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Registered Nurses' Knowledge, Attitudes, and Practices Toward Climate-Sensitive Vector-Borne Diseases: Findings From a Cross-Sectional Survey

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ABSTRACT

Objective: Climate change is contributing to increasing rates of vector-borne diseases, affecting global population health. As the largest group of regulated health professionals, nurses play an integral role in climate-related health challenges. The purpose of this research study was to investigate the knowledge, attitudes, and practices of registered nurses in Canada related to climate sensitive vector-borne diseases.

Design: Cross-sectional survey.

Sample: A national online survey was distributed to practicing registered nurses, through contact with nursing organizations and regulatory bodies, as well as social media.

Measurements: Three hundred and eighty-two survey responses were included in data analysis.

Results: Research findings suggest that nurses' knowledge on climate change and vector-borne diseases was limited, especially among frontline nurses and those in Western and Northern regions of Canada. There was greater knowledge of Lyme disease compared to West Nile virus, particularly among nurses working in endemic areas. Participants did not often consider vector-borne diseases in practice and demonstrated a lack of confidence and preparedness in addressing in practice.

Conclusions: The study validates that while climate-related issues are important for nurses, nurses must be better prepared to address vector-borne diseases in practice and assume a greater role in leading change to advocate for a climate-resilient future.

1 | Background

Worldwide, the climate is changing, affecting the fundamental elements essential for human health and well-being, including clean air, safe drinking water, nutritious food, and secure shelter. Recent estimates indicate the planet was 1.35°C warmer in 2023 than the pre-industrial period (Lindsey and Dahlman 2024). Past and future warming in Canada is double the magnitude of global warming, and the North, changes of 2.3°C have been observed (Bush and Lemmen 2019; Černý et al. 2021).

Planetary health is the concept that human health depends on the health of Earth's natural systems (Myers 2017). Climate change threatens planetary health by disrupting ecosystems, increasing disease risk, and undermining food, water, and air quality. Climate change has been identified as a public health emergency in Canada, and health care professionals (HCPs) must take action to address climate related health challenges (CPHA 2021). For instance, heat waves, wildfires, floods, and droughts have increased in recent years. Climatic factors, including heat and increasing temperatures, have contributed to an expanding geographical distribution of vector-borne diseases (VBDs) and are

becoming a significant health threat (CPHA 2021; Ogden et al. 2022). West Nile virus (WNv) and Lyme disease are believed to be the most common endemic VBDs in Canada that compromise health, and current surveillance specifies that incidence of these diseases is increasing annually (Bouchard et al. 2019; CPHA 2021; Ludwig et al. 2019). Reported Lyme disease rates increased from 144 cases in 2009 to 2634 cases in 2019 (Gasmi et al. 2022).

According to Nuttall (2022), Canada presents the most compelling evidence that climate change influences tick distribution and tick-borne diseases. A northward spread of infectious diseases currently endemic to the United States is occurring, where ticks carrying human granulocytic anaplasmosis and babesiosis are extending their northward range (National Collaborating Centre for Environmental Health 2022). Ticks now populate more regions of Canada than ever before, and several new tick-borne diseases have emerged as public health concerns (National Collaborating Centre for Environmental Health 2022; Nicol 2019).

Consensus exists among researchers that nurses have a significant role to play in mitigating and addressing climate change and VBDs in practice, given their substantial presence within the healthcare system (International Council of Nurses (ICN) 2018; Kalogirou et al. 2020; Martin and Vold 2019; McDermott-Levy et al. 2023). Despite the roles nurses could perform, several authors suggest that most nurses lack awareness, knowledge, and resources to adequately prevent and address climate-related health threats in practice (Kalogirou et al. 2020; Leffers et al. 2017; Martin and Vold 2019). Law et al. (2021) assert that nurses' ambiguity about their role in climate change has contributed to a delayed response to action.

1.1 | Research Questions

In addition to nurses' lack of knowledge about climate change, Vandenberg et al. (2023) completed a scoping review specific to climate-driven VBDs. The results revealed that nurses lack knowledge and confidence regarding climate-driven VBDs (Vandenberg et al. 2023). Therefore, to better understand the current planetary health mindset among practicing nurses in Canada, the research questions guiding this study included:

1. What is the overall knowledge, attitudes, and practices (KAP) of registered nurses (RNs) in Canada related to climate sensitive VBDs?
2. Do knowledge, attitudes, and practices of RNs in addressing climate sensitive VBDs vary by position, education, practice area, age, years of practice, province/territory, urban/rural setting, and Indigeneity?

Given the lack of nursing research on this topic, this research study provides baseline survey data, which can be used to strengthen nurses' preparedness to address planetary health challenges, such as climate change and VBDs in practice. Nurses can encourage policy developers to take a multi-disciplinary and multi-sectoral perspective to develop climate-sensitive policies, given the challenges with the complexities of climate change and VBDs in public health and healthcare settings (Adrian 2020; Butterfield et al. 2021).

2 | Methods

2.1 | Design

Informed by Planetary Health (Myers 2017) as the theoretical framework, a quantitative cross-sectional survey research design was used to conduct this research study. Cross-sectional surveys are relevant when assessing attitudes and knowledge among participants, such as health professionals (Kesmodel 2018). Given that this research examined the knowledge, attitudes, and practices of nurses, it was well-suited to a cross-sectional survey design.

2.2 | Measures

Current literature was reviewed to identify if an existing survey could be utilized; however, established tools located in the literature were not appropriate for the proposed research study. Existing surveys either broadly focused on climate change or were too specific in focus. Therefore, permission was granted by Kircher et al. (2022) to adapt the *Minnesota Survey of Healthcare Professionals on Climate Change and Health* for this research study. The adapted survey tool included 50 items, which were divided into four sections: (1) Demographics, (2) Knowledge of VBD, (3) Attitudes toward VBD, and (4) Practices, experiences, and resources. Items included 5-point Likert-scale questions, yes/no/unsure questions, and single or multiple response-style questions.

An overall knowledge score, as well as scores on knowledge of both Lyme disease and WNv were computed. The total possible knowledge score of 12 Likert scale items was 60, while the minimum possible score was 12. The total score of five Likert scale items on Lyme disease knowledge was 25, while the minimum score was 5. The total score of five Likert scale items on WNv knowledge was 25, while the minimum score was 5. The total score of ten attitude Likert scale items was 45, while the minimum possible score was 10.

To ensure content validity, the adapted survey was pilot tested with eight content experts who were involved in the development of the *Guidelines for Undergraduate Nursing Education on Climate-Driven Vector-Borne Diseases* with the Canadian Association of Schools of Nursing (CASN 2020). Construct validity was measured using factor analysis in the survey instrument. To measure internal consistency of the survey, Cronbach's alpha coefficient tests were conducted. For the knowledge Likert-scale items of the survey, the result was 0.934, whereas the score was 0.822 for the attitude Likert-scale items on the survey. For all ordinal questions in the survey, the Cronbach's alpha was 0.894. These results indicate that the survey demonstrated an acceptable level of internal reliability. Ethical approval for this research study was sought and granted through the appropriate Research Ethics Office at the University of Alberta.

2.3 | Sample

The sample compared practicing registered nurses (RNs) across Canada. RNs were specifically chosen for this research study, given they are one of the largest groups of health care

professionals (HCPs), and are well-positioned to play an integral role in the mitigation of planetary and climate-related health effects, through research, education, advocacy, and practice. Inclusion criteria included participants currently practicing as an RN in Canada and holding valid registration with their designated provincial or territorial professional licensing body. Participants must have had access to the Internet, as the survey was distributed online, using Qualtrics. Additionally, they must have been able to read English, as the survey was distributed in English.

Based on a G*Power calculation, a sample size of 324 was required to ensure adequate power for a one-way ANOVA across six groups. With 382 participants, sufficient power was achieved for five of the eight ANOVA comparisons. However, analyses by practice area, province/territory, and age did not meet the recommended sample size. As the data were normally distributed, ANOVA was still used for these comparisons, but findings were interpreted with caution.

Participants were recruited through a respondent-driven sampling (RDS) technique. Invitations to participate in this study were sent to all Canadian provincial and territorial nursing associations and regulatory bodies, national nursing associations, and nursing specialty and interest groups in Canada through email on three occasions between August and December 2023. Research announcements were also posted to five national social media networks of HCPs and RNs on three occasions during that time. Participants could either click the unique anonymous link to the survey or use the QR code generated for the survey. Participants were unable to submit multiple submissions. Upon completion of the primary Qualtrics survey, participants were invited to complete a secondary survey, where they entered their name and contact information (email and phone number) for a chance to win one of five $50 Amazon gift cards. This process ensured that the survey data was not linked to personal information and survey responses remained anonymous.

2.4 | Analytic Strategy

Data was analyzed using IBM Statistical Package for the Social Sciences (SPSS 29.01.1). Descriptive statistics were generated for initial analysis of all survey responses. Statistical significance was defined as $p < 0.05$. Tests of difference and association were conducted, namely one-way analysis of variance (ANOVA), analysis of covariance (ANCOVA) for Likert-scale data, and Kruskal–Wallis and Chi-square tests for ordinal and nominal data. The Shapiro–Wilk statistic was used to determine normality, and the result was greater than 0.8 for all Likert scale items in the survey. Therefore, parametric tests, using a one-way ANOVA, were conducted to determine comparisons across demographics to answer the research questions. To demonstrate objectivity and diligence throughout data analysis, procedures and results were discussed with the research team, including a team member who possessed expertise in the application of statistics in health sciences.

3 | Results

There was a total of 859 responses to the national survey. In addition to the 411 bot responses, there were 34 blank surveys, which were removed from analysis. A further 32 surveys included demographic information only, and as these responses were incomplete, they were subsequently removed from data analysis. This left 382 survey responses in this study.

3.1 | Demographics

Most (67.8%) survey respondents indicated that they worked as a frontline care provider. The highest level of education varied, with 66.8% of respondents holding a baccalaureate degree (Table 1). A wide range of practice areas were listed on the survey tool, and areas with the highest responses included educational institutions (9.2%), medical-surgical nursing (11.8%), and public health (13.4%) (Table 1). Respondents' ages ranged from 20 years to 66+ years of age, with the most frequent category being those aged between 36 and 45 (31.4%) (Table 1). Years of practice as an RN also varied, where most participants indicated they had practiced between 11 and 20 years (30.1%) (Table 1). Survey responses were received from all provinces and territories in Canada, except from Prince Edward Island. The highest number of respondents were from Alberta (32.7%) and British Columbia (21.2%) (Table 1). Most respondents indicated that they lived in an urban setting (70.2%), and 35 (9.2%) respondents declared as Indigenous, Metis, or Inuit (Table 1).

3.2 | Knowledge of Climate-Driven VBDs

The second section of the survey assessed current perceived knowledge of the most common climate sensitive VBDs in Canada. Almost 95% of respondents were aware that VBDs are caused by viruses, bacteria, or parasites that are transmitted to humans from animals or insects. Two hundred and ninety-eight (78%) of respondents knew that Lyme disease and WNv are the two most prevalent VBDs in Canada. Only 13% of participants indicated that they completed continuing education or formal education on climate sensitive VBDs. Likert-scale items in this section assessed knowledge of climate change, and epidemiology, prevention, transmission, diagnosis, and treatment of Lyme disease and WNv (see Table 2).

The mean knowledge score for respondents was 33.11 ($SD = 11.21$) or 55.2%, while the median score was 32, and the modal score was 34. The mean Lyme disease knowledge score for respondents was 14.54 ($SD = 5.23$) or 58.2%, while the median was 15, and the mode was 11. The mean WNv knowledge score for respondents was 12.57 ($SD = 5.26$) or 50.3%, while the median was 12, and the mode was 10. Participants reported a higher overall knowledge of Lyme disease compared to WNv, when comparing the means for each disease (See Table 3).

ANOVA tests were conducted to determine knowledge differences among demographics (see Table 4 for significant F-value results). Significant differences across groups existed for the total knowledge score. Nurse managers reported significantly higher overall knowledge compared to frontline care providers, and those in educational institutions also had significantly higher knowledge scores than nurses who marked their practice area as "other." Indigenous, Metis, and Inuit nurses reported significantly higher overall knowledge compared to those

TABLE 1 | Demographic characteristics of study participants ($n = 382$).

Characteristics	*n* (%)
Primary position	
Frontline care provider	259 (67.8)
Nurse educator	63 (16.5)
Nurse manager	17 (4.5)
Other	43 (11.3)
Highest level of education	
Diploma	34 (8.9)
Baccalaureate degree	255 (66.8)
Master's degree	71 (18.6)
PhD	17 (4.5)
Other	5 (1.3)
Current primary practice area	
Critical care	22 (5.8)
Educational institution	35 (9.2)
Emergency department	21 (5.5)
Geriatrics	21 (5.5)
Home health	23 (6.0)
Hospice care	1 (0.3)
Medical-surgical	45 (11.8)
Mental health	15 (3.9)
Neonatal care	6 (1.6)
Obstetrics	12 (3.1)
Occupational health	12 (3.1)
Oncology	7 (1.8)
Operating room	12 (3.1)
Orthopedics	1 (0.3)
Pediatrics	14 (3.7)
Primary care	17 (4.5)
Public health	51 (13.4)
School nursing	4 (1.0)
Travel nursing	1 (0.3)
Other[a]	62 (16.2)
Age	
20–25	32 (8.4)
26–30	45 (11.8)
31–35	54 (14.1)
36–40	62 (16.2)
41–45	58 (15.2)
46–50	34 (8.9)
51–55	43 (11.3)
56–60	32 (8.4)
61–65	14 (3.7)
66+	8 (2.1)
Years of practice as a registered nurse	
Less than 5	70 (18.3)
5–10	80 (20.9)
11–20	115 (30.1)
21–30	57 (14.9)
31–40	45 (11.8)
41 or more	15 (3.9)
Province or territory of registration and practice	
British Columbia	81 (21.2)
Alberta	125 (32.7)
Saskatchewan	45 (11.8)
Manitoba	8 (2.1)
Ontario	35 (9.2)
Quebec	14 (3.7)
Nova Scotia	49 (12.8)
Prince Edward Island	0 (0.0)
New Brunswick	4 (1.0)
Newfoundland & Labrador	16 (4.2)
Nunavut	1 (0.3)
Northwest Territories	1 (0.3)
Yukon Territory	3 (0.8)
Where do you live?	
Urban setting	268 (70.2)
Rural setting	112 (29.3)
Unsure	2 (0.5)
Are you indigenous, metis, or inuit?	
Yes	35 (9.2)
No	335 (87.7)
Prefer not to answer	12 (3.1)

Note: Total responses = 382.

[a]Free text response.

participants who did not declare Indigeneity. Nurses in Quebec had a significantly higher overall knowledge score than nurses in British Columbia, Alberta, Newfoundland and Labrador, and Saskatchewan.

For Lyme disease knowledge, significant differences existed between provinces, where nurses in Nova Scotia reported significantly higher overall knowledge compared to British Columbia, Alberta, and Saskatchewan. Nurses in Quebec also reported significantly higher overall knowledge compared to Alberta and Saskatchewan, while nurses in Ontario reported significantly higher Lyme disease knowledge compared to Alberta and Saskatchewan, and similarly, nurses in New Brunswick reported significantly greater knowledge compared to Saskatchewan (see

TABLE 2 | Knowledge of climate sensitive VBDs.

Survey item	Strongly agree *n* (%)	Somewhat agree *n* (%)	Neither agree nor disagree *n* (%)	Somewhat disagree *n* (%)	Strongly disagree *n* (%)
I feel knowledgeable about climate change and subsequent health implications	47 (12.3)	158 (41.4)	53 (13.9)	89 (23.3)	35 (9.2)
I feel knowledgeable about epidemiology of Lyme disease in Canada	28 (7.3)	123 (32.2)	57 (14.9)	109 (28.5)	65 (17.0)
I feel knowledgeable about epidemiology of West Nile virus in Canada	25 (6.5)	67 (17.5)	65 (17.0)	136 (35.6)	89 (23.3)
I feel knowledgeable about primordial, primary, secondary, tertiary, and quaternary prevention of Lyme disease in Canada	25 (6.5)	81 (21.2)	53 (13.9)	107 (28.0)	116 (30.4)
I feel knowledgeable about primordial, primary, secondary, tertiary, and quaternary prevention of West Nile virus in Canada	17 (4.5)	56 (14.7)	53 (13.9)	120 (31.4)	136 (35.6)
I feel knowledgeable about transmission of Lyme disease in Canada	58 (15.2)	203 (53.1)	50 (13.1)	47 (12.3)	24 (6.3)
I feel knowledgeable about transmission of West Nile virus in Canada	41 (10.7)	152 (40.0)	53 (13.9)	82 (21.5)	54 (14.1)
I feel knowledgeable about diagnosis of Lyme disease in Canada	35 (9.2)	118 (30.9)	60 (15.7)	115 (30.1)	54 (14.1)
I feel knowledgeable about diagnosis of West Nile virus in Canada	23 (6.0)	68 (17.8)	67 (17.5)	131 (34.3)	93 (24.3)
I feel knowledgeable about treatment of Lyme disease in Canada	32 (8.4)	110 (28.8)	53 (13.9)	112 (29.3)	75 (19.6)
I feel knowledgeable about treatment of West Nile virus in Canada	22 (5.8)	59 (15.4)	47 (12.3)	134 (35.1)	120 (31.4)
I feel knowledgeable about the controversies in treatment of Lyme disease in Canada	33 (8.6)	92 (24.1)	70 (18.3)	105 (27.5)	82 (21.5)
Increasing my knowledge of climate-sensitive vector-borne diseases is a priority for me	59 (15.4)	159 (41.6)	94 (24.6)	52 (13.6)	18 (4.7)

Note: Total responses = 382.

TABLE 3 | Total knowledge scores.

	Total knowledge score (12 items)	Lyme disease knowledge score (5 items)	West Nile virus knowledge score (5 items)
Mean	33.11	14.544	12.570
Median	32.00	15.00	12.00
Mode	34.00	11.00	10.00
Standard deviation	11.21	5.23	5.26
Minimum	12.00	5.00	5.00
Maximum	60.00	25.00	25.00

Note: Total responses = 382.

Table 4 for significant *F*-value results and Figure 1 for a map of Canada with Lyme disease incidence). Additionally, Indigenous, Metis, and Inuit nurses reported significantly greater knowledge compared to those who did not identify with these groups.

Significant differences also existed among groups for the total knowledge score of WNv. Mean scores for frontline care providers were significantly lower than nurse educators and nurse managers, while nurses who marked their position as "other" had

TABLE 4 | Significant ANOVA results of total knowledge scores.

Total knowledge score	
Primary position	[$F(3, 130.02) = 3.377$*]
	Mean score for frontline care provider ($M = 32.13$, SD = 10.36) was significantly different ($p = 0.043$) than nurse manager ($M = 39.47$, $SD = 8.70$).
Practice area	[$F(14, 356) = 2.158$**]
	Mean score for educational institution ($M = 38.97$, $SD = 15.03$) was significantly different ($p = 0.017$) than Other ($M = 30.08$, $SD = 11.00$).
Province/Territory	[$F(9, 361) = 3.471$***]
	Mean score for Quebec ($M = 42.79$, $SD = 11.10$) was significantly different ($p = 0.039$) than British Columbia ($M = 32.46$, $SD = 11.00$); was significantly different ($p = 0.021$) than Alberta ($M = 32.12$, $SD = 11.30$); was significantly different ($p = 0.006$) than Saskatchewan ($M = 30.00$, $SD = 10.17$); and was significantly different ($p = 0.012$) than Newfoundland & Labrador ($M = 27.86$, $SD = 7.53$).
Indigeneity	[$F(2, 48.28) = 10.76$***]
	Mean score for Yes ($M = 45.51$, $SD = 15.62$) was significantly different ($p = <0.001$) than No ($M = 35.77$, $SD = 10.47$).
Total Lyme disease knowledge score	
Province/Territory	[$F(9, 363) = 5.900$***]
	Mean score for Nova Scotia ($M = 20.51$, $SD = 5.50$) was significantly different ($p = 0.046$) than British Columbia ($M = 17.11$, $SD = 5.80$); was significantly different ($p = <0.001$) than Alberta ($M = 16.05$, $SD = 5.82$); was significantly different ($p = <0.001$) than Saskatchewan ($M = 14.51$, $SD = 5.28$).
	Mean score for Quebec ($M = 21.50$, $SD = 4.99$) was significantly different ($p = 0.029$) than Alberta ($M = 16.05$, $SD = 5.82$); was significantly different ($p = 0.003$) than Saskatchewan ($M = 14.51$, $SD = 5.28$).
	Mean score for Saskatchewan ($M = 14.51$, $SD = 5.28$) was significantly different ($p = 0.004$) than Ontario ($M = 19.57$, $SD = 6.18$); was significantly different ($p = 0.003$) than New Brunswick ($M = 24.50$, $SD = 5.97$).
	Mean score for Ontario ($M = 19.57$, $SD = 6.18$) was significantly different ($p = 0.048$) than Alberta ($M = 16.05$, $SD = 5.82$).
Indigeneity	[$F(2, 370) = 11.16$***]
	Mean score for Yes ($M = 18.26$, $SD = 6.08$) was significantly different ($p = <0.001$) than No ($M = 14.09$, $SD = 5.00$).
Total West Nile virus knowledge score	
Primary position	[$F(3, 129.76) = 5.692$***]
	Mean score for frontline care provider ($M = 11.99$, $SD = 4.95$) was significantly different ($p = 0.046$) than nurse educator ($M = 13.92$, $SD = 6.19$), and was significantly different ($p = 0.003$) than nurse manager ($M = 16.53$, $SD = 4.33$).
	Nurse manager ($M = 16.53$, SD = 4.33) was significantly different ($p = 0.037$) than other ($M = 12.52$, $SD = 5.12$).
Province/Territory	[$F(9, 367) = 4.2$***]
	Mean score for Quebec ($M = 17.21$, $SD = 6.33$) was significantly different ($p = 0.010$) than British Columbia ($M = 11.78$, $SD = 5.16$); was significantly different ($p = 0.021$) than Alberta ($M = 12.99$, $SD = 5.22$); was significantly different ($p = 0.002$) than Nova Scotia ($M = 10.90$, $SD = 4.48$); and was significantly different ($p = <0.001$) than Newfoundland & Labrador ($M = 8.81$, $SD = 3.21$).
	Mean score for Ontario ($M = 14.17$, $SD = 5.76$) was significantly different ($p = 0.018$) than Newfoundland & Labrador ($M = 8.81$, $SD = 3.21$).
Indigeneity	[$F(2, 48.59) = 8.96$***]
	Mean score for Yes ($M = 16.57$, $SD = 7.621$) was significantly different ($p = <0.001$) than No ($M = 12.17$, $SD = 4.83$); and was significantly different ($p = 0.019$) than prefer not to answer ($M = 11.91$, $SD = 3.73$).

*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

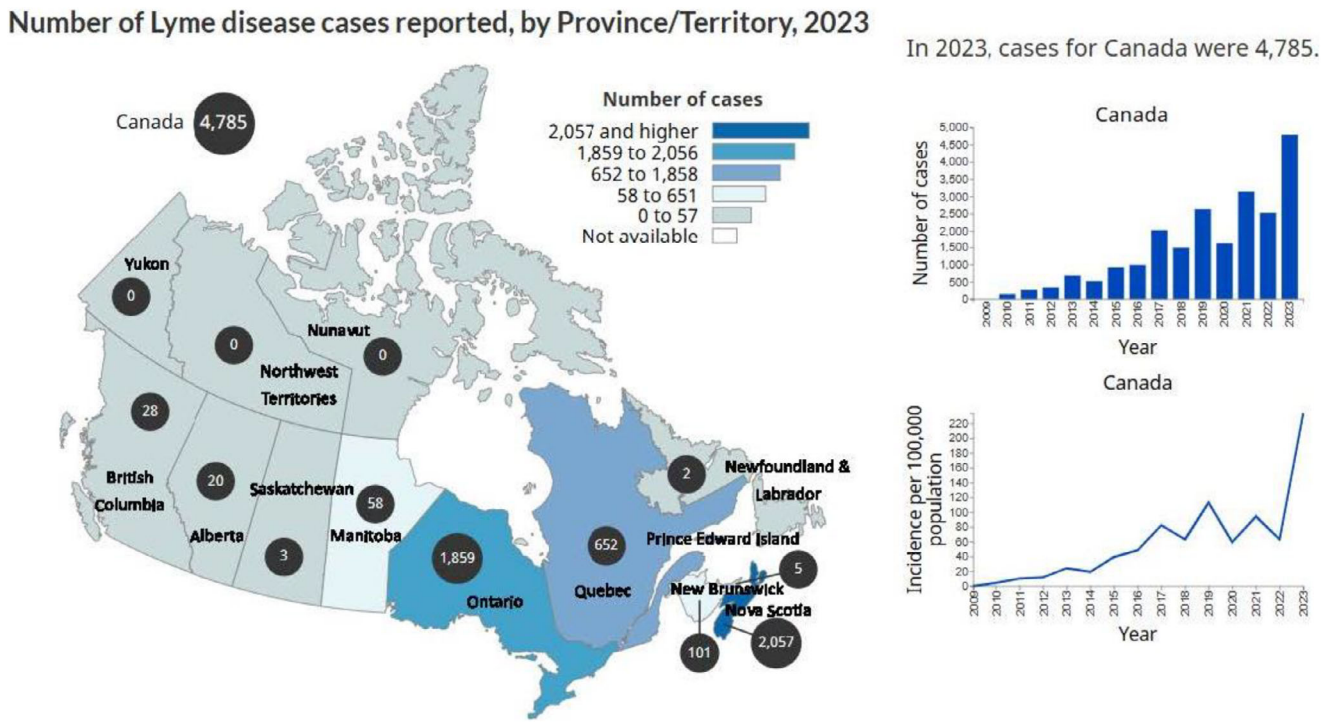

FIGURE 1 | Number of Lyme disease cases reported, by Province/Territory, 2023. [Color figure can be viewed at wileyonlinelibrary.com]

significantly lower knowledge than nurse managers. Significantly greater knowledge scores were found for Indigenous, Metis, and Inuit nurses compared to those who were not members of these groups or who preferred not to answer. Across provinces, nurses in Quebec had significantly higher overall knowledge compared to British Columbia, Alberta, Nova Scotia, and Newfoundland and Labrador. Nurses in Ontario also had significantly higher overall knowledge scores compared to Newfoundland and Labrador (see Table 4 for significant *F*-value results and Figure 2 for a map of Canada with reported WNv cases).

3.3 | Attitudes Toward Climate-Driven Vector-Borne Diseases

The third section of the survey assessed perceptions of risk for climate sensitive VBDs in Canada and degree of confidence in addressing concerns related to these diseases. Almost all respondents (95%) indicated their agreement with the statement: "Climate change is happening." Most respondents (90%) also indicated that climate change directly or indirectly impacts the health of patients, families, communities, and populations they care for. A total of 84% of respondents strongly agreed or agreed that nurses are positioned to help patients, families, communities, and populations understand the health impacts associated with VBDs.

Personal attitude items varied from the responses above. A total of 63% of respondents disagreed or strongly disagreed with the statement on feeling prepared to address VBDs with patients. Over half of participants (56%) indicated they did not feel confident counselling patients about climate change and health, while 258 participants (65%) lacked confidence to counsel patients on climate sensitive VBDs. Most participants (80%) felt that nurses should play an active role in discussing climate sensitive VBDs with patients, while 90% of respondents strongly agreed or agreed that it is important for healthcare professionals to advocate for social justice by addressing socioeconomic inequities which exist among marginalized populations that are at higher risk of VBDs. See Table 5 for full results.

The total score of 10 attitude items was 45, while the minimum possible score was 10. The mean attitude score for respondents was 22.26 ($SD = 6.10$), while both the median and the mode was 22. The remaining two items in the attitude section of the survey inquired about views on climate change and VBDs. Participant views on climate change were influenced primarily by media, while views on VBDs were influenced primarily by professional resources.

ANOVA tests revealed significant differences for several items in the attitudes section of the survey (see Table 6 for significant *F*-value results). Feelings of preparedness to address VBDs with patients was statistically higher among nurses in Quebec than for nurses in British Columbia, Alberta, Saskatchewan, and Newfoundland and Labrador. Confidence in counseling patients about climate change and health was significantly different across practice areas, where nurses in educational facilities reported statistically greater confidence compared to those in geriatrics and "other." Nurses in Quebec also reported statistically higher confidence for this item than nurses in Alberta, Saskatchewan, and Newfoundland and Labrador. Additionally, nurses who declared Indigeneity reported statistically greater preparedness compared to those who did not declare or preferred not to answer.

Confidence in counseling patients about VBDs yielded similar results, where nurses in educational institutions and public

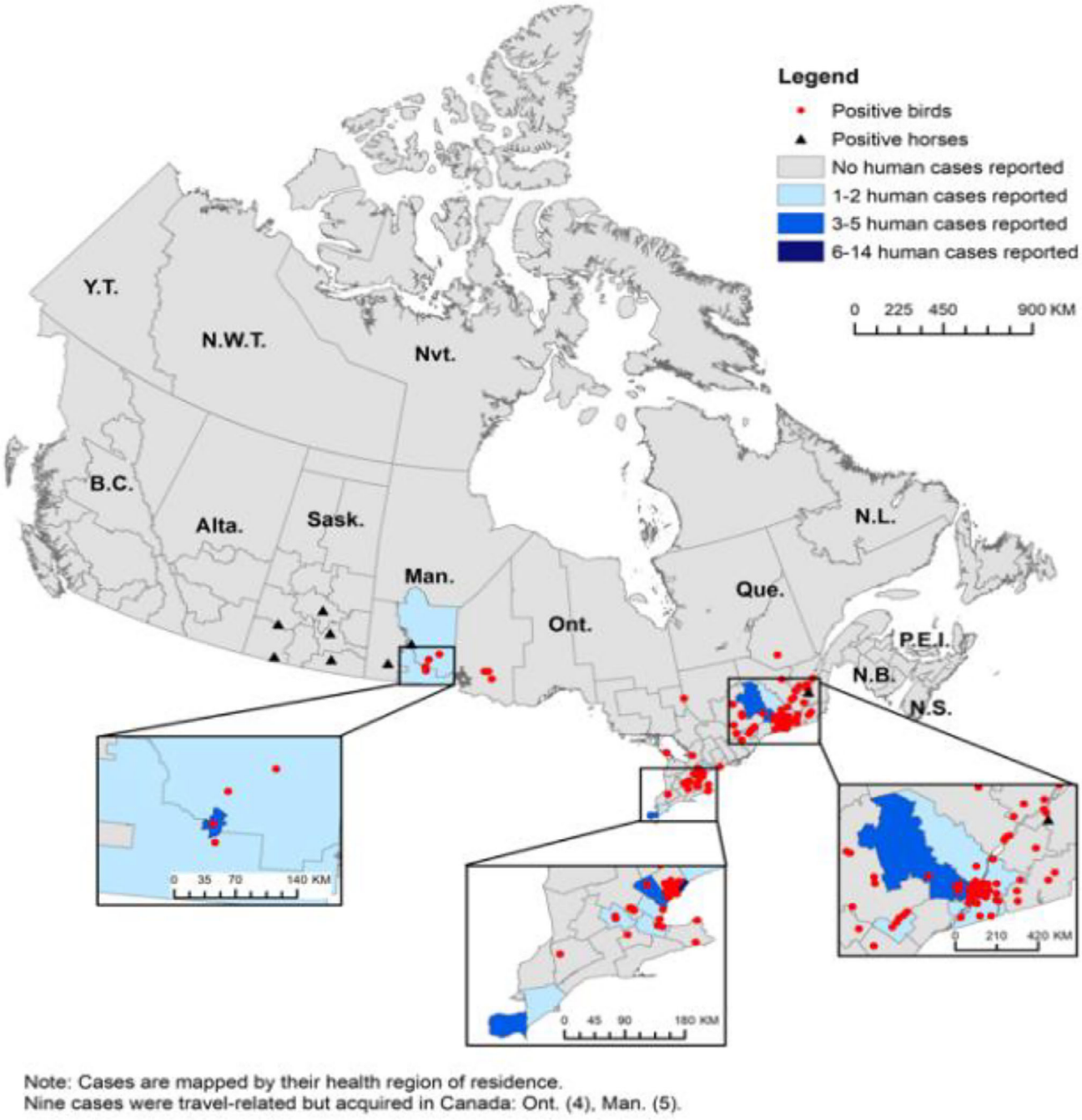

FIGURE 2 | Geographic distribution of reported human West Nile virus cases by health region of residence, positive dead wild birds by geographic coordinates, and positive horse cases by census consolidated subdivision of residence in Canada, 2022. [Color figure can be viewed at wileyonlinelibrary.com]

health reported statistically higher confidence levels than those who indicated their practice area as "other." Statistically higher confidence among nurses was reported in Quebec, significantly differing from Nova Scotia, British Columbia, Alberta, Saskatchewan, and Newfoundland and Labrador. Significantly greater confidence was also felt by Indigenous, Metis, and Inuit nurses compared to other survey respondents.

Significant differences were noted for the overall score of attitude survey items, where nurses with a master's degree and PhD reported statistically higher mean scores than nurses with a diploma or baccalaureate degree. Scores were also statistically higher among nurses in educational institutions compared to those in medical/surgical and "other" practice areas. Additionally, attitude scores were statistically higher for nurses in urban areas compared to those in rural settings, and for Indigenous, Metis, and Inuit nurses compared to those who were not or who preferred not to answer. After controlling for education using an ANCOVA, significant differences across provinces also existed for the total score of attitude items, where nurses in Nova Scotia had significantly higher overall attitude mean scores than nurses in Saskatchewan. For full results see Table 6.

TABLE 5 | Attitudes toward climate sensitive VBDs.

Survey item	Strongly agree *n* (%)	Somewhat agree *n* (%)	Neither agree nor disagree *n* (%)	Somewhat disagree *n* (%)	Strongly disagree *n* (%)
Climate change is happening.	303 (79.3)	58 (15.2)	16 (4.2)	4 (1.0)	1 (0.3)
Climate change directly or indirectly impacts the health of patients, clients, families, groups, communities, and populations in my care.	264 (69.1)	80 (20.9)	28 (7.3)	9 (2.4)	1 (0.3)
As a nurse, I am concerned about the health impacts of climate-sensitive vector-borne diseases on patients/clients, families, groups, communities, and populations.	171 (44.8)	141 (36.9)	47 (12.3)	19 (5.0)	4 (1.0)
Nurses are positioned to help patients/clients, families, groups, communities, and populations understand the health impacts from climate-sensitive vector-borne diseases.	202 (52.9)	119 (31.2)	40 (10.5)	15 (3.9)	6 (1.6)
I feel well prepared to address climate-sensitive vector-borne diseases with patients/clients, families, groups, communities, and populations.	29 (7.6)	56 (14.7)	57 (14.9)	154 (40.3)	86 (22.5)
I feel confident counseling patients, families, groups, communities, and populations about climate change and health.	31 (8.1)	77 (20.2)	59 (15.4)	137 (35.9)	78 (20.4)
I feel confident counseling patients, families, groups, communities, and populations about climate-sensitive vector-borne diseases.	27 (7.1)	44 (11.5)	53 (13.9)	147 (38.5)	111 (29.1)
Nurses should play an active role in discussing climate-sensitive vector-borne diseases with their patients/clients, families, groups, communities, and populations.	138 (36.1)	166 (43.5)	56 (14.7)	15 (3.9)	7 (1.8)
Indigenous Canadians disproportionately experience negative health effects from climate change.	174 (45.5)	119 (31.2)	60 (15.7)	17 (4.5)	12 (3.1)
It is important for healthcare professionals to advocate for social justice by addressing socioeconomic inequities which exist among populations that are at risk of vector-borne diseases.	228 (59.7)	115 (30.1)	24 (6.3)	8 (2.1)	7 (1.8)

Note: Total responses = 382.

3.4 | Practices, Experiences, and Resources

The final section of the survey contained questions about practices and experiences in participants' practice setting related to VBDs, as well as access to resources on VBDs. Over half of respondents indicated they do not discuss the impacts of climate change (53%) or VBDs (63%) on health with patients (see Table 7). Statistically greater number of nurses in Quebec discussed climate change and health compared to nurses in British Columbia Saskatchewan, Alberta, and Newfoundland (see Table 8).

Of the 382 survey responses, 259 nurse participants indicated that they never or rarely encountered a patient with a VBD in practice. The most common barriers preventing discussions with patients or clients about VBDs included lack of knowledge (58%), lack of time (38%), and lack of patient interest (30.9%). The greatest barriers to accessing resources on VBDs included lack of time (52%), lack of knowledge where to locate reliable information (39%), and lack of motivation (21%) (see Table 9). Most participants (78.5%) had never received specific information about VBDs from their employer in the practice setting, and many participants (71%) indicated they were interested in a continuing education course or online modules about VBDs if available. Only 130 respondents (34%) had personal experience with VBDs outside of their work/clinical setting (see Table 10).

4 | Discussion

Of the 382 eligible participants, most worked as frontline care providers, and the highest percentages of participants worked in public health, medical-surgical nursing, and educational institutions. Approximately half of the participants in the study

TABLE 6 | Significant ANOVA results of attitude survey items.

I feel well prepared to address climate-sensitive vector-borne diseases with patients/clients, families, groups, communities, and populations.	
Province/Territory	[$F(9, 71.66) = 3.522^{***}$]
	Mean score for Quebec ($M = 2.29$, $SD = 1.069$) was significantly different** than British Columbia ($M = 3.53$, $SD = 1.215$); was significantly different* than Alberta ($M = 3.63$, $SD = 1.133$); was significantly different*** than Saskatchewan ($M = 3.89$, $SD = 1.092$); and was significantly different*** than Newfoundland & Labrador ($M = 4.31$, $SD = 0.602$).
Indigeneity	[$F(2, 50.00) = 10.98^{***}$]
	Mean score for Yes ($M = 2.63$, $SD = 1.52$) was significantly different*** than No ($M = 3.65$, $SD = 1.14$), and was significantly different* than prefer not to answer ($M = 3.67$, $SD = 0.89$).
I feel confident counseling patients, families, groups, communities, and populations about climate change and health.	
Practice area	[$F(14, 162) = 2.232^{**}$]
	Mean score for Educational Institution ($M = 2.71$, $SD = 1.447$) was significantly different** than Geriatrics ($M = 4.05$, $SD = 0.921$); and was significantly different* than Other ($M = 3.70$, $SD = 1.087$).
Province/Territory	[$F(9, 53.75) = 3.243^{**}$]
	Mean score for Quebec ($M = 2.29$, SD = 0.914) was significantly different** than Alberta ($M = 3.55$, $SD = 1.167$); was significantly different*** than Saskatchewan ($M = 3.98$, $SD = 1.033$); and was significantly different* than Newfoundland & Labrador ($M = 3.75$, $SD = 0.931$).
	Mean score for Saskatchewan ($M = 3.98$, $SD = 1.033$) was significantly different** than British Columbia ($M = 3.10$, $SD = 1.319$).
Indigeneity	[$F(2, 379) = 15.41^{***}$]
	Mean score for Yes ($M = 2.37$, $SD = 1.37$) was significantly different*** than No ($M = 3.53$, $SD = 1.19$).
I feel confident counseling patients, families, groups, communities, and populations about climate-sensitive vector-borne diseases.	
Practice area	[$F(14, 168.42) = 2.061^{*}$]
	Mean score for Educational Institution ($M = 3.26$, $SD = 1.482$) was significantly different* than Other ($M = 4.16$, $SD = 0.954$).
	Mean score for Public Health ($M = 3.38$, $SD = 1.254$) was significantly different* than Other ($M = 4.16$, $SD = 0.954$).
Province/Territory	[$F(9, 372) = 3.835^{***}$]
	Mean score for Quebec ($M = 2.36$, $SD = 1.151$) was significantly different*** than British Columbia ($M = 3.84$, $SD = 1.229$); was significantly different*** than Alberta ($M = 3.78$, $SD = 1.135$); was significantly different*** than Saskatchewan ($M = 3.98$, $SD = 1.076$); was significantly different* than Nova Scotia ($M = 3.63$, $SD = 1.131$); and was significantly different*** than Newfoundland & Labrador ($M = 4.25$, $SD = 0.775$).
Indigeneity	[$F(2, 47.08) = 11.84^{***}$]
	Mean score for Yes ($M = 2.69$, $SD = 1.59$) was significantly different*** than No ($M = 3.83$, $SD = 1.11$).
Total Attitude Likert Scale Score	
Education	[$F(4, 377) = 7.802^{***}$]
	Mean score for Diploma ($M = 24.74$, $SD = 4.88$) was significantly different*** than master's degree ($M = 19.87$, $SD = 5.61$); and was significantly different* than PhD ($M = 19.06$, $SD = 6.90$).
	Mean score for Other ($M = 29.40$, $SD = 3.51$) was significantly different** than master's degree ($M = 19.87$, $SD = 5.61$); and was significantly different** than PhD ($M = 19.06$, $SD = 6.90$).
	Mean score for master's degree ($M = 19.87$, $SD = 5.61$) was significantly different** than Baccalaureate degree ($M = 22.66$, $SD = 6.05$).
Practice area	[$F(14, 367) = 2.432^{**}$]
	Mean score for Educational Institution ($M = 18.83$, $SD = 6.08$) was significantly different* than Medical/Surgical ($M = 23.72$, $SD = 6.55$); and was significantly different* than Other ($M = 23.38$, $SD = 5.81$).

(Continues)

TABLE 6 | (Continued)

Urban/Rural	[$F(2, 376) = 6.78^{**}$]
	Mean score for Urban ($M = 21.56$, $SD = 5.87$) was significantly different** than Rural ($M = 23.78$, $SD = 6.39$).
Indigeneity	[$F(2, 379) = 12.61^{***}$]
	Mean score for Yes ($M = 17.77$, $SD = 6.49$) was significantly different*** than No ($M = 22.60$, $SD = 5.89$), and was significantly different*** than prefer not to answer ($M = 25.67$, $SD = 4.94$).

*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

TABLE 7 | Discussions in nursing practice.

Survey item	All *n* (%)	Most *n* (%)	Some *n* (%)	A few *n* (%)	None *n* (%)	Not applicable[a] *n* (%)
What proportion of your patients or clients do you discuss the impact of climate change on their health?	4 (1.0)	15 (3.9)	48 (12.6)	85 (22.3)	203 (53.1)	27 (7.1)
What proportion of your patients or clients do you discuss the impact of climate-sensitive vector-borne diseases on their health?	4 (1.0)	12 (3.1)	31 (8.1)	62 (16.2)	240 (62.8)	33 (8.6)

Note: Total responses = 382.
[a]Not involved in patient care.

TABLE 8 | Significant Chi-square and Kruskal–Wallis results of practice and experience survey items.

What proportion of your patients or clients do you discuss the impact of climate change on their health?	
Province/Territory	Kruskal–Wallis test found significant differences in mean rank between groups, $X^2(9, N = 382) = 29.04^{***}$
	Significant pairwise comparisons between Quebec and Alberta*, Quebec and Saskatchewan**, Quebec and Newfoundland & Labrador*
	Significant pairwise comparisons between BC and Saskatchewan*
Have you ever received specific information about climate-sensitive vector-borne diseases for your practice setting?	
Practice area	Significant Chi-square statistic was obtained, $X^2(28, N = 361) = 61.20^{***}$
	Significant pairwise comparisons between educational institutions and med/surg, $X^2(2, N = 79) = 8.44^{*}$
	Significant pairwise comparisons between public health and med/surg, $X^2(2, N = 100) = 10.41^{**}$

*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

felt knowledgeable about climate change and subsequent health implications. Frontline staff felt less knowledgeable about climate change and health than nurse educators. The findings of this study are consistent with several recent studies that have been published on nurses' knowledge of climate change, including the study by Kalogirou et al. (2020).

While overall knowledge of climate change and health was reported as average, almost all respondents agreed that climate change is happening and directly or indirectly impacts the health of patients they care for. This finding may indicate that while nurses agree that climate change is an urgent issue in Canada, they may not be more knowledgeable on the issue than other Canadians, despite their healthcare education. This finding demonstrates the need for further education for nurses to ensure they are prepared for healthcare practice settings.

Significantly more nurses working in public health agreed that climate change is happening and directly or indirectly impacts the health of patients, clients, families, groups, communities, and populations, compared to nurses in other practice areas. Given the scope of practice of public health nurses, particu-

TABLE 9 | Barriers and resources.

Survey item	*n* (%)
Barriers preventing discussing climate-sensitive vector-borne diseases with patients or clients	
Lack of knowledge regarding how to approach this issue with my patients or clients	221 (57.9)
Lack of time	145 (38.0)
My patients or clients would not be interested	118 (30.9)
My patients or clients would not be knowledgeable enough about climate-sensitive vector-borne diseases to discuss this issue	97 (25.4)
Discussing this issue with my patients or clients will not make much difference in their overall health	81 (21.2)
Other*	69 (18.1)
Not applicable—I don't face barriers discussing climate-sensitive vector-borne diseases with patients or clients	44 (11.5)
Climate change is not occurring	8 (2.1)
Barriers preventing accessing resources on climate-sensitive vector-borne diseases.	
Continuing education course on climate change and health (including vector-borne diseases)	263 (68.8)
Patient or client education materials	236 (61.8)
Research articles demonstrating the link between climate change and vector-borne diseases	221 (57.9)
Treatment or assessment options	216 (56.5)
Case studies or clinical care examples demonstrating best practices for discussing climate change and health with patients or clients	200 (52.4)
I am not interested in this topic	16 (4.2)
I don't need any resources	10 (2.6)
Other*	10 (2.6)

*Free text response.

TABLE 10 | Practices and experiences with VBDs.

Survey item	True/Yes *n* (%)	False/No *n* (%)	Unsure *n* (%)
Have you ever received specific information about climate-sensitive vector-borne diseases for your practice setting?	61 (16.0)	285 (78.5)	17 (4.5)
If a continuing education course or online modules on climate-sensitive vector-borne diseases were available to you, would you be interested?	271 (70.9)	20 (5.2)	72 (18.8)
Have you had personal experience with vector-borne diseases outside of your clinical/work setting?	130 (34.0)	225 (58.9)	8 (2.1)

Note: Responses = 363, blank responses = 19.

larly around population health issues and communicable disease control, this finding was expected. This finding correlates with the mandate for public health professionals, to effectively promote and protect health in a rapidly changing climate and engage in climate-health action (Public Health Agency of Canada 2022).

Overall mean knowledge scores among RNs for Lyme disease and WNv was limited. Similarly, the total attitude mean score among participants was considered average. These findings align with the results of the scoping review completed by Vandenberg et al. (2023), who found that nurses lack knowledge and confidence regarding climate change and VBDs. The lack of knowledge among nurses may contribute to a lack of practice preparedness in addressing VBDs in the practice setting. These findings are concerning given that nurses, as trusted HCPs, will be sought out for guidance and support in mitigating climate-driven threats, and their expertise in climate-related health outcomes is desirable (Leffers et al. 2017; Liu et al. 2020. While Lyme disease and West Nile virus are already established and increasing in incidence, other diseases, such as Human granulocytic anaplasmosis (HGA), human babesiosis (Babesia microti), and Powassan virus disease are emerging as concerns in Canada. Nurses' lack of preparedness highlights a critical gap in their ability to respond effectively to emerging VBDs and climate-related health outcomes.

Overall knowledge of Indigenous, Metis, and Inuit nurses for both Lyme disease and WNv was significantly higher compared to those who were not members of these groups or who preferred not to answer. A fulsome discussion of the significant survey results of Indigenous, Metis and Inuit nurses is not included in this manuscript, as these findings are presented in a separate manuscript. The enhanced knowledge of Indigenous, Metis, and Inuit nurses on VBDs may be attributed to their increased risk and exposure, as well as intergenerational knowledge transfer among Indigenous Peoples, which has provided them with the knowledge to observe, respond, and adapt to climate change and environmental concerns (National Collaborating Centre for Indigenous Health 2022).

Study findings illustrate the significant knowledge and attitude differences among nurses across Canada. Overall, nurses in eastern provinces (New Brunswick, Nova Scotia, Quebec, and Ontario) were more knowledgeable about VBDs than nurses working in other geographical areas in Canada. These findings correspond to the current incidence rates of VBDs, where Lyme disease incidence is highest in central and eastern Canada, including Ontario, Nova Scotia, Quebec, New Brunswick, and Manitoba (see Figure 1) (Government of Canada 2025), and WNv incidence among human cases is highest in Ontario and Quebec (see Figure 2) (Public Health Agency of Canada 2025). These findings are supported by Cameron et al. (2021), who found that participants in both higher risk areas and in high climate concern groups had greater knowledge and higher perceptions of risk than those in low concern groups and low concern geographical areas.

Knowledge and attitude variations were also found across practice areas. PHNs and nurses working in educational institutions reported higher knowledge and attitude scores than nurses working in other practice areas. These findings are consistent with the scope of practice of nurses in these areas. The Community Health Nurses of Canada (CHNC) outline the role of PHNs, namely, to promote, protect, and preserve the health of populations, participate in surveillance and communicable disease control and management, recognize trends in epidemiological data, and use appropriate prevention approaches in managing communicable diseases and protection of the environment (CHNC 2019). Therefore, it is to be expected that nurses working as PHNs would exhibit advanced knowledge of VBDs than nurses working in other practice areas.

Most participants had never received information on VBDs from their employer for their practice setting. A statistically greater number of nurses working in public health reported receiving information about VBDs compared to nurses working in medical/surgical practice. Given that VBDs relate to communicable disease prevention and control, it is not surprising that PHNs have received information in their practice setting compared to working in acute care settings. A lack of information in the practice setting may intersect with the finding that most respondents indicated they do not discuss the impacts of climate change or VBDs on health with patients or clients.

Given that VBDs are an emerging issue in Canada, it is concerning that most participants have not received information in the practice setting or discuss VBDs with patients, as most nurses are at the frontline of care, and therefore are well-positioned to address the impact of climate on health (Brenndorfer 2020). Lyme disease is ranked second on a prioritization tool for endemic diseases in Canada, which confirms that Lyme disease is significant in Canada (Otten et al. 2020); however, Boudreau et al. (2018) and CPHA (2021) establish that VBDs are not given priority within Canada's healthcare system, confirming the finding in the current survey that most nurses have not received continuing education or information on VBDs in the practice setting. This lack of priority by the healthcare system in Canada may also contribute to nurses' reduced capacity to move beyond the patient to consider planetary-related challenges.

Despite feelings of concern about health impacts of VBDs, over half of participants felt unprepared to address VBDs with patients, and significant differences existed by geographical area, where nurses in Quebec felt more prepared than nurses in British Columbia, Alberta, Saskatchewan, and Newfoundland and Labrador. Nurses also lacked confidence counselling patients and populations about climate change and subsequent health implications. Nurses in Quebec reported higher confidence compared to other provinces and territories. Given the higher rates of both Lyme disease and WNv in Quebec, it is not unexpected that nurses in Quebec feel more prepared and confident addressing climate change and VBDs with patients compared to nurses in other regions of Canada. These findings are consistent with Kircher et al. (2022) study, where they found that while most HCPs recognized the health impacts of climate change, they reported feeling uncomfortable discussing climate change with patients.

Most study participants also agreed that nurses must advocate for social justice by addressing socioeconomic inequities that exist among equity-deserving populations that are at risk of VBDs. Nicholas and Breakey (2017) believed that nurses have a commitment to social justice, where they are obligated to recognize and act on the complex impacts of climate change on health, such as VBDs. Similarly, Smith (2019) and Tiitta et al. (2021) established that nurses should be prepared to address VBDs in practice to fulfil their role as champions of social justice. Sanderson et al. (2020) stated that nurses must understand climate change as a foundation for meaningful response for social justice and environmental health, while Martin and Kaminski (2021) believed that nurses should be strong advocates for health equity.

4.1 | Recommendations

This research study provides baseline data on knowledge, attitudes, beliefs, and behaviors of RNs toward climate driven VBDs; however, there is a need for further research to evaluate RN workforce and practice readiness in meeting the planetary and climate-related health challenges, such as VBDs, which will promote improved practice competence. Research with other groups of HCPs may be necessary to compare perceptions of RNs with other HCPs or members of the multidisciplinary team. Additionally, research conducted in other countries may be valuable to compare nurses' knowledge, attitudes, and practices around the world. Furthermore, research on curricular integration of planetary health, climate change, and VBDs is warranted. Exploring student knowledge, attitudes, beliefs, and behaviors

toward climate driven VBDs may provide additional information on educational preparation of the future nursing workforce.

4.2 | Implications

Given the limited knowledge of nurses on climate change and VBDs revealed in the current study, planetary health, climate change and VBDs content must be better integrated into nursing curriculums to better prepare nurses to address planetary and climate health challenges, such as VBDs, in practice. Both current and future nurses have an integral role in mitigating climate-related health effects, and therefore must be knowledgeable about these issues.

Nurses, particularly those involved in frontline care and public health, are well-positioned to address climate-related health implications; however, study findings revealed that nurses lack knowledge and confidence in the practice setting, and therefore are unprepared to address VBDs with their patients. Most nurses did not receive any formal education on VBDs, and therefore do not discuss climate change or VBDs with patients in the practice setting. In a recently released position statement on planetary health, the CNA (2024) urges all nurses to advance both human and planetary health by delivering care that actively addresses climate change.

Nursing regulatory bodies and associations should revise entry-to-practice nursing competencies and nursing standards of practice to include planetary health, climate change and related health implications, such as VBDs, to ensure practicing nurses are prepared to effectively care for patients. Healthcare and public health entities are advised to enhance continuing education for HCPs on planetary health, climate change, and VBDs, which will create a more informed and appropriately skilled health workforce that is better equipped to use evidence to foster change. Skills in communication and advocacy are necessary to facilitate multisectoral partnerships and planetary health and climate-related policy development. Greater effort must be taken to provide nurses and other HCPs with evidence-based information that is readily available, accessible, and relatable. For instance, learning modules, instructive resources, or education programs are advised for nurses to improve public health knowledge in planetary health, as well as climate change and VBDs mitigation and advocacy.

Nurses, particularly those working in public health, are encouraged to assume greater leadership by advocating and engaging with nursing organizations, regulatory bodies, healthcare organizations, legislators, and governments to act on these issues to advance population and planetary health. Nurses can encourage researchers, policy developers, and practitioners to take a multidisciplinary and multi-sectoral perspective to develop climate-sensitive policies, given the challenges with the complexities of climate change and VBDs. According to Myers (2017), factors, including good governance and financial resources, can mediate the effects of planetary health challenges, such as climate change, on public health.

4.3 | Limitations

While efforts were taken to ensure this study followed research and ethical guidelines, there are several limitations to report. First, the findings of this study are specific to one group of HCPs in one country. Although the study was conducted with RNs in Canada, the perceptions of other HCPs may be like that of nurses and the topic of climate driven VBDs is internationally relevant. Second, the sample size was small, where only a small percentage of eligible RNs in Canada participated in the research study, despite significant efforts to recruit study participants through various methods. While not a specific limitation to this research study, but rather of the nursing profession, there may be a general lack of interest by practicing nurses in climate change research, and specifically research on VBDs, contributing to the small sample size in this study. Third, this study focused specifically on Lyme disease and West Nile virus, as the two most common endemic VBDs in Canada, but does not include other VBDs that threaten health. While it is recommended that this emerging issue should be explored more broadly, this study is an important beginning to inquiry of climate driven VBDs among nurses in Canada.

5 | Conclusions

Given the integral role that RNs have in supporting individuals and populations affected by various climate-related health challenges (ICN, 2018), exploring nurses' knowledge, attitudes, and perceptions toward climate-sensitive VBDs, using cross-sectional survey research was warranted. Research findings indicate that overall, nurses' knowledge on climate change and VBDs was limited, specifically among frontline nurses and those in Western and Northern regions of Canada. RNs demonstrated a lack of confidence and preparedness in addressing VBDs in the practice setting. Barriers to discussing VBDs in practice exist, with lack of knowledge and time reported most frequently. Most study participants never received training or education on VBDs, and information on VBDs for nurses in the practice setting is absent. Most nurse participants believed they have a role in health equity and social justice, particularly for marginalized populations, such as Indigenous Peoples. The goal of this research is that nurses are better prepared to address VBDs in the practice setting and assume a greater role in leading change to advocate for a climate-resilient future. Nurses are encouraged to assume greater leadership and advocacy to advance planetary health challenges, such as climate change and VBDs .

Author Contributions

Shannon Y. Vandenberg: conceptualization, investigation, methodology, formal analysis, resources, validation (lead), visualization, writing—original draft, writing—review and editing (lead). **Tracy Oosterbroek**: supervision, validation (supporting), writing—review and editing (supporting). **Andrea Chircop**: supervision, validation (supporting), writing—review and editing (supporting). **Peter Kellett**: supervision, validation (supporting), writing—review and editing (supporting).

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.

Supporting file 1: phn70035-sup-0001-Appendix.docx