

## Report on Surveillance for Lyme Disease: 2016

May 2017

In 2016, 174 cases of Lyme disease were reported to public health authorities, including 124 cases that were acquired in Québec.

The Laboratoire de santé publique du Québec received 2 158 *Ixodes scapularis* ticks from Québec, primarily from the regions of Estrie, Mauricie et Centre-du-Québec, Montréal, Laurentides, Lanaudière, Montérégie and the Capitale-Nationale. More than 17% of these ticks were positive for *Borrelia burgdorferi*.

### Summary

Human surveillance	1
Acarological surveillance	3
Other diseases transmitted by <i>Ixodes scapularis</i>	6
Limitations	8

Active surveillance carried out in 2016 made it possible to collect 1 036 *Ixodes scapularis* ticks of which 82 were positive for *Borrelia burgdorferi*: they were spread over 22 sites mostly located in Montérégie. Active surveillance identified four new endemic municipalities for Lyme disease in Estrie, Mauricie et Centre-du-Québec, Outaouais and Montérégie.

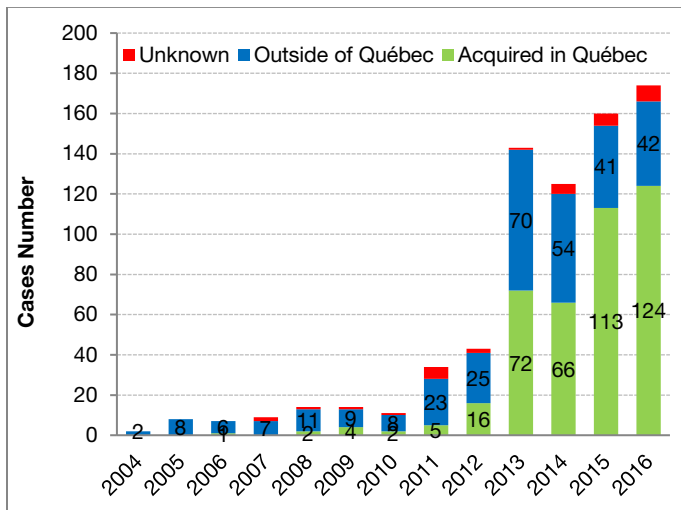
### Human surveillance

Lyme disease is a reportable disease (MADO) in Québec since November 2003. Human surveillance of this disease is based on reports by physicians and laboratories, as well as on epidemiological investigation conducted by public health authorities.

In 2016, 174 cases (113 confirmed and 61 probable)<sup>1</sup> of Lyme disease were reported to the public health authorities of Québec. Of these, 124 (71%) were acquired in Québec, 42 (24%) infected outside of Québec, and the probable acquisition location was unknown for eight cases. The number of reported cases and particularly the number of cases acquired in Québec has been increasing since the definition of “probable case” was added to the nosological definition of Lyme disease in 2011 (Figure 1). This increase could be explained by increased exposure to Lyme disease in Québec or by greater awareness of this disease by health professionals.

<sup>1</sup> The definitions of “confirmed case” and “probable case” for Lyme disease can be found in the glossary of nosological definitions from the Ministère de la Santé et des Services sociaux du Québec at the following address: <http://publications.msss.gouv.qc.ca/msss/document-000480/>.

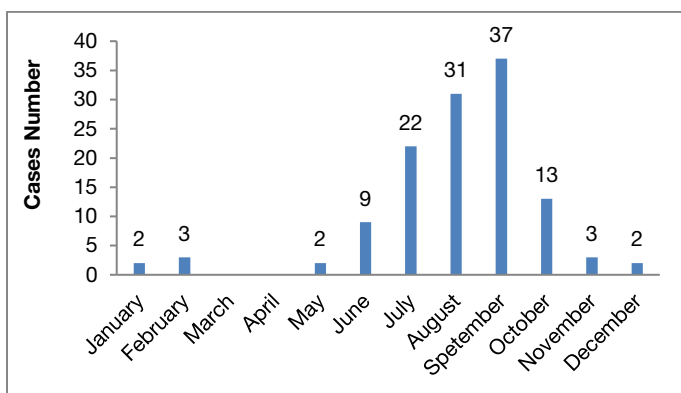
**Figure 1** Evolution of the number of Lyme disease cases reported in Québec from 2004 to 2016 according to the place of infection acquisition



Source: The number of cases reported between 2004 and 2015 come from Flash Vigie, July 2016, and the number of cases in 2016 is extracted from the MADDO file (Bureau de surveillance et de vigie, Infocentre du Québec, INSPQ) retrieved on February 24, 2017.

Among the 124 cases acquired in Québec, 90 (73%) were reported between the months of July and September, with the peak observed in September ( $n = 37$ ) (Figure 2).

**Figure 2** Number of cases of Lyme disease contracted in Québec according to the month and date reported, 2016,  $n = 124$



Source: Bureau de surveillance et de vigie, Infocentre du Québec, INSPQ, MADDO extraction as of February 24, 2017.

### Health regions of infection acquisition

In 2016 the geographical distribution of cases acquired in Québec was essentially limited to Estrie ( $n = 76$ , 61%) and Montérégie ( $n = 38$ , 31%), with respective incidence rates of 23.5 and 2.5/100 000 person-years (PY) (Table 1). Two cases were acquired either in Estrie or in Montérégie, one case was acquired in Mauricie et Centre-du-Québec, and a first case was acquired on the Côte-Nord. The health region of acquisition was unknown for the six remaining cases.

The high incidence observed in Estrie can be explained by the fact that 62/76 (82%) of the cases acquired in this region occurred in two areas of the local services networks (*réseaux locaux de services* or RLS) of Pommeraiie and Haute-Yamaska. These areas were transferred from Montérégie to Estrie as the Centre intégré universitaire de santé et de services sociaux de l'Estrie – Centre hospitalier universitaire de Sherbrooke was created in April 2015. These two areas have several municipalities that are endemic for Lyme disease<sup>2</sup> on their territory.

**Table 1** Number of cases of Lyme disease and incidence rate according to the probable infection acquisition health region, Québec, 2016,  $n = 124$

Health region	Number of confirmed cases (%)	Number of probable cases (%)	Incidence rate/100 000 person-years
Mauricie et Centre-du-Québec	1 (1)	0	0.4
Estrie	51 (67)	25 (52)	23.5
Montérégie	19 (25)	19 (40)	2.5
Estrie or Montérégie	1 (1)	1 (2)	-
Côte-Nord	0	1 (2)	1.1
Unknown	4 (5)	2 (4)	-
<b>Total</b>	<b>76 (100)</b>	<b>48 (100)</b>	<b>1.5</b>

Population estimates used for the incidence rate are drawn from the Institut de la statistique du Québec (2016).

Source: Bureau de surveillance et de vigie, Infocentre du Québec, INSPQ, MADDO extraction as of February 24, 2017.

<sup>2</sup> In 2016 the endemic municipalities for Lyme disease were those where the risk of infection after a tick bite was moderate or high. The list of these municipalities can be found on the INSPQ (2016a) website.

### Characteristics of cases acquired in Québec

Among the 124 cases of Lyme disease acquired in Québec, 57% were men and 43% were women with respective crude incidence rate of 1.7 and of 1.3/100 000 person-years. The average age of cases was 43 years (median age: 49 years, minimum age: 1 year, and maximum age: 84 years). The most affected age group was 60–69 years with an incidence rate of 2.9/100 000 person-years (Table 2).

**Table 2** Number of cases of Lyme disease contracted in Québec and crude incidence rate by sex and age group, 2016, n = 124

	Number of cases (%)	Incidence rate /100 000 person-years
<b>Sex</b>		
Male	71 (57)	1.7
Female	53 (43)	1.3
<b>Age in years</b>		
< 20 years	26 (21)	1.5
20–39 years	21 (17)	1.0
40–49 years	18 (15)	1.7
50–59 years	20 (16)	1.6
60–69 years	30 (24)	2.9
≥ 70 years	9 (7)	0.9

Source : Bureau de surveillance et de vigie, Infocentre du Québec, INSPQ, MADO extraction as of February 24, 2017.

## Acarological surveillance

Acarological surveillance related to Lyme disease combines active and passive surveillance of the *Ixodes scapularis* (*I. scapularis*) tick.

### Passive surveillance

As part of the passive surveillance program, the Laboratoire de santé publique du Québec (LSPQ) received 4 402 ticks, of which 60% (n = 2 627)<sup>3</sup> were *I. scapularis* acquired in Québec. In comparison, the LSPQ received 4 272 ticks in 2015 and 4 617 ticks in

2014, of which 48% (n = 2 028) and 55% (n = 2 549) were *I. scapularis* (INSPQ, 2016b and c).

Table 3 shows the characteristics of the *I. scapularis* acquired in Québec in 2016 and for which the health region of origin is known. These ticks came from 16 regions and the *I. scapularis* ticks were essentially adults and nymphs.<sup>4</sup>

### Human-origin ticks

In Montérégie, unlike the other regions, most of the ticks submitted were of human origin because animal surveillance was stopped in that region in 2009. Furthermore, in the summer of 2014, the Direction de la santé publique of this region asked four local services networks<sup>5</sup> to cease sending ticks of human origin, as the risk of tick exposure in their areas was considered sufficiently high that it was no longer needed to be demonstrated by passive surveillance (INSPQ, 2016c). This measure considerably reduced the total number of ticks of human origin submitted since 2015 (n = 368) compared to 2013 (n = 430 ticks) and 2014 (n = 505 ticks) (INSPQ, 2016b and d).

### Animal-origin ticks

The health regions that submitted the most animal-origin ticks were Montréal, Laurentides, Mauricie et Centre-du-Québec, Lanaudière, Capitale-Nationale and Estrie (Table 3).

### Ticks stage

Although the number of *I. scapularis* ticks submitted in 2015 was similar to that of previous years, more nymphs (n = 37) were submitted that year than in 2015 (n = 29) and in 2014 (n = 21). Most of the nymphs submitted in 2016 came from the same regions as those submitted in 2015 (Mauricie et Centre-du-Québec, Estrie, Montréal, Outaouais and Montérégie). Four other nymphs came from Laurentides, Lanaudière and Côte-Nord.

<sup>3</sup> This number excludes *I. scapularis* ticks when the person who was bitten or the owner of the bitten animal had travelled outside of Québec in the two weeks prior to tick removal. Ticks were also excluded when it was not known where the bitten person or animal had travelled.

<sup>4</sup> Larvae are not usually submitted to the LSPQ as part of passive surveillance because they tend to bite small animals and rarely humans.

<sup>5</sup> Two of the four local services networks targeted by this measure were transferred to the health region of Estrie when the Centre intégré universitaire de santé et de services sociaux de l'Estrie – Centre hospitalier universitaire de Sherbrooke was created in April 2015.

The literature indicates that an increased number of *I. scapularis* nymphs submitted from passive surveillance was associated with an increase in the number of human cases in the State of Maine in the United States (Rand *et al.*, 2007).

The number of multiple submissions received by the LSPQ in 2016 (n = 63) is similar to that of 2015 (n = 61), but higher than that of 2014 (n = 49). A multiple submission is a submission that has more than one tick from the same animal or human. The regions of Estrie (n = 13), Montréal (n = 10) and Outaouais (n = 10) sent

the most multiple submissions in 2016, while in 2015, it was Montréal (n = 14), Outaouais (n = 9), Laval (n = 7) and Mauricie et Centre-du-Québec (n = 7) that sent the greatest number of multiple submissions. In addition, multiple submissions mostly come from animals.

The percentage of *I. scapularis* ticks submitted to the LSPQ and infected by *Borrelia burgdorferi* varied between 0 and 25% depending on the health region from which the ticks originated. These proportions should be interpreted with caution, as they vary substantially when small numbers of ticks are tested (INSPQ, 2014).

**Table 3** Characteristics of *Ixodes scapularis* submitted to the LSPQ in the passive surveillance program by region from which the ticks originated, Québec, 2016

Health region	Number of <i>I. scapularis</i> by origin		Number of <i>I. scapularis</i> by stage		Number of multiple <i>I. scapularis</i> submissions <sup>a</sup>	Proportion of <i>I. scapularis</i> tested positive for <i>B. burgdorferi</i> <sup>b</sup>
	Human	Animal	Adult	Nymph		
Bas-Saint-Laurent	5	53	58	0	0	12/58 (20.7%)
Saguenay–Lac-Saint-Jean	8	86	94	0	1	22/94 (23.4%)
Capitale-Nationale	15	166	181	0	4	42/179 (23.5%)
Mauricie et Centre-du-Québec	53	214	263	4	3	38/264 (14.4%)
Estrie	140	163	284	19	13	48/298 (16.1%)
Montréal	23	222	242	3	10	44/244 (18.0%)
Outaouais	38	88	125	1	10	12/123 (9.8%)
Abitibi-Témiscamingue	1	54	55	0	0	11/54 (20.4%)
Côte-Nord	11	1	11	1	0	3/12 (25.0%)
Nord-du-Québec	0	1	1	0	0	0/1 (0.0%)
Gaspésie–Îles-de-la-Madeleine	0	31	31	0	0	7/31 (22.6%)
Chaudière-Appalaches	15	86	101	0	3	15/99 (15.2%)
Laval	6	84	90	0	4	15/89 (16.9%)
Lanaudière	16	172	187	1	5	27/188 (14.4%)
Laurentides	16	218	232	2	5	39/233 (16.7%)
Montérégie	123	49	166	6	5	37/168 (22.0%)
Nunavik	0	0	0	0	0	0/0 (0.0%)
<b>Total</b>	<b>470</b>	<b>1 688</b>	<b>2 121</b>	<b>37</b>	<b>63</b>	<b>372/2 158 (17.4%)</b>

<sup>a</sup> A multiple submission is a submission that has more than one tick from the same animal or human.

<sup>b</sup> Ticks that are too damaged or inappropriately preserved are not tested.

## Active surveillance

In 2016, active surveillance activities were carried out as part of three different projects.

One of the projects was the MSSS provincial surveillance plan with the objective to document the abundance of *I. scapularis* ticks and their infection rate with *B. burgdorferi* in regions where the tick was established

but where the risk of infection was low or undocumented. The details about this sampling plan can be found in INSPQ (2017a).

The two other projects were research projects. The main objective of one of them was to document the presence of *I. scapularis* ticks in the Laurentides region according to a north-south geographical gradient. The other was aimed at documenting the density of *I. scapularis* ticks

together with their infection rate for *B. burgdorferi* and other pathogens in Québec municipalities located in regions where there are municipalities endemic for Lyme disease: Estrie, Montérégie, and Mauricie et Centre-du-Québec.

A total of 111 sites were visited between May and August 2016 in ten health regions (Table 4). The standard flannel drag method was used (INSPQ, 2017b) for collection at all sites. Some sites were visited twice, but the greatest number of them was visited only once. The majority of the visited sites were public parks. Some private properties were also visited as part of one research project.

Among the visited sites, 51 (46%) had at least one *I. scapularis* tick, 12 (11%) had the three life-cycle stages of the tick (confirming that *I. scapularis* ticks were established there), 22 (20%) had at least one tick positive for *B. burgdorferi*, and 9 (8%) were endemic sites presenting the three life-cycle stages of *I. scapularis* collected in the same year with at least one nymph testing positive for *B. burgdorferi*. These sites were mainly located in Montérégie (n = 6), one site in Estrie, one in Outaouais and one in Mauricie et Centre-du-Québec. The last three sites (Dunham, Bristol and Odanak, respectively) as well as a site in Montérégie (Très-Saint-Sacrement) have been identified as new endemic sectors by collections made in 2016.

**Table 4** Number of visited sites by active surveillance according to the health region, the presence of ticks and that of positive ticks, Québec, 2016

Health region	Number of sites				
	Visited	With at least one <i>I. sc</i>	With the 3 life-cycle stages of <i>I. sc</i>	With at least one positive tick	Endemic*
Capitale-Nationale	6	0	-	-	-
Mauricie et Centre-du-Québec	7	3	1	1	1
Estrie	21	12	2	3	1
Montréal	6	1	0	1	0
Outaouais	6	5	2	1	1
Chaudière-Appalaches	6	2	0	0	0
Laval	6	2	0	0	0
Lanaudière	6	0	-	-	-
Laurentides	18	5	1	0	0
Montérégie	29	21	6	16	6
<b>Total</b>	<b>111</b>	<b>51</b>	<b>12</b>	<b>22</b>	<b>9</b>

*I.sc*: *I. scapularis*.

\* With the three life-cycle stages of ticks + at least one positive nymph.

As part of active surveillance activities made in 2016, 1 036 *I. scapularis* ticks were collected and included 553 larvae, 397 nymphs and 86 adults (Table 5). The larvae were found in 27 sites in six of the ten health regions visited. The nymphs were found in 40 sites in seven regions and adults were found in 24 sites in seven regions.

All the *I. scapularis* adults and nymphs collected were tested for *B. burgdorferi*. Among them, 82 (17%) were positive for this pathogenic agent (Table 5).

**Table 5** Total number of positive ticks collected during active surveillance according to the health region, Québec, 2016

Health region	Larvae <sup>*</sup>	Nymphs	Adults	<i>I. sc. + B. burgdorferi</i>	<i>I. sc. + B. miyamotoi</i>	<i>I. sc. + A. phagocytophilum</i>	<i>I. sc. + B. microti</i>	<i>I. sc. + V. Powassan</i>
Capitale-Nationale	0	0	0	0	0	0	0	0
Mauricie et Centre-du-Québec	55	38	12	6	0	0	0	0
Estrie	47	62	11	6		1		
Montréal	0	5	6	1	0	0	0	0
Outaouais	43	35	5	8	1	0	0	0
Chaudière-Appalaches	44	0	0	0	0	0	0	0
Laval	0	1	1	0	0	0	0	0
Lanaudière	0	0	0	0	0	0	0	0
Laurentides	2	7	2	0	0	0	0	0
Montérégie	362	249	49	61	1	5	0	0
<b>Total</b>	<b>553</b>	<b>397</b>	<b>86</b>	<b>82<sup>1</sup></b>	<b>2<sup>2</sup></b>	<b>6<sup>3</sup></b>	<b>0</b>	<b>0</b>

\* Larvae are not tested for pathogenic agents because the infected female does not transmit them to the eggs.

<sup>1</sup> 56/82 are nymphs.

<sup>2</sup> Both are nymphs.

<sup>3</sup> 4/6 are nymphs.

In 2016 the number of ticks collected and the number of ticks infected by *B. burgdorferi* was higher than in 2015, when 99 *I. scapularis* ticks were collected and only one tested positive for *B. burgdorferi*. This difference may be explained by the different objective of active surveillance in 2015, which was to document the presence of ticks in sectors where their presence was suspected but undocumented, while in 2016, the active acarological surveillance had three distinct objectives and nearly half of the visited sites were found in Montérégie and Estrie, regions where *I. scapularis* ticks are well established.

## Other diseases transmitted by *Ixodes scapularis*

The *I. scapularis* tick, the principal vector of Lyme disease, can also transmit other diseases. The human and acarological surveillance systems in Québec can follow the progression of these diseases (or that of their pathogenic agents) throughout Québec. Some of them are reportable diseases (MADO). In addition, the

molecular analyses<sup>6</sup> made on ticks collected during acarological surveillance are aimed at detecting these other pathogenic agents.

### Human surveillance

Babesiosis (pathogenic agent is *Babesia microti*) and Powassan encephalitis (pathogenic agent is the Powassan virus)<sup>7</sup> are reportable diseases in Québec and can be transmitted by the *I. scapularis* tick. No cases of babesiosis or Powassan encephalitis were reported in Québec in 2016.

Anaplasmosis (pathogenic agent is *A. phagocytophilum*) is another infection that can be transmitted by *I. scapularis*. The exact number of cases of this infection is unknown, as the infection is not currently a reported disease in Québec. However, in 2016 the LSPQ received 93 requests for serological testing for *A. phagocytophilum*. A total of 79 beneficiaries from 12 regions were tested by IFA IgG screening for *A. phagocytophilum* antibodies. Positive serologies (IFA

<sup>6</sup> Molecular analyses are performed by the National Microbiology Laboratory of the Public Health Agency of Canada.

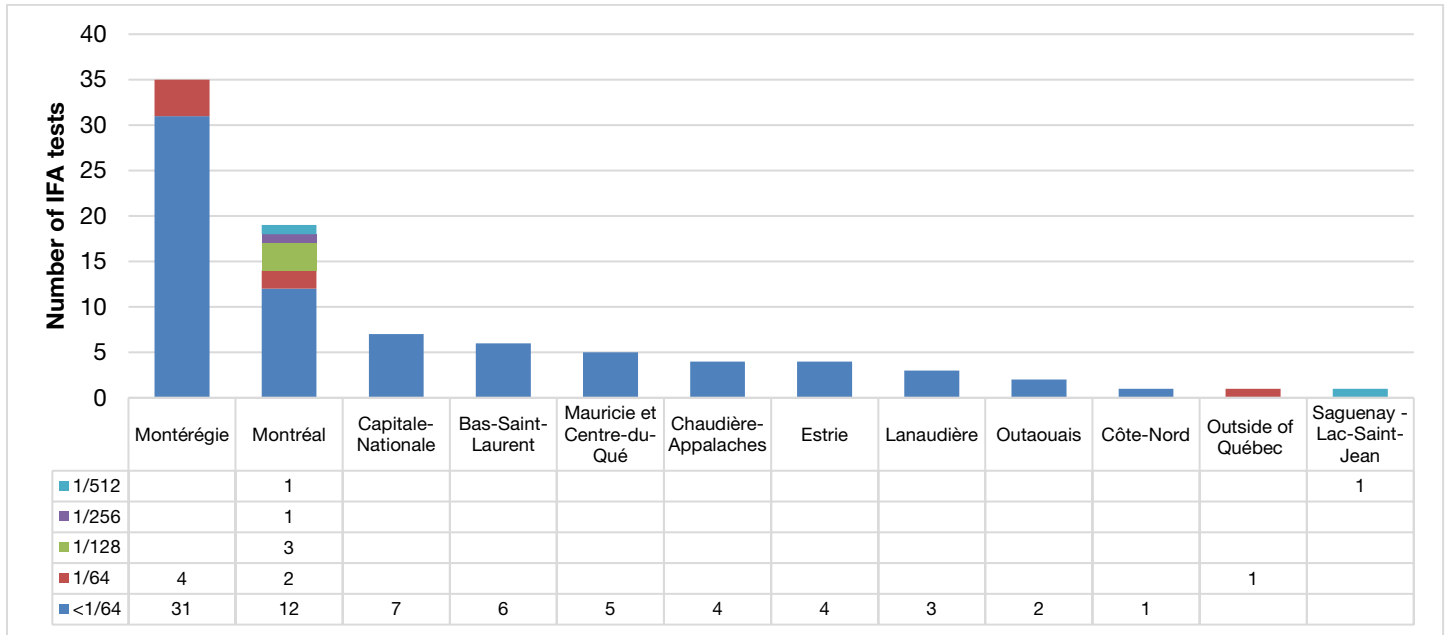
<sup>7</sup> Powassan encephalitis can also be transmitted by *Ixodes cookei* (INSPQ, 2014).



IgG titer  $\geq 1/64$ ) were found in 13 beneficiaries residing in Montérégie (n = 4), Montréal (n = 7), Saguenay–Lac-

Saint-Jean (n = 1), and one beneficiary outside of Québec (Figure 3).

**Figure 3** Number and distribution of results from serological IFA IgG for *A. phagocytophilum*, 2016



## Acarological surveillance

As previously mentioned, it is possible to check the presence of various pathogenic agents including *Anaplasma phagocytophilum*, *Borrelia miyamotoi*, *Babesia microti*, and the Powassan encephalitis virus from molecular analyses of ticks received through passive or active surveillance activities. As part of the passive surveillance program, 41 *I. scapularis* ticks were tested positive for *A. phagocytophilum*, eleven ticks were tested positive for *B. miyamotoi*, and one for *B. microti* (Table 6).

Lastly, as part of active surveillance, two ticks were tested positive for *B. miyamotoi* and six for *A. phagocytophilum* (Table 5). The latter were mostly located in Montérégie.

## Limitations

Data for human and acarological surveillance present some limitations that are documented in the Plan d’analyse de la surveillance intégrée de la maladie de Lyme [integrated surveillance of Lyme disease and other diseases transmitted by the *I. scapularis* tick] (INSPQ, 2017b).

Therefore, the following section will only present the specific limitations directly associated with the 2016 surveillance activities.

The MADDO file is continuously updated. Consequently, new cases of Lyme disease have been added to the database since the date on which the data used in this report were extracted (February 24, 2017) and are not included in this report. Furthermore, establishing postexposure prophylaxis for Lyme in the local services networks of Pommeraiie and Haute-Yamaska in the spring of 2016 may have contributed to a greater awareness by health professionals and thus subsequently led to an increase in the number of cases reported in these areas.

Active surveillance data come from three different projects: one project was focused on surveillance, but the two others had research objectives. Lastly, collecting ticks in active surveillance is based on the standard drag flagging method that has good specificity (sp = 90%),

but poor sensitivity (sn = 50%) to determine areas at risk for Lyme disease. Therefore, ticks that are present in low-density sites may not be found with this method (Ogden *et al.*, 2014).

**Table 6** Proportion of *Ixodes scapularis* ticks infected by *Babesia microti*, *Anaplasma phagocytophilum* and *Borrelia miyamotoi* submitted to the LSPQ in 2016 within passive surveillance program, according to their health region of origin

Health region	Proportion of <i>I. scapularis</i> tested positive for <i>B. microti</i> <sup>a</sup>	Proportion of <i>I. scapularis</i> tested positive for <i>A. phagocytophilum</i> <sup>a</sup>	Proportion of <i>I. scapularis</i> tested positive for <i>B. miyamotoi</i> <sup>a</sup>
Bas-Saint-Laurent	0/58 (0%)	6/58 (10%)	1/58 (2%)
Saguenay–Lac-Saint-Jean	0/94 (0%)	1/94 (1%)	0/94 (0%)
Capitale-Nationale	0/179 (0%)	8/179 (4%)	1/179 (0.6%)
Mauricie et Centre-du-Québec	1/264 (0.4%)	6/264 (2%)	0/264 (0%)
Estrie	0/298 (0%)	4/298 (1%)	4/298 (1%)
Montréal	0/244 (0%)	3/244 (1%)	1/244 (0.4%)
Outaouais	0/123 (0%)	0/123 (0%)	0/123 (0%)
Abitibi-Témiscamingue	0/54 (0%)	0/54 (0%)	0/54 (0%)
Côte-Nord	0/12 (0%)	0/12 (0%)	0/12 (0%)
Nord-du-Québec	0/1 (0%)	0/1 (0%)	0/1 (0%)
Gaspésie–Îles-de-la-Madeleine	0/31 (0%)	0/31 (0%)	0/31 (0%)
Chaudière-Appalaches	0/99 (0%)	2/99 (2%)	1/99 (1%)
Laval	0/89 (0%)	1/89 (1%)	0/89 (0%)
Lanaudière	0/188 (0%)	5/188 (3%)	1/188 (0.5%)
Laurentides	0/233 (0%)	4/233 (2%)	1/233 (0.4%)
Montérégie	0/168 (0%)	1/168 (0.6%)	1/168 (0.6%)
Nunavik	0/0 (0%)	0/0 (0%)	0/0 (0%)
<b>Total</b>	<b>1/2 135 (0%)</b>	<b>41/2 135 (2%)</b>	<b>11/2 135 (0.5%)</b>

<sup>a</sup> Ticks that are too damaged or inappropriately preserved are not tested.



## References

- INSPQ, 2014. Proposition d'un programme de surveillance intégrée pour la maladie de Lyme et les autres maladies transmises par la tique *Ixodes scapularis* au Québec. [ONLINE]. URL: <https://www.inspq.qc.ca/publications/1819>. Page accessed 25/02/17.
- INSPQ, 2016a. Proposition d'un programme pour la surveillance intégrée de la maladie de Lyme et des autres maladies transmises par la tique *Ixodes scapularis* - Mise à jour 2015. [ONLINE]. URL: <https://www.inspq.qc.ca/publications/2082>. Page accessed 25/02/17.
- INSPQ, 2016b. Rapport de surveillance de la maladie de Lyme et des autres maladies transmises par la tique *Ixodes scapularis* - Année 2014. [ONLINE]. URL: <https://www.inspq.qc.ca/publications/2129>. Page accessed 01/05/17.
- INSPQ, 2016c. Rapport de surveillance de la maladie de Lyme et des autres maladies transmises par la tique *Ixodes scapularis* - Année 2015. [ONLINE]. URL: <https://www.inspq.qc.ca/publications/2190>. Page accessed 01/05/17.
- INSPQ, 2016d. Rapport de surveillance de la maladie de Lyme et des autres maladies transmises par la tique *Ixodes scapularis* - Années 2004 à 2013. [ONLINE]. URL: <https://www.inspq.qc.ca/publications/2160>. Page accessed 01/05/17.
- INSPQ, 2017a. Scénarios de surveillance intégrée de la maladie de Lyme au Québec - avis 2016. [ONLINE]. URL: <https://www.inspq.qc.ca/publications/2239>. Page accessed 12/06/17.
- INSPQ, 2017b. Plan d'analyse de la surveillance intégrée de la maladie de Lyme. [ONLINE]. URL: <https://www.inspq.qc.ca/publications/2257>. Page accessed 12/06/17.
- Ministère de la Santé et des Services sociaux du Québec, 2016. Flash Vigie - Bulletin québécois de vigie, de surveillance et d'intervention en protection de la santé publique. May 2016 – Update July 21, 2016. [ONLINE]. URL: [http://publications.msss.gouv.qc.ca/msss/fichiers/flashviegie/FlashVigie\\_vol11\\_no5.pdf](http://publications.msss.gouv.qc.ca/msss/fichiers/flashviegie/FlashVigie_vol11_no5.pdf). Page accessed 01/05/17.
- Institut de la statistique du Québec. Population totale (1986-2016). [ONLINE]. URL: [http://www.stat.gouv.qc.ca/statistiques/population-demographie/structure/ra\\_total.htm](http://www.stat.gouv.qc.ca/statistiques/population-demographie/structure/ra_total.htm). Page accessed 01/05/17.
- Ogden NH, Koffi JK, Lindsay LR., 2014. Évaluation d'un test de dépistage devant servir à déterminer le risque de la maladie de Lyme. *RMTC*; 40-5.
- Rand PW, Lacombe EH, Dearborn R, Cahill B, Elias S, Lubelczyk CB, Beckett GA, Smith RP Jr, 2007. Passive Surveillance in Maine, an Area Emergent for Tick-Borne Diseases. *Journal of Medical Entomology*, 44(6):1118–1129.

# Report on Surveillance for Lyme Disease: 2016

## AUTHORS

Najwa Ouhoumane, PhD  
Ariane Adam-Poupart, PhD  
François Milord, MD, MSc, FRCPC  
Alejandra Irace-Cima, MD, MSc, FRCPC  
Direction des risques biologiques et de la santé au travail  
  
Karine Thivierge, PhD  
Christian Therrien, PhD  
Laboratoire de santé publique du Québec

## WITH THE COLLABORATION OF

Patrick Leighton, PhD  
Faculty of Veterinary Medicine, Université de Montréal  
  
Nicholas Ogden, B.V.Sc, D. Phil.  
National Microbiology Laboratory - Public Health Agency of Canada and the Faculty  
of Veterinary Medicine, Université de Montréal

## LAYOUT

Adolphine Luzayday, administrative agent  
Direction des risques biologiques et de la santé au travail

## TRANSLATOR

Sandra Miller-Sanchez

## LINGUISTIC REVISION

Émilie Pelletier

The translation of this publication was made possible with funding from the  
Public Health Agency of Canada.

*This document is available in its entirety in electronic format (PDF) on the website of  
the Institut national de santé publique du Québec at: <http://www.inspq.qc.ca>.*

*The French version is entitled Rapport de surveillance de la maladie de Lyme :  
année 2016 and is also available on the website of the Institut national de santé  
publique du Québec at: <http://www.inspq.qc.ca>*

*Any reproduction for purposes of private study or research is authorized under  
Section 29 of the Copyright Act. Any other use must be authorized by the  
Government of Québec, which holds the exclusive intellectual property rights for this  
document. Such authorization may be obtained by submitting a request to the  
central clearinghouse of the Service de la gestion des droits d'auteur of Les  
Publications du Québec, using the online form available at the following address:  
<http://www.droitauteur.gouv.qc.ca/autorisation.php>, or by email to:  
[droit.auteur@cspq.gouv.qc.ca](mailto:droit.auteur@cspq.gouv.qc.ca).*

*Information contained in this document may be cited provided that the source is  
mentioned.*

LEGAL DEPOSIT – 3<sup>rd</sup> QUARTER 2018  
BIBLIOTHÈQUE ET ARCHIVES NATIONALES DU QUÉBEC  
ISBN: 978-2-550-79276-5 (FRENCH PDF)  
ISBN: 978-2-550-81729-1 (PDF)

© Gouvernement du Québec (2018)

Publication No: 2417