Manitoba Annual Tick-Borne Disease Report

2016

January 1, 2016 to December 31, 2016

Communicable Disease Control

Active Living, Population and Public Health Branch

Active Living, Indigenous Relations, Population & Public Health Division

Manitoba Health, Seniors and Active Living

Released: December 2017

Manitoba

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Abbreviations

BLT	Blacklegged tick (*Ixodes scapularis*)
MHSAL	Manitoba Health, Seniors and Active Living
MIR	Minimum Infection Rate
NML	National Microbiology Laboratory
NNDSS	National Notifiable Disease Surveillance System
PHAC	*the* Public Health Agency of Canada
RHA	Regional Health Authority
TBD	Tick-borne disease(s)

Regional Health Authorities

Winnipeg RHA	Winnipeg Regional Health Authority[1]
Southern Health – Santé Sud	Southern Health – Santé Sud
Interlake-Eastern RHA	Interlake-Eastern Regional Health Authority
Prairie Mountain Health	Prairie Mountain Health
Northern RHA	Northern Regional Health Authority

---

[1] Note that reference to the Winnipeg RHA in this report does not include the community of Churchill. Rather reference to the Winnipeg RHA in this report refers only to the City of Winnipeg and the Rural Municipalities of East and West St Paul.

Acknowledgments

The *Manitoba Annual Tick-Borne Disease Report (2016)* is the result of the efforts of dedicated individuals throughout the province of Manitoba, including health care providers, laboratory personnel, central and regional public health employees (i.e. Medical Officers of Health, public health nurses, epidemiology & surveillance staff and seasonal field surveillance staff), external stakeholders (i.e. the Public Health Agency of Canada (PHAC) staff) and members of the public who have submitted blacklegged tick specimens.

The historical passive surveillance program (2008 – 2015) was a collaborative effort between Manitoba Health, Seniors and Active Living (MHSAL), PHAC and researchers and students at the University of Manitoba.

Let us know what you think. We appreciate your feedback! If you would like to comment on any aspect of this new report please send an email to: ticks@gov.mb.ca. Include '2016 *TBD report*' in the subject heading.

Executive Summary

The public health impact posed by tick-borne diseases (TBDs) such as Anaplasmosis, Babesiosis, and Lyme disease, continues to increase in Manitoba. This increase can largely be attributed to the continued range expansion of the vector, the blacklegged tick (*Ixodes scapularis*) throughout southern Manitoba. This rapid expansion has allowed for the establishment of populations in areas previously thought to be inhospitable for blacklegged ticks (BLT).

Since the identification of the first BLT risk area in 2006, the number and distribution of said risk areas has steadily increased. Risk areas now extend west from the Ontario border to the Brandon area and north from the United States of America (USA) border to Riding Mountain National Park. Coupled with an increasing distribution of risk areas, is a similar rise in infection rates among field collected BLT specimens. For instance, the minimum infection rate (MIR) for *Borrelia burgdorferi*, the causative agent of Lyme disease currently ranges between 16 and 22%, while the MIR for *Anaplasma phagocytophilum*, the causative agent of Anaplasmosis, ranges between 5 and 11% depending on surveillance data type (i.e. passive or active).

The burden of TBDs among Manitobans, most notably Anaplasmosis and Lyme disease continues to increase. Since becoming provincially reportable in 2015, a total of 21 Anaplasmosis cases have been reported to MHSAL. Moreover, more than 75% of these were reported in 2016, and all but two reported likely exposure within the province. Similarly, the number of confirmed and probable Lyme disease cases has increased 10-fold, from 5 in 2009 to 52 in 2016. Again, approximately 8 in 10 cases indicate likely local exposure. The risk of exposure to BLTs potentially infected with the agents of Anaplasmosis and Lyme disease remain highest in the Southern Health – Santé Sud, an area with a long history of established BLT populations and a greater number of BLT risk areas.

MHSAL continues to monitor the distribution and infection rates of BLTs to identify new risk areas and develop and refine guidance and communications for both health care professionals and the public. Further, MHSAL continues to work with public health colleagues provincially and nationally to assess the human burden of known and emerging TBDs.

What to Expect in This Report

The aim of this report is to summarize the burden posed by the three provincially reportable tick-borne diseases in Manitoba (Anaplasmosis, Babesiosis and Lyme disease), in a user-friendly manner that will allow the reader to quickly access the information. This *Manitoba Annual Tick-Borne Disease Report (2016)* will highlight recent tick and human surveillance data to illustrate the increasing impact posed by tick-borne diseases. It should be cautioned that the data presented in this report may differ from data presented on the MHSAL tick-borne disease website (www.gov.mb.ca/health/publichealth/cdc/tickborne/index.html). Any differences in the counts of human cases are likely due to the availability of new information (e.g. new laboratory results, or additional travel or clinical information) that may allow for subsequent reclassification (e.g. from a "probable" case to a "confirmed" case) or additional tick identification results, that may allow for changes to the BLT risk area map.

> The '**burden**' of disease refers to the number of people living with a disease. The more people that have a disease, the larger the '**burden**' on public health is.

What you will see in this report:

- Maps outlining the continued range expansion of BLTs in Manitoba,
- Maps and tables highlighting BLT surveillance efforts and detailing infection rates,
- Tables, figures and maps illustrating the human impact posed by tick-borne diseases,
- Text boxes that elaborate on key concepts and quickly highlight important surveillance findings.
- Supporting text to provide context to the data.

Note that the data presented in this report only addresses the three provincially reportable tick-borne diseases. MHSAL continues to work with various stakeholders, including PHAC, to monitor for emerging tick-borne diseases that may pose a public health burden. Should surveillance detect an increasing risk posed by other tick-borne diseases MHSAL may consider revising reporting procedures. For instance, in 2015, following increasing human and tick surveillance signals, Anaplasmsosis and Babesiosis were made provincially reportable under the *Public Health Act* (*Reporting of Diseases and Conditions Regulation* – Schedule B http://web2.gov.mb.ca/laws/regs/current/_pdf-regs.php?reg=37/2009). In addition, the most recent communication to physicians, issued in April 2017, highlighted *Borrelia miyamotoi* disease, a tick-borne infection that continues to be detected at low levels

in   locally   collected   tick   populations   (see
www.gov.mb.ca/health/publichealth/cdc/docs/hcp/2017/040717.pdf).

Blacklegged Ticks, Surveillance and Tick-Borne Diseases

Blacklegged tick biology

BLTs are parasitic animals which are related to spiders. BLTs cannot jump or fly. Instead, they seek hosts by climbing on vegetation such as grasses or shrubs and waiting for a host to rub against them. When this occurs, they climb onto the host's body and eventually attempt to attach and feed.

BLTs feed by attaching their mouth parts to the skin of an animal (including humans) and drinking blood very slowly over a period of days. A tick bite is generally painless. As ticks feed, their bodies expand to accommodate the blood meal. This is called engorgement. If a BLT is infected with a tick-borne disease causing agent, it can pass this infection along to its host during feeding.

Tick-borne diseases naturally circulate between BLTs and wild animals. Animals such as rodents, small mammals and white-tailed deer are the **reservoirs** (the source) of the tick-borne disease causing agents and the BLT is the **vector** (the vehicle) which moves the disease agents between animals. Most wild animals do not become ill from these agents, nor can you become infected with tick-borne diseases by consuming meat or handling the pelt from a wild animal. However, there is a risk for these ticks to transfer to you when handling the animal. Humans and some domestic animals are **accidental hosts** and may become ill when they are fed upon by an infected BLT and exposed to the disease causing agent.

> **Even if you are bitten by a BLT, it does not mean that it will transmit a disease to you.** First, not all BLTs are infected with disease causing agents. Second, only nymph and adult stages can transmit the agents of the three reportable TBDs (larvae can however play a role in the transmission of newly emerging *Borrelia miyamotoi*). And third, BLTs need time to prepare their bodies to significantly expand with blood and often do not start to feed for the first 24 hours after attaching themselves to a host. Because of this, BLTs typically need to be attached to a host for at least 24 hours in order to transmit the disease causing agents of Anaplasmosis, Babesiosis and Lyme disease. **This is why performing a tick check is so important.**

BLTs exist in three life stages: larva, nymph and adult. The life cycle of BLTs takes at least three years to complete and each stage usually survives for up to one year. Blood is

required by the tick to move to the next stage. Unfed larvae and nymphs are light in color and very difficult to see.

Passive Surveillance

> Passive surveillance is when health care providers, veterinarians, or members of the public send ticks to MHSAL, in order for the species to be identified. Suitable specimens are then tested for tick-borne diseases. Results of the passive surveillance program are used to identify locations for active surveillance.
>
> For information on how to submit ticks to the passive surveillance program, please visit www.gov.mb.ca/health/publichealth/cdc/tickborne/about.html.

The passive BLT surveillance program was formally launched in Manitoba in 1996 and continued until 2002, when stable submission numbers coupled with low and consistent infection rates led to its termination. The program was renewed in 2008 following an investigation into a cluster of human cases with common exposure history which identified the first established BLT population in the extreme southeast corner of the province in 2006. Between 2008 and the fall of 2015 the program was a collaborative effort between MHSAL, the University of Manitoba and PHAC. As of the fall of 2015 the program is now a sole collaboration between MHSAL and PHAC.

Data from the passive surveillance program provide invaluable information regarding the potential distribution of BLTs and their associated pathogens. Blacklegged tick specimens are submitted by health care providers, veterinarians and members of the public on a voluntary basis throughout the year. Suitable specimens are tested for *Anaplasma phagocytophilum*, *Babesia microti* (the causative agent of Babesiosis) and *Borrelia burgdorferi*[2] to determine and compare infection rates. Moreover data such as locations with multiple submissions and/or locations from which more than one specimen was submitted, are used to guide and prioritize the active surveillance program. Sites warranting active surveillance correspond to areas where the passive program has identified clusters and/ or high numbers of BLT submissions and/ or infection rates.

> Testing for additional emerging tick-borne pathogens such as *B. miyamotoi, B. mayonii* and Powassan virus is also conducted. However, as these pathogens are currently not reportable in Manitoba, the results are not considered in this report. MHSAL continues to work with PHAC to monitor the impact of emerging pathogens of public health importance.

---

[2] Note that the report refers primarily to *Borrelia burgdorferi* sensu stricto. Strains of the broader *B. burgdorferi* sensu lato complex can, and have, been detected in both tick and human (so long as there is a relevant travel history) specimens.

Active Surveillance

> Active surveillance is when MHSAL staff go out into the field to find BLTs in the environment. Active surveillance is necessary to identify risk areas.

Active surveillance is a vital component of the overall BLT surveillance program for two reasons. It is required to demonstrate evidence of BLTs in the environment, and circulation of TBDs within both BLTs and within the surveyed environment. The combination of this evidence allows an area to be designated as a BLT risk area.

> ### Criteria for identifying a BLT risk area
>
> A region will be classified as a risk area when active surveillance, conducted over 2km, detects a minimum of one BLT **provided** that the surveillance efforts were triggered by one of the following:
>
> 1) It represents an extension of a previously identified BLT risk area, **OR**
> 2) Positive passive surveillance results (i.e. multiple submissions and/ or multiple specimens in a submission), **OR**
> 3) A cluster of human cases with likely exposure within the area, **OR**
> 4) The area is in close proximity, **and** has suitable habitat to support establishment, of a known BLT risk area.

Identifying BLT risk areas is critical for risk assessment and risk communication, and is valuable for the classification of human cases. The risk of encountering BLTs, and any associated pathogens, is greater in BLT risk areas[3]. MHSAL recommends that visitors and residents of BLT risk areas adopt personal protective measures to minimize their risk of TBD transmission (for more information see the TBD website: www.gov.mb.ca/health/publichealth/cdc/tickborne/prevention.html). Further, MHSAL encourages physicians to consider tick-borne diseases in their differential diagnosis when seeing patients with compatible clinical symptoms and travel history to, or residence within, a risk area or region with suitable BLT habitat.

---

[3] Though the risk of encountering potentially infected BLTs is greater in known risk areas, it is still present (albeit to a lesser degree) outside of these areas, particularly in regions with suitable tick habitat.

Reportable Tick-Borne Diseases

While the signs and symptoms of each TBD may vary, they each share two common features; the vector (BLTs) and prevention measures. The key prevention measure to reduce the risk of transmission is to minimize the risk of exposure to BLTs. Thus, the adoption of frequent tick-checks and other prevention measures can greatly reduce the probability of disease transmission when traveling or residing within BLT risk areas, or regions with suitable habitat. For more prevention information see www.gov.mb.ca/health/publichealth/cdc/tickborne/ .

Anaplasmosis

Anaplasmosis, formerly known as Human Granculocytic Anaplasmosis, is caused by the bacterium *Anaplasma phagocytophilum*. The most common route of transmission is via the bite of an infected BLT. Common symptoms include fever, plus one or more of the following: chills, headache, muscle aches and joint pain. While most cases of Anaplasmosis are mild and self-limiting, older individuals and those with compromised immune systems can develop severe illness that often requires hospitalization. Antibiotic treatment is started based on a physician's suspicion of infection with most symptoms. Treatment is typically successful, with symptoms resolving within 30 days of onset, although resolution may be slightly longer for those with more severe illness.

Babesiosis

Babesiosis is an infection caused by a parasite most commonly transmitted via the bite of an infected BLT, though transmission through blood and other transfusion products is also possible. There are a number of *Babesia* species worldwide however the most common species in North America and Manitoba is *Babesia microti*. Common symptoms of Babesiosis are often mild, non-specific and flu-like. Symptoms may start with the gradual onset of fatigue and discomfort, followed by one or more of the following: chills, sweats, anorexia, headache, weakness, nausea, non-productive cough and joint pain. The risk of severe illness is greater among older individuals and those with underlying medical conditions. Babesiosis can be successfully treated with anti-parasitic drugs with most symptoms resolving within 1 – 2 weeks.

Lyme Disease

Lyme disease can be caused by one of three species of tick-borne bacteria. In Manitoba, as in North America, locally acquired cases are associated with *Borrelia*

burgdorferi, which can be transmitted via the bite of an infected blacklegged tick[4]. Common symptoms of Lyme disease include a red-expanding rash (Erythema migrans), headache, fever, fatigue and chills. If left untreated Lyme disease infection can cause joint, heart and nervous system complications. Physicians are encouraged to treat based on clinical symptoms, and the disease can be treated successfully with antibiotics, particularly when diagnosed early.

Introduction

In Manitoba, there are several species of ticks, but this report focuses on *Ixodes scapularis*, which is responsible for spreading TBD to humans. This tick is more commonly known as the deer tick or the blacklegged tick. Other tick species, such as the more common wood tick (*Dermacentor variabilis*), are not effective vectors of disease causing agents of human importance in Manitoba.

Tick-borne diseases are recognized as some of the most common vector-borne diseases in North America[5], and the impact of these diseases, particularly Lyme disease, continues to expand in both Canada and Manitoba. In Manitoba there are three principle TBDs of public health concern; Anaplasmosis, Babesiosis and Lyme disease. Lyme disease became provincially reportable in 1999 and nationally reportable in 2009. With increasing infection rates among BLT collected via surveillance programs, Anaplasmosis and Babesiosis were made provincially reportable beginning January 1, 2015. This report details activity associated with the three provincially reportable TBD, among both humans and BLTs, between January 1, 2016 and December 31, 2016.

The Communicable Disease Control (CDC) unit of MHSAL routinely monitors both human and tick surveillance data in an effort to assess and communicate changes associated with tick-borne disease transmission risk. The risk of exposure to BLTs, and potentially any associated pathogens, is significantly greater in risk areas where surveillance has demonstrated that they are established. These BLT risk areas are identified through passive surveillance data and human case clusters, and subsequently confirmed via active tick surveillance. MHSAL reviews BLT surveillance and human data annually to identify new risk areas, assess risk and refine risk messaging and guidance for both health care professionals and the general public.

---

[4] Note that the western blacklegged tick (*Ixodes pacificus*) can also transmit *Borrelia burgdorferi*, however its range is limited to the Pacific Coast of North America.

[5] Eisen, R. J., Kugeler K. J., Eisen, L., Beard, C. B. and Paddock, C. D. **2017**.Tick-Borne Zoonoses in the United States: Persistent and Emerging Threats to Human Health, *ILAR Journal*, https://doi.org/10.1093/ilar/ilx005

Methods

Tick-borne disease data (Anaplasmosis, Babesiosis and Lyme disease) was reported for the period January 1, 2016 to December 31, 2016. Anaplasmosis and Babesiosis cases meeting provincial surveillance case definitions (see Appendix A and B) were reported, and given the low numbers, Anaplosmosis cases were pooled with 2015 data, to observe trends. Lyme disease data focused primarily on cases that met the confirmed and probable National surveillance case definitions (see Appendix C). In some instances cases classified as 'other' (not meeting the National surveillance case definitions) were included to further illustrate trends. Throughout the report, confirmed and probable Lyme disease cases for 2016 were compared with the previous five year average (2011 – 2015) and where appropriate with National surveillance data.

Incidence rates were calculated using the MHSAL population files (www.gov.mb.ca/health/population/index.html) which provide the mid-year population count as of June 1 of the year in question. All rates are crude incidence rates calculated as the number of cases (numerator) divided by the population of the group specified (denominator) and multiplied by 100,000 to produce the number of reported cases per 100,000 persons. That is, the number of cases per 100,000 individuals in that population. For example, the 2016 Lyme disease incidence rate for residents of Southern Health – Santé Sud was calculated with a numerator of the number of Lyme disease cases (meeting National surveillance case definitions), and a denominator of the total population in that RHA as of June of that year. The five-year average incidence rates were calculated with a numerator of the total number of Lyme disease cases from the specified RHA from 2011 to 2015, and a denominator of the cumulative population of the RHA specified, from 2011 to 2015, with the results multiplied by 100,000.

When comparing incidence rates, and especially when comparing case counts between RHAs, it is important to keep in mind that the differing population counts between regions can contribute to an incidence rate that looks conspicuously large even when there are only a few cases, or an incidence rate that appears small even when there are many cases. For example, Northern Health Region may experience large changes in incidence when there are small changes in the case count, due to its small population; the opposite goes for the Winnipeg RHA. The same observation applies to comparisons between incidence rates and case numbers at the smaller health district level.

Key Elements in Tick Surveillance Maps

Manitoba is divided into 5 Health Regions. Tick surveillance occurs primarily in southern Manitoba. This densely populated region is associated with the majority of tick submissions and most tick-borne disease cases.

Maps display areas of interest: Prairie Mountain Health, Southern Health – Santé Sud, Winnipeg and Interlake Eastern RHA health regions.

N

Interlake-Eastern RHA

Dauphin ■

Prairie Mountain Health

Gimli ■

Selkirk ■

Portage la Prairie ■

Brandon ■

Winnipeg RHA

Treherne ■

Steinbach ■

Turtle Mountain Provincial Park ■

Southern Health - Santé Sud

Sprague ■

Kilometers
0   25   50   75   100

Projection: UTM Zone 14 NAD83
Basemap data from Manitoba Land Initiative.
Created: October 2016

Tick surveillance is a collaborative project involving the Public Health Agency of Canada, the University of Manitoba and MHSAL.

Active and passive tick surveillance data is current through the 2015 season.

Manitoba
Health, Seniors and Active Living

LEGEND

■ Reference Cities

▮ Manitoba Lakes

▯ Health Regions

Health regions, Manitoba lakes and reference cities symbology will not be listed in the legends going forward. Please use this map as a reference.

All maps use the same projection, scale and base map data.

Tick Surveillance

Passive Surveillance - 2016

Highlights of 2016 Passive Surveillance
- Approximately 9 in 10 BLT specimens received were collected in Manitoba.
- Higher numbers of BLT specimens and submissions were received in 2016, compared to the previous year.
- Submissions were received from 149 locales in southern Manitoba.
- In 2016 BLT minimum infection rates for the agents of Anaplasmosis and Lyme disease were 5.0% and 15.7% respectively.
- Most infected BLTs were collected from locations within, or in close proximity to previously identified risk areas.

In 2016 the passive surveillance program received a total of 657 submissions, from which a total of 432 submissions contained specimens belonging to the genus *Ixodes*, or 'hard ticks' (Table 1). The number of *Ixodes* submissions received marked an increase from 2015. One submission contained *Ix. pacificus* ('west coast tick') and another contained *Ix. cookei* ('ground hog tick'), while the remaining 430 contained *Ix. scapularis,* the BLT. The number of specimens received in 2016 was again greater than 500 (Figure 1). Nearly 90.0% of the BLT specimens were collected within Manitoba (Table 1). In 2016 BLT specimens were collected from late March through early December with a small peak in May/ June and a larger one in October (Figure 2). Although small in numbers, BLT nymphs were most abundant in May – July. While the majority of specimens were collected from dogs (~51.0%), the number collected from humans increased from approximately 23.0% in 2015 to 37.0% in 2016.

A BLT specimen refers to a single tick. A submission refers to one or more tick specimens that are submitted at once by one individual.

Table 1: Overview of submissions containing *Ixodes* species received as part of the 2016 passive surveillance program

Species	In Province		Out of Province		Unknown	
	# Submissions	# Specimens	# Submissions	# Specimens	# Submissions	# Specimens
Ix. scapularis	388	482	23	42	19	19
Ix. pacificus	0	0	1	1	0	0
Ix. cookei	0	0	1	1	0	0
Total	**388**	**482**	**25**	**44**	**19**	**19**
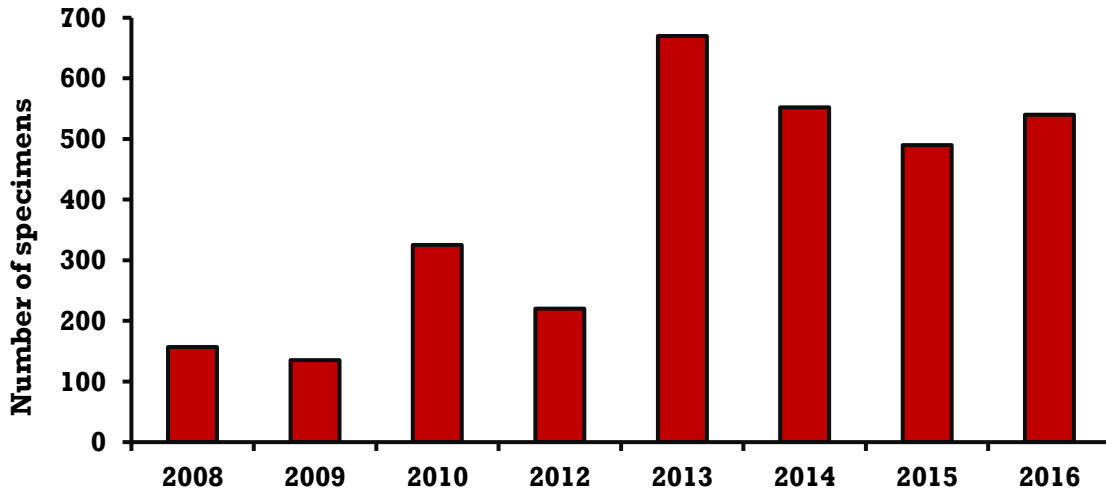
Figure 1: Number of BLT specimens received annually as part of the passive surveillance program since 2008.
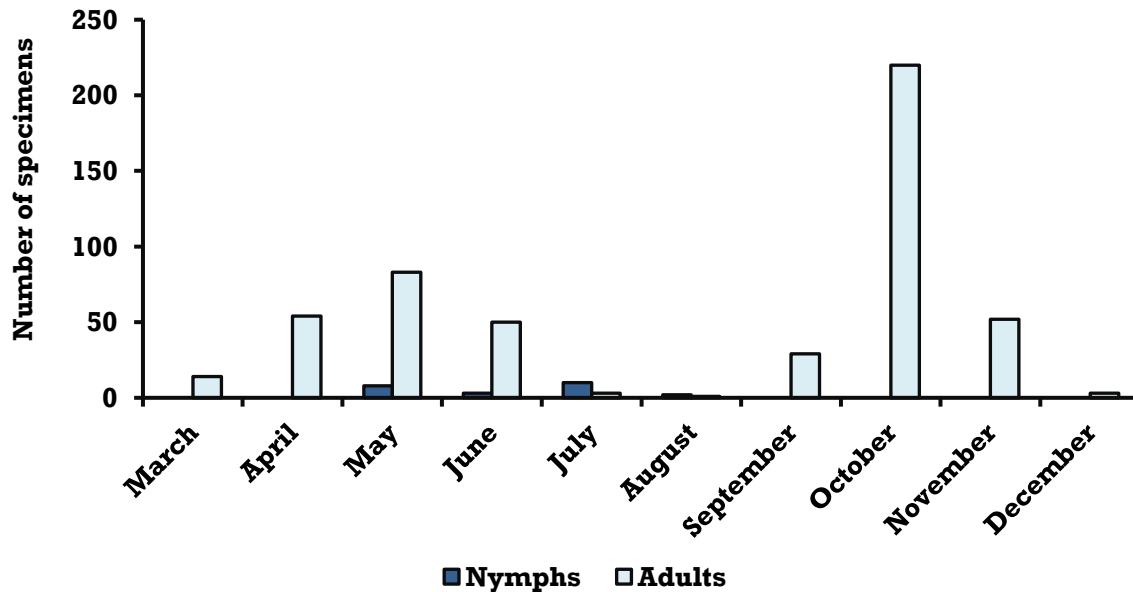
Figure 2: Comparison of seasonal trend in submissions of *Ix. scapularis* nymphs and adults based on month of collection.

BLT specimens were collected from sites in all four southern Manitoba Health Regions. The collection area stretched from the Ontario border as far west as Swan River, and from the USA border as far north as Bellsite (north of Swan River) (Figure 3). Submissions were received from 165 locales in 2016, with 149 of these distributed across southern Manitoba. Nearly three quarters of the submission sites in southern Manitoba were associated with previously identified BLT risk areas. Based on the 2016 passive surveillance data, active

surveillance efforts in 2017 were focused in western portions of the province and in the Whiteshell Provincial Park region.
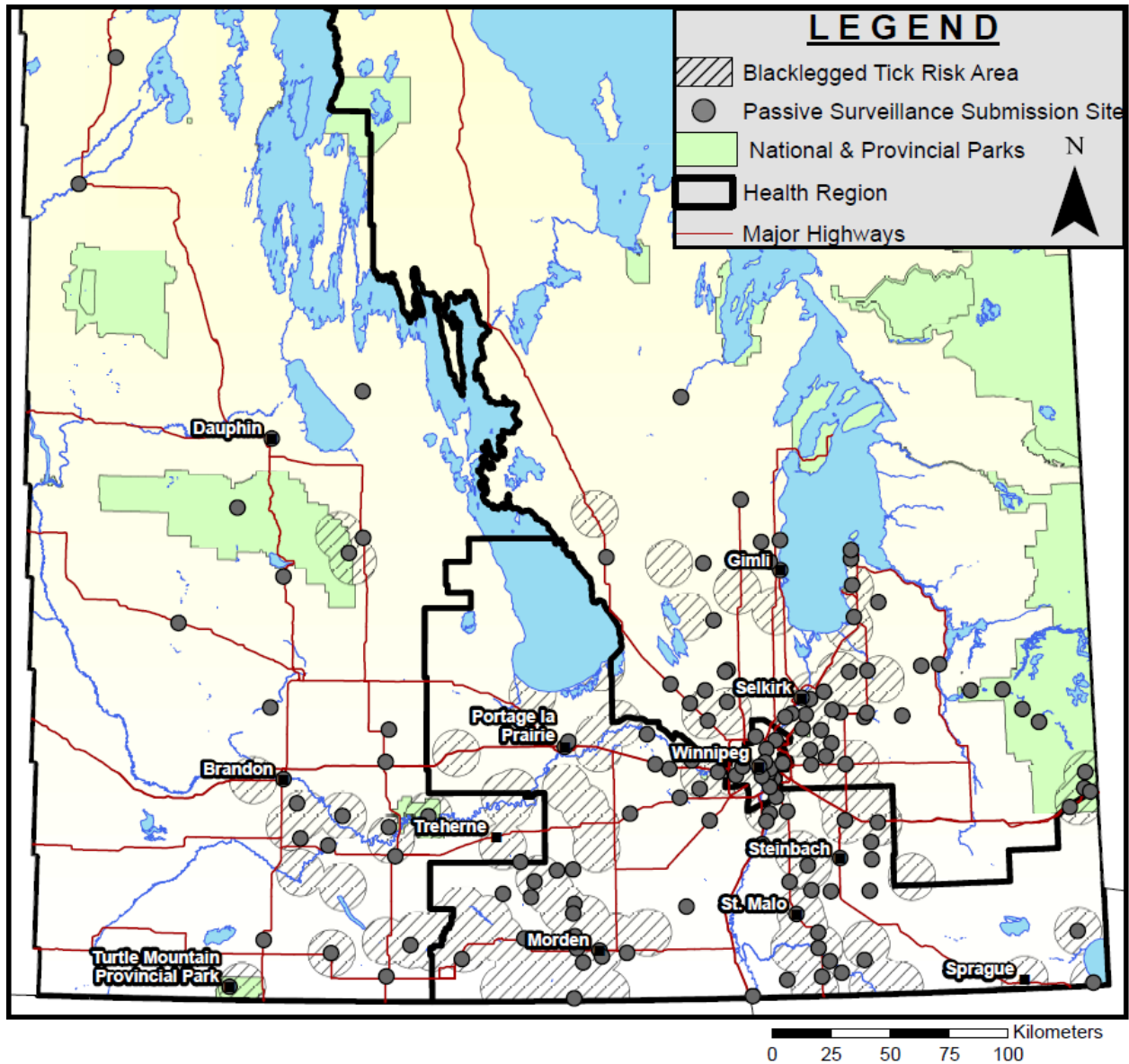
Figure 3: Distribution of BLT submission sites and known BLT risk areas, 2016

Anaplasma phagocytophilum

Anaplasmosis phagocytophilum was the second most common pathogen detected among BLTs submitted as part of the passive surveillance program (Table 2). Since 2013 the MIR associated with *A. phagocytophilum* have typically exceeded 5.0%. In 2016 specimens infected with *A. phagocytophilum* were collected from 17 locations across southern Manitoba (Figure 4), all of which were situated within, or in close proximity, to known BLT risk areas.

The minimum infection rate in 2016 was lower than that observed in 2015 and no evidence of *A. phagocytophilum* was again detected in nymphs (Table 3).
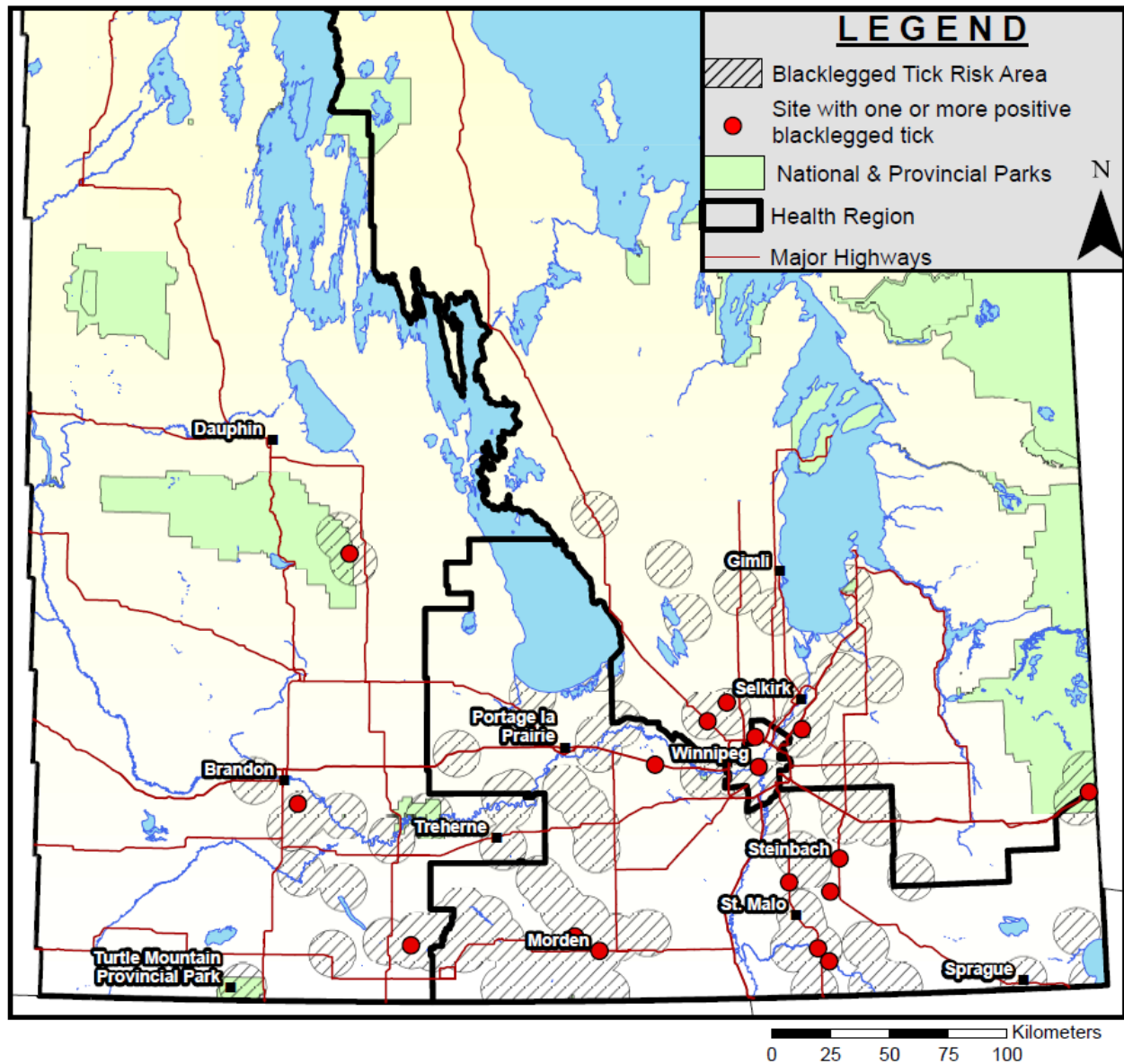
Figure 4: Distribution of collection sites for BLTs submitted as part of the 2016 passive surveillance program that tested positive for *A. phagocytophilum*

Where more than one adult BLT is submitted from a non-human host (i.e. dog, cat, etc.), they are placed in pools of up to five ticks for testing. Any adult ticks that are removed from a human host are tested individually. All nymphs are also tested individually. **The data in this report assume that only a single specimen in a pool is positive, so infection rates are presented as a minimum infection rate.**

Table 2: Minimum and maximum prevalence of infection rates for *B. burgdorferi*, *A. phagocytophilum* and *B. mircroti* in 2016

	B. burgdorferi		*A. phagocytophilum*		*B. microti*	
	Min IR	**Max IR**	**Min IR**	**Max IR**	**Min IR**	**Max IR**
Adults	16.0%	23.5%	5.2%	7.7%	3.9%	4.4%
Nymphs	8.7%	8.7%	0.0%	0.0%	8.7%	8.7%
Total	**15.7%**	**22.8%**	**5.0%**	**7.7%**	**4.1%**	**4.6%**

Table 3: Minimum infection rates for *A. phagocytophilum* among BLTs collected as part of the 2016 passive surveillance program with comparison to 2015 data

	Negative	**Positive**	**% Positive (2016)**	**% Positive (2015)**
Adults	493	27	5.2%	6.4%
Nymphs	23	0	0.0%	0.0%
Total	**516**	**27**	**5.0%**	**6.2%**

Adult male BLTs will attach to a host, but do not take a blood meal, so they cannot transmit disease to humans or other hosts.

Babesia microti

Babesia microti, the causative agent of Babesiosis, was the least common pathogen detected among BLTs submitted as part of the passive surveillance program (Table 2). Testing for this pathogen only began in 2013 and until 2015 minimum infection rates have remained relatively low, ranging between 0.8% and 1.7%. However, in 2016 the minimum infection rate with *B. microti* jumped to 4.1% (Table 4).

In 2016, specimens infected with *B. microti* were collected from 12 sites broadly spread across southern Manitoba, a marked increase from the 4 sites recorded in 2015. With one exception in Western Manitoba, all of the sites were associated with previously identified BLT risk areas (Figure 5). In comparison with 2015, minimum infection rates increased among both adults and nymphs (Table 4).

Table 4: Minimum infection rates for *B. microti* among BLTs collected as part of the 2016 passive surveillance program with comparison to 2015 data.

|	Negative	Positive	% Positive (2016)	% Positive (2015)
Adults	500	20	3.9%	0.6%
Nymphs	21	2	8.7%	8.3%
Total	521	22	4.1%	0.8%
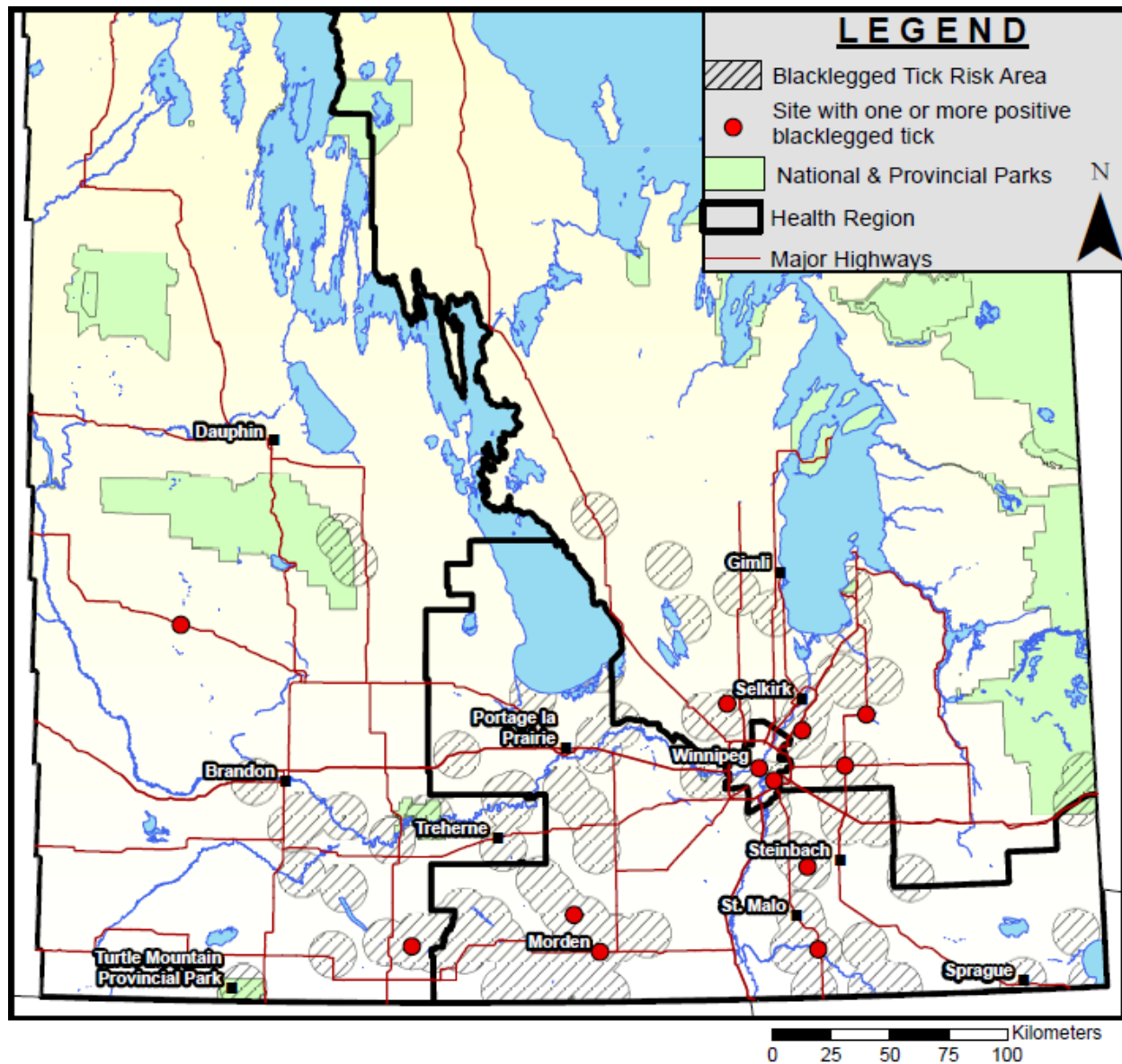
Figure 5: Distribution of collection sites for BLTs submitted as part of the 2016 passive surveillance program that tested positive for *B. microti*.

Borrelia burgdorferi

Borrelia burgdorferi was the most common tick-borne pathogen detected among BLTs collected in Manitoba in 2016 (Table 2). Since 2013, the minimum infection rate has often hovered around, and/ or, exceeded 20%. However, in 2016, the MIR declined to 15.7% from 19.1%, though the maximum infection rate (assuming all specimens in a pool were positive) was 22.8 (Table 5).

In 2016, specimens infected with *B. burgdorferi* were collected from 48 locations across southern Manitoba (Figure 6), the majority of which were in or close to known BLT risk areas. The number of locales with positive BLTs in 2016 was less than that observed in 2015 (n = 60). The distribution of these sites in 2016 was predominantly limited to eastern sections of the province.

Table 5: Minimum infection rates for *B. burgdorferi* among BLTs collected as part of the 2016 passive surveillance program with comparison to 2015 data.

	Negative	Positive	% Positive (2016)	% Positive (2015)
Adults	437	83	16.0%	18.4%
Nymphs	21	2	8.7%	50.0%
Total	**458**	**85**	**15.7%**	**19.1%**
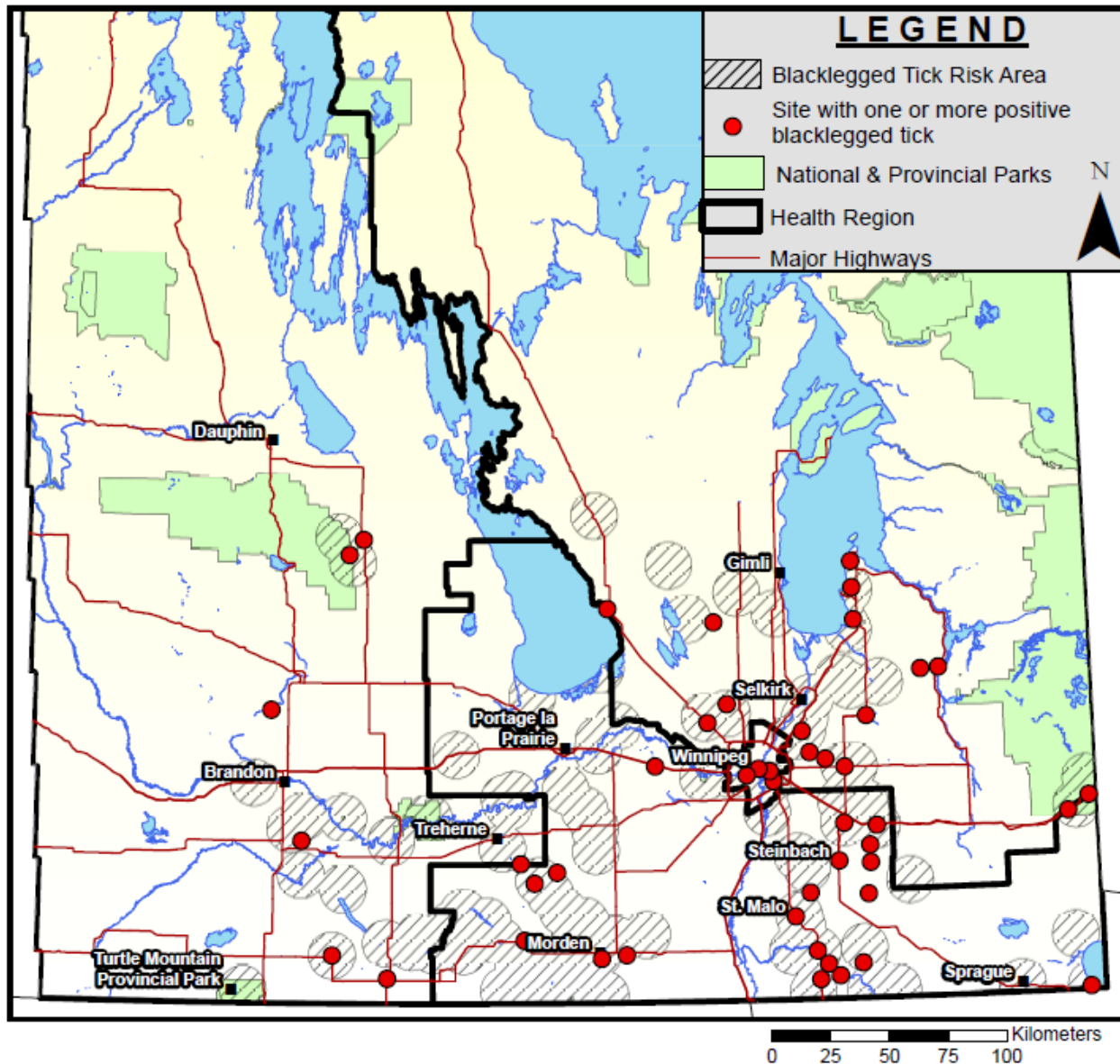
Figure 6: Distribution of collection sites for BLTs submitted as part of the 2016 passive surveillance program that tested positive for *B. burgdorferi*

Active Surveillance - 2016

Highlights of 2016 Active Surveillance
- Active surveillance efforts in 2016 expanded significantly compared to 2015 and earlier.
- In 2016 active surveillance identified 14 new risk areas, six of which were not associated with previously known areas.

In 2016 active surveillance was conducted at 185 sites across southern Manitoba, a marked increase from the 86 sites surveyed in 2015 (Table 6; Figure 7)[6]. In addition, approximately 376 km were surveyed in 2016, more than double the approximately 165 km surveyed in 2015. A total of 104 BLT specimens, 51 adult females, 42 adult males and 11 nymphs, were collected from 16 sites in 2016. Active surveillance identified a total of 14 new risk areas (Figure 7). Three of these sites (east side of Riding Mountain National Park, Whiteshell Provincial Park and the Eriksdale area) are notable given their distance from previously known risk areas. The distribution of BLT risk areas further expanded both westward and northward (Figure 8).

Table 6: Summary of active surveillance conducted in Manitoba, 2015 – 2016.

	Distance covered (km)	Number of sites surveyed	Sites w/ BLT	Total # of BLT Collected
2016	376.4	185	16	104
2015	165.4	86	6	12

---

[6] MHSAL's surveillance capacity in 2016 was significantly increased through funding received from PHAC.
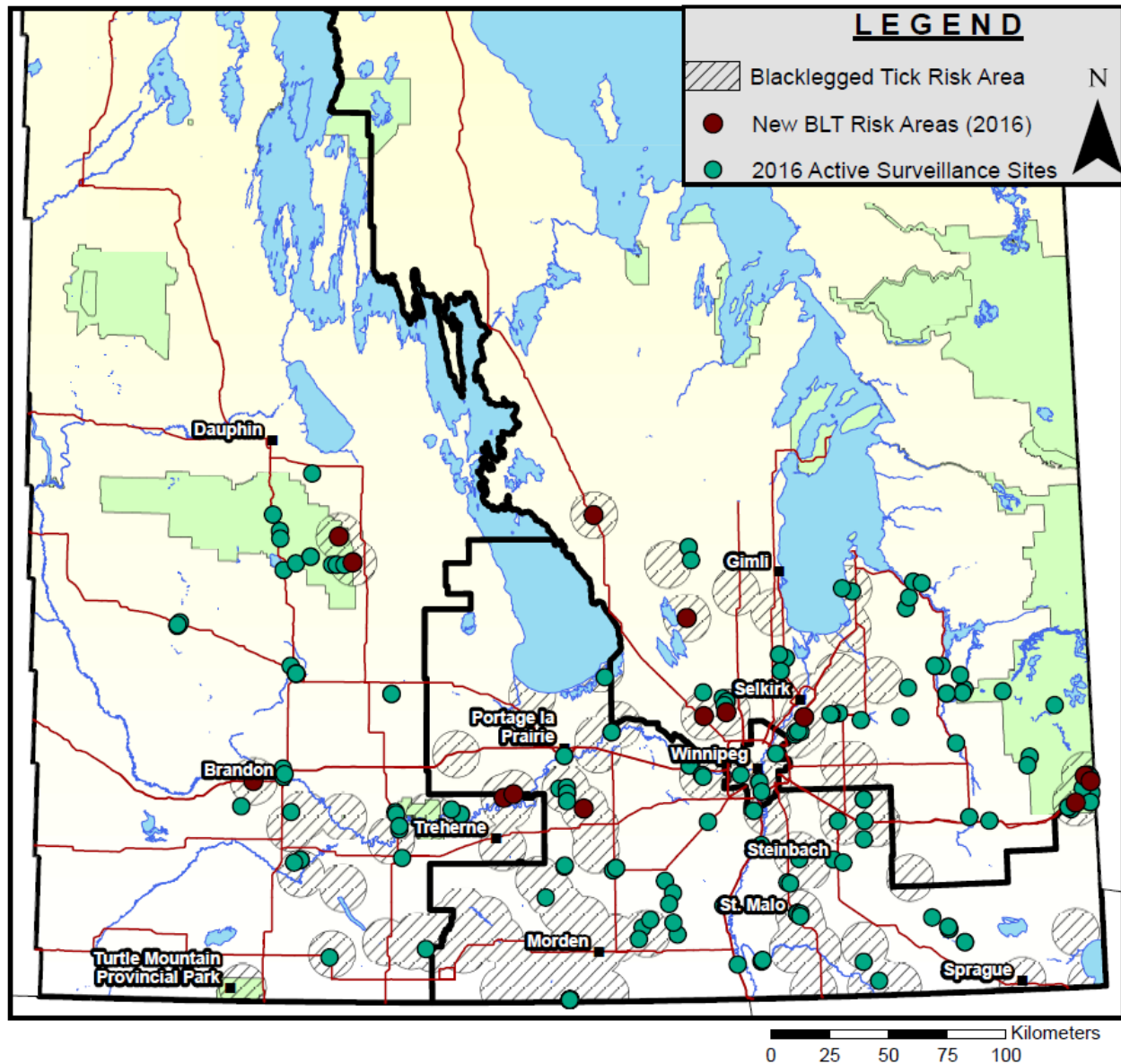
Figure 7: Distribution of active surveillance efforts, and newly identified BLT risk areas in 2016.

All BLT suitable specimens were submitted to PHAC's National Microbiology Laboratory (NML) for pathogen testing. Specimens were screened for the causative agents of Anaplasmosis, Babesiosis and Lyme disease in addition to a broad range of emerging or novel tick-borne pathogens[7]. In 2016, the infection rate for *B. burgdorferi* was 22.1%, a decrease

---

[7] The NML screens all suitable BLT specimens collected as part of the active & passive surveillance programs for a broad range of emerging or novel tick-borne pathogens. This includes a variety of *Borrelia* species (i.e. *B. mayonii, B. hermsii, B. bissettii, B. carolensis* and *B. kurtbacheni*), *Babesia* species, *Ehrlichia chaffensis* and Powassan virus (i.e. Deer Tick virus).

from the high of 50.0% observed in 2015 (Table 7). It should be cautioned that the number of specimens tested in 2015 (n = 12) was significantly lower than that in 2016. Infection rates with *A. phagocytophilum* and *B. microti* were 10.6% and 1.0% in 2016 respectively, slight increases from those observed in 2015. A total of 4 BLT specimens were co-infected with more than one pathogen, with the most common combination being *B. burgdorferi* and *A. phagocytophilum* (Table 8).

Table 7: Infection rates among BLT specimens collected via active surveillance in 2015 (n = 12) and 2016 (n = 104).

	Borrelia burgdorferi	*Anaplasma phagocytophilum*	*Babesia microti*
2016	22.1%	10.6%	1.0%
2015	50.0%	8.3%	0.0%

Table 8: Co-infection status of BLTs collected by active surveillance in 2016.

	B. burgdorferi + A. phagocytophilum	*B. burgdorferi + B. microti*
2016	3	1
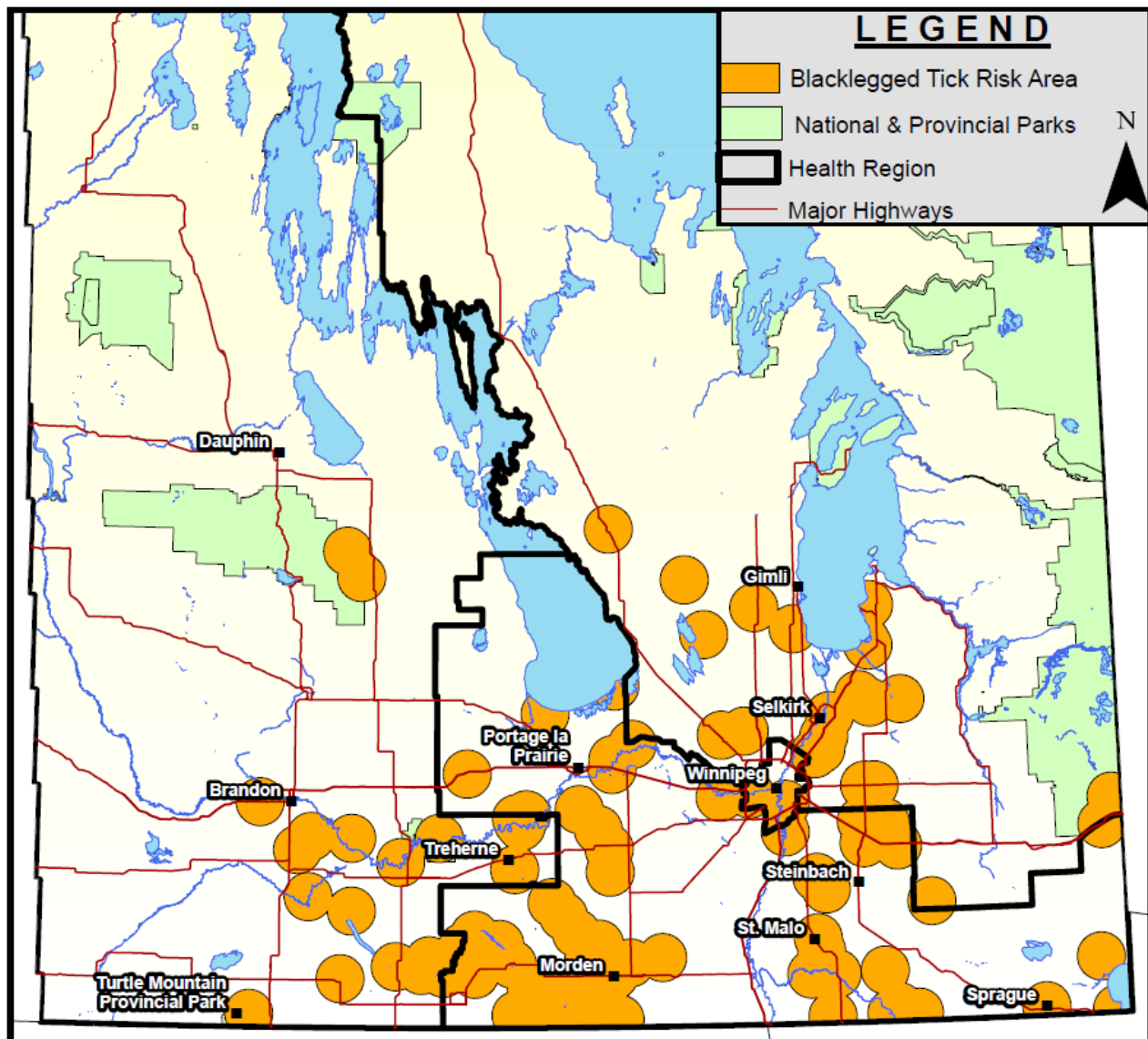
Figure 8: Distribution of BLT risk areas in 2016[8]

Tick-Borne Diseases in Humans

Anaplasmosis

In 2016 seventeen Anaplasmosis cases were reported to MHSAL. Fifteen of the cases met the provincial surveillance case definition for a confirmed case, while two were classified

---

[8] Although the risk of encountering a BLT is greater in these risk areas, it should be cautioned that 1) the distribution of blacklegged ticks in these risk areas is not uniform, and 2) BLTs can also be found outside of these risk areas. TBDs can be acquired anywhere in Manitoba, though the risk is greater in known risk areas.

as probable (see Appendix A for the provincial surveillance case definitions). Case numbers were more than four-fold higher in 2016 when compared to 2015 (Table 9).

Table 9: Reported Cases of Anaplasmosis in Manitoba, 2015 - 2016.

	2016	2015	Total
Confirmed Case	15	2	17
Probable Case	2	2	4
Total Reported	17	4	21

Since 2015, there were slightly more male than female cases reported (12 versus 9) and the median age was 48.5 years (Table 10)[9]. Twenty of the twenty-one Anaplasmosis cases reported were in individuals 20 years of age and older (Figure 9). Moreover, nearly 3 in 4 cases were recorded in individuals 40 years of age or older. Incidence rates were lowest among individuals 20 years of age or younger (0.15/ 100,000), while they were highest among individuals aged 40 to 59 years of age (1.71/ 100,000).

Table 10: Number of confirmed and probable Anaplasmosis cases and incidence rates (per 100,000) by sex, with age analysis, in Manitoba, 2015 - 2016

	2016		2015	
	Case Count	**Incidence**	**Case Count**	**Incidence**
Total	17	1.27	4	0.30
Female	7	1.04	2	0.30
Male	10	1.50	2	0.30
	Age Analysis (in years)		**Age Analysis (in years)**	
Average	48.5		48.8	
Median	52.0		53.0	
St. Dev.	15.2		13.0	
Min. Age	8		36	
Max. Age	67		59	

---

[9] Note that given the limited Anaplasmosis case numbers, data from 2015 and 2016 have been combined for analysis purposes.
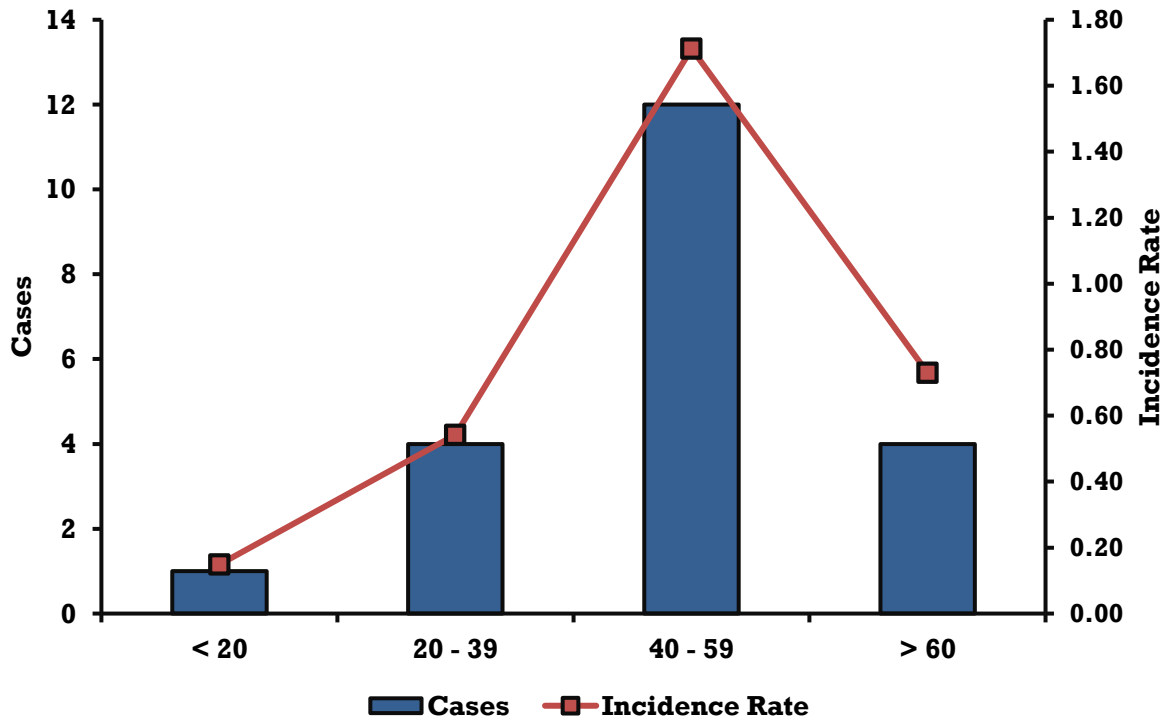
Figure 9: Numbers of confirmed and probable Anaplasmosis cases and incidence rates (per 100,000) by age group recorded in Manitoba since 2015.

At the provincial level the incidence (per 100,000) of Anaplasmosis cases increased from 0.30 in 2015 to 1.27 in 2016. While most cases resided in either the Southern Health Region (n = 8) or the Winnipeg Regional Health Authority (n = 8), the incidence rates were greatest in the Southern Health – Santé Sud (2.04) and Interlake-Eastern (1.96) Health Regions (Figure 10).
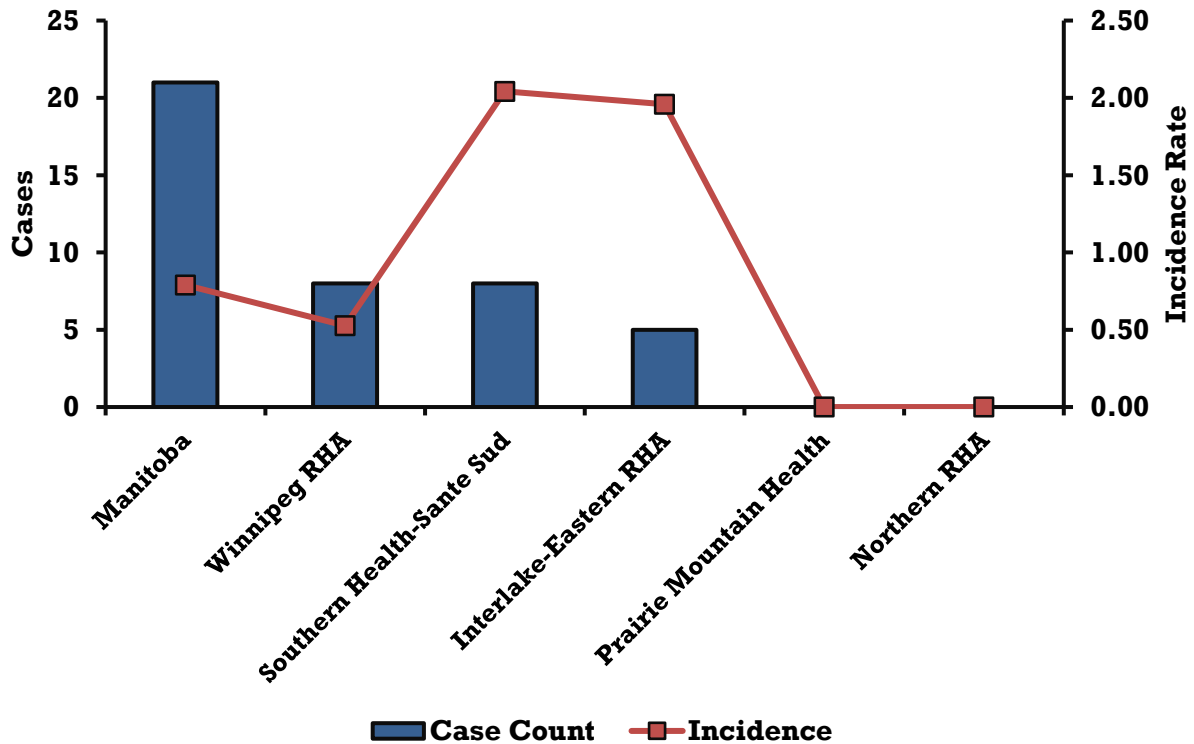
Figure 10: Anaplasmosis incidence rates (per 100,000) and case numbers reported by Health Region of residence since 2015 (n = 21).

All but two of the 21 Anaplasmosis cases reported since 2015 indicated likely exposure in Manitoba (one in 2015, and one in 2016). Both cases with out of province exposure indicated North Western Ontario as the likely exposure sites. The exposure locations in the province correspond to well-known BLT risk areas situated in eastern and southern Manitoba (Figure 11). Health Districts[10] with the highest incidence rates (per 100,000), based on likelihood of case exposure, are situated in the southeast portion of the province where surveillance has shown a longer period of BLT establishment.

---

[10] Health Districts are groupings of populations with approximately 10,000 to allow for analysis to be conducted at a smaller scale than possible when using the larger Regional Health Authority or Health Zone level.
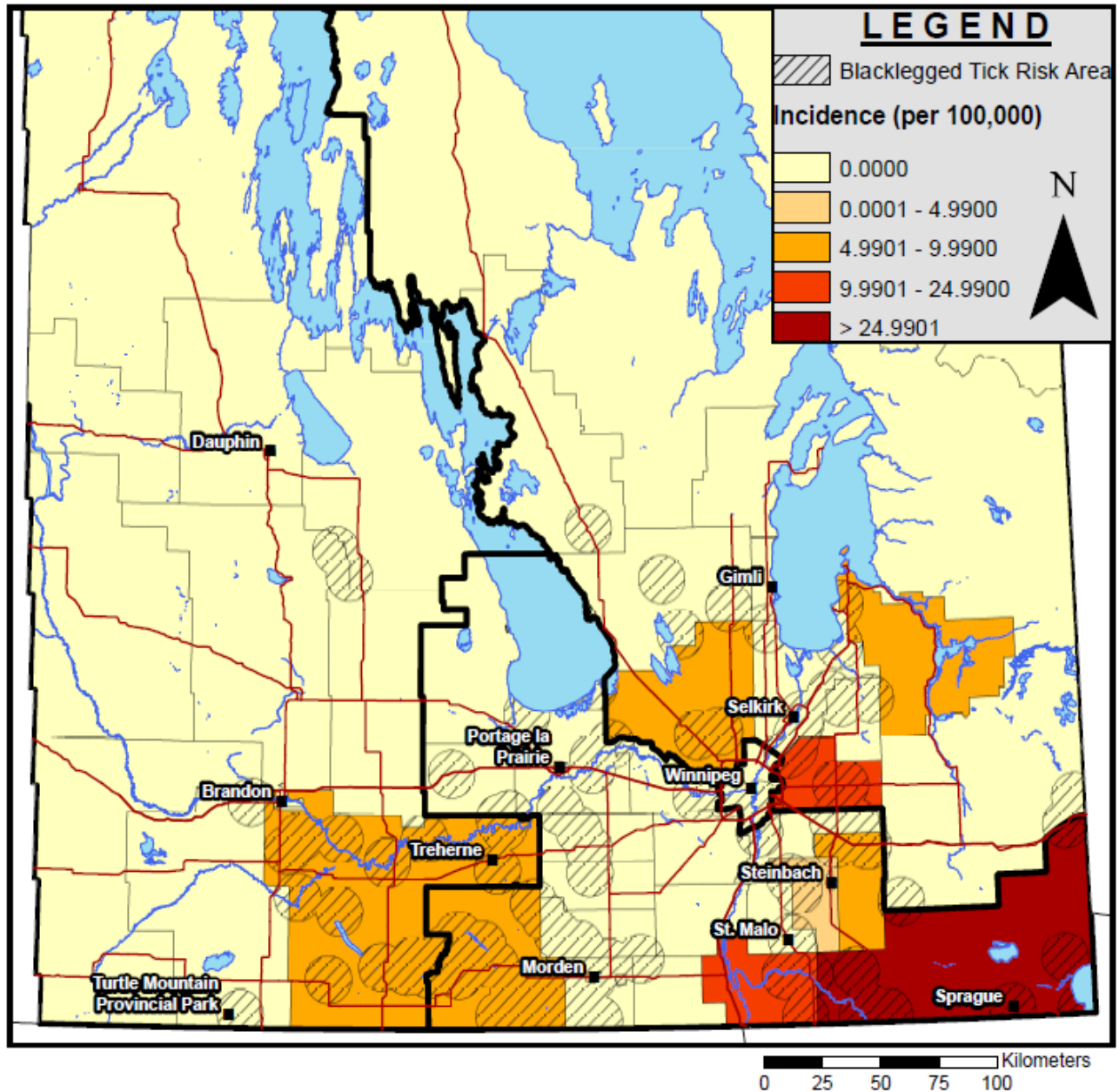
Figure 11: Incidence, per 100,000, of all confirmed and probable Anaplasmosis cases reported in Manitoba since 2015 based on Health District of likely exposure (n = 19).

Babesiosis

On January 1, 2015 Babesiosis became provincially reportable (see Appendix B for provincial surveillance case definitions). The decision to make it reportable reflected the continued detection of this pathogen in locally acquired BLT specimens, and the identification

of the first locally acquired human case in Manitoba in 2013. Note that the 2013 case was also the first Babesiosis case with local acquisition in Canada[11].

In 2016 there was only one Babesiosis case reported to MHSAL, although the case had likely exposure within Manitoba. The case had likely exposure to a previously known BLT risk area in the Interlake-Eastern Health Region.

Lyme disease

Highlights

- The 52 confirmed and probable Lyme disease cases reported in 2016 far exceeded the previous high of 37 reported in 2014.
- Highest incidence rate, based on region of residence, for confirmed and probable cases was the Southern Health – Santé Sud RHA (9.12 per 100,000 in 2016)
- Approximately 8 in 10 cases reported likely exposure within Manitoba.
- Nearly 2 in 3 cases were reported among individuals 30 years of age or older.
- Likely exposure ranged between May and July for approximately 80% of the Lyme disease cases.
- Risk of exposure was highest among males 60 years of age and older.
- Erythema migrans was observed in approximately 62% of all confirmed and probable Lyme disease cases.

The number of confirmed and probable Lyme disease cases reported in 2016 far surpassed the previous high of 37 recorded in 2014 (Table 11). A total of 52 confirmed or probable Lyme disease cases were reported in Manitoba in 2016, representing an incidence rate of 3.88 (Table 12). This represents a notable increase from 2015 where 32 confirmed and probable Lyme disease cases were reported and the incidence was 2.42. Similarly the 2016 data is nearly double the five year average (2011 – 2015). Though lower in overall number (n = 12), a similar increase in case numbers and incidence rate was observed for those Lyme disease cases reported provincially as 'other' in 2016 compared to the five year average (Table 13).

---

[11] Bullard, J. M. P., Ahsanuddin, A. N., Perry, A. M., Lindsay, L. R., Iranpour, M., Dibernardo, A., and Van Caeseele, P. G. **2014**. The first locally acquired tick-borne *Babesia microti* infection in Canada. *Canadian Journal of Infectious Diseases & Medical Microbiology* 25 (6), 87 – 89.

Table 11: Reported cases of Lyme disease in Manitoba, 2009 – 2016

	2016	2015	2014	2013	2012	2011	2010	2009	Total
Confirmed Case*	24	12	22	16	9	8	7	1	**99**
Probable Case*	28	20	15	15	11	6	6	4	**108**
Other Case**	12	8	11	8	11	2	5	6	**63**
Total Reported**	**64**	**40**	**48**	**39**	**31**	**16**	**18**	**11**	**270**

* National surveillance case definitions are available at:
https://www.canada.ca/en/public-health/services/diseases/lyme-disease/surveillance-lyme-disease/case-definition.htm
** Cases listed as 'other' are reported by either physician or lab but fail to meet the classification criteria for 'confirmed' or 'probable'
*** Total cases reported and classified as of July 25, 2017.

Table 12: Number of confirmed and probable Lyme disease cases* and incidence rates (per 100,000) by sex, with age analysis, in Manitoba, 2016 and 5 year average (2011 – 2015)

	2016		2011 - 2015 Average	
	Case Count	**Incidence**	**Case Count**	**Incidence**
Total	52	3.88	26.0	2.02
Female	20	2.97	9.4	1.45
Male	32	4.81	16.6	2.60
	Age Analysis (in years)		**Age Analysis (in years)**	
Average	41.2		40.0	
Median	45.0		43.5	
St. Dev.	23.2		21.9	
Min. Age	1		3	
Max. Age	80		84	

* As per the National surveillance case definitions (https://www.canada.ca/en/public-health/services/diseases/lyme-disease/surveillance-lyme-disease/case-definition.html. Accessed September 5, 2017)

Table 13: Number of '*other*' Lyme disease cases* and incidence rates (per 100,000) by sex, with age analysis, in Manitoba, 2016 and 5 year average (2011 – 2015)

	2016		2011 - 2015 Average	
	Case Count	**Incidence**	**Case Count**	**Incidence**
Total	12	0.90	8	0.62
Female	7	1.04	3.2	0.49
Male	5	0.75	4.8	0.75
	Age Analysis (in years)		**Age Analysis (in years)**	
Average	45.3		46.6	
Median	55.0		48.0	
St. Dev.	22.4		22.1	
Min. Age	3		3	
Max. Age	68		85	

* Note that Manitoba records 'other' Lyme disease cases where the data is suggestive of infection, but is not sufficient, more often incomplete, to meet the more stringent requirements of the National surveillance case definition.

In 2016 more cases of Lyme disease were reported in males than in females. Males accounted for approximately 2 in 3 (~ 61.5% of cases) confirmed or probable Lyme disease cases (Table 12). The incidence rate in males was 4.81 in 2016 compared to 2.97 for females. These observations are similar to those observed over the past 6 years, where 63% (n = 117) of the confirmed or probable Lyme disease cases reported have been among males. The number of Lyme disease cases in males in 2016 (n = 32) was nearly double the average observed in the previous five year period (n = 16.6). Similarly the number of female cases (n = 20) reported in 2016 was more than double the five year average (9.4). Among cases classified as 'other' there was a nearly equal breakdown of male and female cases.

The age range of confirmed and probable Lyme disease cases remained relatively unchanged from the five year average, with the youngest case in a 1 year old and the oldest in an 80 year old (Table 12). The average age (41.2) in 2016 was lower than that observed in 2015 (46.4), but slightly higher than the five year average.

In 2016 there were two relative peaks in both incidence rates and overall case numbers, one for individuals aged 20 years and younger and a second for individuals 60 years of age and older (Figure 12). Individuals aged 40 and over accounted for approximately 56% of all cases reported in 2016. Lyme disease cases were more common among males aged 60 and older than any other age group. The incidence rate for males 60 years of age and older was approximately 7.79 (per 100,000) in 2016. The lowest incidence was observed among males and females aged 20 to 39, with rates equal to 2.67 and 2.41 respectively. While higher in overall rates and case numbers, the 2016 incidence rates broken down by age and gender align with trends observed since 2009 (Figure 13). More than half of the total Lyme disease cases reported (n = 94) were in individuals 40 years of age and older.
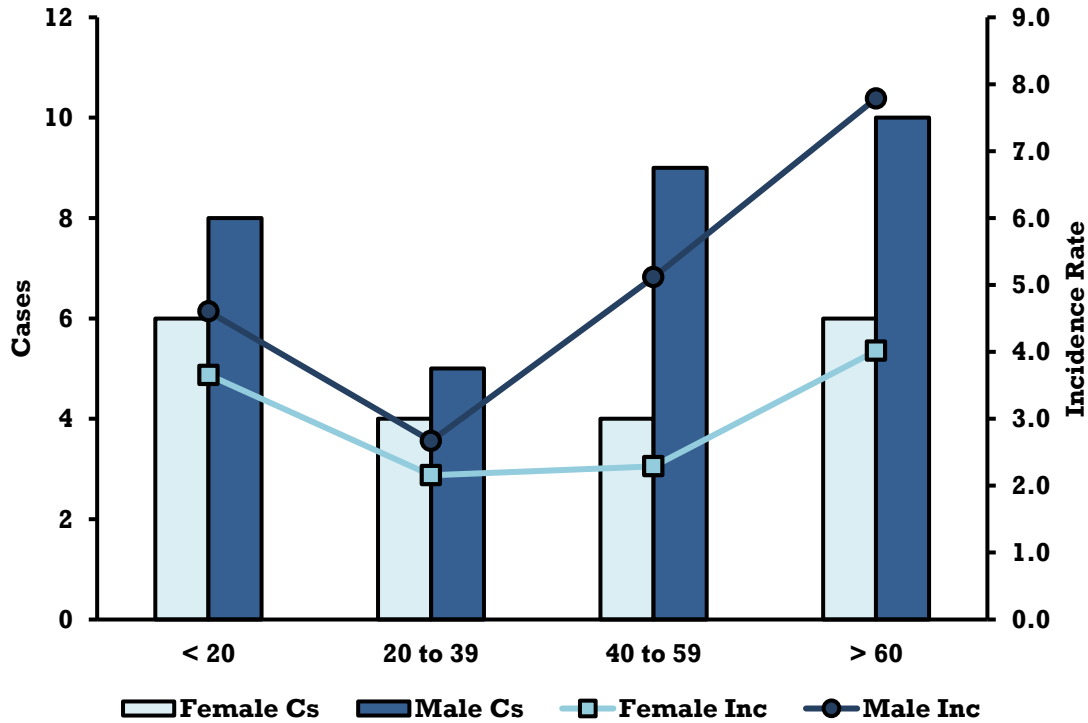
Figure 12: Number and incidence rate (per 100,000) of confirmed and probable Lyme disease cases by gender and age group in Manitoba for 2016.
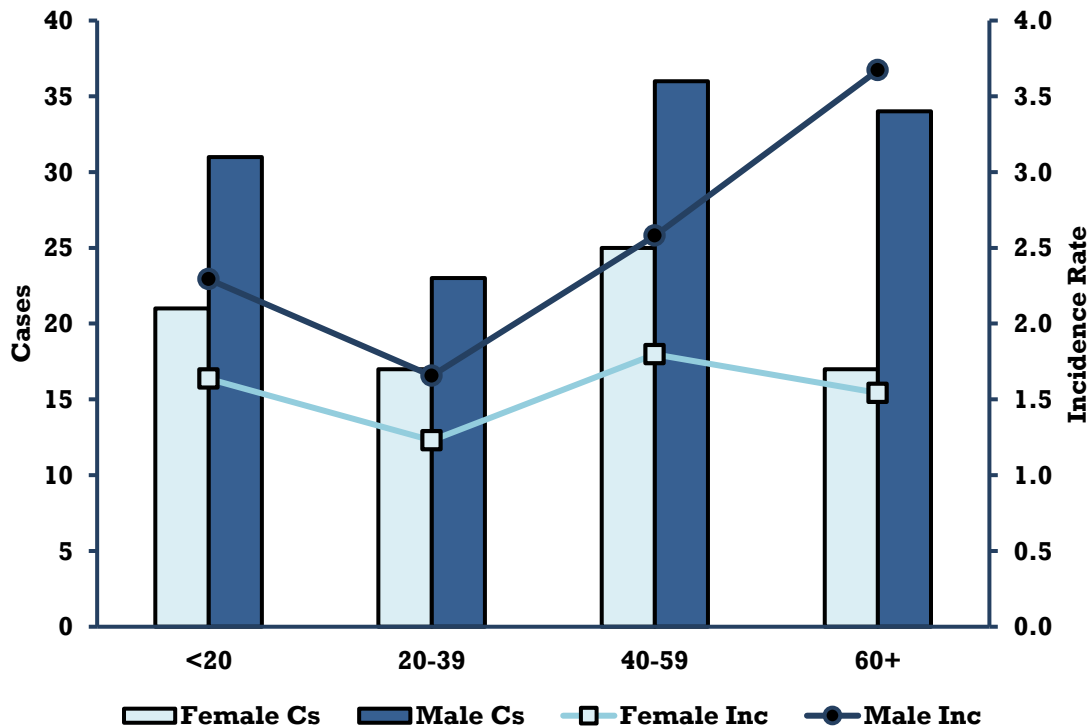

Figure 13: Number and incidence rate (per 100,000) of confirmed and probable Lyme disease cases by gender and aged group in Manitoba, 2009 – 2016.

In 2016 approximately 79% of confirmed and probable Lyme disease cases (n = 41) had a likely exposure history within Manitoba (Figure 14). This represents a slight decrease from the previous few seasons (2013 – 2015) where the percentage of locally acquired Lyme disease cases hovered around 86%. However, the overall trend mirrors that seen nationally where an increasing number of locally acquired Lyme disease cases has been observed since 2009[12][13]. Among the cases with out of province exposure, most indicated exposure to known risk areas within Canada (n = 7), five of which were linked to travel to northwestern Ontario. The remaining four cases indicated travel to the US (n = 3) or Europe (n = 1).
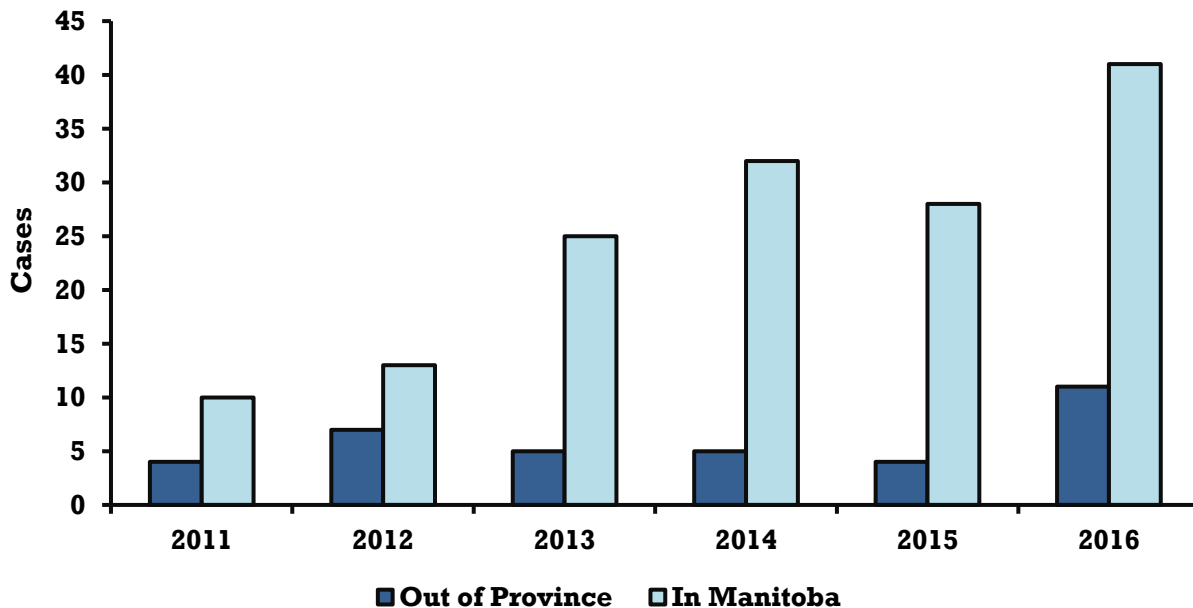
Figure 14: Confirmed and probable Lyme disease cases reported between 2011 and 2016 based on likely exposure, within or outside of the province (n = 186).

Seasonally the highest risk period, based on likely month of exposure, falls between May and July (Figure 15). For confirmed and probable cases with available data approximately 80.0% (n = 139) reported likely exposure between May and July. This late spring/ early summer time frame corresponds to the peak activity period for BLT nymphs. When compared to adults, nymphs are smaller and even harder to see and hence remove. Among the 186 confirmed and probable cases recorded since 2011, only 56 (~ 30%) indicated

---

[12] Surveillance of Lyme disease. http://healthycanadians.gc.ca/diseases-conditions-maladies-affections/disease-maladie/lyme/surveillance-eng.php (accessed August 14, 2017).

[13] National Lyme disease surveillance in Canada 2013: Web Report. http://www.healthycanadians.gc.ca/publications/diseases-conditions-maladies-affections/lyme-surveillance-2013/index-eng.php (accessed August 14, 2017)

a history of a tick-bite. Individuals with a history of local exposure were more likely to recall a tick bite (n = 53/ 159, or 33.3%) than those with out-of-province exposure (n = 3/27, or 11.1%). The number of cases recalling a tick bite rose to 22/52 (22%) in 2016, from which nearly all (21/22) had a local exposure history.
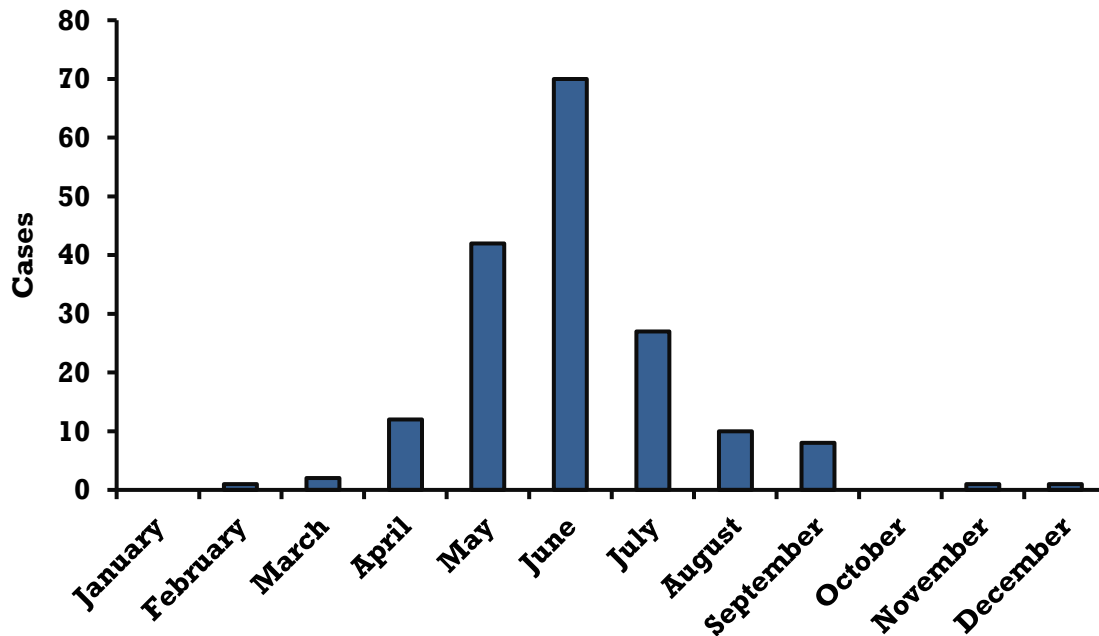
Figure 15: Confirmed and probable Lyme disease cases reported between 2011 and 2016, based on likely month of exposure (n = 174)[14]

The burden of Lyme disease cases increased in all four southern Manitoba Health Regions in 2016 compared to the previous 5 year average. Based on region of residence, the case numbers were highest in the WRHA (n = 23), followed by Southern Health – Santé Sud (n = 18) (Figure 16; Table 14). The incidence rates were highest in Southern Health – Santé Sud (9.12 per 100,000) and the Interlake-Eastern Health Region (5.46 per 100,000). The higher incidence rates in these two regions, reflects both the distribution and longer history of numerous BLT risk areas within.

---

[14] Data presented in Figure 15 includes data from cases with exposure histories within and outside of the province. Likely exposure information was unavailable for twelve confirmed and probable cases between 2011 and 2016.

Figure 16: Lyme disease incidence (per 100,000) rates and cases numbers for confirmed and probable cases reported by Health Region of residence between 2011 and 2016.

Table 14: Lyme disease incidence rates (per 100,000) for confirmed and probable cases, reported by Health Region of residence between 2011 and 2016.

	Manitoba	WRHA	SH-SS	IEHR	PMH	Northern
2016 Count	52	23	18	7	4	0
2011-15 Avg. Count	26.6	7.8	15.2	2	1.4	0.2
2016 Incidence	3.88	3.00	9.12	5.46	2.36	0.00
2011-15 Avg. Incidence	2.10	1.08	8.28	1.61	0.85	0.27

When the incidence rates (per 100,000) are examined based on likely exposure location at the health district[15] level two distinct observations are apparent (Figure 17). First, with one exception, all health districts with a minimum of one confirmed or probable Lyme disease case contain a BLT risk area. Second, health districts with the highest incidence rates

---

[15] Health Districts are groupings of populations with approximately 10,000 to allow for analysis to be conducted at a smaller scale than possible when using the larger Regional Health Authority or Health Zone level.

based on likely exposure locations (i.e. greater than 24.99) correspond to regions with a longer history of BLT establishment.
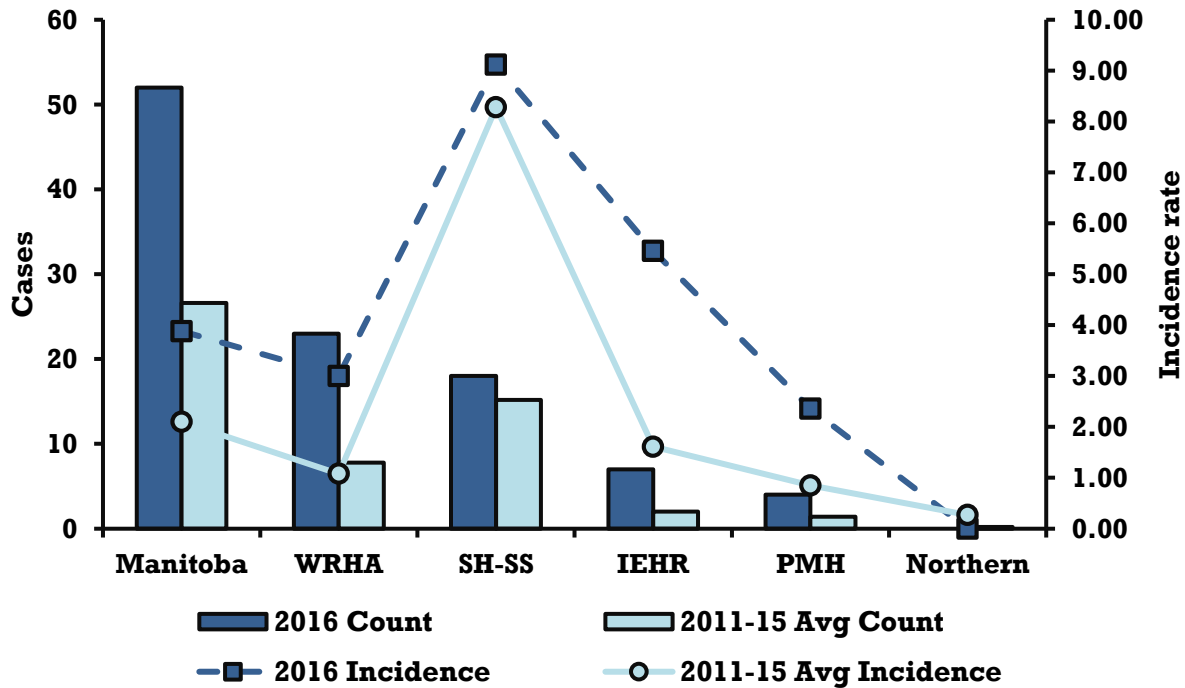

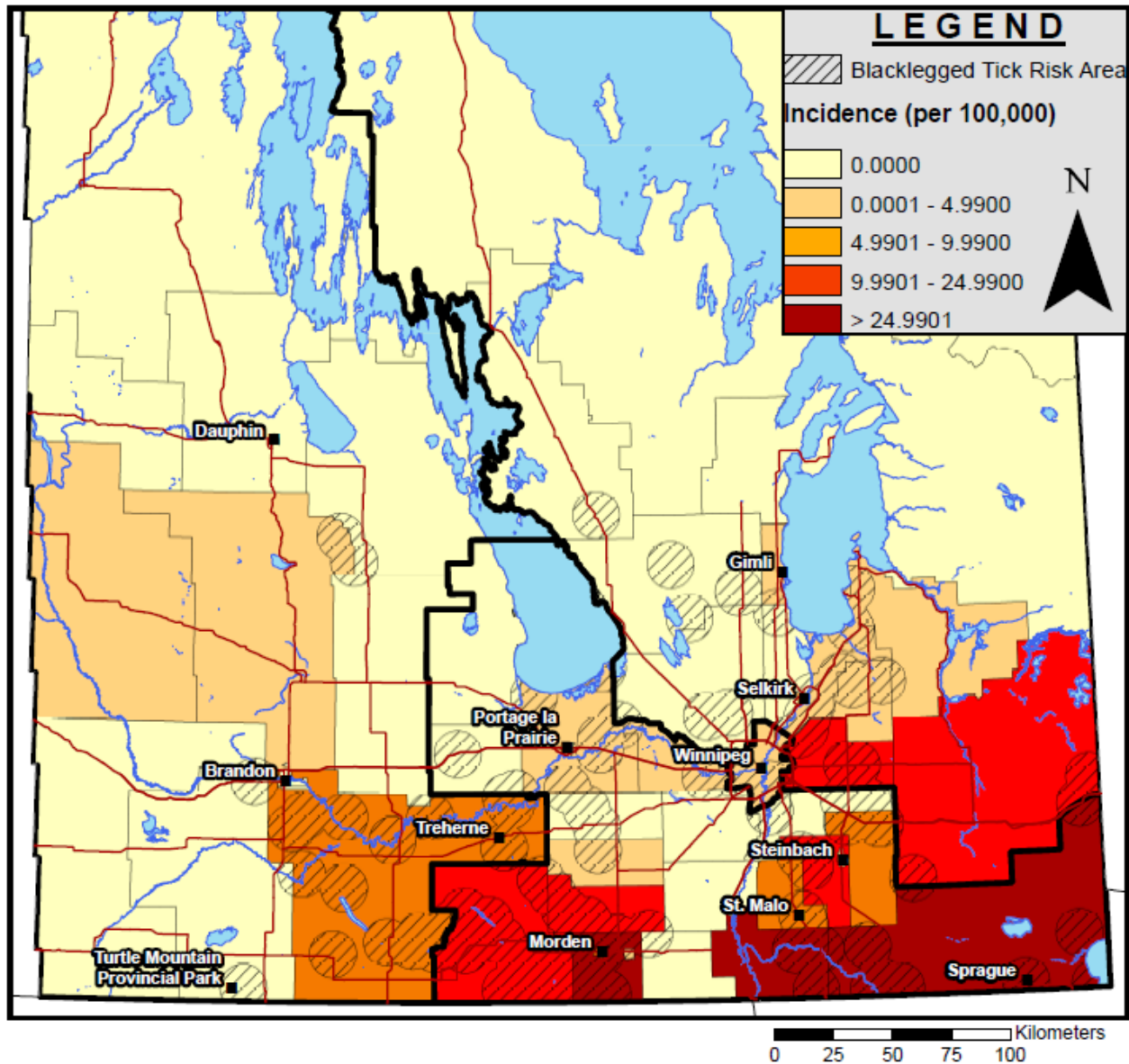**Figure 17:** Incidence, per 100,000, of all confirmed and probable Lyme disease cases reported in Manitoba between 2009 and 2016 based on Health District of likely exposure (n = 152).

Clinically the most common symptoms reported were those associated with early Lyme disease. Erythema migrans (EM) was observed in approximately 62% of confirmed and probable cases reported in 2016 (Figure 18). In comparison, across Canada, EM was

observed in approximately 74% of reported confirmed and probable cases[16]. Other commonly observed symptoms associated with early Lyme disease included fatigue (~ 65%), Fever (~ 48%), headache (~ 46%), myalgia (~46%), malaise (~ 46%) and arthralgia (~39%). Manifestations associated with early disseminated Lyme disease, such as Bell's palsy, 'other' neurological symptoms and cardiac symptoms were recorded in 10%, 8% and 6% of cases respectively. Recurrent brief joint swelling (i.e. arthritis), a symptom associated with late disseminated Lyme disease, was reported among approximately 1 in 3 cases (~37%) in 2016.
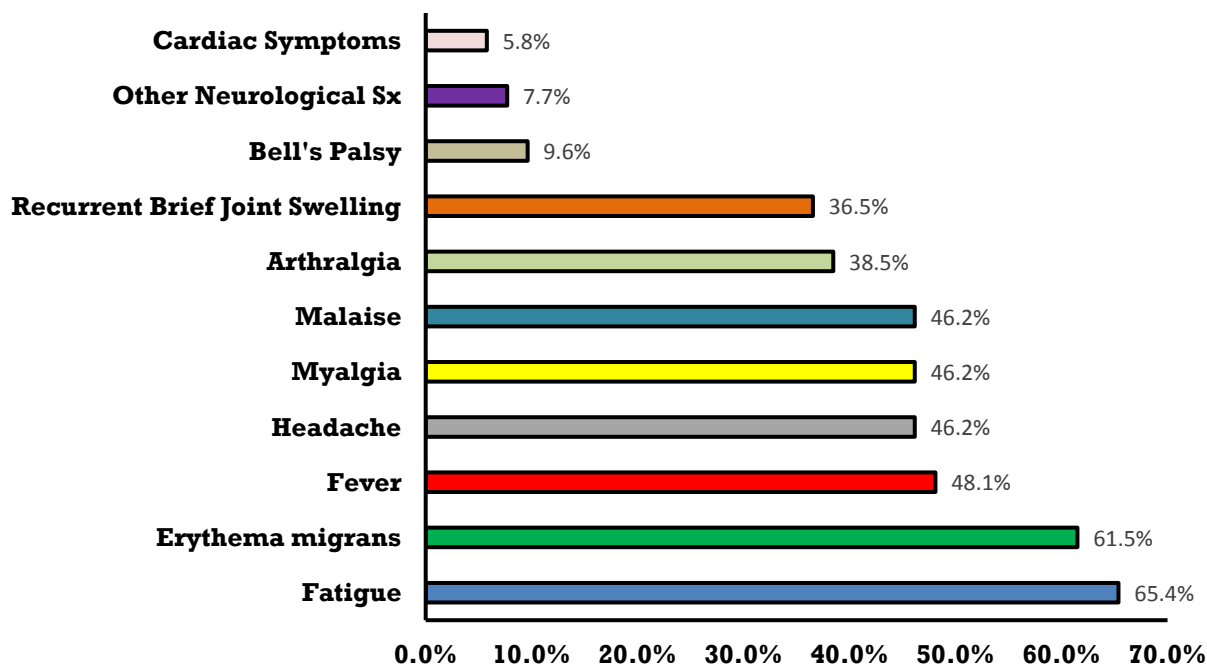
Figure 18: Percentage of clinical symptoms reported among confirmed and probable Lyme disease cases in 2016 (n = 52).

Discussion

BLTs were first identified in Manitoba in 1989[17] [18]. Despite intensive surveillance efforts throughout the 1990s and early 2000s, no evidence of BLT establishment was detected.

---

[16] Gasmi, S., Ogden, N. H., Lindsay, L. R. et al. **2017**. Surveillance for Lyme disease in Canada, 2009 to 2015. *Canadian Communicable Disease Report*, 43 (https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2017-43/ccdr-volume-43-10-october-5-2017/surveillance-surveillance-lyme-disease-canada-2009-2015.html).

[17] Galloway, T. D. **1989**. Lyme disease vector, *Ixodes dammini*, identified in Manitoba. *Canada Diseases Weekly Report*, 15 (37): 185.

[18] Galloway, T. D., Christie, J. E., Sekla, L. and Stackiw, W. **1991**. Current status of the Lyme borreliosis vector, *Ixodes dammini*, in Manitoba. *Canada Diseases Weekly Report*, 17 (47): 259-260.

However, following an investigation into a cluster of human cases with a common exposure history, the first BLT risk area was identified in the extreme southeast corner of the province in 2006. Since then, and likely aided by changing climate[19], the number and distribution of BLT risk areas have continued to increase.

In 2016 more than 9 in 10 submissions received as part of the passive surveillance program were collected from locales in Manitoba. Three quarters of the local submission sites were associated with known BLT risk areas. Nearly 1 in 3 submissions received indicated likely host as human, a marked increase from previous seasons, suggesting further establishment of BLTs in Manitoba.

Surveillance data shows that BLTs continue to be collected via the passive program in relatively steady numbers. The seasonality of BLT abundance in Manitoba, a small peak in May/ June and a larger peak in October, aligns with trends seen elsewhere in Canada[20]. Similarly, although low in number, nymph activity appears to peak between May and July which corresponds to the peak in likely exposure of human cases, again seen both locally and elsewhere[21].

The MIR, among specimens collected via passive surveillance, for common pathogens of human health importance fluctuated in comparison to previous seasons. For instance, the MIRs for *B. burgdorferi* and *A. phagocytophilum* decreased to 15.7% and 5.0% respectively, whereas the MIR for *B. microti* increased to 4.1%. The distribution of most infected BLT specimens aligns, with few exceptions, to previously identified BLT risk areas. A handful of BLT specimens were co-infected with more than one pathogen, with the most common combination being *B. burgdorferi* and *A. phagocytophilum*.

Active surveillance efforts expanded considerably in 2016 and 14 new BLT risk areas were identified. Most of the new risk areas were associated with previously identified ones,

[19] Ogden, N. H., St- Onge, L., Barker, I. K., Brazeau, S., Bigras-Poulin, M., Charron, D. F., Francis, C. M., Heagy, A., Lindsay, L. R., Maarouf, A., Michel, P., Milord, F., O'Callaghan, C. J., Trudel, L., and Thompson, R. A.. **2008**. Risk Maps for Range Expansion of the Lyme disease Vector, *Ixodes scapularis*, in Canada Now and With Climate Change. *International Journal of Health Geographics*, 7 (24), https://doi.org/10.1186/1476-072X-7-24
[20] Nelder, M. P., Russell, C., Lindsay, L. R., Dhar, B., Patel, S. N., Johnson, S., Moore, S., Kristjanson, E., Li, Y. and Ralevski, F. **2014**. Population-Based Passive Tick Surveillance and Detection of Expanding Foci of Blacklegged Ticks *Ixodes scapularis* and the Lyme disease Agent *Borrelia burgdorferi* in Ontario, Canada. *PLoS One*, 9 (8): 1 – 12.
[21] Eisen, R. J., Kugeler K. J., Eisen, L., Beard, C. B. and Paddock, C. D. **2017**.Tick-Borne Zoonoses in the United States: Persistent and Emerging Threats to Human Health, *ILAR Journal*, https://doi.org/10.1093/ilar/ilx005

however 6 sites were new. Two sites were identified in Riding Mountain National Park, one in the western Interlake region and three in the southern Whiteshell Provincial Park.

In 2016 the *B. burgdorferi* MIR for BLTs collected in Manitoba ranged from 15.7% (passive) to 22.1% (active). These rates are considerably lower than those observed in areas defined as 'hyper-endemic' in the US. For instance, active surveillance in New York's Hudson Valley region yielded *B. burgdorferi* infection rates ranging from 45.7 to 65.0%[22]. Similarly the rates in New Jersey, Pennsylvania and Wisconsin often exceeded 30 or 40% [23] [24] [25].

The MIR for *A. phagocytophilum* in Manitoba was considerably higher than those observed in other Canadian jurisdictions, such as Ontario, where passive surveillance conducted between 2008 and 2012 showed that they never exceeded 0.50%[26]. Moreover, the MIR rates, approximately 5.0% and 10.6% for BLT collected via passive and active surveillance respectively, are on par with those observed in 'hyper endemic' regions in the US. For example, *A. phagocytophilum* infection rates in Wisconsin ranged between 3 and 9%, while in New York's Hudson Valley active surveillance revealed rates of 12.3%.

The burden of tick-borne disease continues to increase, most notably for Anaplasmosis and Lyme disease. Since it became provincially reportable in 2015 the number of Anaplasmosis cases has risen four-fold. However, with only two years of data the trend may not be completely accurate as it should be cautioned that this four-fold increase may also reflect greater awareness amongst physicians.

90% of Anaplasmosis cases reported to date indicated likely local exposure. In addition, approximately 75% of the cases were reported in individuals 40 years of age and

[22] Prusinski, M. A., Kokas, J. E., Hukey, K. T., Kogut, S. J., Lee J. and Backenson, P. B. **2014**. Prevalence of *Borrelia burgdorferi*, *Anaplasma phagocytophilum*, and *Babesia microti* in *Ixodes scapularis* Collected from Recreational Lands in the Hudson Valley Region, New York State. *Journal of Medical Entomology*, 51 (1): 226-236.

[23] Adelson, M. E., Rao, R. V. S., Tilton, R. C., Cabets, K., Eskow, E., Fein, L., . Occi, J. L. and Mordechai, E. **2004**. Prevalence of *Borrelia burgdorferi*, *Bartonella* spp., *Babesia microti* and *Anaplasma phagocytophila* in *Ixodes scapularis* Ticks Collected in Northern New Jersey. *Journal of Clinical Microbiology*, 42 (6): 2799 – 2801.

[24] Hutchinson, M. L., Strohecker, M. D., Simmons, T. W., Kyle, A. D. and Helwig, M. W. **2015**. Prevalence Rates of *Borrelia burgdorferi*, *Anaplasma phagocytophilum*, and *Babesia microti* in Host-Seeking *Ixodes scapularis* from Pennsylvania. *Journal of Medical Entomology*, 52 (4): 693-698.

[25] Lee, X., Coyle, D. R., Hoang Johnson, D. K., Murphy, M. W., McGeehin, M. A., Murphy, R. J., Raffa, K. A. and Paskewitz, S. M. **2014**. Prevalence of *Borrelia burgdorferi* and *Anaplasma phagocytophilum* in *Ixodes scapularis* Nymphs collected in Managed Red Pine Forests in Wisconsin. *Journal of Medical Entomology*, 51 (3): 694-701.

[26] Nelder, M. P., Russell, C., Lindsay, L. R., Dhar, B., Patel, S. N., Johnson, S., Moore, S., Kristjanson, E., Li, Y. and Ralevski, F. **2014**. Population-Based Passive Tick Surveillance and Detection of Expanding Foci of Blacklegged Ticks *Ixodes scapularis* and the Lyme disease Agent *Borrelia burgdorferi* in Ontario, Canada. *PLoS One*, 9 (8): 1 – 12.

older, and all but one case was reported among individuals over 30. These observations align with a recent retrospective sero-survey conducted in Manitoba that demonstrated that Anaplasmosis is more common among older individuals (i.e. > 48 years of age)[27]. This study also revealed that Anaplasmosis may be more prevalent than currently reported, and thus health care providers should be mindful when assessing cases with suitable tick exposure history.

Both Lyme disease case numbers and incidence rates continue to increase in Manitoba. The number of confirmed and probable Lyme disease cases reported in 2016 was the highest recorded to date in a single season. Case numbers have increased more than 10-fold since 2009 when Lyme disease became nationally reportable. Moreover, the provincial incidence rate has increased from 0.4/100,000 in 2009 to 3.9/100,000 in 2016. The Manitoba data mirrors the national trend where incidence rates have risen and confirmed and probable Lyme disease case numbers have increased more than six-fold from 144 in 2009 to 917 in 2016. The Manitoba incidence rate of 3.9 is closest to the 2.7 observed in Ontario (2015), but well below the national high of 26.1 recorded in Nova Scotia (2015)[28].

Approximately 8 in 10 Lyme disease cases reported in 2016 were likely exposed within the province. Moreover, there was a higher risk of exposure among individuals 30 years of age and older, as this group accounted for 2/3rds of all cases. The risk of exposure was significantly higher among males aged 60 years of age and older. The number of cases with symptoms consistent with 'early Lyme disease' was slightly lower in Manitoba than the National average, while those with symptoms consistent with 'early disseminated' and 'late disseminated Lyme disease', with minor exceptions, were on par.

In Manitoba, as in Canada, the impact posed by TBDs continues to increase. MHSAL continues to monitor the distribution and establishment of BLT risk areas throughout the province. In addition, MHSAL monitors the infection rates of BLT specimens collected via passive and active surveillance for known pathogens of public health importance and newly emerging ones (i.e. *Borrelia miyamotoi*, *Borrelia mayonii* and Powassan virus). Information

---

[27] Kadkhoda K and Gretchen A. **2016**. Retrospective Study Investigating the Seroprevalence of *Anaplasma phagocytophilum* in Manitoba, Canada: 2011–2014. *Open Forum Infectious Diseases*, 3(4):ofw199. https://academic.oup.com/ofid/article/3/4/ofw199/2343997 .

[28] Gasmi, S., Ogden, N. H., Lindsay, L. R. et al. **2017**. Surveillance for Lyme disease in Canada, 2009 to 2015. *Canadian Communicable Disease Report*, 43 (https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr-monthly-issue/2017-43/ccdr-volume-43-10-october-5-2017/surveillance-surveillance-lyme-disease-canada-2009-2015.html).

regarding the prevalence of human infections with TBD is reviewed to pinpoint trends and target health care provider specific messaging. Overall, MHSAL analyses tick and human disease data to provide members of the public with relevant information to encourage the adoption of personal protection measures to minimize their potential exposure to BLT, the first and primary line of defence against TBDs.

Appendix A (Provincial Surveillance Case Definitions – Anaplasmosis)

Provincial surveillance case definitions for confirmed and probable Anaplasmosis cases:

Confirmed Anaplasmosis case:
 A clinically compatible[29] case that is laboratory confirmed[30].

Probable Anaplasmosis case:
 A clinically compatible case with non-confirmatory laboratory results[31].

---

[29] Clinical evidence includes, fever plus one or more of the following: headache, myalgia, anemia, leukopenia, thrombocytopenia or any elevation of hepatic transaminase concentrations.

[30] Laboratory confirmation requires one of:
 a. Serological evidence of a four-fold change in IgG specific antibody titre by indirect IFA assay between paired serum specimens (one taken during the first week of illness and a second 2 – 4 weeks later), OR by specific nucleic acid amplification test of blood specimen during acute phase of illness, **OR**
 b. Detection of *Anaplasma phagocytophilum* DNA in a clinical specimen via amplification of a specific target by polymerase chain reaction (PCR) assay, **OR**
 c. Demonstration of anaplasmal antigen in a biopsy/ autopsy sample by immunohistochemical methods, **OR**
 d. Isolation of *A. phagocytophilum* from a clinical specimen in cell culture.

[31] Non Confirmatory laboratory results include:
 a. Identification of morulae in the cytoplasm of neutrophils or eosinophils by microscopic examination, **OR**
 b. Single *A. phagocytophilum* IgG antibody titre of 128 or greater plus *A. phagocytophilum* IgM antibody titre of 20 or greater.

Appendix B (Provincial Surveillance Case Definitions – Babesiosis)

Provincial surveillance case definitions for confirmed and probable Babesiosis cases:

Confirmed Babesiosis case:

Has confirmatory laboratory[32] results AND meets at least one of the objective or subjective clinical evidence criteria[33], regardless of mode of transmission.

Probable Babesiosis case:

Has supportive laboratory[34] results and meets at least one of the objective clinical evidence criteria; **OR**

A case that is in a blood donor or recipient epidemiologically linked to a confirmed or probable Babesiosis case, **AND**

Has confirmatory laboratory evidence but does not meet any objective or subjective clinical evidence criteria.

---

[32] Confirmatory laboratory evidence includes one of the following:
- Identification of intraerythrocytic *Babesia* organisms by light microscopy in a Giemsa, Wright or Wright-Giemsa stained blood smear; **OR**
- Detection of *Babesia species* DNA in a whole blood specimen by PCR; **OR**
- Isolation of *B. microti* organisms from a whole blood specimen by animal inoculation.

[33] Objective clinical evidence includes one or more of fever, anemia or thrombocytopenia. Subjective clinical evidence includes one or more of chills, sweats, headache, myalgia or arthralgia.

[34] Supportive laboratory evidence includes demonstration of *Babesia* species by IFA with specific IgG antibody titre greater than or equal to 1:256.

Appendix C (National Surveillance Case Definitions – Lyme Disease)

National surveillance case definitions for confirmed and probable Lyme disease[35]:

Confirmed Lyme disease case:

1) Clinical evidence of illness with laboratory information:

   - Isolation of *Borrelia burgdorferi* from an appropriate clinical specimen, OR
   - Detection of *B. burgdorferi* DNA by PCR

2) Clinical evidence of illness with a history of residence, or visit to, an endemic area and with laboratory evidence of infection:

   - Positive serological test using the two-tiered ELISA and Western Blot criteria

Probable Lyme disease case:

1) Clinical evidence of illness without a history of residence, or visit to, an endemic area and with laboratory evidence of infection:

   - Positive serological test using the two-tier ELISA and Western Blot criteria

2) Clinician-observed Erythema migrans without laboratory evidence but with history of residence in, or visit to, an endemic area.

---

[35] For more detailed information please see PHAC's '*Lyme disease 2016 case definition*' at https://www.canada.ca/en/public-health/services/diseases/lyme-disease/surveillance-lyme-disease/case-definition.html