Notification Timeline:

From Lab/Practitioner to Public Health: Within 48 hours.
From Public Health to Ministry of Health: Within 2 weeks.

Public Health Follow-up Timeline: Within 72 hours.

Public Health Purpose for Notification of Lyme Disease (adapted from Public Health Ontario, 2016)

- To track trends of the epidemiology of Lyme disease in Saskatchewan including risk factors and geographic distribution;
- To inform the public and health care provider community about this emerging disease and how to prevent it;
- To identify locations where increased transmission of Lyme disease may be occurring in order to inform other interventions.

Surveillance Case Definition[1] (adapted from US Centers for Disease Control and Prevention, 2017)

Saskatchewan's Ministry of Health has adapted surveillance case definitions from US Centers for Disease Control and Prevention for surveillance of Lyme disease. The provincial case definitions will facilitate identification of Lyme disease acquired in Saskatchewan from:

1) adventitious infected black-legged ticks originating in the United States that are dropped by migrating birds; and
2) undetected reproducing infected black-legged ticks .

These case definitions acknowledge that Lyme disease is an emerging concern in this province. The Ministry is committed to surveillance of black-legged ticks in the province but this surveillance will never be exhaustive.

[1] Surveillance case definitions ensure uniform reporting to allow comparability of surveillance data and support public health investigation and management. The definition is not intended to be used for clinical or laboratory diagnosis or management of patients.

Confirmed Case	Clinical evidence of illness with laboratory confirmation by one of the following methods: • isolation of *Borrelia burgdorferi* from an appropriate clinical specimen **OR** • detection of *B. burgdorferi* DNA by PCR in synovial fluid, cerebrospinal fluid, erythema migrans tissue biopsies or blood. **OR** Clinical evidence of illness with: • a history of a tick exposure[a] **OR** history of residence in or visit to a risk area **AND** • laboratory evidence of infection: o positive serologic test results using the two-tiered approach (ELISA followed by an immunoblot assay; e.g. Western Blot or line blot).[2]
Probable Case	Clinical evidence of illness without a history of exposure and with laboratory evidence of infection: • positive serologic test results using the two-tiered approach (ELISA followed by an immunoblot assay; e.g. Western Blot or line blot). **OR** Clinician-observed erythema migrans without laboratory evidence and one or more of the following: • history of tick exposurea; • residence in a risk area; • visit to a risk area
Suspect Case	Erythema migrans rash without history of residence in or travel to a risk area and treatment with antibiotics prior to lab test confirmation. NOTE: Visual documentation (digital photo) of the erythema migrans rash may be useful in supporting this diagnosis.
[a] Tick exposure: having been (less than or equal to 30 days before onset of EM) in wooded, brushy, or grassy areas (i.e. potential tick habitats) of Lyme disease vectors. A detailed travel history is needed since infected ticks are not uniformly distributed. History of a tick bite is not required.	

[2] See guidelines of the Canadian Public Health Laboratory Network at: https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2014-40/ccdr-volume-40-11-may-29-2014/ccdr-volume-40-11-may-29-2014-1.html

Epidemiology and Occurrence

Lyme disease is a well-established tick-borne disease in many areas of North America and Europe. The risk of acquiring it increases in areas where the *Ixodes* species that carry *Borrelia burgdorferi* have become established. The range of Ixodes scapularis (black-legged tick) has expanded significantly in Canada and the United States, resulting in an increase in the potential for acquiring Lyme disease. The Public Health Agency of Canada has defined a risk area[3] in Canada as a locality in which there is evidence for the occurrence of reproducing populations of known tick vector species (particularly *Ixodes scapularis* and *I. pacificus*) and the likely transmission of *B. burgdorferi* (Public Health Agency of Canada, 2016).

In Saskatchewan, there are **no known** reproducing populations of black-legged ticks at this time. However, each year adventitious black-legged ticks are found in the province, most likely carried by migratory birds. Since 2008, eight of these ticks have tested positive for *B. burgdorferi*. Primary care providers regularly submit hundreds of blood specimens to the Roy Romanow Provincial Laboratory for testing (**Table 1**). Each year the number of tests increases (Figure 1 - Geographic distribution of black-legged ticks in Saskatchewan 2008–2017). In Saskatchewan, the risk of acquiring Lyme disease or other tick borne infections is low, but not zero.

The known locations of Lyme disease risk areas are available at:

- In Canada - Please refer to provincial risk maps if available, if not refer to the map at this link: https://www.canada.ca/en/public-health/services/diseases/lyme-disease/risk-lyme-disease.html#a3
- In US - https://www.cdc.gov/ticks/geographic_distribution.html
- In Europe (vector is Ixodes ricinus) - https://ecdc.europa.eu/en/disease-vectors/surveillance-and-disease-data/tick-maps
- Elsewhere - https://wwwnc.cdc.gov/travel/destinations/list

[3] A risk area in Canada is determined by one of the following methods:

i) active field surveillance involving capture of wild rodent reservoirs as well as drag sampling on multiple occasions to ensure that ticks have become established (as evidenced by demonstration of all three feeding stages of the tick over more than one year) and that *B. burgdorferi* is being transmitted (as evidenced by molecular detection or culture of ticks or rodent samples);
ii) active field surveillance involving only drag sampling for ticks;
iii) evidence from passive tick surveillance when using field-validated methods of analysis of these data to improve their specificity in detecting tick populations (these may include high numbers of submitted ticks, immature ticks and multiple ticks found feeding on humans or animals);
iv) field-validated signals from human case surveillance; or
v) field-validated ecological/niche models that predict risk.

Table 1: Ticks, human cases and blood samples tested in Saskatchewan by year (2008-2017)

Year	Ticks			Human		
				Cases		Blood specimens Tested
	Ticks (all species)	Black-legged ticks	Black-legged ticks positive for *Borrelia burgdorferi*[1]	Canada	SK	
2008	N/A	5	0	N/A	0	N/A
2009	1,478	5	1	144	0	543
2010	1,139	3	0	143	0	801
2011	736	3	1	266	1[3]	599
2012	2,896	1	0	338	0	850
2013	1,726	10	1	682	1[3]	811
2014	3,176	5	0	522	0	1,174
2015	5,103	9	1	917	0	1,311
2016	5,300	9	0	987	1[3]	1,428
2017	5,112[2]	15[2]	4	N/A	4[3]	1,639[4]
Total	**26,666**	**65**	**8**	**3,853[5]**	**7**	**9,156[5]**

Sources: Public Health Agency of Canada and the Roy Romanow Provincial Laboratory
Notes:
[1] *Borrelia burgdorferi* is the agent that causes Lyme disease.
[2] Number of ticks collected to November 5, 2017.
[3] 2011 case possibly locally acquired but associated with travel; 2013 and 2016 cases linked to travel outside the province; in 2017, one case acquired locally and three cases linked to travel outside the province.
[4] Testing increased by 202 per cent from 2009 to 2017.
[5] Canadian cases include both probable and confirmed cases; Saskatchewan cases are confirmed cases only.

Additional Background Information

Causative Agent

Borrelia burgdorferi, a tick-borne spirochete (Heymann, 2015).

Symptoms

Lyme disease is a multisystem inflammatory disease that generally manifests in three stages: early localized, early disseminated, and late disease.

Symptoms of early or late disseminated Lyme disease are described in the 2006 clinical practice guidelines of the Infectious Diseases Society of America (Wormser, 2006).

Objective evidence of Lyme disease includes the following when an alternative explanation is not found:

Lyme disease has three stages if left untreated:

i) Early localized Lyme disease characterised by a red rash called erythema migrans (EM) that spreads from the site of the tick bite (as described below);

ii) Early disseminated Lyme disease characterised by one of the following:
- multiple EM rashes;
- neurological (facial paralysis or meningitis-like) manifestations;
- heart problems (palpitations caused by heart block) which may last several weeks to months; and

iii) Late disseminated Lyme disease which is most commonly characterized by intermittent arthritis that may last months to over a year.

Erythema migrans: a round or oval expanding erythematous area of the skin greater than 5 cm in diameter and enlarging slowly over a period of several days to weeks. It appears 7-14 days (range 3-30 days) after infection and persists for up to eight weeks. Some lesions are uniform in redness while others have a prominent central clearing or a distinctive target-like appearance. On the lower extremities, the lesion may be partially purpuric. Signs of acute or chronic inflammation are not prominent. There is usually little pain, itching, swelling, scaling, exudation or crusting, erosion or ulceration, except that some inflammation associated with the tick bite itself may be present at the very centre of the lesion.

Note: An erythematous skin lesion present while a tick vector is still attached or that has developed within 48 hours of detachment is most likely a tick bite hypersensitivity reaction (i.e., a non-infectious process), rather than erythema migrans. Tick bite hypersensitivity reactions are usually < 5 cm in largest diameter, sometimes have an urticarial appearance and typically begin to disappear within 24-48 hours.

Complications

Post-Treatment Lyme Disease Syndrome

A small percentage of patients complain of pain, neurocognitive, or fatigue symptoms for months or years afterwards, despite resolution of the objective manifestations of the initial infection with antibiotic therapy (Steere, 2012). Indistinguishable from chronic fatigue syndrome or fibromyalgia, these patients tend to have more generalized or disabling symptoms: marked fatigue, severe headache, diffuse musculoskeletal pain, multiple symmetric tender points in characteristic locations, pain and stiffness in many joints, diffuse paresthesias, difficulty with concentration, or sleep disturbance. Patients with these conditions lack evidence of joint inflammation; they have normal neurologic test results; and they usually have a greater degree of anxiety and depression.

At the present time there is no evidence that persistent subjective symptoms after recommended courses of antibiotic therapy for Lyme disease are caused by active *B. burgdorferi* infection (Steere, 2012). Most medical experts believe that the lingering symptoms are the result of residual damage to tissues and the immune system that occurred during the infection.

Reservoir/Source

The survival and spread of *B. burgdorferi* depends on the availability of a suitable tick vector as ticks and their hosts are the primary means by which the bacteria can move from one habitat to another. Two species of ixodid ticks act as the primary reservoirs for Lyme disease in Canada: *Ixodes scapularis* (blacklegged tick) in eastern and central North America and *Ixodes pacificus* (western blacklegged tick) west of the Rocky Mountains (Ogden, 2009).

Movement of the bacteria into new geographic areas requires the presence of suitable habitat (Public Health Agency of Canada, 2008), vectors and hosts (larval and nymphal stages feed on small mammals, adult ticks feed primarily on deer), and climate (Heymann, 2015). Infected hosts can move the disease into areas with uninfected vectors and vice versa. Refer to Surveillance for approaches for monitoring for black-legged ticks in Saskatchewan.

Mode of Transmission

Infection is transmitted most often through the bite of infected nymphs and adult ticks. Transmission does not occur between infected female ticks and their eggs.

Lyme disease is not transmitted person-to-person. Mother-to-baby transmission of Lyme disease is possible in theory, but the risk appears to be very low (National Institute for Health and Care Excellence, 2018)

Incubation Period
The incubation period from infection to onset of EM is typically 7-14 days, but may be as short as three days and as long as 30 days (Heymann, 2015).

Period of Communicability
Not applicable as there is no evidence of natural transmission from person-to-person. The *B. burgdorferi* spirochete survives in stored blood so transfusion-associated transmission may be possible, though rare.

Specimen Collection and Transport
For details refer to the Roy Romanow Provincial Laboratory (RRPL) Newsletter[4] and RRPL Compendium of Tests at https://rrpl-testviewer.ehealthsask.ca/.

Public Health Investigation

I. Case

History

Classify case in consultation with the attending physician and the case definitions. Refer to Attachment – Lyme Disease Data Collection Worksheet to assist.

- Clinical manifestation and onset dates (presence or history of erythema migrans (EM)-like rash or other clinical symptoms) can help identify exposure timelines.
- Risk factors with consideration to incubation period and clinical stage of illness.
- Acquisition Risk factors include:
  - history of a tick bite or exposure to ticks (tick bites may not always be noticed);
  - travel to a known risk area;
  - residential exposure during property maintenance, recreation, and leisure activities in wooded, brushy, or grassy areas;
  - occupational exposure such as landscaping, brush clearing, forestry, and wildlife and parks management in wooded, brushy, or grassy areas;

[4] https://www.saskhealthauthority.ca/Services-Locations/RRPL/Documents/RRPL-Newsletter-Feb-2012.pdf#search=lyme%20disease

- recreational exposure such as hiking, camping, fishing, and hunting in wooded, brushy, or grassy areas; or
- outdoor dog or cat with exposure to wooded, brushy or grassy areas that shares bed or living space.

- Determine if risk of transmission exists.
- Transmission Risk factor includes history of donating blood/plasma/tissue.

Public Health Interventions

Education

- All cases should be provided disease information as well as information on prevention and control measures.

Referrals

- Complex cases require referral to an infectious disease (ID) or other specialist for case management.
- Canadian Blood Services is to be notified when a case has identified any history of receiving or donating blood or blood products. See Appendix K – Notification to Canadian Blood Services for the template form for making these referrals.

Treatment/Supportive Therapy

Treatment choices are governed by the most recent guidelines. The public health practitioner should direct any questions regarding the current treatment protocols to the physician or an infectious disease specialist. The Infectious Disease Society of America (IDSA) website provides additional information at http://www.idsociety.org/lyme/. or refer to the most current National Institute for Health and Care Excellence (NICE) Guidelines.

II. Contact

Contact Definition

Not applicable. Even though congenital infection occurs with other spirochetal infections, no causal relationship between maternal Lyme disease and abnormalities of pregnancy or congenital disease has been documented conclusively (American Academy of Pediatrics, 2015; National Institute for Health and Care Excellence, 2018).

III. Environment

Ecological and environmental measures that can assist in the management of Lyme disease include habitat modification (clearing underbrush and grass mowing), host exclusion (deer fencing, removing wood piles for rodents) as well as both on and off-host measures (Rahn, 1993).
Personal protective measures continue to be important prevention measures.

IV. Epidemic Measures

Reinforce personal protective measures through education and risk communication.
Educate public about the vector, mode of transmission and identify tick-infested areas.

Prevention Measures

Refer to the Vector-borne and Zoonotic Diseases – Introduction and General Considerations section of the manual that highlights topics for client education and provides information on high-risk groups and activities. Refer to the Government of Saskatchewan website for general information on Lyme disease and prevention measures at http://www.saskatchewan.ca/residents/health/diseases-and-conditions/lyme-disease

Immunization

There is no vaccine currently available.

Education and Risk Communication

Public communication about measures individuals can take to reduce the risk of tick bites may be beneficial. Key preventative measures include:

Personal Protective Measures

- Avoid tick-infested areas such as scrub land, forest/grassland fringes, forest glades, wooded, brushy, or grassy areas.
- Stay on well-cleared trails and stay in the center of trails or paths.
- Wear long sleeved shirts and long pants tucked into socks or boots.
- Apply DEET - or Icaridin-based repellents (N, N-m-diethyl toluamide; hydroxyethyl isobutyl piperidine carboxylate) according to instructions.
- Insect repellents containing lemon eucalyptus oil, soybean oil, citronella **do not** provide protection from ticks.

- Find and remove ticks from your body.
  - Do a total body check after having been outdoors in wooded, brushy or grassy areas.
  - Bathe or shower as soon as possible after coming indoors (preferably within two hours) to wash off and more easily find ticks that are crawling on you.
  - Conduct a full-body tick check using a hand-held or full-length mirror to view all parts of your body. Parents should check their children for ticks under the arms, in and around the ears, inside the belly button, behind the knees, between the legs, groin area, around the waist, and especially in their hair.
- Examine gear and pets. Ticks can ride into the home on clothing and pets, and then attach to a person later; carefully examine pets, coats, and daypacks. Tumble clothes in a dryer on high heat for 10 minutes to kill remaining ticks (Centers for Disease Control and Prevention, 2018).

Tick Removal[5]

- If you find a tick attached to your skin:
  - Carefully remove it with fine-tipped tweezers and grasp the mouth of the tick as close to the skin as possible.
  - Pull slowly upward and out with a firm steady pressure.
  - Do not handle the tick with bare hands and be careful not to squeeze, crush or puncture the body after removal as this may also contain infectious fluids.
  - Removing ticks within 24-36 hours after the tick bite usually prevents infection.

Surveillance

Tick Surveillance

- The Saskatchewan Tick Surveillance Program monitors whether the black-legged tick is endemic or established in Saskatchewan to inform the risk assessment of acquiring Lyme disease (and other tick-borne diseases) in this province. Tick surveillance determines the distribution and level of establishment of black-legged tick populations, within an area. Tick surveillance is *passive* (examining ticks voluntarily submitted by the public) and *active* (targeted collection of ticks through surveys in their natural habitat). Both methods are useful for monitoring changes in the risk of Lyme disease.

[5] https://www.canada.ca/en/public-health/services/diseases/lyme-disease/removing-submitting-ticks-testing.html

- Black-legged ticks submitted or collected are tested for *Borrelia burgdorferi* (the agent that causes Lyme disease)*, Anaplasma phagocytophilum* (the agent that causes human granulocytic anaplasmosis), and, as of 2013*, Babesia microti* (the agent that causes babesiosis), *Borrelia miyamotoi (*the agent that causes relapsing fever), and *Borrelia mayonii,* a newly described organism that can cause Lyme disease.
- Monitoring for black-legged ticks and the prevalence of infection with *Borrelia* or other bacteria allows Public Health to assess the risk of human exposure to infected ticks in a given area. The status of blacklegged tick populations in an area is classified as:
  - Established – field surveillance suggests that reproducing populations occur. This could consist of all tick life stages (larvae, nymphs and adults) found in one or more calendar years, *B. burgdorferi* or *A. phagocytophilum* infections are detected in resident reservoir hosts such as mice or squirrels or a succession of different tick cohorts is observed (i.e. collection of annual cohorts of ticks, specifically adult ticks from two different cohorts)[6].
  - Adventitious – ticks are found only sporadically, both in time and space, and usually only a single stage of tick (i.e. adult females) is present. These ticks are carried into the area from another location in Canada or the United States by a migratory bird or other animal.
  - Not Present – ticks have not been found in an area.
- Habitat suitability - The habitat suitability for establishment of the black-legged tick has been mapped in Saskatchewan. The map integrates various layers of data such as temperature, relative humidity, woodland habitat and other factors such as deer density and this information has been used to produce a risk map for Saskatchewan. Data from this project have identified areas of low to high potential (risk index 0-5) for the black-legged tick to be present and this has helped to further guide tick surveillance efforts in the province. Of the 64.6 million hectares of habitat classified, 106,049 have been classified as having a high-risk potential for establishment of *I. scapularis*. (Refer to Figure 2 – Potential Risk Areas for Black-legged Tick Establishment in Saskatchewan – Low to High Potential Risk)
- See the Lyme Disease page for detailed information: http://www.saskatchewan.ca/residents/health/diseases-and-conditions/lyme-disease

[6] Ogden NH, Koffi JK, Lindsay LR . Assessment of a screening test to identify Lyme disease risk. Can Comm Dis Rep 2014 40, 83-87

Figure 1. Geographic distribution of black-legged ticks in Saskatchewan 2008-2017.

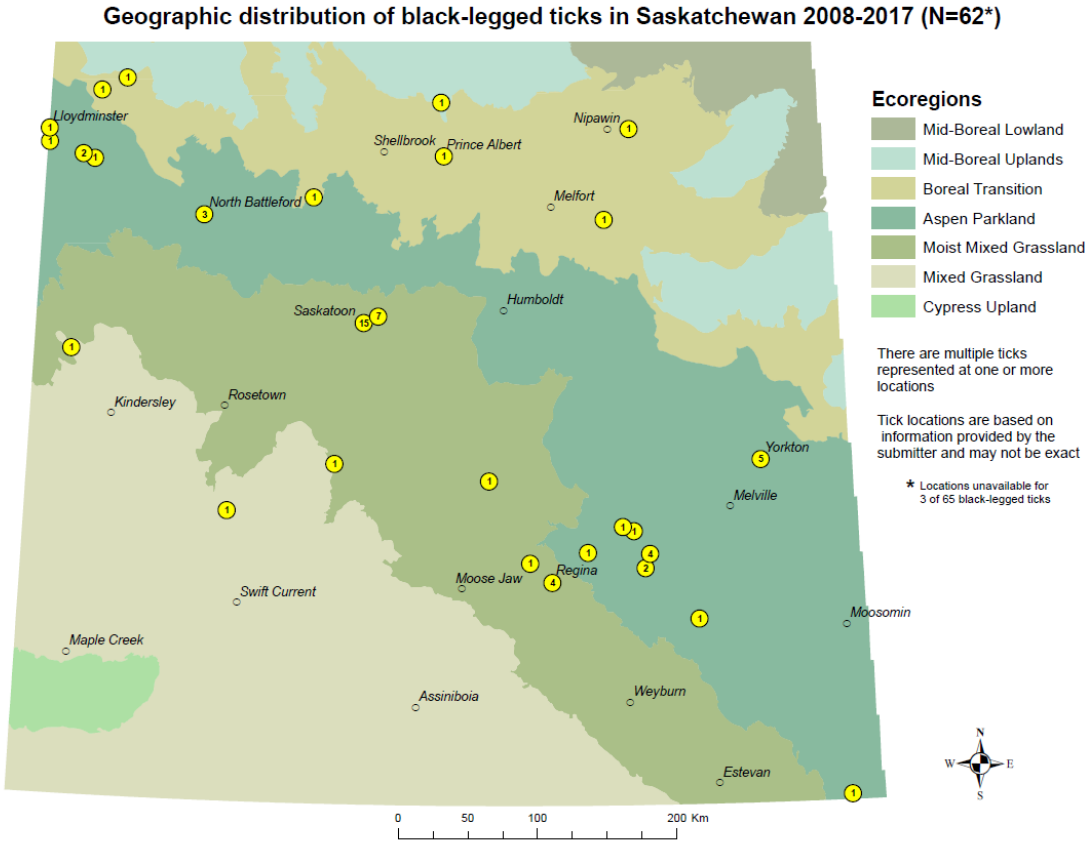
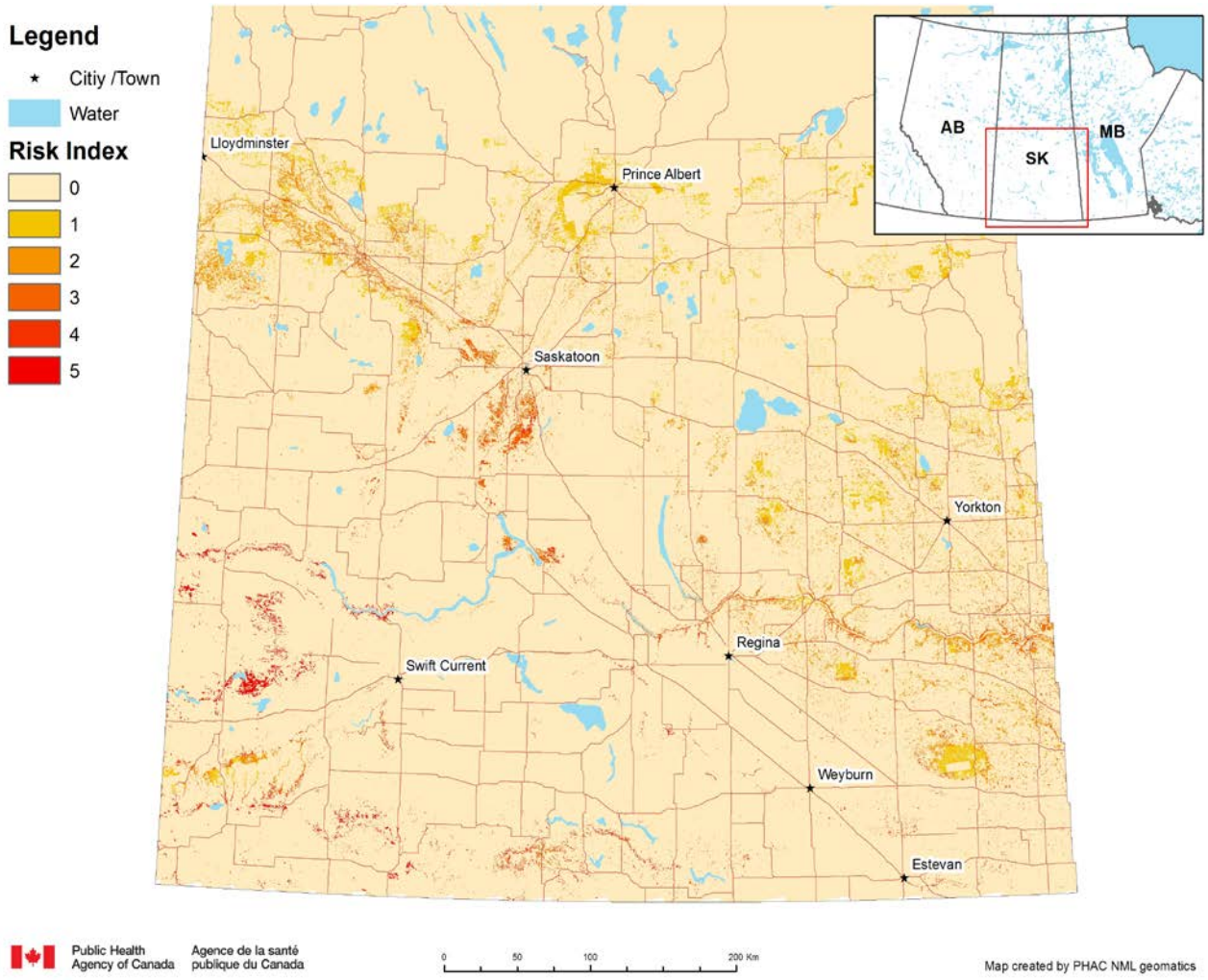


Figure 2: Potential Risk Areas for Black-legged Tick Establishment in Saskatchewan – Low to High Potential Risk (Risk Index 0 – 5)



Revisions

Date	Change
May-September 2018	• Reorganized chapter and applied new format. • Incorporated Public Health Purpose of Notification. • Updated case definition based on adaptation of CDC 2017 definition. • Added **Epidemiology and Occurrence** section. • Updated the information on Risk Areas. • Aligned with Panorama configuration. • Incorporated reference to National Institute for Health and Care Excellence (2018)

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Government of Saskatchewan

Lyme disease Data Collection Worksheet

PANORAMA

Panorama QA complete: ☐ **Yes** ☐ **No**
Initials:

Please complete **all** sections.

Panorama Client ID: _____
Panorama Investigation ID: _____

A) CLIENT INFORMATION

LHN -> SUBJECT -> CLIENT DETAILS -> PERSONAL INFORMATION

Last Name:	First Name: and Middle Name:	Alternate Name (Goes by):
DOB: YYYY / MM / DD Age: _____	Health Card Province: _____ Health Card Number (PHN): _____	Preferred Communication Method: (specify - i.e. home phone, text): Email Address: ☐ Work ☐ Personal
Phone #: ☐ Primary Home: ☐ Mobile contact: ☐ Workplace:		
Place of Employment/School:	Gender: ☐ Male ☐ Female ☐ Other ☐ Unknown	
Alternate Contact: _____ Relationship: _____ Alt. Contact phone: _____	Address Type: ☐ No fixed ☐ Postal Address ☐ Primary Home ☐ Temporary ☐ Legal Land Description Mailing (Postal address): Street Address or FN Community (Primary Home):	

B) INVESTIGATION INFORMATION

LHN-> SUBJECT SUMMARY-> ZOONOTIC & VEVTORBORNE ENCOUNTER GROUP-> CREATE INVESTIGATION

Disease Summary Classification: CASE:	**Date**			**LAB TEST INFORMATION:**
☐ Confirmed	YYYY / MM / DD	☐ Does Not Meet Case Definition	YYYY / MM / DD	Date specimen collected: YYYY / MM / DD
☐ Probable	YYYY / MM / DD	☐ Suspect	YYYY / MM / DD	
☐ Person Under Investigation	YYYY / MM / DD			

Disposition:
FOLLOW UP:

☐ In progress	YYYY / MM / DD	☐ Complete	YYYY / MM / DD
☐ Incomplete - Declined	YYYY / MM / DD	☐ Not required	YYYY / MM / DD
☐ Incomplete – Lost contact	YYYY / MM / DD	☐ Referred – Out of province	YYYY / MM / DD
☐ Incomplete – Unable to locate	YYYY / MM / DD	(Specify where)	YYYY / MM / DD

REPORTING NOTIFICATION Name of Attending Physician or Nurse**:**	Location:
Provider's Phone number:	Date Received (Public Health): YYYY / MM / DD
Type of Reporting Source: ☐ Health Care Facility ☐ Lab Report ☐ Nurse Practitioner ☐ Physician ☐ Other_____	

C) DISEASE EVENT HISTORY

LHN-> INVESTIGATION-> DISEASE SUMMARY (UPDATE)-> DISEASE EVENT HISTORY

Staging: ☐ Early disseminated ☐ Early localized ☐ Late disseminated ☐ Unknown

Lyme disease Data Collection Worksheet

Please complete **all** sections.

Panorama Client ID: _____
Panorama Investigation ID: _____

D) SIGNS & SYMPTOMS (*bold are part of confirmed case definition*)

LHN-> INVESTIGATION-> SIGNS & SYMPTOMS

Description	No	Yes – Date of onset	Description	No	Yes - Date of onset
Arthralgia		YYYY / MM / DD	**Meningitis - lymphocytic**		YYYY / MM / DD
Arthritis		YYYY / MM / DD	**Meningitis-like manifestations**		YYYY / MM / DD
Cardiac - arrhythmia		YYYY / MM / DD	Myalgia (muscle pain)		YYYY / MM / DD
Cardiac - myopericarditis		YYYY / MM / DD	Neck stiffness (nuchal rigidity)		YYYY / MM / DD
Cardiac - palpitations		YYYY / MM / DD	**Confusion**		YYYY / MM / DD
Chills		YYYY / MM / DD	**Neurologic - memory loss or lapses**		YYYY / MM / DD
Dizziness		YYYY / MM / DD	**Neurologic - paresthesia (numbness)**		YYYY / MM / DD
Encephalomyelitis		YYYY / MM / DD	**Neuropathy - cranial (including motor and sensory palsies)**		YYYY / MM / DD
Encephalopathy		YYYY / MM / DD	Neuropathy - mononeuropathy multiplex		YYYY / MM / DD
Fever		YYYY / MM / DD	Neuropathy - peripheral (including motor and sensory palsies)		YYYY / MM / DD
Headache		YYYY / MM / DD	Neuropathy - radiculopathy		YYYY / MM / DD
History of tick bite		YYYY / MM / DD	Paralysis - facial		YYYY / MM / DD
Joint effusion		YYYY / MM / DD	**Rash - erythema migraines - single lesion (> 5 cm) at site of tick bite (Bull's eye)**		YYYY / MM / DD
Lethargy (fatigue, drowsiness, weakness, etc)		YYYY / MM / DD	**Rash - erythema migraines - multiple lesions**		YYYY / MM / DD
Lymphadenopathy		YYYY / MM / DD			YYYY / MM / DD

E) INCUBATION AND COMMUNICABILITY

INVESTIGATION->INCUBATION & COMMUNICABILITY

Incubation for Case (period for acquisition):

Earliest Possible Exposure Date: YYYY / MMM / DD

Latest Possible Exposure Date: YYYY / MMM / DD

Exposure Calculation details:

F) RISK FACTORS

LHN-> SUBJECT->RISK FACTORS

DESCRIPTION	YES	N – No NA – not asked U - Unknown	DESCRIPTION	YES	N – No NA – not asked U - Unknown
Behaviour - Lack of personal protective measures			**Travel** - Outside of Canada (Add'l Info)	YYYY/MM/DD AE	
Bite - Tick	YYYY/MM/DD		**Travel** - Outside of Saskatchewan, but within Canada (Add'l Info)	YYYY/MM/DD AE	
Tick - Infested area (Add'l Info)	YYYY/MM/DD		**Travel** - Within Saskatchewan (Add'l Info)	YYYY/MM/DD AE	

G) TREATMENT

LHN-> INVESTIGATION-> MEDICATIONS->MEDICATIONS SUMMARY

Medication *(Panorama = Other Meds) :* _____

Prescribed by:_____ Started on: YYYY / MM / DD

Lyme disease Data Collection Worksheet

Please complete **all** sections**.**

Panorama Client ID: _____
Panorama Investigation ID: _____

H) INTERVENTIONS

LHN-> INVESTIGATION->TREATMENT & INTERVENTIONS->INTERVENTION SUMMARY

Intervention Type and Sub Type:

General: Investigator name

☐ Disease-Info/Prev-Control YYYY/ MM / DD

☐ Disease-Info/Prev-Cont/Assess'd for Contacts YYYY/ MM / DD

Referrals: Investigator name

☐ Canadian Blood Services YYYY/MM/DD

☐ Infectious Disease Specialist YYYY/MM/DD

Education/counselling: Investigator name

☐ Prevention/Control measures YYYY/MM/DD

☐ Disease information provided YYYY/MM/DD

Other Investigation Findings:

☐ Investigator Notes ☐ Document Management

Date	Intervention subtype	Comments	Next follow-up Date	Initials
YYYY / MM / DD			YYYY / MM / DD	
YYYY / MM / DD			YYYY / MM / DD	
YYYY / MM / DD			YYYY / MM / DD	
YYYY / MM / DD			YYYY / MM / DD	
YYYY / MM / DD			YYYY / MM / DD	
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YYYY / MM / DD			YYYY / MM / DD	
YYYY / MM / DD			YYYY / MM / DD	

I) OUTCOMES (*optional except for severe influenza*

LHN-> INVESTIGATION->OUTCOMES

☐ Not yet recovered/recovering YYYY / MM / DD ☐ ICU/intensive medical care YYYY / MM / DD ☐ Hospitalization YYYY / MM / DD

☐ Recovered YYYY / MM / DD ☐ Intubation /ventilation YYYY / MM / DD ☐ Unknown YYYY / MM / DD

☐ Fatal YYYY / MM / DD ☐ Other _____ YYYY / MM / DD

Cause of Death: (if Fatal was selected) _____

Initial Report completed by:		**Date initial report completed:** YYYY / MM / DD

Two-tiered algorithm for the laboratory diagnosis of Lyme disease

The two-tiered approach to testing is illustrated in Figure 1.

1. The first tier involves the use of an EIA. If this EIA test is negative, WB testing is not indicated. If symptoms persist, the EIA test can be repeated on a convalescent sample collected 3-6 weeks later.
2. If the EIA is positive or equivocal, the second tier or corroborative Western blot assay is performed. In early infections (i.e. symptoms for less than six weeks), both the IgM and IgG Western blot tests are performed; however, if the patient has had symptoms for more than six weeks, only the IgG Western blot assay is performed.

The final result of serological testing is considered positive only when the EIA is reactive (positive or equivocal) and the WB is also positive (Table 3). This two-tiered system maximizes the sensitivity and specificity of the assays and increases the likelihood of observing a seroconversion (from IgM to IgG) that is evident in most bona fide *B. burgdorferi* infections

Figure 1. Two-tiered approach to testing Lyme

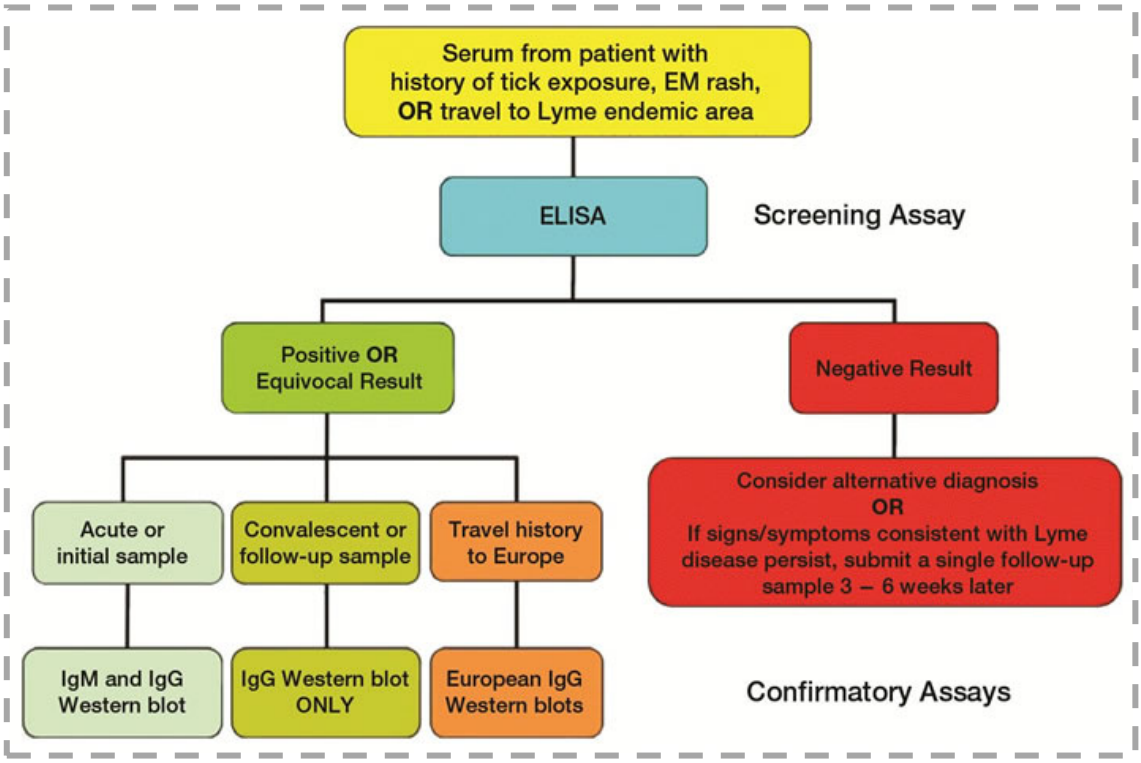

Table 1. Interpretation of Western blot result (in conjunction with an equivocal or positive EIA)

Western blot result	Interpretation
Both IgM and IgG Western blots negative	Result not consistent with a B. burgdorferi infection; however, if symptoms persist submit a follow-up sample 3-6 weeks later.
Only IgM Western blot positiveTable 3 Footnote*	Potentially a false-positive result if this is NOT an acute case (i.e. < 6 weeks post onset of symptoms).
Only IgG Western blot positiveTable 3 Footnote**	Result consistent with an infection with *B. burgdorferi* of greater than 4 weeks' duration.
Both IgM and IgG Western blots positive	Result indicates recent or previous infection with *B. burgdorferi* .
Note: IgM Line Blot is not performed if the sample tested positive by IgG Westernblot	

Source: Canadian Public Health Laboratory Network (retrieved September, 2018) from https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2014-40/ccdr-volume-40-11-may-29-2014/ccdr-volume-40-11-may-29-2014-1.html