Lyme Disease in Ontario

Hamilton Conservation Authority
Deer Management Advisory Committee
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Overview

• Introduction to ticks in Ontario
• Lyme disease in Ontario
• Areas of risk in Ontario
• Role of hosts in Lyme disease
• Prevention and control strategies
• Considerations in management
• Public awareness for Lyme disease
• Questions
Ticks in Ontario

• Several different species of ticks in Ontario

• 4 Life Stages
  • Egg
  • Larva (6 legs)
  • Nymph (8 legs)
  • Adult (8 legs)

• Life cycle can use several hosts

• A number of diseases transmitted by ticks: most which have a very low incidence rate in Ontario.

American Dog tick (*Dermacentor variabilis*) lower and blacklegged tick (*Ixodes scapularis*) upper
The blacklegged tick (BLT), also called the deer tick (*Ixodes scapularis*), is the vector responsible for transmitting Lyme disease (LD) in Ontario.
Lyme disease

• Tick-borne bacterial disease caused by spirochete *Borrelia burgdorferi*
• Reportable in Ontario since 1988
• Transmitted by *Ixodes scapularis* and *Ixodes pacificus* (BC) in Canada
• Occurs mainly in the summer, peaking in June and July; but can occur throughout the year

Tick Lifecycle and Lyme disease

Larva feeds on small animals, particularly the white-footed mouse, and becomes infected with bacteria that cause Lyme disease.

Female tick drops off deer host and lays eggs on the ground.

Nymph grows to adult tick, which feeds on large animals, particularly deer. At this stage, the tick also mates.

Infected nymph bites and transmits Lyme disease to host—another animal or person.

Larva molts into a nymph—the most aggressive stage.

http://www.brown.edu/Courses/Bio_160/Projects2005/lyme_disease/life_cycle_clip_image001.gif
Symptoms of Lyme disease

- Early symptoms of Lyme disease usually occur within one to two weeks, but can occur as soon as three days or as long as a month, after a tick bite.
- Fever, headache, muscle and joint pains, fatigue and a skin rash especially one that looks like a red bull's eye. Not all patients with Lyme disease will develop the bull’s eye rash.
- Promptly seek medical advice. It is important to tell your doctor the time and the geographical location of where you were bitten by a tick.

Erythema migrans (bull’s eye rash)
Seasonal Pattern of Lyme disease

Seasonal Pattern Of Lyme Disease Cases

Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sept  Oct  Nov  Dec

Human Cases

Adult Deer Tick
Abundant October to May

Nymphal Deer Tick
Abundant May to Late July

Larval Deer Tick
Abundant August to October

Seasonal Activity of Deer Tick Life Stages

http://www.tickencounter.org/education/
LD Trends and Incidence Rates (2005-2009)

<table>
<thead>
<tr>
<th>Year</th>
<th>Cases</th>
<th>Rate per 100,000 pop.</th>
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<tbody>
<tr>
<td>2005</td>
<td>43</td>
<td>0.34</td>
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<tr>
<td>2006</td>
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<td>108</td>
<td>0.84</td>
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<td>2009</td>
<td>76</td>
<td>0.58</td>
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</tbody>
</table>

Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted [04/02/2010].
Ontario LD Exposures (2005-2009)

- Locally Acquired: 36%
- Travel-related: 40%
- Missing/Unknown: 24%

Ontario Ministry of Health and Long-Term Care, integrated Public Health Information System (iPHIS) database, extracted [04/02/2010].
Blacklegged Tick Submissions (2009)
Lyme disease Cases in the US (2008)

Reported Cases of Lyme Disease -- United States, 2008

1 dot placed randomly within county of residence for each confirmed case

http://www.cdc.gov/ncidod/dvbid/Lyme/ld_Incidence.htm
**Established**
- Blacklegged ticks found in the same area over multiple years
- Blacklegged ticks not positive for *Borrelia burgdorferi*

**Endemic**
- Blacklegged ticks (all life stages) found in the same area over multiple years
- Blacklegged ticks and small mammals found positive for *Borrelia burgdorferi*
Lyme disease Endemic Areas in Ontario

Long Point Provincial Park
Turkey Point Provincial Park
Rondeau Provincial Park
Point Peele National Park
Prince Edward Point National Wildlife Area
St. Lawrence Islands National Park
Wainfleet Bog Conservation Area
Local Risk Areas for Lyme disease
Wainfleet Bog Conservation Area

- Found positive blacklegged ticks in 2007
- Conducted tick dragging in 2008 and found positive ticks
- Conducted small mammal trapping in 2009 to determine if area is endemic for Lyme disease
Lyme disease: Role of Small Mammals

- Primary reservoir for *B. burgdoferi* is small mammals such as the white footed mouse
- Larval and nymph life stages of tick feed on small mammal hosts
- Impact dependent on the abundance of the animal host, number of ticks feeding on the host, and the host’s ability to infect feeding ticks with *B. burgdoferi*.
- Some animals may have a lot of ticks, but these hosts may not be able to infect their ticks with spirochetes.
- White-footed mice have a home range of generally < 1km
- Nests in stonewalls, tree cavities, abandoned bird or squirrel nests, under stumps, logs, and stacked firewood in woodland and brushy areas.

http://www.pinebarrensanimals.com/web_images/pix1/White-FootedMouse1.jpg
Lyme disease: Role of Deer

- White tailed deer is the preferred large host animal, particularly for adult tick life stages.
  - Abundant population
  - Ticks not easily removed through grooming
  - Highly mobile, therefore transport ticks into new areas
- Presence of high deer populations has been shown to enhance the abundance and distribution of tick populations. However, the tick populations are not necessarily infected with *B. burgdorferi* and therefore not transmitting disease and increasing human risk.
- Ticks cannot pickup the bacteria from the deer (dead-end hosts).

http://depts.washington.edu/natmap/photos/mammals/white-tailed_deer_5924np.jpg
Lyme disease: Role of Migratory Birds

Blacklegged ticks are also known to feed on migratory birds and as a result, they can be transported throughout the province. Therefore, while the potential is low, it is possible for people to encounter blacklegged ticks, or to be infected with Lyme disease from the bite of an infected blacklegged tick, almost anywhere in the province.

http://www.tpwd.state.tx.us/huntwild/wild/birding/migration/flyways/images/atlanticmap.gif

Photograph courtesy of Dr. Thomas Nicholls
Prevention and Control Strategies

Personal Protection Measures

• Wear light coloured clothing (its easier to spot them on you)
• Wear long sleeves and pants when going outside
• Pants tucked into your socks (they can't get to your skin)
• Apply repellent containing DEET
• Check yourself after going out—check clothing first, then when you are home check your skin.
• Check pets and/or small children after going outside, they can bring ticks into the house

http://euphrates.wpunj.edu/faculty/tickinfo/Assetts/Sprayinganklesocks.jpg
Prevention and Control Strategies

• Cut long grass and undergrowth
• Remove leaf litter
• Remove brush, weeds and yard debris
• Cut away undergrowth several feet into the edge of any woods near your home or public property
• Fence property
• Wood chip/gravel barriers along paths

Ticks cannot fly and usually come in contact with people or animals by positioning themselves on tall grass and bushes and grabbing on when something walks by. By cutting the grass lower and creating barriers, it is creating an environment where ticks do not flourish.
Prevention and Control Strategies

- In endemic areas with high rates of Lyme disease in the public, it may be necessary to conduct host-targeted control (rodent and/or deer removal) for additional prevention strategies:
  - Small mammal trapping (time consuming and not cost effective)
  - Landscape alteration: removal wood piles and stonewalls that can harbour rodents. Mature, shaded forests with poor forage and browse support low densities of deer and fewer ticks.
  - Deer exclusion by fencing or other barriers
  - Deer repellents (low to moderate densities)
  - Deer resistant plantings to create an undesirable habitat
  - Deer reduction and management through regulated hunting or capture and removal

http://www.fungi.com/mycotech/mycotechpics/dnr/road.jpg
http://www.just-green.com/ProductImages/fullsize/deer_fencing_mesh500.jpg
Deer Reduction Studies

• In Connecticut, deer were reduced from 200/mi2 to 30/mi2 (~84%) in a geographically isolated area producing a >90% decline in nymphal tick abundance (Stafford et al. 2003).

• Deer were completely eliminated from an island in Maine over a 28-month period resulting in the steady disappearance of I. scapularis from the island (Rand et. al. 2004).

• Computer simulations (LYMESIM) suggest that a 70% reduction in deer density and maintenance level of 19 deer per square mile (7.5/km²) would achieve ~40% reduction in infected nymphs within 4 years (Mount et. al. 1997).

• Observational studies and computer models suggest in areas with high Lyme disease rates in humans, a reduction of deer density to less than 20 deer per square mile (7.5km²) may significantly reduce risk to a tick bite. However, because of issues of where these studies were conducted in the US, limited human case reports and the actual impact of human disease risk is limited (Stafford 2007).
Host Management Considerations

- Any control program would require an initial reduction phase to lower high densities of deer and a maintenance phase to keep the deer population at the desired targeted level.

- Given the resources required to mount and maintain a community-based program of sufficient magnitude to effectively reduce vector tick density in ecologically open situations where there are few impediments to deer movement, it may be that deer reduction, although serving other community goals, is unlikely be a primary means of tick control by itself (Jordan et al. 2007).

- Although deer and tick reductions have been successfully carried out on some islands, peninsulas or some other defined geographical tract, it is not clear is a deer population can be reduced sufficiently to achieve a satisfactory level of tick control in more densely populated areas on the mainland (Stafford 2007).

http://www2.uwrf.edu
Other Considerations for Host Management

• There are several factors to consider for a community that is considering implementing a host management strategy due to Lyme disease:
  ● Current risk of Lyme disease: how much must deer populations be lowered to reduce tick exposure and human risk to Lyme?
  ● Real or perceived safety or liability concerns
  ● Hunting restrictions and associated regulations (MNR)
  ● Conflicting public attitudes on managing wildlife populations

• Incremental removal and reduction of deer have been shown to reduce tick abundance. However, ticks may continue to be introduced into an area on migrating birds and other animals, even with the complete removal of deer.
Prevention and Control Strategies

• The best method of control against Lyme disease is to use an Integrated Pest Management (IPM) approach: landscape/barrier practices, management of host animals, targeted application of low-toxic pesticides (if approved) in high risk tick habitats in conjunction with personal protection measures.
• Learn about ticks, Lyme disease, and areas of risk
• Remove attached tick promptly using tweezers to reduce risk
• Talk to your physician if you have concerns about exposure to Lyme disease
Public Awareness Campaign

• Provincial Lyme disease awareness campaign (June 2010)
• Brochures, posters
• Physician mail-out
• You-tube video “Dr. Bug’
• Website:  www.ontario.ca/lyme
Additional Work by MOHLTC

- Continued surveillance efforts identifying new endemic areas in Ontario
- Continued human surveillance
- Working with partners to post signage in endemic areas (Conservation Authorities, MNR, Parks Canada)
- Collaborations with Public Health Agency of Canada (PHAC) and other partners
Thank you

- Curtis Russell, Dawn Marvin, Karen Johnson
- MOHLTC, PHAC, Ontario Health Units, and other partners

Questions?