
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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 - ✓ **Objectives**
 - ✓ **Materials and methods**
 - ✓ **Results:**
 - Prevalence**
 - Space - time cluster analysis**
 - ✓ **Discussion and conclusions**
 - ✓ **Future research**
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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**
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***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**
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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**
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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
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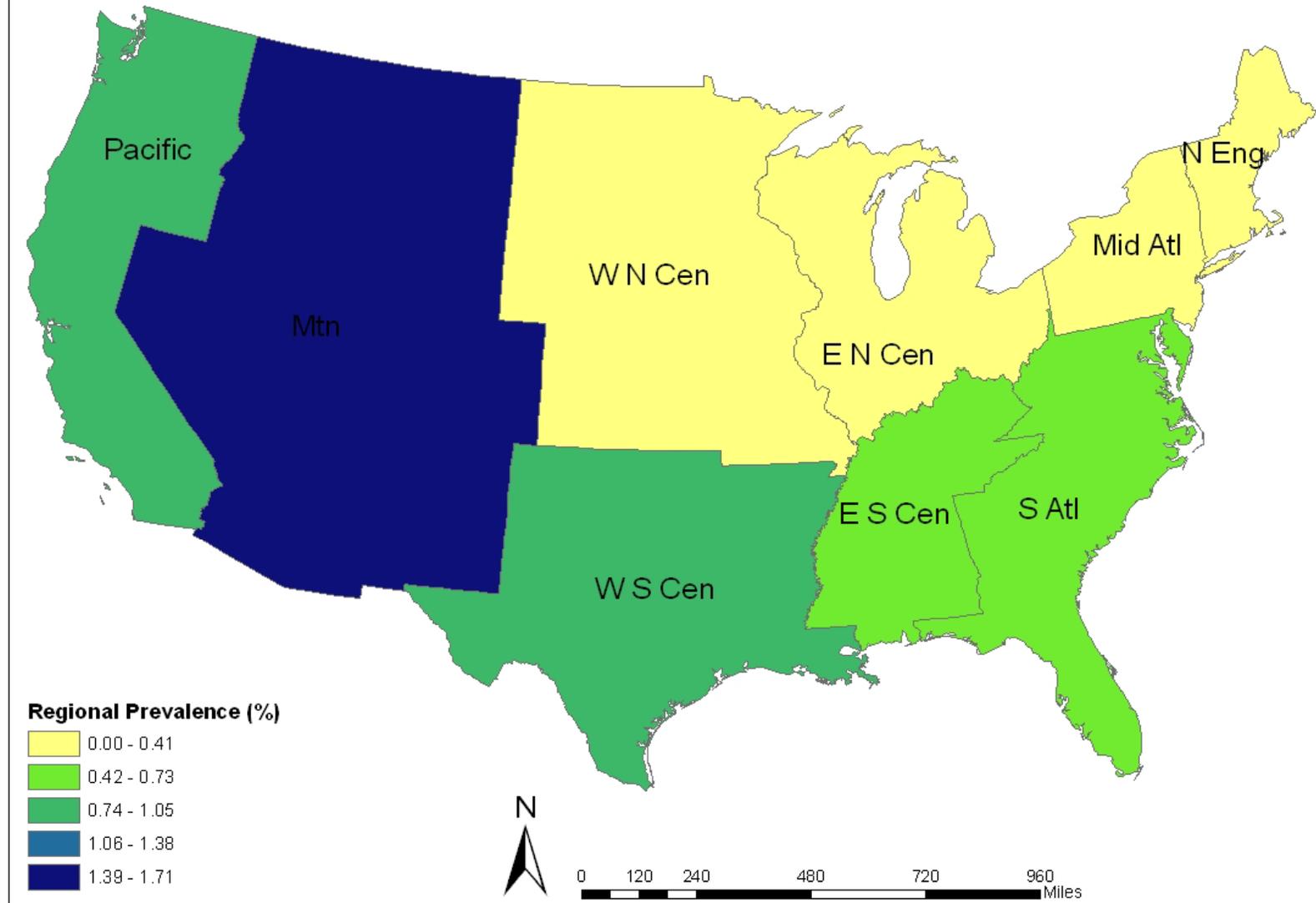
Material and methods

- 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
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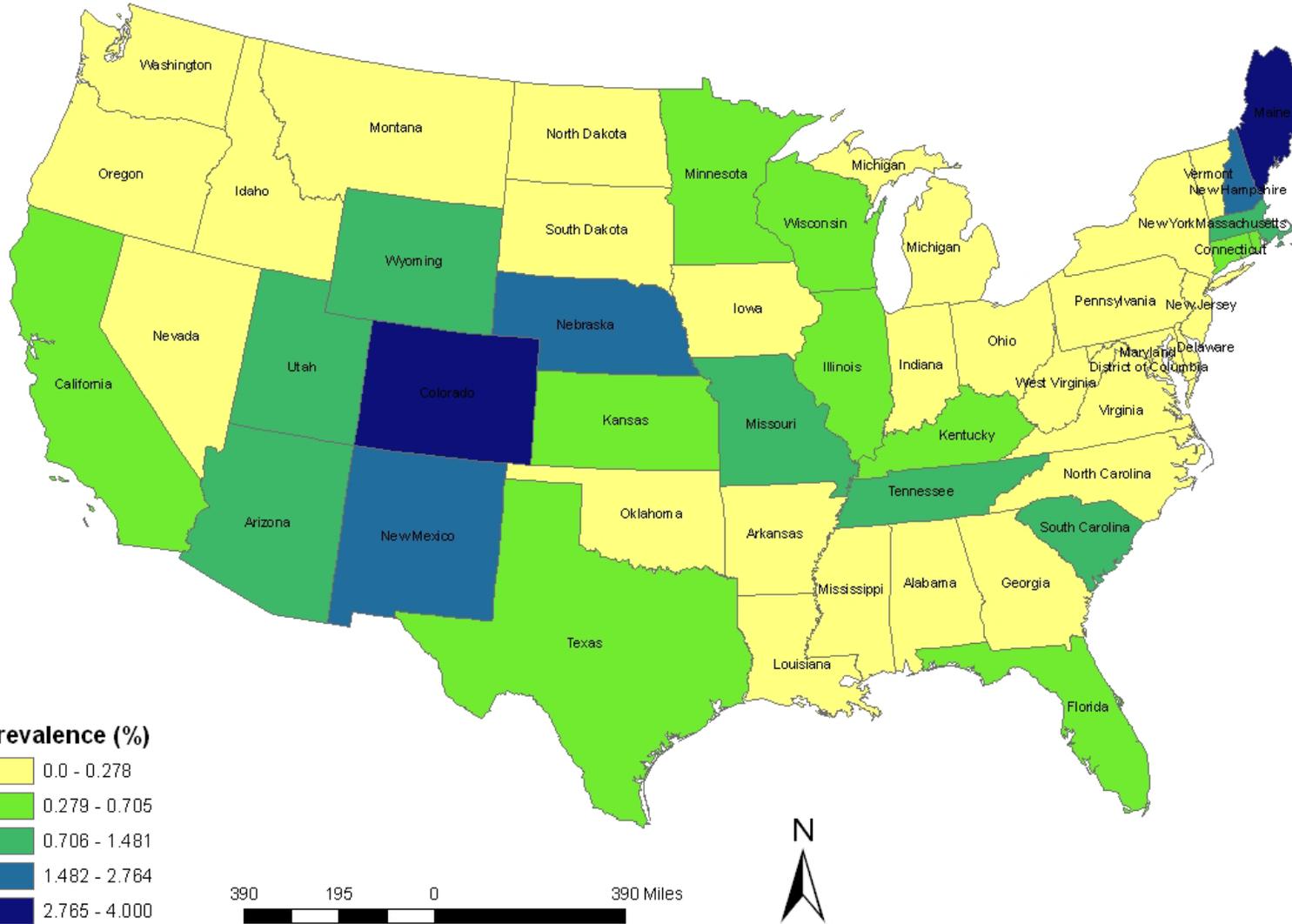
Results

Category	No. tested	Prevalence	Highest prev. group	Lowest prev. group
Overall	1,201,471	0.55 %	N/A	N/A
Age			<0.5 yrs 0.78 %	>5 yrs 0.33 %
Gender			Intact male 0.62 %	Sp. female 0.48 %
Breed			Working 0.65 %	Mixed 0.50 %
Region			Mountain 1.70 %	Mid Atlantic 0.10 %
Month of office visit			January 0.65 %	March 0.48 %

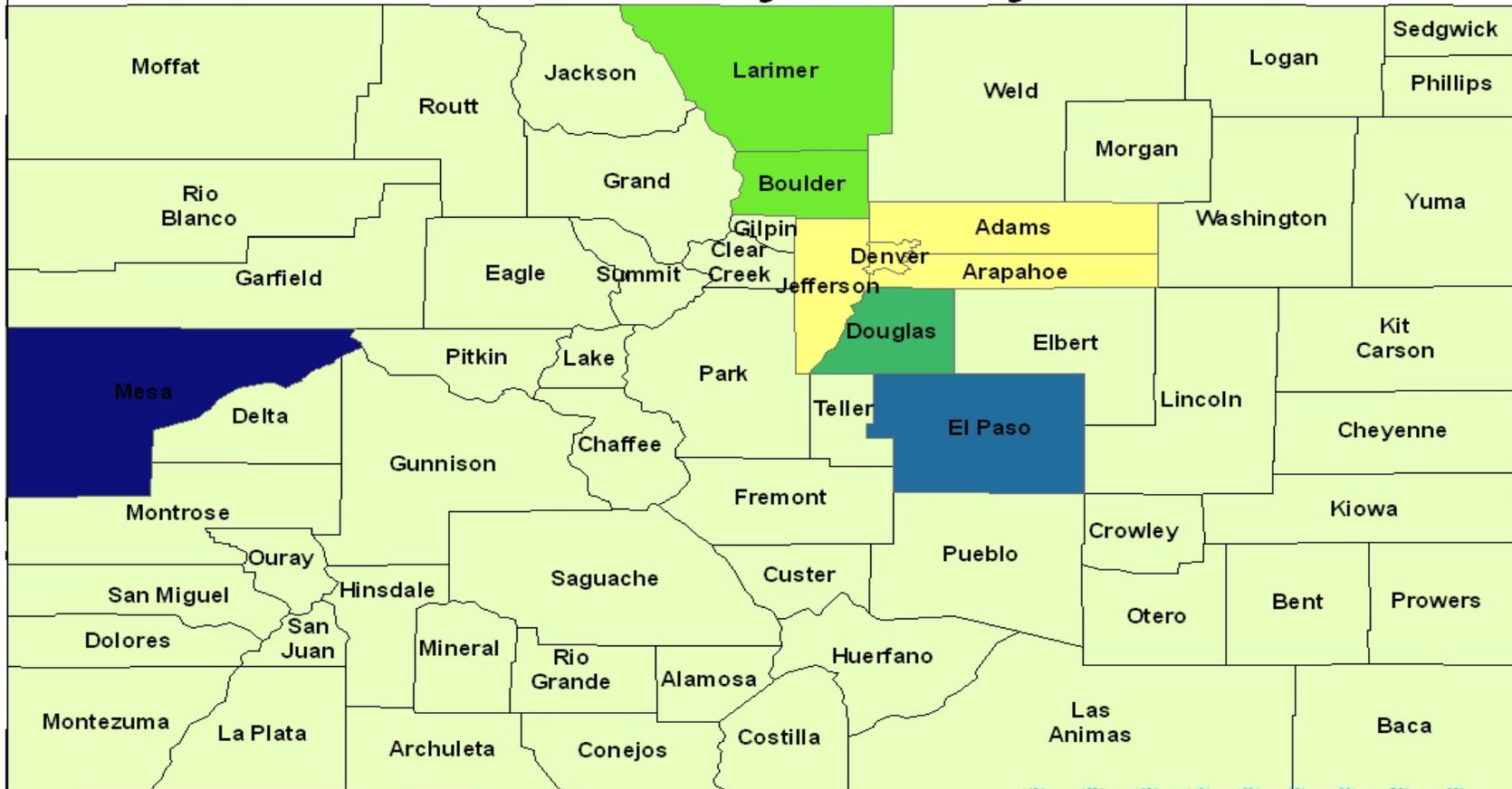
Giardia Prevalence by Region



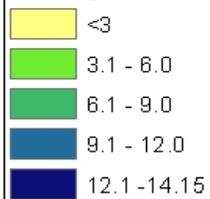
Giardia Prevalence by State



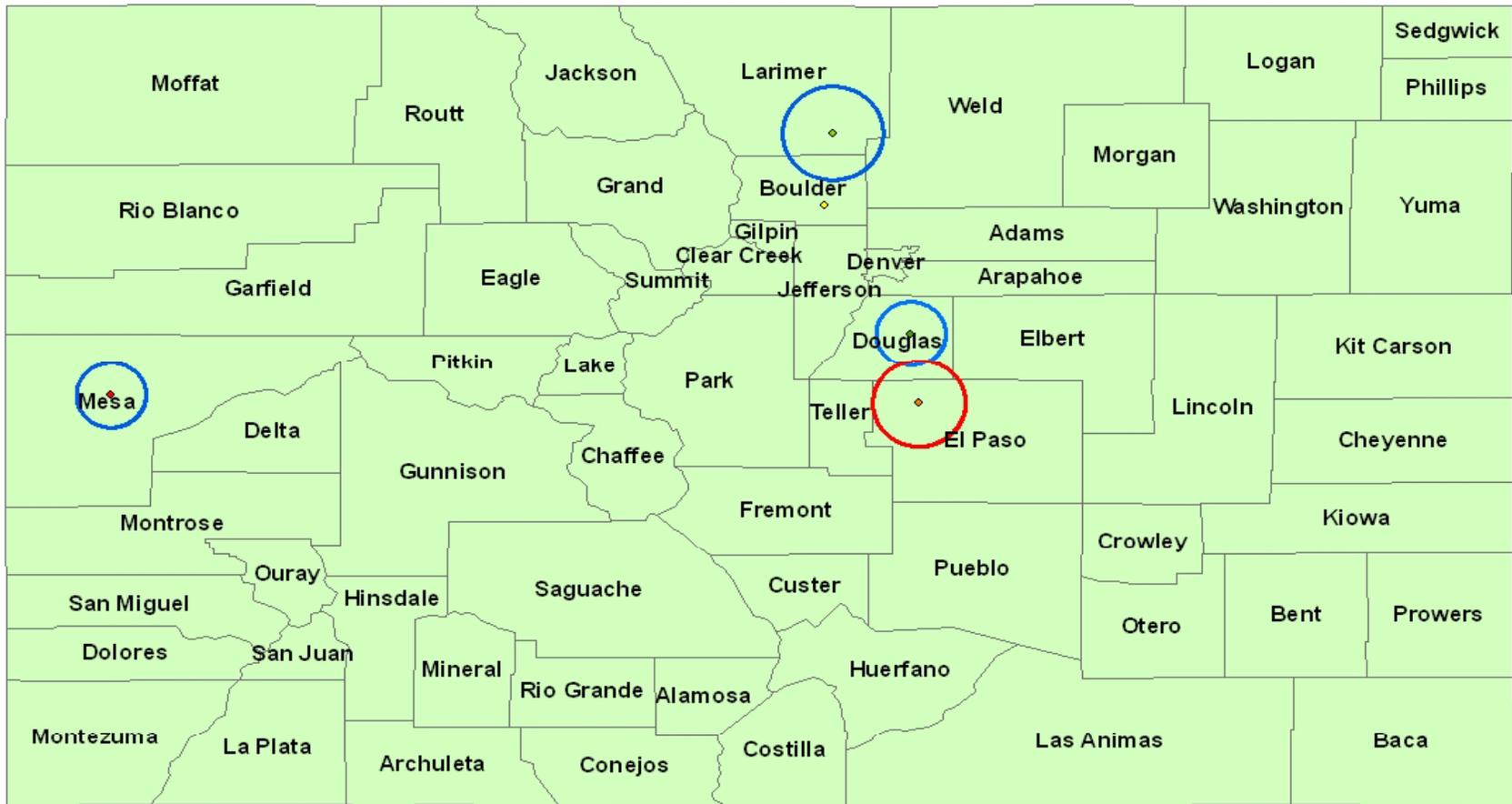
Giardia Prevalence by County in Colorado



County Prevalence (%)



Space-Time Cluster (6 mos) of Giardia in Colorado



Legend

-  Space-time 6 mo (sec)
-  Space-time 6 mo (prim)



Space-time Cluster Characteristics

Cluster	Time interval	Radius	Obs./Exp.	P-value
Primary	01/03 - 06/03	24 km	5.6	0.001
Secondary				
1	01/06 - 06/06	19 km	9.91	0.001
2	01/04 – 06/04	18 km	7.55	0.001
3	07/04 – 12/04	26 km	12.65	0.001

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
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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?**
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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)**
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Major Limitations

- **Did not identify species of *Giardia***
 - **Probably underestimated *Giardia* spp. prevalence.**
 - **floatation method alone is less sensitive than centrifugation**
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References

1. Traub, R.J., Monis, P.T., Robertson, I., Irwin, P., Mencke, N., Thompson, R.C., 2004, Epidemiological and molecular evidence supports the zoonotic transmission of *Giardia* among humans and dogs living in the same community. *Parasitology* 128, 253-262.
 2. Hunter, P.R., Thompson, R.C.A., 2005, The zoonotic transmission of *Giardia* and *Cryptosporidium*. *International Journal for Parasitology* 35, 1181-1190.
 3. Kappus, K.D., Lundgren, R.G., Jr., Juranek, D.D., Roberts, J.M., Spencer, H.C., 1994, Intestinal Parasitism in the United States: Update on a Continuing Problem. *Am J Trop Med Hyg* 50, 705-713.
 4. Yoder, J., Beach, M.J., 2007, Giardiasis Surveillance --- United States, 2003--2005. *MMWR Surveillance Summary* 56, 11 - 18.
 5. Blagburn, B., Lyndsay, D.S., Vaughan, B.S., et al., 1996, Prevalence of canine parasites based on fecal flotation. *Compen Contin Educ Pract Vet* 18, 483 - 509.
 6. Hahn, N., Glaser, C.A., 1988, Prevalence of *Giardia* in the feces of pups. *Journal of American Veterinary Medical Association* 192.
 7. Carlin, E.P., Bowman, D.D., Scarlett, J.M., Garrett, J., Lorentzen, L., 2006, Prevalence of *Giardia* in symptomatic dogs and cats throughout the United States as determined by the IDEXX SNAP *Giardia* test. *Vet Ther* 7, 199-206.
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Thank you

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