INSPQ INSTITUT NATIONAL DE SANTÉ PUBLIQUE DU QUÉBEC

Surveillance of Lyme disease and other diseases transmitted by the *Ixodes scapularis* tick: 2014

ANNUAL REPORT

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In 2014, 127 cases of Lyme disease were reported to public health authorities, including 66 cases that were acquired in Québec.

During that same year, the Laboratoire de santé publique du Québec received 2,549 *Ixodes scapularis* ticks from Québec, primarily from the Montérégie, Montréal, Mauricie and Centre-du-Québec, Lanaudière, Laurentides and Estrie regions.

Lastly, active surveillance in 2014 identified three new endemic sites for Lyme disease, all in Montérégie.

Sommaire

Human surveillance

Surveillance of human cases of Lyme disease in Québec began in 2003, when the disease was added to the reportable diseases registry (MADO). Human surveillance is therefore based on reports by physicians and laboratories, as well as epidemiological studies conducted by public health authorities.

In 2014, 127 cases of Lyme disease were reported to public health authorities. However, the analyses presented in this report focus solely on the 120 cases (76 confirmed and 44 probable) extracted from the MADO registry as of February 25, 2015.[1]

Among the 120 extracted cases, 63 cases were infections acquired in Québec, while 49 were acquired outside of Québec (United States, n = 39; Europe, n = 3; Ontario, n = 5; elsewhere in the Americas, n = 2). The probable acquisition location was unknown in the remaining eight cases.

The numbers of confirmed and probable cases of infections acquired in Québec, as well as the overall incidence rate by health region are presented in Table 1. These cases were reported between January and November 2014, with the vast majority of them reported during the months of August (n = 13) and September (n = 8).

From 2004 to 2013, only the Montérégie, Estrie and Mauricie and Centre-du-Québec health regions (INSPQ, 2014) had been identified as probable Lyme disease acquisition regions. However, in 2014, two new health regions, Laurentides and Montréal, were identified as probable acquisition location.

As in previous years, the majority (86%) of domestic cases (i.e. human cases acquired in Québec) in 2014 were infected in Montérégie.

[1] The MADO registry is updated on an ongoing basis. Between February 25, 2015, and January 20, 2016, seven new cases of Lyme disease were added to the MADO database. These cases are not included in the analysis presented in this report.

Québec

Tableau 1 Number, percentage and crude incidence rate of Lyme disease cases by probable infection acquisition health region in 2014

Health region	Number of confirmed cases (%)	Number of probable cases (%)	Incidence rate /100,000 persons-year
Mauricie and Centre-du-Québec	--	3 (10)	0.59
Estrie	1 (3)	--	0.21
Montréal	--	3 (10)	0.15
Laurentides	1 (3)	--	0.17
Montérégie	30 (91)	24 (80)	3.98
Unknown	1 (3)	--	--
Total	**33 (100)**	**30 (100)**	**0.77**

Sources: Bureau de surveillance et de vigie, Infocentre du Québec, INSPQ, MADO extraction as of February 25, 2015. Population estimates used for incidence rates provided by the MSSS (2015a).

Among the 63 domestic cases of Lyme disease, 54% were men and 46% women, with respective crude incidence rates of 0.8 person-years (p-y) for men and 0.7/100,000 p-y among women. The average age of the cases was 46 (median: 48 years, minimum: 1 year and maximum: 81 years). The most affected age groups were 60-69 and 0-9 years, with incidence rates of 1.4 and 0.6/100,000 p-y, respectively.

Other diseases can be transmitted by the *Ixodes scapularis* tick, the principal Lyme disease vector. These include babesiosis and Powassan encephalitis, which are also reportable diseases. In 2014, one case of United States-acquired babesiosis was reported in the MADO database, while two cases were reported between 2002 and 2012 (INSPQ, 2014). No cases of Powassan encephalitis were reported in 2014, with three cases reported between 2002 and 2012 (INSPQ, 2014).

Anaplasmosis is another infection that can be transmitted by the Ixodes scapularis tick. The exact number of anaplasmosis cases is unknown, as the infection is not currently a reportable disease in Québec. However, serology for *Anaplasma phagocytophilum* was sent to the Laboratoire de santé publique du Québec (LSPQ) for 53 patients in 2014, with 9 results (17%) coming back positive.[2] This positivity rate is similar to that observed in 2012-2013, when 14 of 82 patients (17%) tested positive for the disease (INSPQ, 2014).

Acarological surveillance

Acarological surveillance combines passive and active surveillance of the *Ixodes scapularis* tick.

Passive surveillance

As part of the passive surveillance program, the LSPQ receives and identifies ticks voluntarily submitted by health establishments and veterinary clinics. Once the species has been identified, *Ixodes scapularis* ticks are sent to the Public Health Agency of Canada's National Microbiology Laboratory to test for *Borrelia burgdorferi* (the pathogen responsible for Lyme disease), *Anaplasma phagocytophilum* (the pathogen that causes anaplasmosis) and *Babesia microti* (the pathogen responsible for babesiosis). *Ixodes scapularis* ticks are generally not tested for the presence of Powassan virus, which causes Powassan encephalitis.

Since the passive surveillance program began in 1990, the number of ticks submitted, included *Ixodes scapularis* specimens, has grown steadily. In 2014, the LSPQ received 4,617 ticks, of which 55% (n = 2,549) were *Ixodes scapularis* ticks acquired in Québec. For comparison purposes, in 2013, the LSPQ received 3,868 ticks, of which 2,182 were *Ixodes scapularis* ticks acquired in Québec; in 2012, it received 3,073 ticks, of which 1,516 were *Ixodes scapularis* specimens acquired in Québec.

Table 2 represents the characteristics of *Ixodes scapularis* specimens acquired in Québec in 2014, for which the health region of origin is known (n = 2,116). The ticks came from 15 regions. The Montérégie, Montréal, Mauricie and Centre-du-Québec, Lanaudière, Laurentides and Estrie regions submitted the most ticks. Those *Ixodes scapularis* specimens essentially were adults and nymphs.[3]

[2] Serology was positive with a titre ≥ 64. Probable infection acquisition locations were not documented, but the patients resided in the Capitale-Nationale (n = 2), Laval (n = 1), Montérégie (n = 5) and Montréal (n = 1) health regions.

[3] Larvae are not usually submitted to the LSPQ as part of passive surveillance, as they generally only bite small animals and rarely humans.

Tableau 2 Number, percentage and crude incidence rate of Lyme disease cases by probable infection acquisition health region in 2014

Health region	Number of *Ixodes scapularis* specimens by origin		Number of *Ixodes scapularis* specimens by life-cycle stage		Number of multiple *Ixodes scapularis* submissions[a]	Of those tested, proportion of *Ixodes scapularis* specimens that tested positive for *Borrelia burgdorferi* (%)[b]
	Human	Animal	Adult	Nymph		
01- Bas-Saint-Laurent	5	30	35	0	0	10/35 (29)
02- Saguenay–Lac-Saint-Jean	9	28	37	0	0	7/35 (20)
03- Capitale-Nationale	12	111	122	1	1	16/123 (13)
04- Mauricie et Centre-du-Québec	63	214	275	2	8	38/270 (14)
05- Estrie	44	111	153	2	4	21/151 (14)
06- Montréal	15	262	276	1	7	44/276 (16)
07- Outaouais	25	68	93	0	2	9/90 (10)
08- Abitibi-Témiscamingue	--	3	3	0	0	0/3 (0)
09- Côte-Nord	0	4	4	0	0	0/4 (0)
10- Nord-du-Québec	--	--	--	--	--	--
11- Gaspésie–Îles-de-la-Madeleine	1	6	7	0	0	0/7 (0)
12- Chaudière-Appalaches	14	69	83	0	2	13/82 (16)
13- Laval	5	66	71	0	2	15/68 (22)
14- Lanaudière	12	180	192	0	5	45/191 (24)
15- Laurentides	16	176	191	1	5	40/192 (21)
16- Montérégie	505	62	553	14	13	112/548 (20)
17- Nunavik	--	--	--	--	--	0 (0)
Total	**726**	**1,390**	**2,095**	**21**	**49**	**370/2,075 (18)**

[a] Multiple submissions mean one submission where several ticks were found on a single animal or human.

[b] Only nymphs and adult ticks are tested for *Borrelia burgdorferi*. Ticks that are too damaged or inappropriately preserved are not tested.

Source: Laboratoire de santé publique du Québec, extraction of passive surveillance data for 2014.

In Montérégie, unlike the other regions, the ticks submitted were of human origin, since animal surveillance was discontinued in that region in 2009 (INSPQ, 2014).

In the summer of 2014, the Direction de la santé publique de la Montérégie requested authorization from four local service areas to cease sending in human-origin ticks, as the risk of tick exposure was considered sufficiently high in their area that it no longer needed to be demonstrated through passive surveillance.[4] Because the request was made late in the tick submission period, the four areas in question continued to send ticks to the LSPQ in 2014. These ticks are included in the number of human-origin ticks submitted by the Montérégie region and shown in Table 2 (n = 505). Montérégie submitted the most human-origin ticks in 2014. For comparison purposes, the number of human-origin ticks submitted by the other Québec regions varied from 0 (Côte-Nord) to 63 ticks (Mauricie and Centre-du-Québec) for that same year. The impact of the Direction de la santé publique de la Montérégie's request to halt tick submission in the four areas in question, with the eventual decrease in the number of human-origin ticks from Montérégie, should be observed in 2015.

[4] This measure was put in place in response to a request from a microbiology laboratory that was receiving large numbers of ticks and no longer wished to take part in the surveillance program. After studying the available data, the Direction de la santé publique de la Montérégie considered that the risk of tick exposure was high in the four local service areas in question and that it was no longer necessary to collect ticks to prove this (Milord F., personal communication dated May 19, 2015).

Montérégie also distinguished itself in 2014 by its high number of nymph submissions. The literature indicates that an increase in this indicator was related to an increase in the number of human cases (on a county scale) in Maine, United States (Rand et al., 2007). Montérégie is also the region that sent the most multiple submissions to the LSPQ, i.e., submissions of several ticks found on a single animal or human.

The percentage of *Ixodes scapularis* ticks submitted to the LSPQ and infected with *Borrelia burgdorferi* varied by health region from 0 to 29%. These proportions should be interpreted with caution, as they vary substantially when small numbers of ticks are tested (INSPQ, 2014).

In addition, 22 ticks submitted to the LSPQ for which the health region of origin was known turned out to be infected with *Anaplasma phagocytophilum.* These were from Montréal (n = 7), Lanaudière (n = 4), Montérégie (n = 3), Estrie (n = 2), Laval (n = 2), Bas-St-Laurent (n = 1), Mauricie and Centre-du-Québec (n = 1), Outaouais (n = 1) and Laurentides (n = 1) regions. The percentage of *Ixodes scapularis* ticks infected with *Anaplasma phagocytophilum* varied by health region from 0 to 3%.

Lastly, two ticks submitted to the LSPQ were infected with *Babesia microti* in 2014. The specimen came from Montréal and Estrie.

Active surveillance

As part of active surveillance activities, tick gathering was performed in nine health regions (Table 3). In total, 100 sites were visited between June and September 2014, with one visit per site. The standard drag flagging method (INSPQ, 2014) was used and 1,930 *Ixodes scapularis* ticks were collected at 52 sites in seven regions. These consisted of 1,537 larvae, 343 nymphs and 50 adult ticks. The larvae were found in six of the nine regions visited, while the nymphs and adults were only found in Estrie, Lanaudière and Montérégie.

The ticks collected were identified at the LSPQ and the *Ixodes scapularis* ticks were sent to the National Microbiology Laboratory for pathogen screening (*Borrelia burgdorferi*, *Anaplasma phagocytophilum* and *Babesia microti*). Powassan virus testing is not generally performed.

Ticks that tested positive for *Borrelia burgdorferi* were found in Montérégie only (n = 9 sites), with infection rates varying from 8% to 34%. Ticks that tested positive for *Anaplasma phagocytophilum* were also found in Montérégie, with infection rates from 3% to 24% by site visited. These proportions should also be interpreted with caution, as they vary greatly when small numbers of ticks are tested (INSPQ, 2014). None of the collected ticks tested positive for *Babesia microti*.

In 2014, the INSPQ defined a sector as endemic for Lyme disease when all three life-cycle stages of the tick (larva, nymph and adult) were collected in one year through active surveillance and when at least one nymph tested positive for *Borrelia burgdorferi.*[5] Applying these criteria to the findings for the 2014 collection made it possible to identify three new endemic sectors, all in Montérégie (Hemmingford, Saint-Bernard-de-Lacolle and Saint-Dominique).

These three endemic sectors are added to the 13 others identified in Québec since active surveillance began in 2007. Those are located in Montérégie (Farnham, Henryville, Noyan, St-Valentin, Longueuil, Réserve St-François du Lac, Parc du Mont St-Bruno, Marieville, Carignan, Salaberry-de-Valleyfield, Saint-Étienne de Beauharnois), Estrie (Danville) and Mauricie and Centre-du-Québec (Drummondville).

[5] The criteria for defining an endemic sector were revised in 2015 and may be consulted in the document entitled Proposition d'un programme pour la surveillance intégrée de la maladie de Lyme et des autres maladies transmises par la tique *Ixodes scapularis* au Québec : mise à jour 2015 (in press).

Tableau 3 Characteristics of sites sampled in 2014, by health region

Health region	Number of sites		
	Visited	At least one *Ixodes scapularis* specimen collected (number, %)	Three life-cycle stages of *Ixodes scapularis* collected and one nymph positive for *Borrelia burgdorferi*
03- Capitale-Nationale	4	0 (0)	0 (0)
04- Mauricie and Centre-du-Québec	2	0 (0)	0 (0)
05- Estrie	23	4 (17)	0 (0)
06- Montréal	4	1 (25)	0 (0)
07- Outaouais	3	1 (33)	0 (0)
13- Laval	4	1 (25)	0 (0)
14- Lanaudière	5	1 (20)	0 (0)
15- Laurentides	4	1 (25)	0 (0)
16- Montérégie	51	43 (84)	7 (14)
Total	**100**	**52 (52)**	**7 (7)**

Limitations of surveillance data

First, in a context where Lyme disease remains emergent in Québec, it is possible that the human surveillance system, which relies on reporting by health care professionals, is influenced by their knowledge and that of patients. Professionals' reports depend on their own awareness of the disease, their knowledge of risk, their clinical assessment and consideration of the places frequented by patients during the exposure period. Consequently, diagnosis and exposure suspicion bias is possible, and the data should be interpreted with caution.

In addition, surveillance of human cases of infectious diseases relies on Québec's case definitions, which have consistent criteria for confirming and standardizing cases. In the case of Lyme disease, that definition includes the concept of endemic areas (MSSS, 2015b). Differing applications of the concept of endemicity among Québec regions, as well as the use of different definitions of endemicity, may have an impact on the data. The impact on human surveillance results of the use of differing endemicity definitions is currently being assessed.

The MADO registry 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.

As with human surveillance, the passive acarological surveillance system is influenced by the knowledge of professionals in human and animal health care with regard to the risk of Lyme disease infection in their area and their willingness to submit tick specimens to the LSPQ. In this context, some municipalities may be over- or under-represented in the corresponding data file.

Lastly, active surveillance data must also be interpreted with caution. The standard drag flagging tick collection method has good specificity (specificity = 90%) for determining areas at risk for Lyme disease, but lacks sensitivity (sensitivity = 50%). This means that ticks that are present in low-density sites may not be found using this method (Ogden et al., 2014).

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AUTHORS

Ariane Adam-Poupart, Ph. D.
Direction des risques biologiques et de la santé au travail

Karine Thivierge, Ph. D.
Laboratoire de santé publique du Québec

Najwa Ouhoummane, Ph. D.

Alejandra Irace-Cima, M.D., M. Sc., FRCPC

François Milord, M.D., M. Sc., FRCPC

Direction des risques biologiques et de la santé au travail, Institut national de santé publique du Québec

WITH THE COLLABORATION OF

Christian Therrien, Ph. D.
Laboratoire de santé publique du Québec
Institut national de santé publique du Québec

Patrick Leighton, Ph. D.
Faculté de médecine vétérinaire, Université de Montréal

Nicholas Ogden, B.V.Sc., Phil. D.
Public Health Agency of Canada and
Faculté de médecine vétérinaire de l'Université de Montréal

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