAP *Giardia* Test.\(^1\) Because of limitations associated with flotation techniques and intermittent agent shedding,\(^9,10\) it is suggested that the SNAP *Giardia* Test would be beneficial in many practices. The test may also be useful in shelters, in which the prevalence of *Giardia* may be equivalent to or substantially higher than in the general population.\(^4,11\)

**CONCLUSION**

Because of its ease of use and interpretation, the IDEXX SNAP *Giardia* Test has allowed for a relatively easy clinic survey on a national level. The results of the test are reproducible because of the minimal staff training required to use the device correctly. Prevalence among dogs and cats with GI signs was high, 15.6% and 10.3%, respectively. Given the difficulties of diagnosing *Giardia* with traditional in-clinic techniques, veterinarians should consider *Giardia* in any dog or cat presenting with GI signs and prioritize it based on such factors as age, history, and geographic locale. The issue of differential regional prevalence is being further examined with an additional data set from these and other clinics.

**REFERENCES**


