The epidemiology of *Giardia* spp. infection among pet dogs in the United States indicates space-time clusters in Colorado

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Outline

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✓ Results:
  - Prevalence
  - Space - time cluster analysis
✓ Discussion and conclusions
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Introduction

- *Giardia* spp. are enteric parasites that infect a wide range of hosts including humans and animals

- Only *G. duodenalis* (*G. lamblia, G. intestinalis*) have been recovered from human and animal species

- *G. duodenalis* is the most common intestinal parasite identified by public health laboratories in human fecal specimens in the United States

- Epidemiologic and molecular evidence suggest that some *Giardia* spp. are zoonotic
Giardia spp. infection in dogs

- Prevalence of *Giardia* spp. in dogs in North America ranges from 0.62% to 100%

- Most previous studies of Giardia in dogs have been limited to select population and relatively small geographic regions

- Prevalence of *Giardia spp.* in pet dogs visiting primary care veterinary hospitals has not been well characterized
Objectives

- Estimate *Giardia* spp. prevalence in pet dogs visiting a representative sample of primary care veterinary hospitals in the United States.

- Identify high prevalence areas of *Giardia* spp. infection.

- Characterize the spatial distribution and clustering of *Giardia* spp. infection in a high prevalence state.
Materials and methods

- Retrieved the electronic medical records of dogs examined at Banfield® veterinary hospitals from January 2003 to December 2006

- Fields abstracted:
  - Unique ID for each dog
  - *Giardia* spp. fecal floatation test results (positive or negative)
  - Age, Gender and neuter status, Breed, date of the office visit
  - Latitude and longitude of owner’s residence
Material and methods

- Prevalence calculated as percentage of fecal samples testing positive for *Giardia spp.* by flotation method
- Only used the first fecal test result for each dog to calculate prevalence and 95% confidence interval (CI)
- Stata 9.2 (StataCorp) for data analysis
- ArcMap 9.2 (ESRI) to map *Giardia* spp. prevalence
- SatScan 7.2 (Kulldorff M. and Information Management Services, Inc.) software to perform spatial and temporal cluster analysis
## Results

<table>
<thead>
<tr>
<th>Category</th>
<th>No. tested</th>
<th>Prevalence</th>
<th>Highest prev. group</th>
<th>Lowest prev. group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>1,201,471</td>
<td>0.55 %</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td>&lt;0.5 yrs 0.78 %</td>
<td>&gt;5 yrs 0.33 %</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td>Intact male 0.62 %</td>
<td>Sp. female 0.48 %</td>
</tr>
<tr>
<td>Breed</td>
<td></td>
<td></td>
<td>Working 0.65 %</td>
<td>Mixed 0.50 %</td>
</tr>
<tr>
<td>Region</td>
<td></td>
<td></td>
<td>Mountain 1.70 %</td>
<td>Mid Atlantic 0.10 %</td>
</tr>
<tr>
<td>Month of office visit</td>
<td></td>
<td></td>
<td>January 0.65 %</td>
<td>March 0.48 %</td>
</tr>
</tbody>
</table>
Space-Time Cluster (6 mos) of Giardia in Colorado

Legend
- Space-time 6 mo (sec)
- Space-time 6 mo (prim)
## Space-time Cluster Characteristics

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Time interval</th>
<th>Radius</th>
<th>Obs./Exp.</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>01/03 - 06/03</td>
<td>24 km</td>
<td>5.6</td>
<td>0.001</td>
</tr>
<tr>
<td>Secondary</td>
<td>01/06 - 06/06</td>
<td>19 km</td>
<td>9.91</td>
<td>0.001</td>
</tr>
<tr>
<td>1</td>
<td>01/04 – 06/04</td>
<td>18 km</td>
<td>7.55</td>
<td>0.001</td>
</tr>
<tr>
<td>2</td>
<td>07/04 – 12/04</td>
<td>26 km</td>
<td>12.65</td>
<td>0.001</td>
</tr>
</tbody>
</table>
Discussion and conclusions

- Overall *Giardia* spp. prevalence (0.55%) in this study was lower than most previously reported estimates.

- High prevalence of *Giardia* spp. infection in Colorado was not expected.

- Dogs in Maine had highest prevalence (4.00%), but small samples size made this estimate unreliable.
  - A high prevalence of *Giardia* spp. infection in dogs from NH has been reported.
Discussion and conclusion

- Significant space and space/time clusters of *Giardia* spp. infection observed in high prevalence state (CO)

- Clustering (non-random occurrence) suggests role for local environmental factors:
  - water sources (well, municipal)
  - water treatment (chlorination, filtration)
  - wildlife reservoirs (beavers)

- Dogs may be useful sentinel for *Giardia* spp. infection in humans and for deficiencies in water quality

- Dogs (unlike humans) undergo routine fecal examinations
  - More likely to reveal outbreaks than reportable disease surveillance?
Future research

1. Compare prevalence of infection and disease in dogs and humans living in same geographic area

2. Further examine risk factors that explain observed clustering:
   - Seasonality/climate
   - Water sources
   - Water treatment

3. Evaluate predictive value of dogs as sentinel for human infection (public health)
Major Limitations

- Did not identify species of *Giardia*

- Probably underestimated *Giardia* spp. prevalence.
  - Floatation method alone is less sensitive than centrifugation
References


Thank you

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