A One Health Approach to Vector-Borne Disease: Tick & Mosquito Program Updates

To:	Chair and Members of the Board of Health
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Recommendations

It is recommended that the Board of Health receive this report for information.

Key Points

Surveillance and Control:

- Blacklegged ticks identified using the Online Tick Identification tool rose by 13% to 62% of submissions (95/153), compared to 49/100 ticks identified in 2023.
- Human Lyme disease cases in WDG rose by 30% to 26 confirmed cases in 2024, compared to 20 cases in 2023.
- Mosquito monitoring continued in 2024. Although all samples tested negative for West Nile Virus (WNV), there was one human case reported in a WDG resident, but likely not locally acquired.

Community Engagement: Education and Awareness Initiatives

- In collaboration with municipalities and conservation authorities, WDG Public Health installed nearly 100 tick awareness signs in local parks and trails with known tick activity.
- Starting in 2025, WDG Public Health is collaborating with local school boards to support Vector Borne Disease (VBD) education with staff and students.

- In collaboration with the Public Health Agency of Canada and the University of Guelph, WDG Public Health will continue to host annual in-person workshops for tick identification for professional across the province.
- The Zoonotic and Vector-Borne Diseases Hub, launching in spring 2025, will provide localized online data and public health guidance for emerging VBDs

Background

Vector-borne diseases such as Lyme disease and WNV are increasingly recognized as critical public health concerns due to their strong links to climate change. [1,2] As temperatures rise and the summer season lengthens, vectors such as blacklegged ticks and *Culex* mosquitoes are expanding their geographic range, increasing the likelihood of human exposure. [1,2] Every year, Wellington-Dufferin-Guelph (WDG) Public Health uses an integrated surveillance, control, and education program to mitigate these risks. These initiatives encompass passive and active tick monitoring, mosquito surveillance, targeted larviciding of catch basins, as well as public education campaigns and collaborations with local municipalities and community partners.

Mosquito Surveillance and Control Program

WNV poses a persistent health threat in Ontario, including in the WDG region. Infected individuals typically experience mild, flu-like symptoms, but a small percentage can develop severe and potentially life-threatening conditions such as meningitis or encephalitis. These severe cases underscore the importance of proactive public health measures to prevent human exposure. The disease is primarily transmitted through *Culex pipiens or Culex restuans* mosquitoes. The presence of these vector species can help inform which geographic areas might be at higher risk and where further control measures or targeted education might be required. [1]

Eastern Equine Encephalitis Virus (EEEV), though rare in Ontario, is an emerging mosquito-borne disease with a high fatality rate in a small percentage of severe cases. Primarily spread among birds by *Culiseta melanura* mosquitoes, the virus can reach humans and horses through bridge vectors like *Aedes* and *Coquillettidia* species. A 2024 case in Eastern Ontario highlights its presence in Ontario, reinforcing the need for proactive surveillance and control in WDG. Monitoring mosquito populations and equine cases helps guide public health responses to prevent further emergence in WDG.

To reduce mosquito populations, WDG Public Health, in partnership with the Canadian Centre for Mosquito Management Inc. (CCMM), conducts larval mosquito surveillance and applies environmentally friendly larvicides to identified breeding sites such as municipal catch basins, stormwater ponds, and roadside ditches. Municipal bylaw officers support these efforts by enforcing local standing water bylaws and ensuring compliance with source reduction measures to prevent mosquito breeding.

Tick Surveillance Program

WDG Public Health conducts a tick-borne disease program focusing on blacklegged tick surveillance, disease case investigations, and public education. Lyme disease, caused by *Borrelia burgdorferi* and transmitted through blacklegged tick bites, is one of the most common vector-borne diseases in North America, with symptoms ranging from fever and fatigue to chronic complications if untreated. Rising temperatures and longer warm seasons are increasing tick activity and expanding their habitats, reinforcing the importance of ongoing surveillance and public education to mitigate the risks of tick-borne diseases in the region. Prevention strategies emphasize tick bite avoidance, prompt removal, and habitat reduction. WDG Public Health employs both passive surveillance through public tick submissions and active surveillance via tick dragging with partners at the Ontario Veterinary College and College of Biological Sciences at the University of Guelph. These efforts contribute to updating Ontario's Blacklegged Tick Established Risk Areas map published by Public Health Ontario (**Figure 1**). [4]

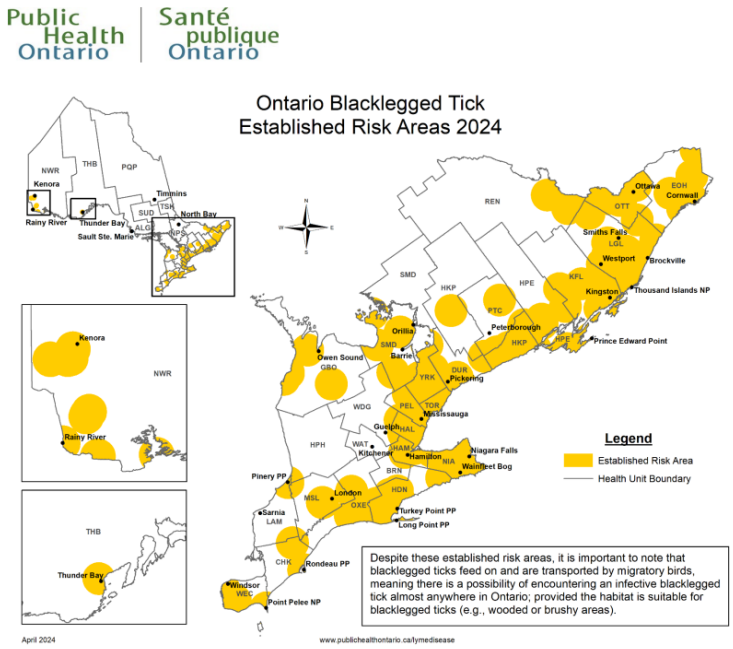


Figure 1. Public Health Ontario's Ontario Blacklegged Tick Established Risk Areas in 2024
Source: Ontario Blacklegged Tick Established Risk Areas 2024, Public Health Ontario [4]

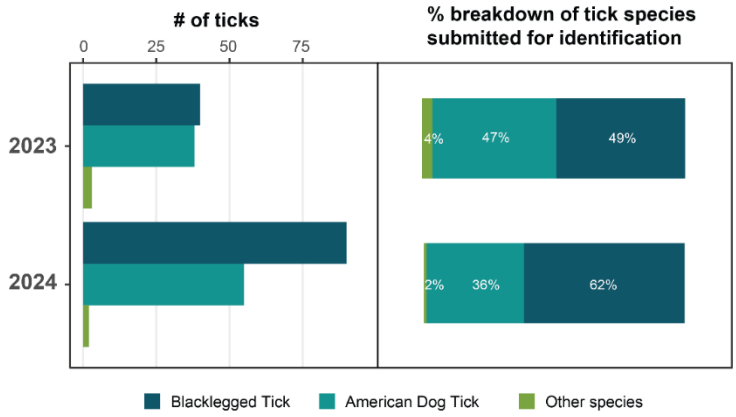
Discussion

Tick Surveillance and Disease Trends

Passive surveillance:

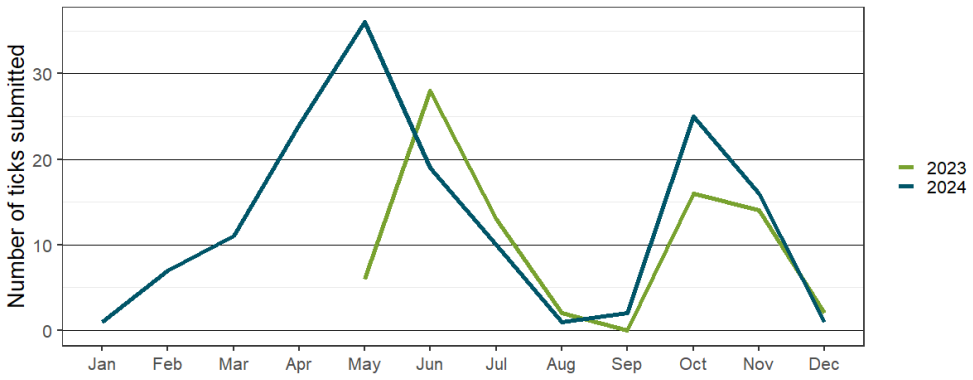
The passive surveillance program has seen an increase in tick submissions over the past two years, highlighting growing public awareness of tick-borne disease risks and engagement with WDG Public Health's efforts (**Figure 2**). A month-by-month comparison of submissions between 2023 and 2024 reveals high submission rates during peak tick activity in spring (May-June) and fall (September-November; **Figure 3**). This seasonal pattern reflects the two active periods for ticks, when they are most likely to seek hosts.

Figure 2. Number of ticks submitted to WDG Public Health's Online Tick Identification Tool and breakdown of species identified, 2023-2024.



*Tick form went live in late May 2023; 2023 numbers are an underestimate.

Figure 3. Number of ticks submitted to WDG Public Health's online passive surveillance Online Tick Identification Tool per month, 2023-2024.



*Tick form went live in late May 2023.

A significant proportion of submissions were identified as blacklegged ticks (BLTs), the primary vector for Lyme disease, with the percent of BLT submissions increasing from 49% in 2023 to 62% in 2024 (**Figure 2**). Many submissions (72%) were also engorged or partially engorged female BLTs (**Table 1**). Blacklegged ticks need to feed for at least 24 hours to be able to transmit bacteria. In some instances, ticks were feeding for more than 24 hours when the tick was submitted. These findings underscore the importance of the passive surveillance program in monitoring disease vectors and providing timely information to individuals who may be at risk of developing tick-borne illnesses.

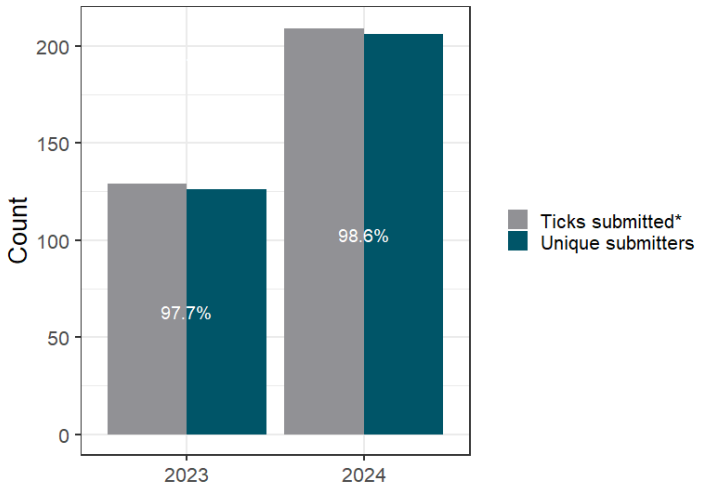
Table 1. Feeding status of blacklegged ticks submitted to WDG Public Health's online passive surveillance tick ID submission form, 2023-2024.

Feeding Status	2023	2024
Engorged (partially or fully)	21 (55%)	67 (72%)
Unfed	13 (34%)	20 (22%)
Unclear	4 (11%)	6 (6%)

*Tick form went live in late May 2023; 2023 numbers are an underestimate

The steady rise in submissions also aligns with enhanced public education campaigns, suggesting greater recognition of the risks associated with tick exposure and the role of prompt identification and prevention in reducing tick-borne disease transmission. This is also reflected in the number of unique users to our online submission form: 98% of ticks submitted in 2023 were from first-time users, with 99% of ticks submitted from first-time users in 2024 (**Figure 4**).

Figure 4. Number of ticks submitted and the number of unique users of the online passive surveillance tick ID submission form, 2023-2024.



*Tick form went live in late May 2023; 2023 numbers are an underestimate

Active surveillance:

WDG Public Health conducted tick dragging in October 2024 at three sites in Wellington County. Tick populations were identified at Starkey Hill Conservation Area and Rockwood Conservation Area (GRCA), emphasizing the need for public awareness and protection when venturing on hikes in the region (**Figure 5**). The regions identified in October 2024 were not previously included on the PHO risk map as blacklegged tick-endemic areas (**Figure 1**). The data collected through our active surveillance efforts is directly supporting the improvement of federal and provincial monitoring data by providing up-to-date risk data for the WDG region.

Figure 5. Active surveillance conducted by WDG Public Health in October 2024. Left: tick dragging along a patch of long grass leading into GRCA's Starkey Hill Conservation Area. Right: a blacklegged tick on a tick dragging sheet, acquired at Starkey Hill Conservation Area.

WDG Public Health is expanding active surveillance efforts in 2025 to better understand tick populations and the pathogens they carry. Identified ticks highlight the need for targeted surveillance to refine risk assessments and allocate resources effectively. The rising threat of diseases like anaplasmosis and babesiosis underscores the need for robust environmental monitoring. [2,5]

Lyme disease cases in WDG:

Human cases of Lyme disease continue to increase in WDG. In 2018, just six Lyme disease cases were reported, increasing to 26 in 2024 (**Table 2, Figure 6**). The increase in human cases is consistent with the increase seen across Ontario. Exposures often occurred during outdoor activities such as gardening on private property, hiking on local trails, or from family pets bringing ticks into the home.

Table 2. Lyme disease cases and rates reported in Ontario and Wellington-Dufferin-Guelph, 2018-2024.

Year	Ontario rate	WDG rate	WDG cases
2018	4.5	2.6	6
2019	7.8	2.6	8
2020	5.7	1.6	5
2021	11.3	3.2	10
2022	9.6	3.7	12
2023	11.8	6.1	20
2024	**13.4**	**7.7**	**26**

Data source: The integrated Public Health information System (iPHIS) via PHO ID Query, extracted January 28th, 2025.

Figure 6. Incidence rates for lab-confirmed Lyme disease cases in Ontario and Wellington-Dufferin-Guelph, 2018-2024.

Data source: The integrated Public Health information System (iPHIS) via PHO ID Query, extracted January 28th, 2025.

Tick Emerging Disease:

The first case of anaplasmosis was reported in WDG in 2024 but was not locally acquired. It is suspected that this case was acquired in Eastern Ontario, where case counts are highest. In 2023, 18 cases (0.12 per 100,000 people) were reported in Ontario, increasing to 52 (0.32 per 100,000 people) in 2024. Prior to 2023, anaplasmosis was not a reportable disease, so earlier data on anaplasmosis cases in Ontario is not available. As climate change drives milder winters and increased precipitation, tick range expansion and overwintering success are expected to lead to increased exposure to ticks. [4,5] Continuing to monitor for new and emerging diseases will be important to protect the health of WDG residents.

Mosquito Surveillance and Disease Trends

Surveillance and Control:

Extensive larval surveillance was conducted to identify breeding sites and to detect the presence of key vector species. These inspections focused on municipal catch basins, stormwater management ponds, and roadside ditches. Based on surveillance data, four rounds of treatment for over 104,000 roadside catch basins, with additional treatments applied to non-roadside basins in parks and residential areas. Environmentally sensitive areas were treated using a biological larvicide designed to minimize environmental impacts.

Despite no WNV-positive mosquito pools being identified in 2024, consistent with historically low activity levels, the presence of WNV was confirmed through three avian cases and one WNV-positive horse (**Table 3**). In contrast, 2023 data showed three WNV-positive mosquito pools but no reported human cases, reflecting a consistent but low-level presence of the virus in the region (**Table 3**). These findings highlight the importance of proactive public health measures, including continued robust surveillance, larviciding and public education to mitigate the risks posed by WNV in WDG.

Table 3. WNV vector surveillance data and human cases counts reported in Ontario and Wellington-Dufferin-Guelph, 2019-2024.

Year	Positive Mosquito pools	% Culex pipiens/restuans	WDG cases	ON cases
2019	0	6.67%	1	19
2020	0	4.98%	1	70
2021	1	10.29%	1	18
2022	0	42.44%	0	24
2023	3	42.49%	0	48
2024	**0**	**19.49%**	**1***	**77**

Data source: Mosquito data generated by Entomogen, contracted by WDG Public Health. Case data obtained from the integrated Public Health information System (iPHIS) via PHO ID Query, extracted January 28th, 2025.
*Case likely not locally acquired.

Mosquito Emerging Disease:

In WDG, no *C. melanura* were collected. Ottawa Public Health reported one human case of Eastern Equine Encephalitis (EEEV) in 2024. EEEV is not a reportable human disease, so cases may be underreported. Disease transmission to humans is rare. Climate change is leading to wetter and longer summers, supporting habitats for new mosquito species in Ontario [3,6]. Preventing mosquito bites, eliminating standing water around properties and maintaining larvicide applications remain important preventive steps in combatting mosquito-borne illnesses in WDG.

Public Education, Engagement and Next Steps!

Collaboration with local partners, including the Grand River Conservation Authority and local municipalities, supported the installation of close to 100 permanent tick awareness signs in local parks and trails in 2024. Based on active and passive surveillance initiatives from WDG Public Health, the signs provide actionable prevention tips and QR codes linking to WDG Public Health's online submission platform (**Figure 7**).

Starting in 2025, WDG Public Health will work with local school boards to support vector-borne disease education. Schools can borrow tick dragging kits, allowing students to participate in active surveillance and learn about risks from Lyme disease and other vector-borne diseases. The programming will include safety considerations and skills, providing educational opportunities for students and will help WDG Public Health gather local data for future health initiatives.

Figure 7. Tick education signs posted in 90 parks and trails across Wellington, Dufferin, and Guelph.

New online Zoonotic and Vector borne Diseases Hub:

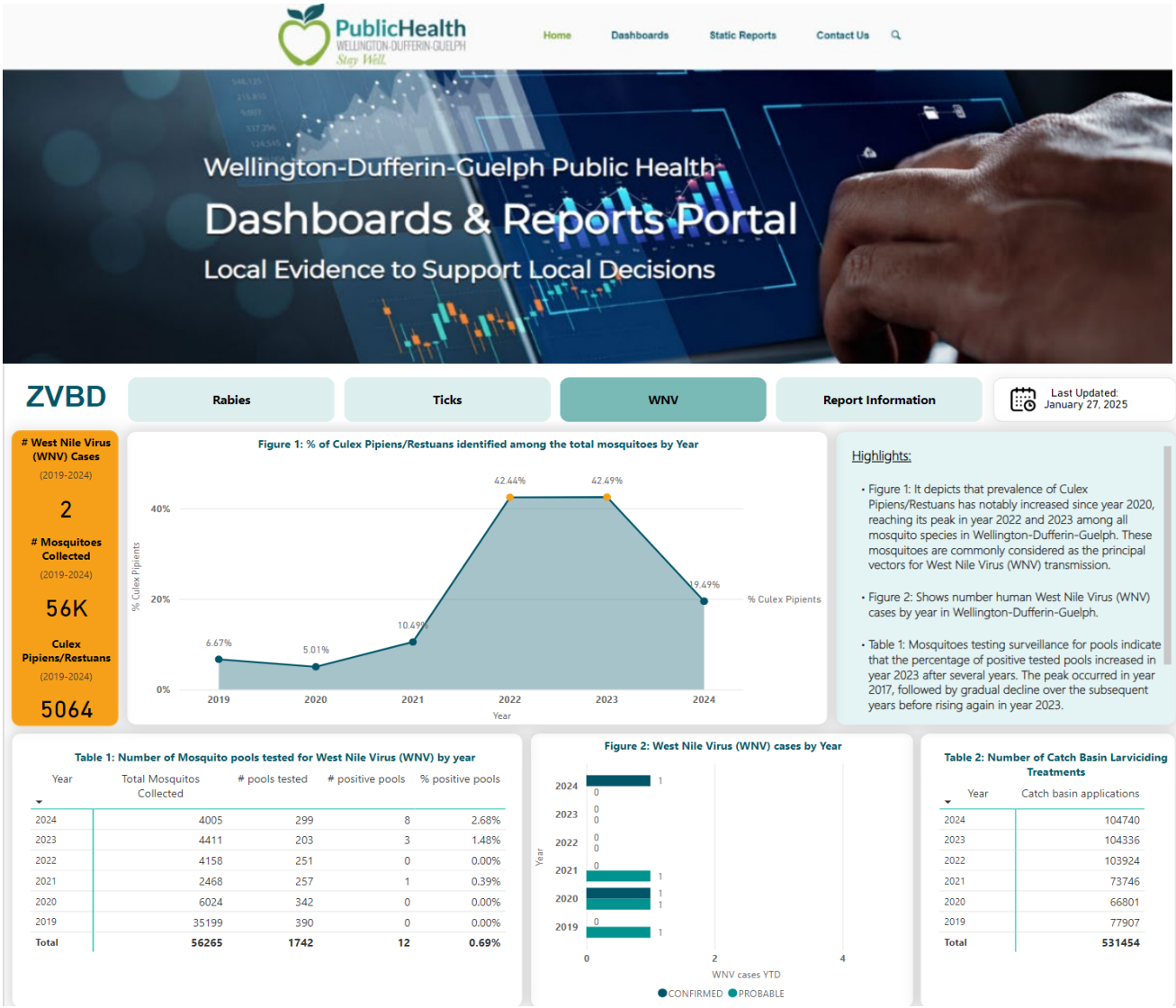
Launching in Q2 of 2025, a new zoonotic and vector-borne diseases hub on the WDG Public Health website will support public health education and resources, focusing on emerging and zoonotic diseases, including Lyme disease and WNV. The focus of all developed materials will be on the regional scale.

For the public, it will provide easy access to educational materials, guidance on what steps to take and connections to relevant services.

It will also offer localized data on emerging zoonotic and vector-borne diseases to help the community understand the prevalence within the region. For internal and external partners, the hub will serve as a resource centre featuring high-level educational materials and best practice recommendations. It will centralize tools for surveillance and reporting, including rabies and veterinary reporting systems, and provide toolkits for health practitioners at the point of care. This integrated approach aims to streamline access to critical health information and strengthen the response to both local and emerging health challenges.

Incorporated into the hub will be a zoonotic and vector-borne disease dashboard that will highlight regional risks and provide case count information to the public (**Figure 8**).

Figure 8. New Z/VBD dashboard now live on the WDG Public Health Dashboards & Reports Portal.



Year	Total Mosquitos Collected	# pools tested	# positive pools	% positive pools
2024	4005	299	8	2.68%
2023	4411	203	3	1.48%
2022	4158	251	0	0.00%
2021	2468	257	1	0.39%
2020	6024	342	0	0.00%
2019	35199	390	0	0.00%
Total	**56265**	**1742**	**12**	**0.69%**

Year	Catch basin applications
2024	104740
2023	104336
2022	103924
2021	73746
2020	66801
2019	77907
Total	**531454**

Tick Identification Workshops

WDG Public Health continues to be provincial leaders in tick identification training, addressing a critical gap for professional development in public health. Our annual workshop, conducted in partnership with the Public Health Agency of Canada and the University of Guelph, underscores our commitment to this mission.

In 2024, over 50 public health professionals from across the province attended the in-person training session held at the University of Guelph. This session was led by our highly skilled Public Health Inspectors, reinforcing our pioneering role in vector-borne diseases work across the province.

Advancing the One Health Approach

The One Health approach is an integrative framework that recognizes the interconnectedness of human, animal, and environmental health. This perspective is especially critical for zoonotic and vector-borne diseases, as many of these illnesses, such as WNV and EEEV, affect both humans and animals, with animal cases often serving as early indicators of potential risks to human health. In the region, an increase in animal cases of vector-borne diseases between 2023 and 2024, particularly EEEV in horses, underscores the importance of integrating animal health data into public health surveillance systems.

Incorporating animal data into WDG Public Health's Z/VBD dashboard is a key step in strengthening this One Health approach. Companion animals, such as dogs and cats, often share environments with humans and can serve as sentinels for emerging diseases, while equine cases of EEEV frequently precede human cases. For example, anaplasmosis cases in dogs local to WDG have increased steadily since 2019, indicating that vectors for this disease are present and active in the region (**Table 4**). Monitoring animal health data enables earlier detection of disease trends and enhances the ability to implement timely interventions to protect both animal and human populations. The increased incidence of EEEV and other VBDs in animals in the region highlights the necessity of fostering cross-sector collaboration among veterinarians, public health professionals, and environmental experts. WDG Public Health is in the process of coordinating data sharing with the Ministry partners and the Ontario Veterinary College to obtain region-specific data on Z/VBDs in companion and farm animals. This integrated strategy will ensure a more comprehensive understanding of disease dynamics and improve the region's capacity to respond effectively to Z/VBD threats.

Table 4. Lab-confirmed vector-borne diseases in dogs, 2018-2024.

VBD in dogs	2018	2019	2020	2021	2022	2023	2024
Anaplasmosis	13	16	18	34	51	117	177
Lyme disease	39	34	63	122	191	270	443

Data source: IDEXX Laboratories, ANTECH Diagnostics, and Zoetis Diagnostics, compiled and presented by Companion Animal Parasite Council, 2024. Extracted on January 28, 2025.

Health Equity Implications

Addressing Barriers to Access

While online tools have improved accessibility for many, certain populations—such as rural residents, low-income individuals, and non-English speakers—face barriers. To mitigate these challenges, Public Health is looking to implement the following:

- Building relationships with community groups to support the dissemination of information to priority and equity-deserving groups.
- Creating resources that are accessible to all groups and translated into required languages, as needed.
- Using a Health Equity Impact Assessment tool to guide project planning to ensure that our work meets the needs of the community, and that it adequately identifies underserved groups, supporting the needs of the most vulnerable in our communities.
- Providing print resources, distributed to community groups with direct connection to underserved groups or individuals that may not be able to access online resources, as needed.
- Educational tools and school-based citizen science initiatives will empower children to recognize and mitigate Z/VBD risks early and encourage life-long application of the knowledge and skills they attain.

By prioritizing equity, WDG Public Health will ensure inclusive access to surveillance and prevention services related to the expanding threat of zoonotic and vector-borne diseases.

Conclusion

Vector-borne diseases are an escalating public health concern due to climate change, ecological shifts, and increasing urbanization. WDG Public Health's integrated surveillance, education, and collaboration initiatives exemplify proactive leadership in addressing these risks.

Next Steps:

1. Launch the zoonotic and vector-borne disease hub in May 2025.
2. Expand the One Health Community of Practice to strengthen regional collaboration.
3. Continue public education efforts with an emphasis on reaching underserved populations.
4. Maintain surveillance and control measures for vectors in WDG.

Through innovative tools, cross-sectoral partnerships, and equity-focused strategies, WDG Public Health is well-positioned to mitigate the growing risks of vector-borne diseases resulting from climate change and urbanization.

Ontario Public Health Standards

Foundational Standards

- ☒ Population Health Assessment
- ☒ Health Equity
- ☐ Effective Public Health Practice
- ☒ Emergency Management

Program Standards

- ☒ Chronic Disease Prevention and Well-Being
- ☐ Food Safety
- ☒ Healthy Environments
- ☐ Healthy Growth and Development
- ☐ Immunization
- ☒ Infectious and Communicable Diseases Prevention and Control
- ☐ Safe Water
- ☐ School Health
- ☐ Substance Use and Injury Prevention

2024-2028 WDGPH Strategic Goals

More details about these strategic goals can be found in WDGPH's 2024-2028 Strategic Plan.

- ☒ Improve health outcomes
- ☒ Focus on children's health
- ☒ Build strong partnerships
- ☒ Innovate our programs and services
- ☒ Lead the way toward a sustainable Public Health system

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