Lyme Disease and Tick Surveillance in British Columbia

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Lyme disease

• Discover in early 80’s in Connecticut
• #1 Vector borne diseases in North America
• # By far the most public and media interest
• # 1 Conflict between mainstream clinician/ Scientist and Lyme Disease support group
• Tick species carrying pathogen for Lyme disease are different in East and West Coast
• Tick carrying Lyme disease in BC has 3-host life cycle.
3-host Tick Life-Cycle
Left: Adult female *Ixodes pacificus* after blood meal
Right: Adult female *Ixodes pacificus* before blood meal
Lyme disease

- Transmit through Tick bite only
- There are other theoretical risks but evidences are lacking
- Field Tick surveillance is one of the method of assessing risk of getting Lyme disease
- Tick field surveillance in BC were initiated in 1995.
Tick Surveillance

Field dragging

Small mammal trapping
Field Sampling Locations for *Borrelia burgdorferi* in British Columbia

Data source: Dr. Muhammad Monshid, PHSA Public Health Microbiology and Reference Laboratory – 1993-2008 tick and mouse sampling locations. Map created Nov 2012.

Courtesy: Sunny Mak
Isolation and/or Detection of *Borrelia burgdorferi* from Tick and Mice Populations in B.C. (1993 – 1996)

<table>
<thead>
<tr>
<th>Year</th>
<th>Tick</th>
<th></th>
<th>Mice</th>
<th></th>
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</thead>
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<tr>
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<td>Total</td>
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0.40 %  

0.90 %
Isolation and/or Detection of *Borrelia burgdorferi* from Tick and Mice Populations in B.C. (1997 – 2007)

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0.35% 0.60%
# Anti-*borrelia* Serology Tests on Deer Mice in BC

<table>
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<tr>
<th>Year</th>
<th>Total Mice Sera Tested</th>
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<td>164</td>
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</tbody>
</table>

3.66%
Ixodes pacificus
Distribution in BC

Data source: Dr. Muhammad Morshed, PHSA Public Health Microbiology and Reference Laboratory – 1990-2008 field sampling and clinical specimens. Map created Nov 2012.

Courtesy: Sunny Mak
Ixodes angustus
Distribution in BC

- Field sampling observations
- Clinical specimen submissions


Courtesy: Sunny Mak
Positive 
*Borrelia burgdorferi* 
Ticks and Rodents in British Columbia

- Feeding or questing tick
- Submitted tick
- Trapped rodent

Data source: Dr. Muhammad Mashhad, PHSA Public Health Microbiology and Reference Laboratory — 1993-2008 field sampling and clinical specimens. Map created Nov 2012.

Courtesy: Sunny Mak
Ticks Received for ID and *B. burgdorferi* Culture from BC Physicians, Veterinarians and Residents (2000-2007).
Endemic and travel-related cases of Lyme disease* in BC between 1997 and 2011.

*Includes both lab confirmed and clinical cases

Courtesy: Bonnie Henry & Marsha Taylor
Conclusions

• Lyme disease pathogen carrying ticks are concentrated in Lower mainland and Vancouver Island

• Very few *Ixodes* ticks are carrying Lyme disease pathogen *B. burgdorferi*

   BUT...
Field Study

• No field surveillance has been carried out since 2007

• Few studies in the east showed Lyme disease pathogen carrying tick population are increasing due to climate change
Number of cases and incidence rates of Lyme disease in the United States from 1993 to 2007.

Source: Ashleigh et al. CMAJOpen; Jan16, 2013, Vol 1
Temporal trends in Lyme disease incidence by state from 1993 to 2007. States are classified as having a decreasing trend, increasing trend or no change in incidence if the average yearly incident rate ratio (IRR) over the study period was significantly less than 1, greater than 1 or not significantly different from 1, respectively. Alaska (increasing trend, IRR 1.28, 95% confidence interval [CI] 1.15 to 1.42) and Hawaii (no change, IRR 0.60, 95% CI 0.28 to 1.23) are not shown.

Source: Ashleigh et al. CMAJ Open; Jan16, 2013, Vol 1
What we would like to do

• Successful in securing funding for two years field study: Thanks to BCCDC Foundations.
• Will carry out field study in 11 different sites based on BC ecological niche modeling study
  – Trap mice and retrieve ticks from them
  – Detect Lyme disease carrying pathogens DNA using Real Time PCR
• Metagenomic analyses of ticks to find novel pathogens
• Request Cross-Border Partners to Participate
What we will achieve …at the end of this study

- Update current status of Tick surveillance data
- Share data with Provincial Health Authorities
- Field data will help to drive public health policy and programs around prevention, detection and treatment of Lyme disease in BC
- Update GIS map of ticks and Lyme positive areas using current and previous data
- To find out whether tick population is expanding due to global climate change in BC
- Metagenomic analyses may help to see if there is any novel pathogen in BC ticks