

Canadian Lyme Disease Research Network

Pillar 2 - Risk Reduction

Annual General Meeting

November 10th, 2021

Trainees and Projects

Student	University (Supervisor)	Project
Andreea Slatculescu (PhD)	U. Ottawa (Kulkarni)	Examining associations between environmental and epidemiological risk of Lyme disease in Ontario: a case-control study
Camille Guillot (PhD)	U. Montréal (Leighton)	Sentinel surveillance for vector-borne disease: tracking the emergence of Lyme disease in Canada
Cyril Akwo (PhD)	U. Guelph (Clow/Jardine)	One Health approaches to Tick and Tick-borne disease surveillance (including establishment of veterinary surveillance)
Daniel Szaroz (PhD)	U. Montréal (Zinszer)	Multi-site case control study of Lyme disease risk factors (linked to patient cohort) + spatial diffusion using pan-Canadian data
James Logan (PhD)	U. Ottawa (Kulkarni)	Landscape-scale modelling and impacts of urban planning on Lyme disease risk
Natasha Bowser (MSc)	U. Montréal (Aenishaenslin)	Evaluating the adaptation of the Canadian population to Lyme disease using a “One Health” approach
Katarina Ost	U. Ottawa (Kulkarni)	Assessing strategies for the prevention and control of emerging tick-borne diseases in urban and peri-urban settings

Working Groups

Surveillance WG

Objectives: Plan and oversee the implementation of the Canadian Lyme Sentinel Network (CaLSeN)

Leads: Patrick Leighton, Claire Jardine

Epidemiology WG

Objectives: Plan and oversee the implementation of the Longitudinal Risk Study

Leads: Manisha Kulkarni, Kate Zinszer

Modelling WG

Objectives: Establish research priorities for risk modelling and mapping in Canada; plan and oversee the implementation “modelling and mapping” component of the Risk Reduction Innovation Program.

Leads: Nicholas Ogden, Jianhong Wu

Intervention WG

Objectives: Establish research priorities for Risk Reduction Interventions in Canada; plan and oversee the implementation of the “risk reduction interventions” component of the Risk Reduction Innovation Program.

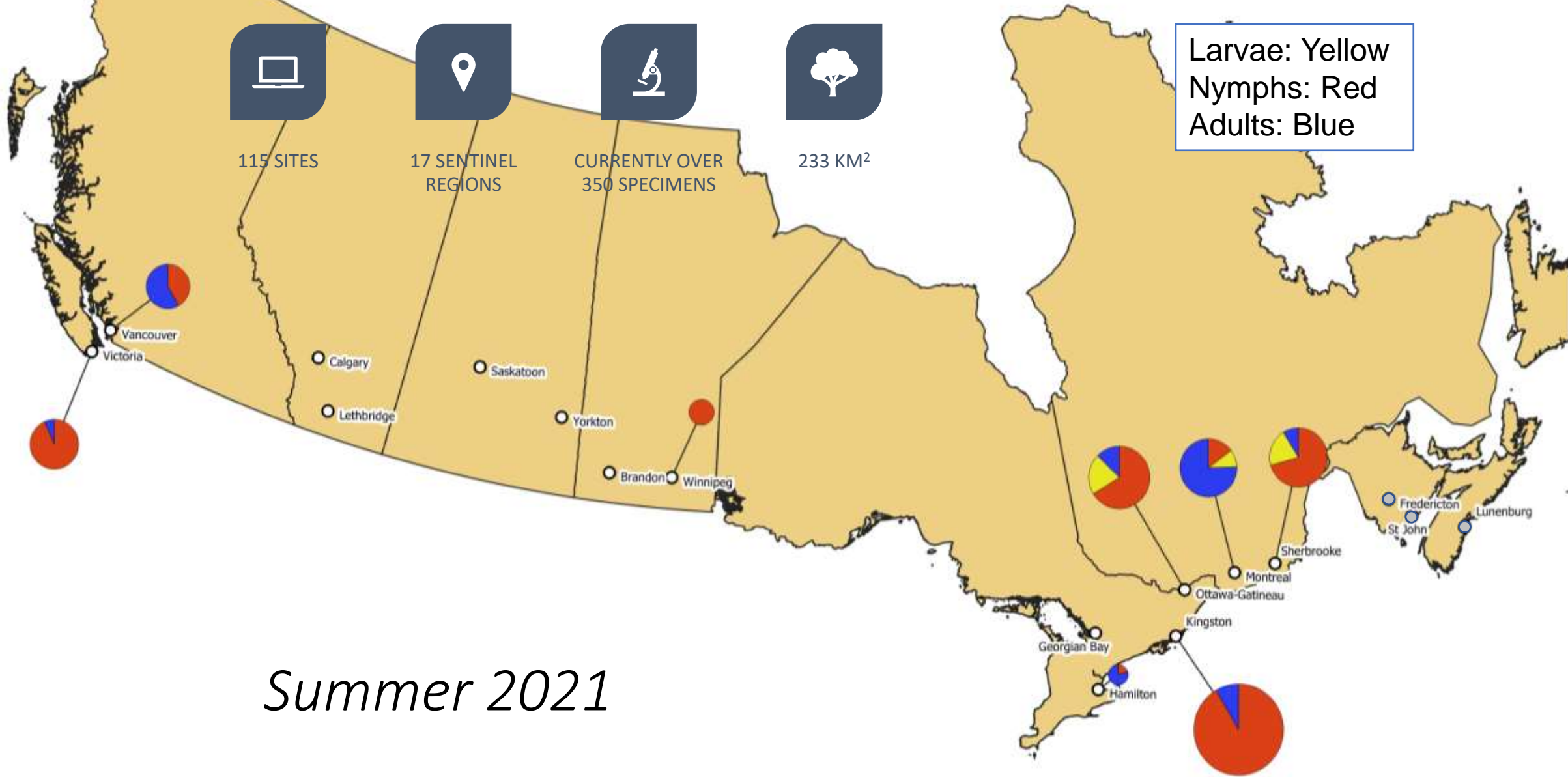
Leads: Catherine Bouchard, Jean-Philippe Rocheleau



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Surveillance Working Group
Update

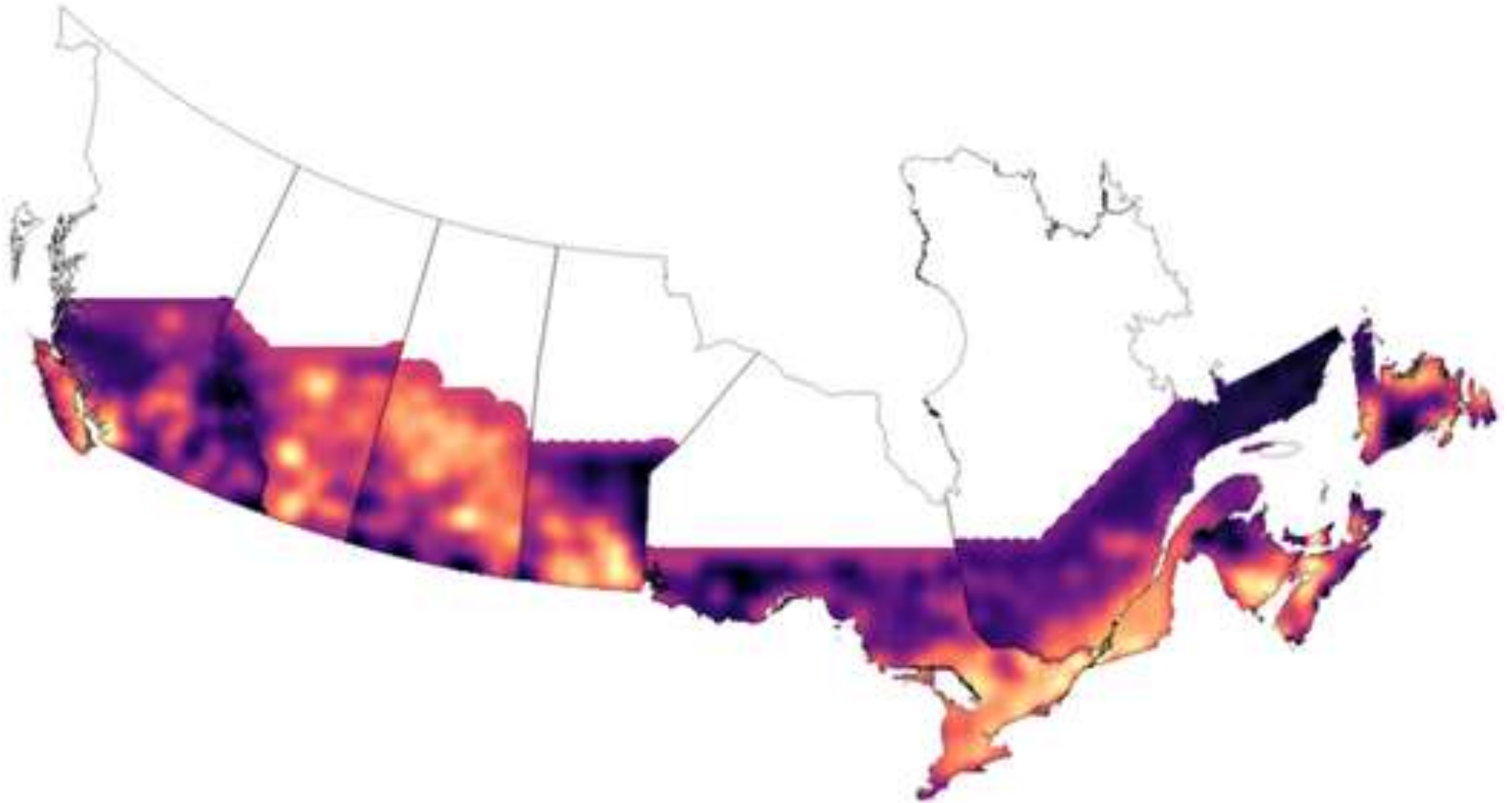
Canadian Lyme Sentinel Network (CaLSeN)



Preliminary
results
(Nova Scotia and
New Brunswick
pending...)

Province	Region	Distance	No. Sites	Larva	Nymphs	Adults	Density (/100m ²)
BC	Victoria	10 000	5	0	14	1	0.15
BC	Vancouver	10 000	5	0	5	7	0.12
AB	Lethbridge	6 000	3	0	0	0	0
AB	Calgary	6 000	3	0	0	0	0
SK	Saskatoon	8 000	4	0	0	0	0
SK	Yorkton	8 000	4	0	0	0	0
MA	Winnipeg	10 000	5	0	4	0	0.04
MA	Brandon	8 000	4	0	0	0	0
ON	Hamilton	20 000	10	0	1	4	0.025
ON	Georgian Bay	8 000	4	0	0	0	0
ON	Ottawa-Gatineau	30 000	15	15	47	9	0.237
ON	Kingston	30 000	15	0	140	13	0.51
QC	Sherbrooke	16 000	8	7	24	3	0.213
QC	Montreal	20 000	10	4	6	31	0.205
NB	St John	10 000	5	.	.	.	0
NB	Fredericton	10 000	5	.	.	.	0
NS	Lunenburg	20 000	10	.	.	.	0

Sentinel Network Expansion : MCDA

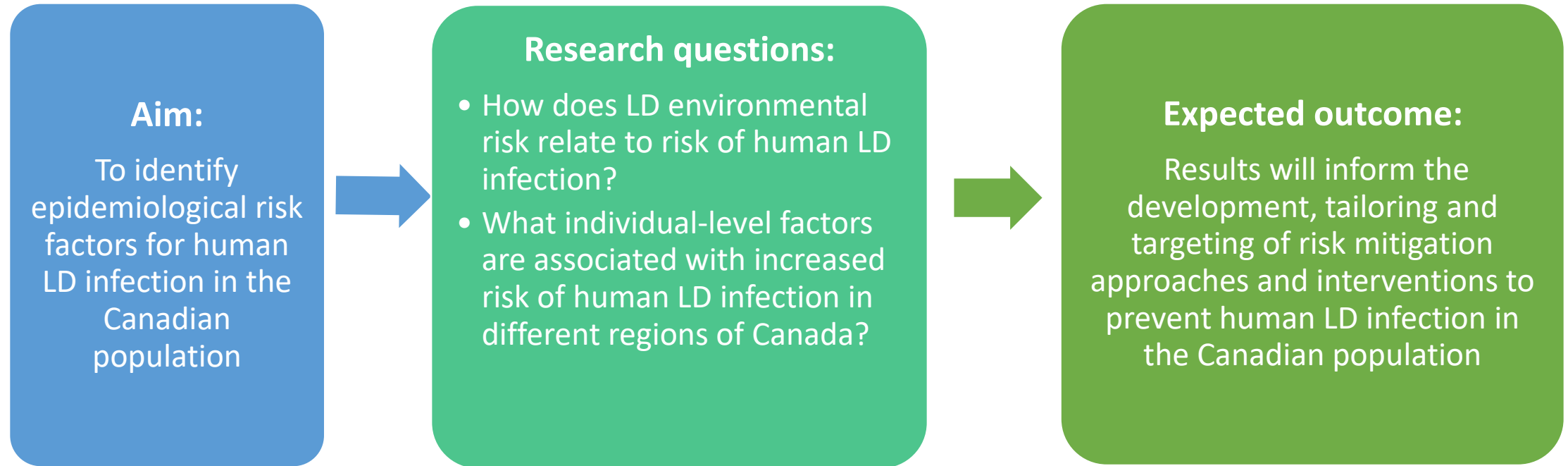




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Epidemiology Working Group
Update

Pillar 2 – Epidemiology Working Group



Component #1 - Retrospective case-control study

(A. Slatculescu PhD project)

Objectives:

- To evaluate the association between environmental risk and human Lyme disease infection at the dissemination area level

Study area:

- Southern/eastern Ontario

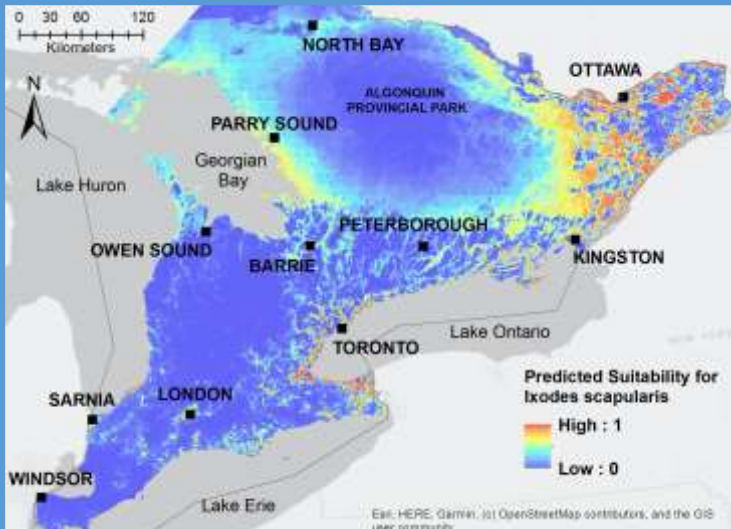
Data sources:

- PHOL dataset of lab-confirmed human LD cases in Ontario from 2014-2018 (held at ICES)
- Age- and sex-matched controls from Registered Persons Database (held at ICES)
- Ecological niche model of *I. scapularis* for southern/eastern ON (Slatculescu et al., 2020; PLOS ONE)

Spatial linkage of environmental risk data with human case data; incorporation of census data on relevant socioeconomic factors

Analysis in progress; target completion by Dec 2021

METHODS



(Slatculescu et al., 2020; PLOS ONE)

- LD cases and controls were matched 1:4 on age, sex, index year
- Home address was linked with area-level environmental and socioeconomic factors
 - Dissemination area (DAUID): smallest area for which census data is available, representing regions of 400-700 people bounded by features like roads, railways, water sources
- Average risk of encountering ticks in the environment was calculated from a species distribution model for *Ixodes scapularis*
- Univariate conditional logistic regression model to identify area-level risk factors for LD in southern/eastern Ontario
- Multivariate conditional logistic regression model to identify residential risk for LD when adjusting for socioecological risk factors

	Cases (N = 2,630)	Controls (N = 10,520)
Sex, F (%)	1,145 (43.5)	4,580 (43.5)
Age, years (\pm S.D.)	46.9 (21.4)	46.9 (21.4)

RESULTS

Table 1 Univariate conditional logistic regression models showing the matched odds ratios for LD environmental and socioeconomic risk factors

	OR	95% CI	P value
Environmental factors			
Average predicted habitat suitability for <i>Ixodes scapularis</i>	3.89	3.38, 4.48	<.0001
Proportion of provincial/federal regulated parks	1.03	1.02, 1.04	<.0001
Neighbourhood walkability index	0.88	0.86, 0.89	<.0001
Transit index	0.90	0.89, 0.92	<.0001
Socioeconomic factors			
Neighbourhood income quintile 2 v 1	1.29	1.10, 1.51	0.0003
Neighbourhood income quintile 3 v 1	1.82	1.57, 2.11	<.0001
Neighbourhood income quintile 4 v 1	1.69	1.46, 1.97	0.0174
Neighbourhood income quintile 5 v 1	2.01	1.81, 2.42	<.0001
Residential instability quintile 2 v 1	1.77	1.54, 2.02	<.0001
Residential instability quintile 3 v 1	1.88	1.65, 2.16	<.0001
Residential instability quintile 4 v 1	1.21	1.05, 1.40	0.2635
Residential instability quintile 5 v 1	0.85	0.73, 0.98	<.0001
Material deprivation quintile 1 v 5	2.30	1.97, 2.69	<.0001
Material deprivation quintile 2 v 5	2.36	2.02, 2.76	<.0001
Material deprivation quintile 3 v 5	1.85	1.57, 2.18	0.1961
Material deprivation quintile 4 v 5	1.61	1.36, 1.91	0.0968
Dependency quintile 2 v 1	1.44	1.24, 1.67	<.0001
Dependency quintile 3 v 1	1.88	1.62, 2.18	0.3636
Dependency quintile 4 v 1	2.20	1.91, 2.54	<.0001
Dependency quintile 5 v 1	3.20	2.79, 3.68	<.0001
Ethnic concentration quintile 1 v 5	12.8	10.7, 15.3	<.0001
Ethnic concentration quintile 2 v 5	7.19	5.99, 8.62	<.0001
Ethnic concentration quintile 3 v 5	4.46	3.71, 5.37	0.0210
Ethnic concentration quintile 4 v 5	3.20	2.65, 3.87	<.0001
Rurality index	1.03	1.02, 1.04	<.0001

RESULTS

Table 2 Multivariate conditional logistic regression model showing the adjusted odds ratios for LD residential exposure

	OR	95% C.I.	P value
Average predicted habitat suitability for <i>Ixodes scapularis</i>	2.83	2.42, 3.32	<.0001
Neighbourhood walkability index	1.02	1.00, 1.03	0.0432
Proportion of provincial/federal regulated parks	1.02	1.01, 1.02	<.0001
Material deprivation quintile 1 v 5	1.47	1.24, 1.75	0.0001
Material deprivation quintile 2 v 5	1.48	1.25, 1.76	<.0001
Material deprivation quintile 3 v 5	1.14	0.96, 1.37	0.0962
Material deprivation quintile 4 v 5	1.12	0.98, 1.42	0.3491
Ethnic concentration quintile 1 v 5	8.70	7.17, 10.5	<.0001
Ethnic concentration quintile 2 v 5	5.98	4.94, 7.24	<.0001
Ethnic concentration quintile 3 v 5	3.96	3.27, 4.80	0.0529
Ethnic concentration quintile 4 v 5	2.91	2.40, 3.54	<.0001

- The odds of acquiring LD increase 2.8 times per unit increase in average DAUID habitat suitability for *I. scapularis*, when adjusting for DAUID-level neighbourhood walkability, proportion of parks, and socioeconomic status

Component #2 – ‘Prospective’ case-control study (D. Szaroz PhD project)

Objectives:

- To identify risk factors for human Lyme disease infection, including exposure to risk areas and use of preventive measures
- To assess differences in risk factors and knowledge, attitudes, practices (KAP) between regions

Study area(s):

- Sites with CLyDRN patient cohort recruitment

Data sources:

- Early localized & early disseminated human LD cases identified through the patient cohort (n=90)
- Age- and sex-matched controls recruited from same hospitals/clinics (n=180)
- Questionnaire data: knowledge, attitudes, practices, demographics, socioeconomic factors (e.g. income, occupation), and history of exposure to risk areas

To start recruitment of controls in Kingston and Lunenburg in Spring 2022



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Intervention Working Group
Update

Objectives of the WG

1. Identifying the most promising **research** topics **for reducing LD risk** across Canada
2. Continuous **scientific monitoring**, knowledge sharing about the new intervention/**mitigation strategies** (from the WG to the CLyDRN) and **facilitating their implementation** in Canada.
3. Developing **guidelines to evaluate** tick and LD **intervention**/mitigation strategies including (1) the potential public health impact of the existing or novel approaches and (2) **obstacles and levers** to the implementation of these interventions.

Current projects

- Project funded by the WG grant:
 - *Cost-utility modeling and MCDA for rodent-targeted interventions*
Launched fall 2021
- Innovation projects by members of the WG
 - *Innovate by making the One Health approach a reality to tackle emerging tick-borne diseases*
 - *Spatial extent of rodent-targeted interventions*
 - *Integration of educational and environmental interventions to reduce human-tick encounters*



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Modelling Working Group
Update

Objectives of the WG

1. Be a point of contact for CLyDRN members involved in modelling and mapping relevant to network objectives
2. Be a source for sharing expertise amongst WG members.
3. Be a resource for members to develop proposals for funding modelling/mapping projects
4. Assist CLyDRN in developing research priorities.

Current status : on hold - Covid-19

- Core membership formed (9 Canadian CLyDRN members)
- Additional preferred members identified (1 US-based CLyDRN member, 3 Canadian and 4 international non-members)
- Funding for face-to-face meeting obtained