Geographic Epidemiology of Canine Leptospirosis in Southern Ontario and the Modifiable Areal Unit Problem

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1. About Leptospirosis

Leptospirosis is a zoonotic disease and

- of global importance
- is neglected
- is re-emerging

Leptospirosis in humans

- severity can vary from mild infection to death
- in pregnancy carries the risk of fetal death
- is always acquired from an animal source
2. Canine Leptospirosis

Leptospirosis in dogs

- Diagnostics: MAT (ELISA, PCR,...)
- Leptospira are classified into over 200 serovars
- Most dogs in Ontario are seropositive for serovars
  *canicola, icterohaemorrhagiae, grippotyphosa, pomona, autumnalis, bratislava*

- Vaccines
  - early 1970s: *canicola, icterohaemorrhagiae*
  - 2001: *grippotyphosa, pomona*
  - Immunized dogs may be infected with other serovars

- Considered re-emerging in North America

=> Geographic Epidemiology to find new clues

3. Studies in North America

Gautam et al. (2010) US postal codes areas, 2000-2007, MAT $\geq 1:1600$

$=>$ Environmental risk factors (season, wildlife exposure)
    dominate over dog factors (age, sex, breed)

$=>$ There are high risk disease cluster

Gautam et al. (2010)
Increase in seroprevalence of canine leptospirosis and its risk factors, 
Ontario 1998–2006

Gillian D. Alton, Olaf Berke, Richard Reid-Smith, Davor Ojkic, John F. Prescott

Study at FSA level (464 FSAs in southern Ontario)
- Confirm known risk factors
- No spatial case cluster (scan test)
- No spatial disease clustering (semivariogram, Moran’s I)

MAUP?
5. The MAUP and Ecological Bias

**Ecological Fallacy:** Inferences for individuals based on group data fail

**MAUP:** modifiable areal unit problem

=> 2 effects: zooning and aggregating

=> Affect on spatial patterns: trend, clustering and cluster

5. The MAUP and Ecological Bias

6. More Results for Southern Ontario

Changing the analysis from FSA to **Public Health Unit level**
464 FSA => 29 PHU’s
Reason: vet postal code ≠ location where the infection was acquired

Spatial scan test
=> RR =1.2
=> p=0.051

No clustering
7. Discussion & Conclusion

- MAT > 1:100 was used to identify sero-positive dogs
- Simple analysis => not serovar specific, not adjusted for age, sex, breed
- Disagreement in studies reflects methodological issues
  - Time
  - Place
  - MAUP/ecological bias
- Analyze the data at the appropriate spatial level
  - Postal code area
  - Forward Sortation Area
  - County
  - Public Health Units
  - Province/State
- Canine Leptospirosis needs further attention