LYME DISEASE

Guidance Manual for Healthcare Providers, 2015

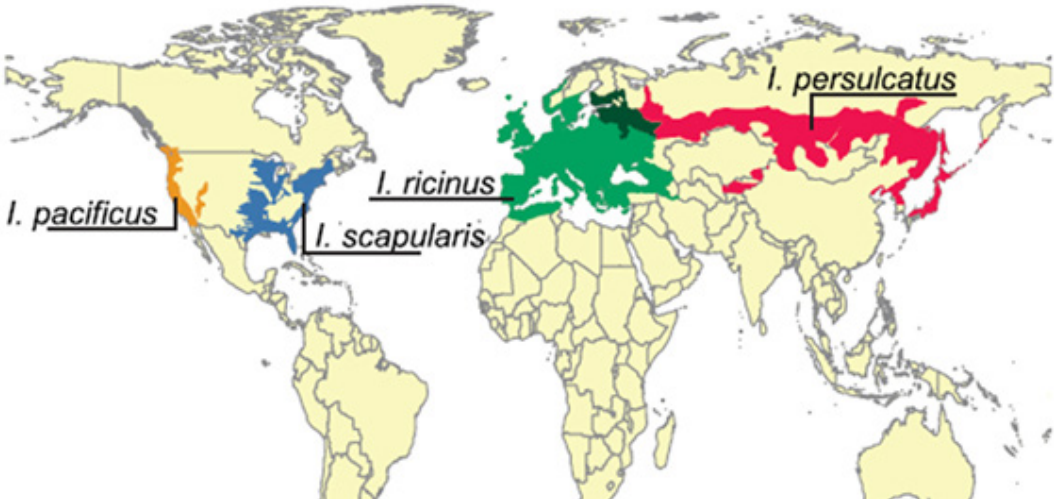
RISK MAPS | TICK IDENTIFICATION | SYMPTOMS | DIAGNOSIS | TREATMENT

Health Unit
Haldimand-Norfolk

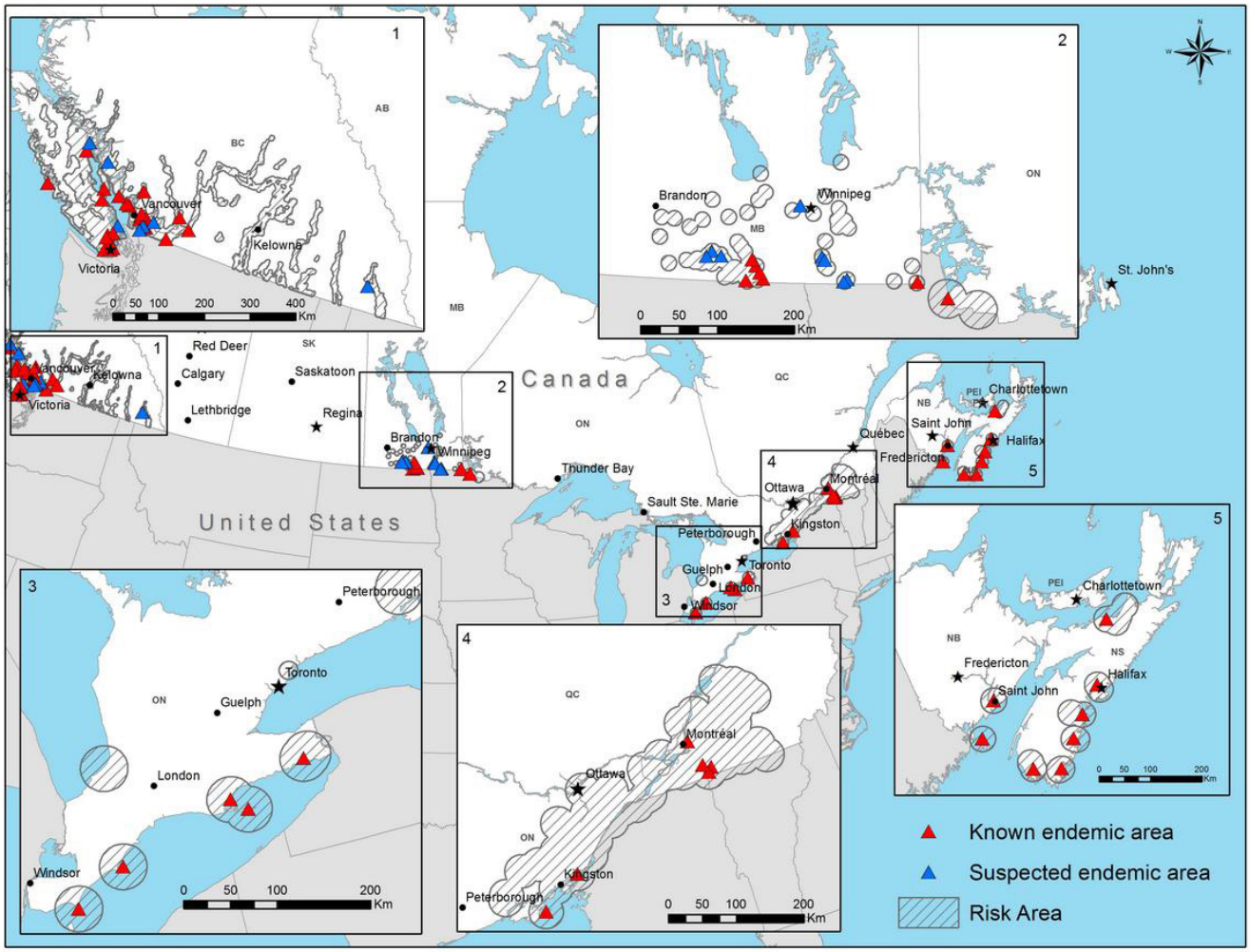
hnhu.org • info@hnhu.org
Simcoe: 12 Gilberston Dr., Simcoe, ON N3Y 4L1
T: 519-426-6170 F: 519-426-9974
Caledonia: 282 Argyle St. S., Caledonia, ON N3W 1K7
T:905-318-6623 F:905-765-8905

Table of Contents

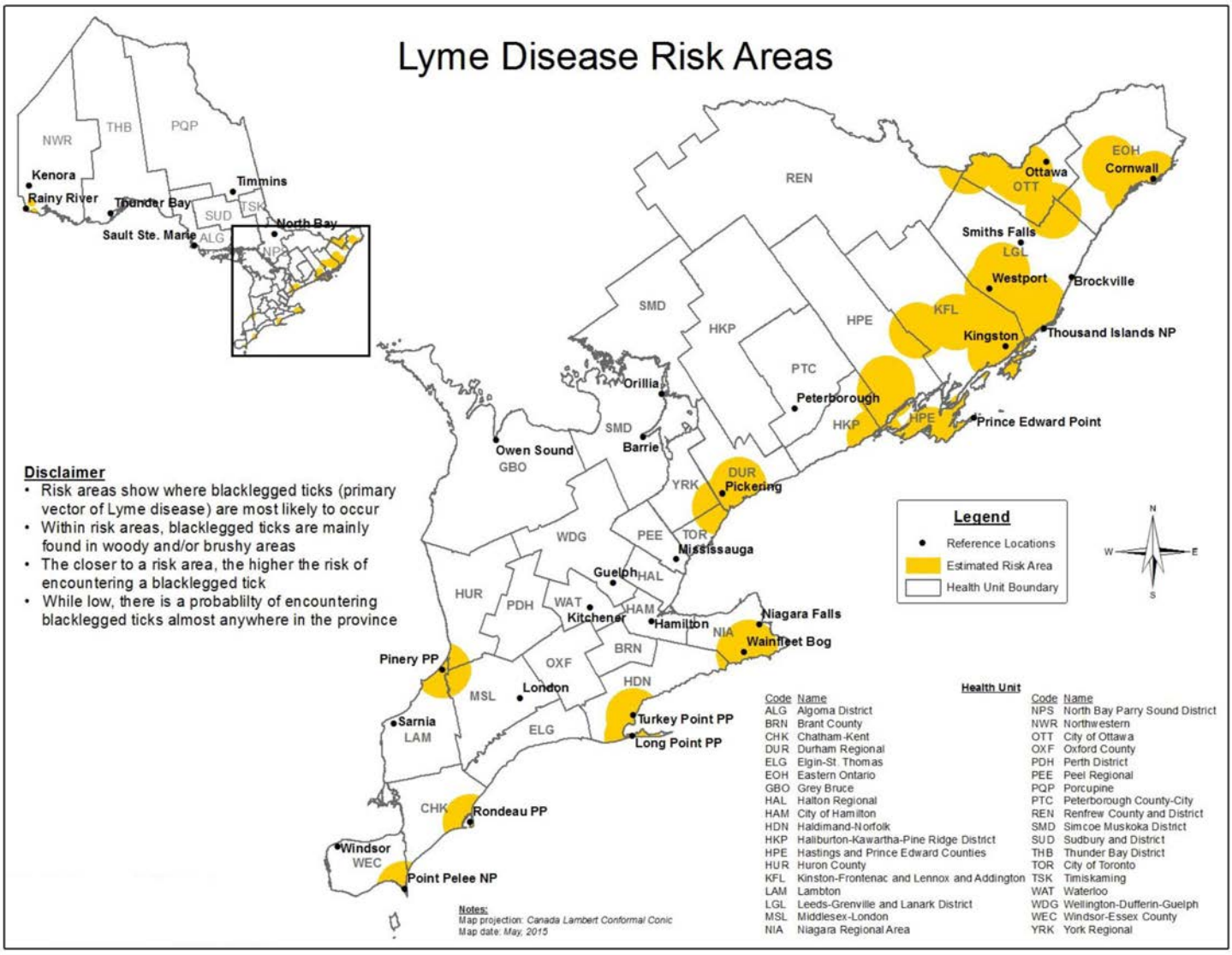
Geographical distribution of Ixodes ticks capable of transmitting Lyme disease



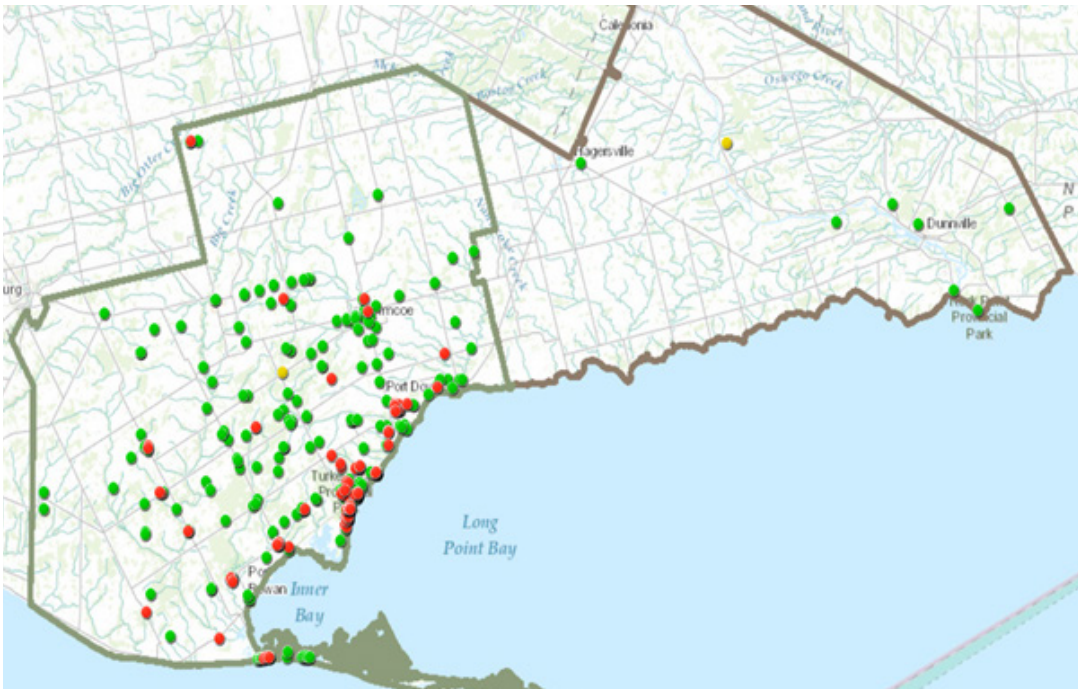
Public Health Agency of Canada's Lyme Disease Risk Map



Public Health Ontario's Lyme Disease Risk Map



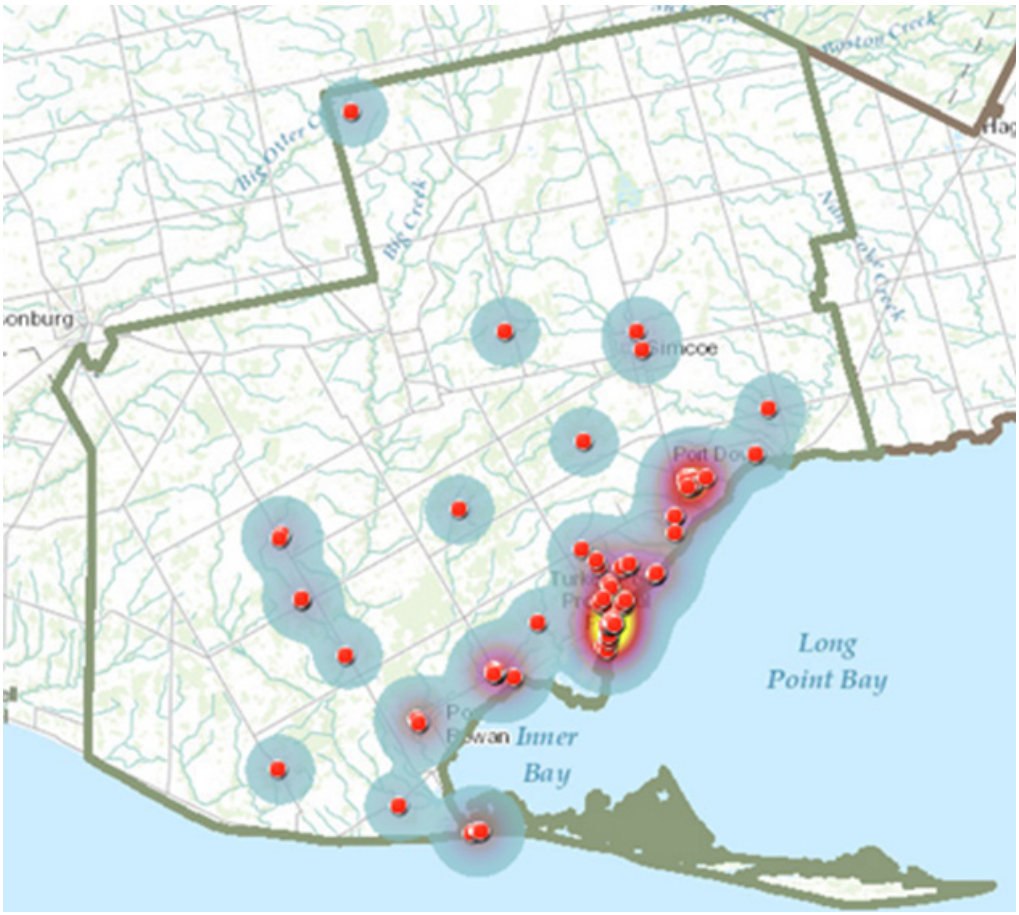
HNHU Deer Tick Submission Results for 2011-2014



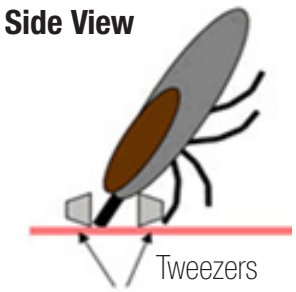
Legend

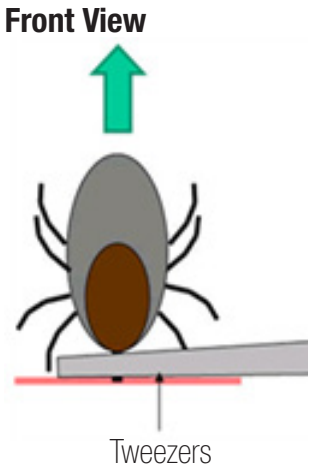
- Red — Deer Tick Positive for Lyme Disease
- Green — Deer Tick Negative for Lyme Disease
- Yellow — Deer Tick Postive for Anaplasmosis

HNHU Deer Tick Submissions Testing Positive for Lyme Disease (2011-2014)



Tick Removal Instructions





STEP 1
Position the jaws of the tweezers around the mouthparts of the tick and as close to the skin as possible.

STEP 2
Hold tweezers at a right angle to the tick's body.

STEP 3
While firmly clinching the tick's mouthparts with the tweezers, gently pull the tick straight up and away from the skin. Avoid twisting or turning the tick during removal as this can cause the tick's mouthparts to break off inside and/or while attached to the skin.

STEP 4
Disinfect the bite site after the tick is removed.

STEP 5
Place the tick in a collection vial and label the vial with the patient's name, the location where the tick was likely acquired and the date it was collected. See Shipping Instructions for further instructions.

Shipping Instructions

Documentation
After placing the tick in a collection vial and labelling it accordingly, complete a General Test Requisition form (MOHLTC) requesting 'tick identification' and fill in as many fields on the form as applicable. The completed form and specimen can then be sent away for identification and, if identified as a deer tick by the Public Health Lab (PHL), Lyme disease testing by the National Microbiology Lab (NML).

When ticks are collected from different patients (e.g. mother and son) or different locations (e.g. patient with a tick from Long Point and another from Turkey Point), separate General Test Requisition forms should be completed.

Specimen Storage
Prior to shipment, ticks (live or dead) can be temporarily stored (within the collection vials), for 7 to 10 days, in a refrigerator. If collected ticks appear to be dead, based on a lack of movement, or they cannot be shipped for several weeks, they can also be stored in a freezer, as this will prevent mold from degrading them.

Shipping Conditions
Collection vials can be shipped without any further preservatives such as cold packs or dry ice.

NOTICE
The Haldimand-Norfolk Health Unit (HNHU) does not recommend delaying diagnosis and treatment while awaiting tick results. Identification results from the Public Health Lab (PHL) usually takes approximately 2-4 weeks. If the tick is then identified by the PHL as a deer tick it will be sent away for Lyme disease testing to the National Microbiology Lab (NML) in Winnipeg. Based on the HNHU's experience, results from the NML can take approximately 3 months to acquire. Processing times for both labs often depend on the volume of ticks they receive (i.e. more submissions during peak adult periods in spring and fall).

Patients should not be referred to their local Public Health Unit to acquire tick identification and test results for specimens submitted by a physician. Public Health Units are not provided with such information.

Lyme**Disease**

Tick Identification Guide

Deer ticks and dog ticks are the most common types of ticks found in Norfolk County. In comparison, tick submissions to the HNHU suggest deer ticks are less common Haldimand County and the overwhelming majority from this area are identified as dog ticks.

Note: Photos are not to actual size.

Deer Tick (Ixodes scapularis)

Tip One

One of the easiest ways to tell the difference between a deer tick and a dog tick is to look at the markings in its back (also known as its shield or scutum). Adult deer ticks do not have any white markings on their back where adult dog ticks do.

American Dog Tick/Wood Tick (Dermacentor variabilis)

Tip Two

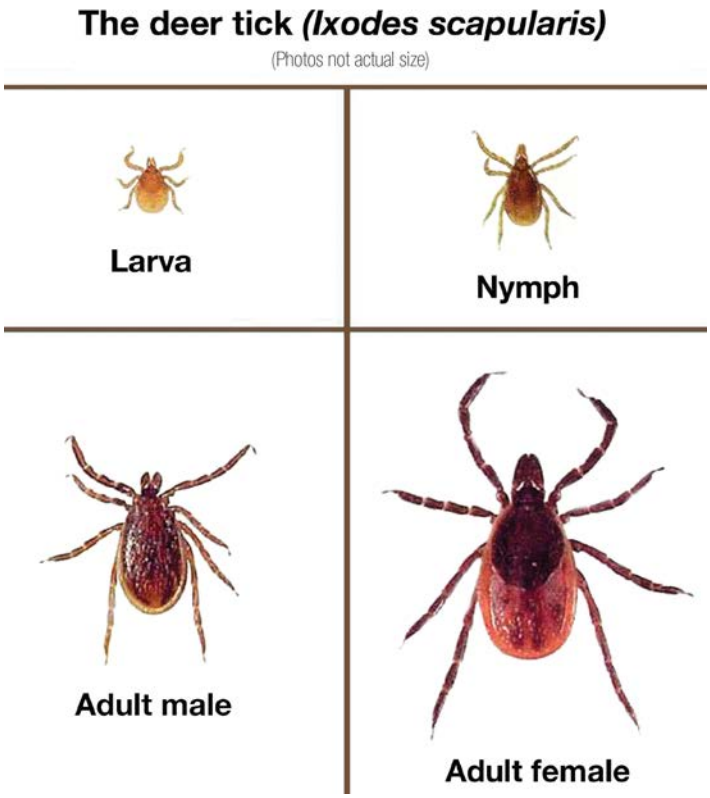
Adult dog ticks are relatively larger in size than adult deer ticks. The following table provides approximate sizes of unfed deer and dog ticks.

Deer Tick Size	Stage	Dog Tick Size
3-4mm	Adult Female	5-6mm
2-3mm	Adult Male	5-6mm
1-2mm	Nymph	1-2mm
<1mm	Larva	<1mm

Habitat

Deer ticks are more commonly found in wooded and forested areas containing leaf litter that provides them with a moist habitat and animals to feed on.

American dog ticks are more commonly found in the tall grass and weeds that border roads and trails. They are also present where their hosts live including pastures, meadows, marshes, and the edges of lakes and streams.



Other Tips

- The mouth parts of a deer tick are longer than the mouth parts of a dog tick.
- Deer ticks have smoother backs than dog ticks.

If the Tick has Fed on a Person or Animal:

- The markings on the tick's back will still be visible (See Tip One).
- An adult female deer tick that has fed can grow up to approximately 10mm long.
- An adult female dog tick that has fed can grow up to approximately 15mm long.

Picture above shows female adult deer ticks at various levels of engorgement. Moving clockwise starting from the smallest – 0hrs, 24hrs, 48hrs, 72hrs, >96hrs is the largest.

Dog ticks do not transmit Lyme disease. • Deer ticks can transmit Lyme disease.

Symptoms of Lyme Disease by Stage

Stage	Symptoms
Early Localized Lyme Disease **(Days to weeks following exposure)**	A typical sign of early localized Lyme disease is an expanding rash called erythema migrans (EM). It can occur at the site of the infected tick bite, usually in 7 to 14 days. The rash can appear as early as 3 days or as late as 30 days. It can persist up to 8 weeks. *Borrelia burgdorferi* can disseminate via the bloodstream to other body sites where bacterium provokes damage to body tissues. Most medical textbooks indicate the EM occurs in 70% to 80% of cases. The bull's eye occurs in 50% of those cases. Some recent studies, however, suggest that the bull's eye appearance occurs less frequently. The rash is not painful or pruritic, but it may be warm to the touch. In dark-skinned patients, the rash may appear more as a bruise. While variations of a rash are highly suggestive of Lyme disease, it is not absolutely pathognomonic of the disease. Variations can take the following forms: • solid lesions • blue-purple hues • crusted lesions • blistering • bull's eye appearance Some people may have minor symptoms. Therefore, it is best not to make a diagnosis based solely on the presence or absence of a bull's eye rash. Consider other signs and symptoms as part of your differential diagnosis of the disease, including: • low-grade fever • fatigue • headache • arthralgia
Early Disseminated Lyme Disease **(Weeks to months following exposure)**	If untreated, Borrelia burgdorferi, can disseminate via the bloodstream to other body sites where the bacterium provokes damage to body tissues. This stage of the disease can last up to several months. It can include the following symptoms: • fatigue and general weakness • neurological symptoms: ❍ cranial neuropathy ❍ meningitis ❍ motor and sensory radiculoneuropathy ❍ mononeuritis multiplex ❍ subtle cognitive difficulties ❍ encephalopathy ❍ radiculopathy • cutaneous symptoms (for example, multiple EM lesions) • cardiac symptoms: ❍ conduction abnormalities (for example, atrioventricular node block or orventricular node block) ❍ myocarditis ❍ pericarditis • other manifestations: ❍ conjunctivitis ❍ keratitis ❍ uveitis ❍ mild hepatitis ❍ splenomegaly
Late Disseminated Lyme Disease **(Months to years following exposure)**	If it remains untreated, late Lyme disease can last months or even years. Symptoms can be musculoskeletal: • asymetric oligoarticular arthritis (usually affects the knees) • chronic arthritis • transient, migratory arthritis and effusion in one or multiple joints • Baker's cyst If untreated, arthritis may recur in the same or different joints. Symptoms can also be neurological: • subacute mild encephalopathy affecting memory and concentration • an encephalomyelitis or leukoencephalopathy (rare) • chronic mild axonal polyneuropathy manifested as distal paresthesias or radicular pain (less common) Symptomatic infection of the heart is rare in Lyme disease cases. However, 3 sudden cardiac deaths associated with Lyme carditis were reported in the United States between 2012 and 2013.

Symptoms can occur in overlapping stages. Some people with Lyme disease may have no or minimal symptoms. Others may suffer severe symptoms.

Serological Testing for Lyme Disease Explained

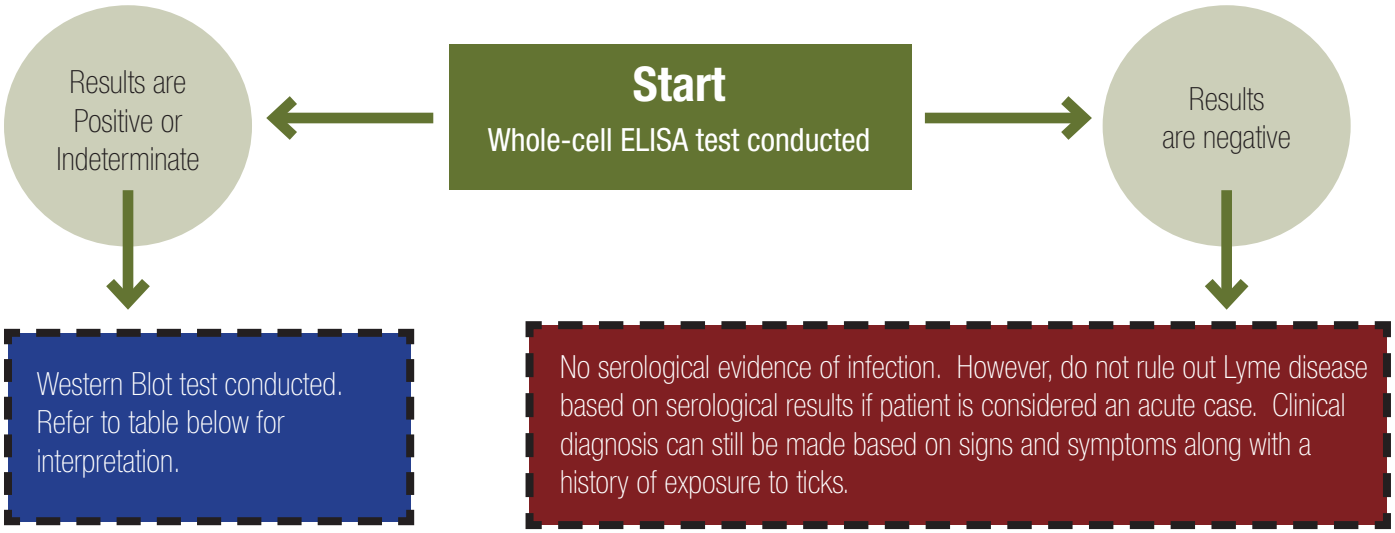
Currently, the Public Health Labs perform serological testing to detect antibodies against the Lyme disease causing agent *Borrelia burgdorferi*. Hence, part of the reliability of this test depends on the response of the patient's antibodies. In general, the immunoglobulin M (IgM) and immunoglobulin G (IgG) antibodies appear 2 to 4 weeks and 4 to 6 weeks, respectively, after the onset of erythema migrans. Serological testing prior to this time can result in false negatives.

Laboratory testing should only be used to supplement clinical findings, not as a basis for diagnosis for early Lyme disease.

"The sensitivity of serology assays is reported to be only 33-49% during the acute stage of disease. Patients with early stage lyme disease are primarily diagnosed based on clinical presentations compatible with lyme disease and epidemiological risk factors, as serological testing at this stage is disease is often negative." (Public Health Ontario, 2012)

The Two-tiered System of Serological Testing

Both ELISA and WB assays in two-tier system are considered complementary rather than independent tests to improve accuracy of the laboratory results.



Result	IgM Positive IgG Positive	IgM Positive IgG Negative	IgM Negative IgG Positive	IgM Negative IgG Negative
Interpretation	Confirmed case	Possible acute case or false positive	Possible previous exposure	No exposure

NOTES:

- In persons with illness over 1 month, only IgG testing should be performed (not IgM). A positive IgM test alone is not sufficient to diagnose current disease in these patients.
- Serological tests cannot be used to measure treatment response (they should not be done as a "test of cure").

See Serological Test Performance Concerns For Lyme Disease For More Information Regarding Serological Testing Accuracy Including False-Positive Results.

Serological Test Performance Concerns for Lyme Disease

Early Lyme disease is primarily a clinical diagnosis where two-tiered serological testing should be used to support, rather than supersede, the physician's judgment.

Controversies in Laboratory Testing

Some private labs in the U.S. offer testing for Lyme using methods that are not validated and their results must be interpreted with caution.

"*The results from laboratories that are not using validated tests can lead to misdiagnosis that can be harmful to patients, to the extent that appropriate diagnosis and treatment can be delayed or precluded.*" (Public Health Ontario, 2012)

For example,

- Private labs using unvalidated IgG and IgM Western Blot tests for Lyme disease will use a more limited number of bands in their determination of what constitutes a positive test.
- Private labs may place additional weight on specific bands that are not validated and peer-reviewed by the scientific community.

False Positives

ELISA tests are considered to have lower specificity and can produce false-positive results where it cross reacts with antibodies that are produced as a result of other infections including:

- Infections caused by other spirochetes (e.g. syphilis)
- Infections caused by certain viruses (e.g. cytomegalovirus, Epstein–Barr virus, Hepatitis B virus, Hepatitis C virus, Parvovirus)
- Infections caused by other bacteria
- Patients with autoimmune disorders
- Patients with inflammatory conditions

The Western Blot, especially IgM, can also yield false-positive results if not interpreted correctly in the context of clinical disease presentation. An IgM only reactive result in a patient with persisting non-specific symptoms for more than two months will most likely represent a false-positive result.

Performance Characteristics of Serological Assay in Patients with Lyme disease

(Adapted from Aguero-Rosenfeld)

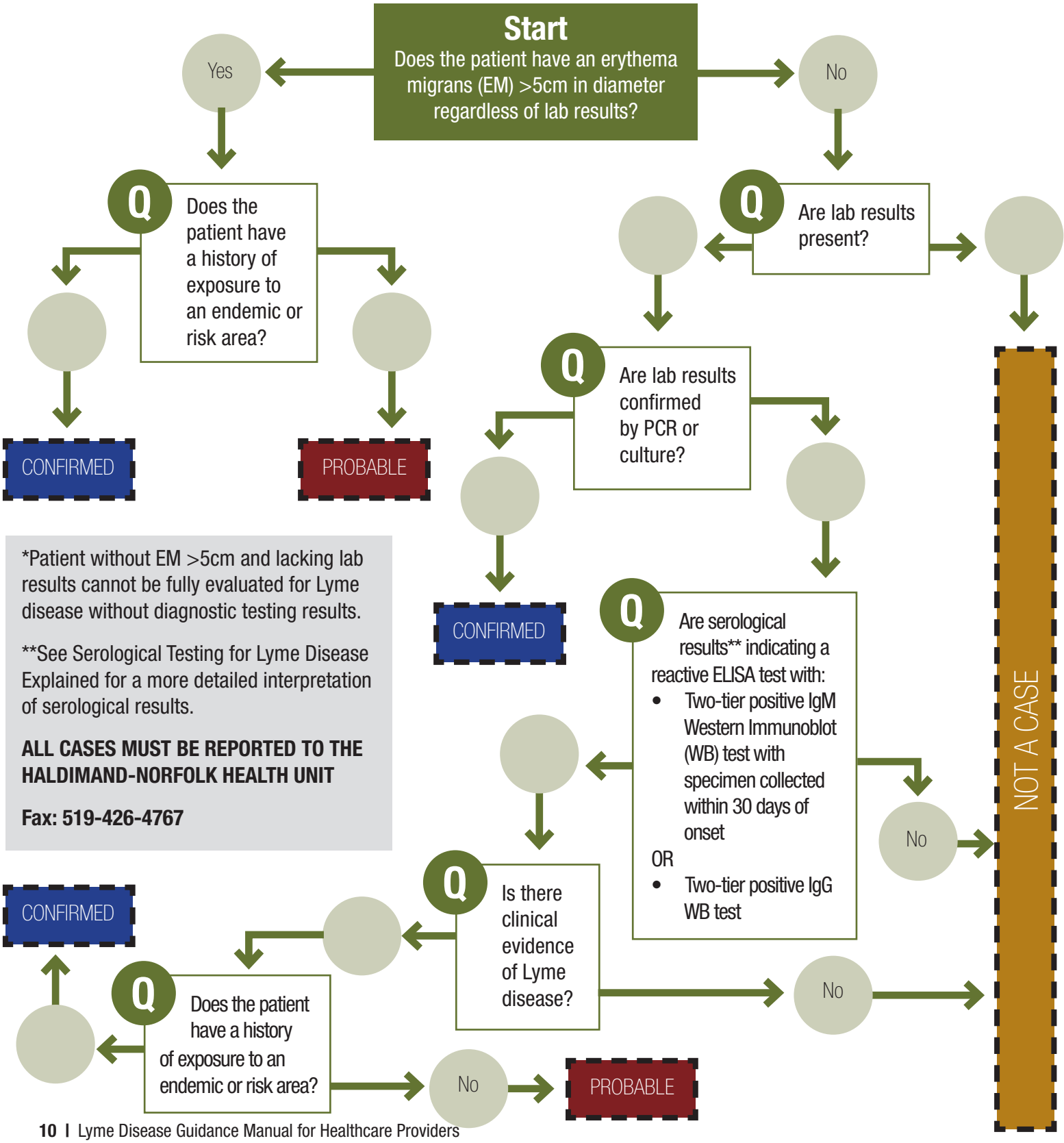
Public Health Labs in Ontario follow guidelines published by the Canadian Public Health Laboratory Network. These guidelines are consistent with guidelines published by other organizations including the Centre for Disease Control, Infectious Disease Society of America, British Infection Association, and the German Association of Hygiene and Microbiology.

(Public Health Ontario, 2012)

Percent Reactivity* in Patients with Lyme Disease				
Test	**EM, Acute**	**EM, Convalescent****	**Neurological Involvement**	**Arthritis**
Whole-Cell ELISA	33-49	75-86	79 (IgG only)	100 (IgG only)
IgM Western Blot	43-44	75-84	80	16
IgG Western Blot	0-13	15-21	64-72	96-100
Two-Tier Testing	29-40	28-78	87	97

*Percent reactivity refers to the frequency that the different serological assays will be positive depending on the stage of the Lyme disease infection. ** Sera obtained after antibiotic treatment.

Lyme disease Case Classification Algorithm



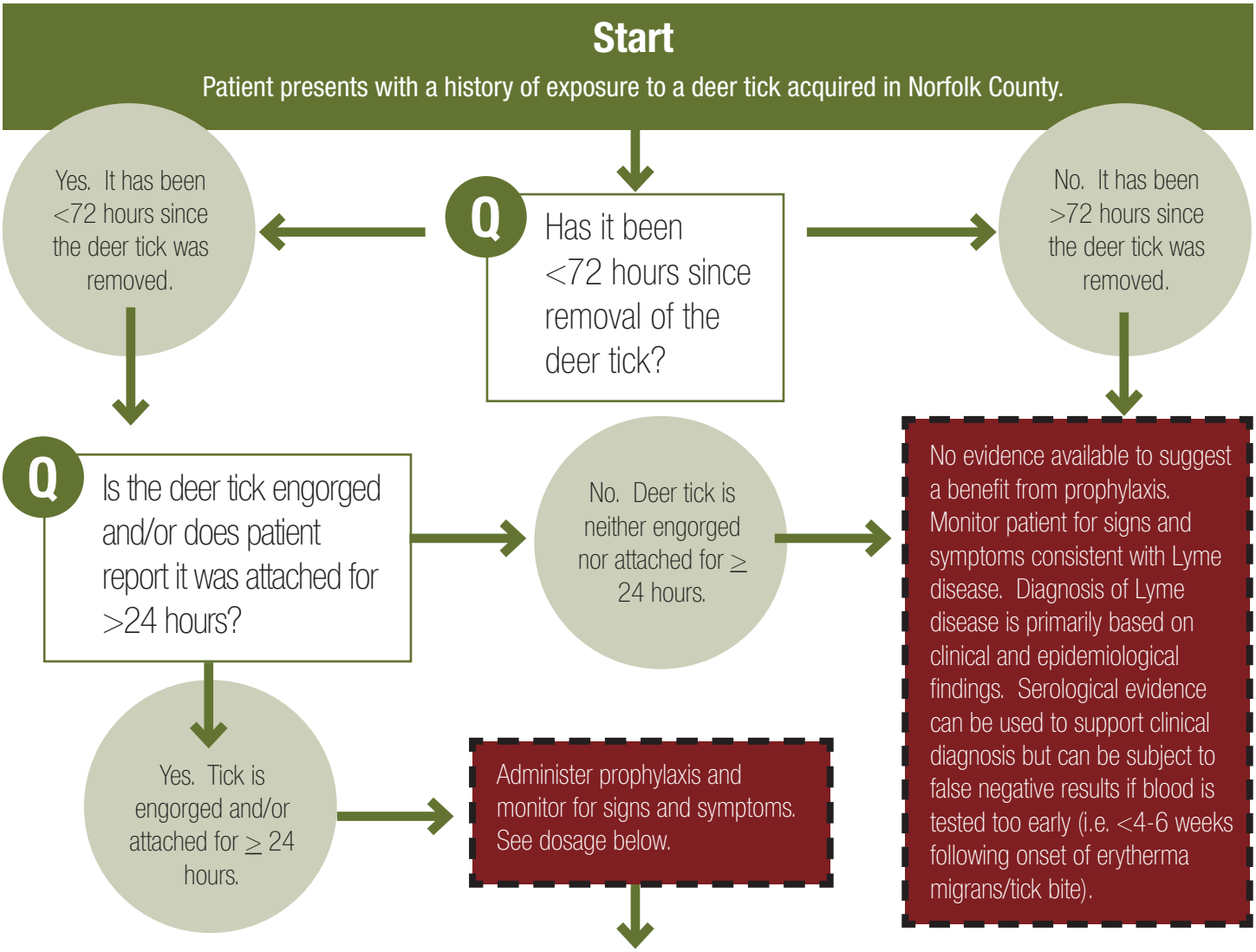
*Patient without EM >5cm and lacking lab results cannot be fully evaluated for Lyme disease without diagnostic testing results.

**See Serological Testing for Lyme Disease Explained for a more detailed interpretation of serological results.

ALL CASES MUST BE REPORTED TO THE HALDIMAND-NORFOLK HEALTH UNIT

Fax: 519-426-4767

Lyme Disease Prophylaxis Algorithm for Patients ≥ 8 Years Old Exposed to a Deer Tick from Norfolk County



Age	Recommended Prophylaxis	Contraindications
>12 years	Doxycycline, 200 mg po X 1	• Pregnancy • Lactation • Allergy or sensitivity to doxycycline
8-12 years*	Doxycycline, 4mg/kg (to a maximum of 200mg) po X 1	
<8 years	Prophylaxis is not recommended due to the absence of data for this age group "on an effective short-course regimen for prophylaxis, the likely need for a multiday regimen (and its associated adverse effects), the excellent efficacy of antibiotic treatment of Lyme disease if infection were to develop, and the extremely low risk that a person with a recognized bite will develop a serious complication of Lyme disease." (Wormser et al., 2006). If a healthcare provider would like to provide prophylaxis to this age group the dosage below can be used.**	

*Recommendation for prophylaxis in this age group is based on data from children ≥12 years old.
**Amoxicillin, 50 mg/kg per day in 3 divided doses (maximum 500 mg per dose) x 10 days in children without an allergy or sensitivity to amoxicillin

References
Warshafsky S, Lee DH, Francois LK, et al. Efficacy of antibiotic prophylaxis for the prevention of Lyme disease: An updated systematic review and meta-analysis. J Antimicrob Chemother 2010; 65: 1137-1144
Wormser GP, Dattwyler RJ, Shapiro ED, et al. The Clinical assessment, treatment, and prevention of Lyme disease, human granulocytic anaplasmosis, and babesiosis: Clinical practice guidelines by the Infectious Diseases Society of America. Clin Infect Dis 2006; 43:1089–134. 2.

Lyme Disease[1,2,3,4] Treatment Guidelines* (HNHU, 2015)

The treatment regimens listed below may need to be adjusted depending on the patient's:

- Age
- Medical history
- Underlying health conditions
- Pregnancy status
- Allergies

Doxycycline is contraindicated in children younger than 8 years of age and in women who are pregnant or lactating. Amoxicillin is the drug of choice for these groups.

Age Category	Line	Drug	Usual Dosage‡
Adults	First	Doxycycline[3,5]	100 mg BID
		Amoxicillin	500mg TID
	Second	Cefuroxime-AX	500 mg BID
	Third	Ceftriaxone IV	2 g q24h
		Cefotaxime IV	2 g q8h
		Penicillin G IV	3-4 million units q4h
Children	First	Amoxicillin	50 mg/kg/day divided q8h
	Second	Cefuroxime-AX	30 mg/kg/day divided q12h
		Doxycycline[3,5]	2-4 mg/kg/day divided q12h
	Third	Ceftriaxone IV	75-100 mg/kg/day divided q24h
		Cefotaxime IV	100-180 mg/kg/day divided q6-8h
		Penicillin G IV	200,000-400,000 U/kg/day divided q4h

Patients unable to tolerate the drugs above can be prescribed one of the following macrolides (although they have lower efficacy):

- azithromycin
- clarithromycin
- erythromycin

Patients treated with one of these macrolides should be closely monitored to ensure their symptoms are resolved.

*Adapted from: Anti-infective guidelines for community-acquired infections (Anti-infective Review Panel 2013) and Information for Health Professionals on Lyme disease (Public Health Agency of Canada, 2015)
‡Common oral dosage ranges are provided unless otherwise stated, Consult the drug monograph for details on age and condition-specific drug.

1. Adapted from the ISDA Practice Guidelines for the Treatment of Lyme Disease (Wormser 2006).
2. Reportable to the local Medical Officer of Health. Humans can contract Lyme disease without visiting endemic or high risk areas; it should not be excluded from differential diagnosis based on geographic location unless the location is sufficiently northern to preclude migratory birds from dropping their ticks in the area (PHAC 2008). Expansion of the geographic range of the tick vector in Canada is leading to increasing numbers of endemic areas for Lyme disease (Ogden 2009).
3. Usual duration of therapy is 14-21 days. In patients with early localized disease, 10 days of doxycycline treatment has proven effective for erythema migrans/early localized stage of disease and where there is disseminated cardiac involvement (Wormser 2006). For patients who have had improvement during or after a course of oral antibiotics but who have persistent or recurrent joint swelling, a second four week course of oral antibiotics is recommended (Halperin 2009). Prolonged courses of antibiotics provide no additional benefits and should be discouraged (Fallon 2008; Klemper 2001; Krupp 2003; Sider 2012; Wormser 2007). There is no definitive evidence that persistent symptoms represent ongoing infection, however, research continues into the causes of these persistent symptoms and methods of treatment (PHAC 2015). Post-infectious inflammation due to damage from the infectious process may respond to anti-inflammatory drugs (PHAC 2015).
4. Lyme disease must be considered whenever neurologic disease occurs in association with significant constitutional or extraneural features. Neurologic involvement occurs in 10-40% of symptomatic infections and occurs at all stages of infection. Patients with early local disease may experience mild headache, stiff neck, fatigue and myalgias. The dissemination stage is associated with certain neurologic syndromes that tend to improve spontaneously after several weeks to months without treatment. Cases have been documented in all regions of Ontario. Serologic testing to diagnose Lyme disease is a source of controversy since specific antibodies may not be detectable until four to six weeks after the initial infection. One should not complete the test in the absence of good epidemiological evidence of infection (PHAC 2008).
5. The use of tetracyclines in children under 9 years of age and pregnant women is not generally recommended.
6. Parental therapy (generally 14-28 days) should be considered in patients with acute neurological disease (meningitis or radiculopathy), 3rd degree heart block, CNS or peripheral nervous system disease in late Lyme disease, and in case of recurrent arthritis after oral regimens of 1-2 months have been used.

REFERENCES: Baker 2010; Fallon 2008; Halperin 2007; Hengge 2003; Klempner 2001; Krupp 2003; Lantos 2010; Ogden 2009; PHAC 2008 and 2015; Wormser 2006.

Tick Habitat Tips

- Tick season usually runs throughout spring, summer and fall depending on the weather. A warmer winter can increase tick survival rates and thus, increase the tick population.
- Deer ticks are more commonly found in wooded areas containing leaf litter. By comparison, the American dog tick is more commonly found in tall grasses and weeds that border roads and trails.
- Ticks prefer a humid climate, however, you are less likely to encounter them in sunny areas during hot afternoon temperatures in the summer.
- Leaf litter creates ideal conditions (namely humidity) for ticks to live in. Removing leaf litter will help reduce tick habitat.
- An ideal habitat for mice (e.g. wood piles, cluttered sheds) can create a feeding ground for ticks. Positioning wood piles away from your home and high traffic areas as well as removing clutter from structures neighbouring the home can help prevent tick exposures.
- Stick to the middle of pathways when walking or biking through tick habitat. Pathways should be well maintained so that people can avoid contact with vegetation like tall grass and shrubs where ticks will wait to climb onto passers-by.
- Ensure pets are protected from tick exposures. Consult a veterinarian to discuss preventative treatment options. Limiting your pet's access to tick habitat on your property and when taking them outdoors (e.g. walking your dog) can help avoid tick exposures. Pets can also bring ticks into the home with them.
- Ticks can travel by attaching themselves to birds. Song birds have been found to be an ideal transport vehicle for ticks. Consider relocating bird feeders to lower traffic areas and ensure they are maintained to avoid attracting other wildlife that ticks can feed on (e.g. mice, deer).
- Maintained lawns are NOT a likely source of ticks. Keep your lawn short (<16cm).
- A 3 foot wide barrier of wood chips or gravel between lawns and wooded areas and around patios and play equipment can help restrict tick migration into recreational areas.
- Tables, swing sets, play equipment, etc. should be located away from woods, shrubs and tall grass. Place in a sunny location, if possible.
- Consider using a professional pesticide company to apply pesticides (e.g. acaricides) at your home.

Personal Avoidance Tips

- Don't walk barelegged in tall grass, wooded areas or marshlands.
- Try to stay in the centre of a cleared trail to avoid contact with overgrown grass, brush, and leaf litter.
- Wear long sleeves, slacks and fully-closed boots or shoes when walking in grassy or wooded areas.
- Conduct a "tick check" on yourself, your family and your pets after exposure to tick habitat.
- Wear light-coloured clothing to make the ticks easier to find.
- Insect repellents containing 20 to 30% DEET (N, N-diethyl-meta-toluamide) are useful and can be sprayed onto clothing, especially pants and socks. Please read the instructions when using any repellents, in particular when using them on young children. For safety tips on using personal insect repellents containing DEET, visit Health Canada's website.