Lyme Disease Prevention:
Enhancing Vaccine Access and Public Awareness Initiatives

Climate change is expanding the geographic range of the black-legged tick, increasing the risk of human exposure to Lyme disease. Vaccination against Lyme disease has faced significant resistance in the past due to misinformation and poor public perception. Since then, extensive research has been conducted, paving the way for the development of a novel vaccine. Through a public education campaign and facilitating access to a Lyme disease vaccine, we can encourage vaccination to limit the spread of this debilitating disease.

Key Recommendations

- Healthcare provider engagement
- Trailhead and outdoor activity partnerships
- Online platforms and social media engagement
- Availability in pharmacies, clinics, and upon scheduling
- Subsidies for at-risk communities
- Tax credits for employers

Life-altering disease transmitted by black-legged ticks

Lyme disease in humans is caused by the bacteria *Borrelia burgdorferi*, which is transmitted to humans via the bite of a black-legged tick. The infection typically exhibits a distinctive bulls-eye rash, accompanied by fever, aches, and chills. However, early symptoms of the disease are highly variable. Treatment with antibiotics is generally effective when addressed early on, but, if left untreated, the infection can cause serious complications, such as stiffness, facial palsy, paralysis, neurological issues, and arthritis. For some patients, these debilitating effects can last for months or years after treatment ends.

The geographic range of the black-legged tick is expanding northwest at an average rate of 50 km per year due to warming temperatures. As a result, an increasing number of people are encountering these ticks, putting them at risk of contracting Lyme disease. In Canada, cases of Lyme disease increased by 1502% between 2009 and 2022. The cost to treat Lyme disease averaged at $268 000 between 2015 and 2019 in Quebec alone. As reported cases of Lyme disease continue to rise with the expanding range of ticks, this cost will only increase. Ensuring access to a safe vaccine would reduce the burden of Lyme disease on the healthcare system and protect Canadians from the life-altering effects of this disease.

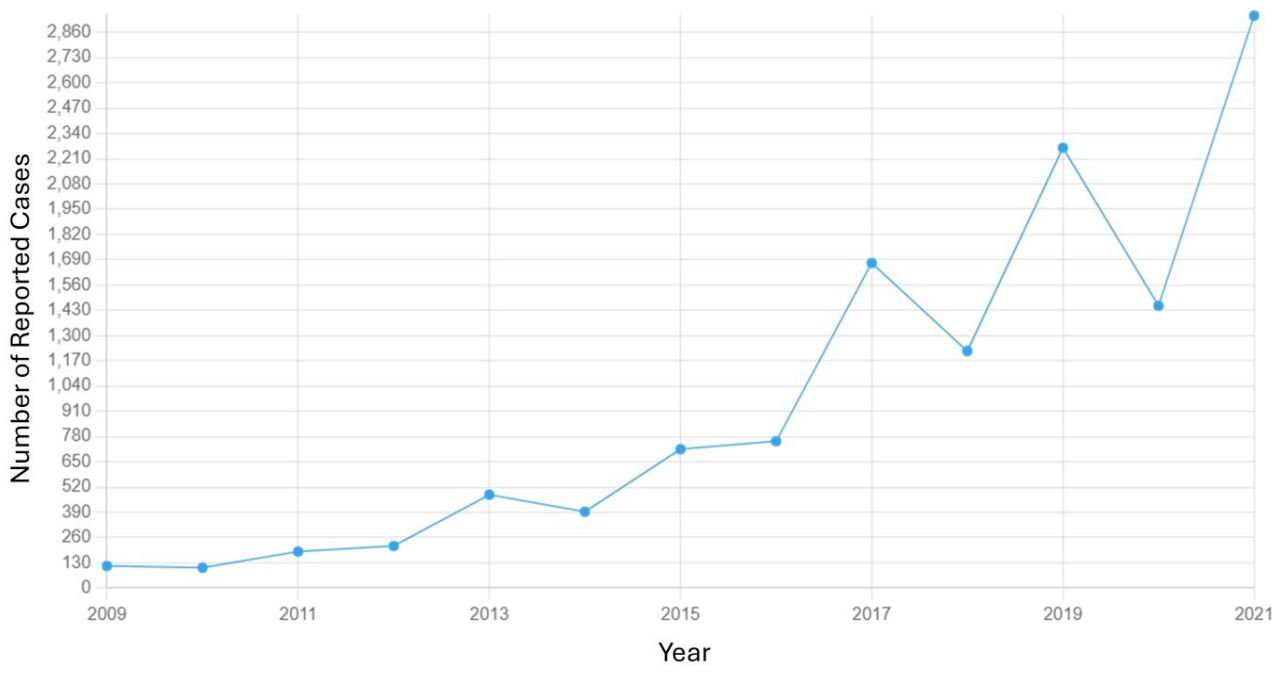

Figure 1: Reported cases of Lyme Disease in Canada from 2009-2021. From Public Health Agency of Canada

Learning lessons from past experiences

In 1998, LYMErix, a Lyme disease vaccine designed by GlaxoSmithKline Pharmaceuticals, was approved by the FDA. The LYMErix vaccine consisted of *B. burgdorferi*'s OspA protein, a protein exclusively produced by *B. burgdorferi* when it is inside of a tick. When a vaccinated person is bitten, anti-OspA antibodies neutralize the *B. burgdorferi* inside of the tick. This way, if any *B. burgdorferi* does enter the vaccinated individual after being bitten, it will not cause Lyme disease. Clinical trials showed that after three doses delivered over 12 months, LYMErix was 76% effective against symptomatic Lyme disease infections and 100% effective against infections with no symptoms.

Sales of LYMErix were high when it initially hit the market, but dropped once adverse effects thought to be caused by the vaccine began to be reported. These reports were widely circulated by Lyme disease advocacy groups and the media, despite there being no evidence to support these claims. Additionally, when LYMErix was commercialized, an academic article proposing that OspA was involved in the development of Lyme arthritis was published. While this article has since been disproven, at the time it raised unfounded concerns of a link between LYMErix and the development of severe arthritis. These concerns and misinformation were picked up by the media and anti-vaccine groups, further amplifying the public's negative perception of LYMErix. As advertising for LYMErix targeted individual consumers, not healthcare professionals, the latter ones were unable to address any concerns individuals had about the vaccine, furthering public distrust in LYMErix. Concerns surrounding LYMErix culminated in a 1999 class action lawsuit filed against GlaxoSmithKline Pharmaceuticals. The negative media attention, misinformation, and high profile lawsuit eroded public trust in LYMErix, resulting in low uptake of the vaccine, and eventually in 2002 GlaxoSmithKline pulled LYMErix from the market due to low sales.

Future success lies in effective communication

A new OspA-based Lyme vaccine candidate is currently in development. Learning from the LYMErix experience, a Lyme disease vaccination program must have public confidence and acceptance to be successful. Robust education campaigns are essential for educating the population about the importance of vaccination, increasing awareness and dispelling myths. These campaigns must also emphasize the safety and efficacy of the Lyme disease vaccine, as well as the role of the vaccine in preventing Lyme disease and protecting people from its potential long-term consequences.

Collaborative efforts among healthcare systems, regulatory agencies, such as the Institut national de santé publique du Québec (INSPQ) and Public Health Agency of Canada (PHAC), and pharmaceutical companies should be encouraged to monitor the prevalence of Lyme disease, and carry out post-marketing studies to ensure a continuous assessment of the vaccine's effectiveness and safety. It is also crucial to involve the Committee on Accreditation of Continuing Medical Education (CACME) to ensure healthcare professionals are educated on Lyme disease, as well as to advertise the vaccine so they are able to better communicate with their patients about the risks of contracting Lyme disease and the vaccination benefits. Governments should also take a proactive role in negotiating pricing agreements with pharmaceutical companies to help subsidize the cost of public health programs that ensure equitable access to the vaccine. These subsidies should target vulnerable demographics that will not have the vaccine covered by an employer, such as children under 14 and seniors, or regions with high concentrations of ticks carrying *B. burgdorferi*. To protect workers in high-risk occupations, tax credits should be given to incentivize employers to vaccinate their employees.

As we develop a policy to ensure a safe and effective Lyme disease vaccine, these issues must be addressed to improve public trust in the vaccine and ensure the vaccine and booster doses are available and accessible to all Canadians.

Policy recommendations

To address the challenges of promoting vaccines against Lyme disease, the following policy recommendations are designed to promote public awareness about a Lyme disease vaccine and to enhance vaccine accessibility, affordability, and availability.

1. Public Education and Outreach

- **Healthcare provider engagement:** Launch an advertising campaign promoting the importance of Lyme disease prevention and the efficacy of the vaccine. Educate healthcare providers about the vaccine via regular seminars and continuing medical education. Encourage healthcare providers and veterinarians to inform populations at high risk of infection about the Lyme disease vaccine, such as people in regions with high tick prevalence and pet owners, during routine check-ups or vaccinations.

- **Trailhead and outdoor activity partnerships:** Collaborate with parks and outdoor organizations, as well as regional sports associations, to disseminate information about Lyme disease and the vaccine. Educational materials, signage, and vaccine information should be strategically placed at trailheads in areas with high tick activity, promoting awareness amidst outdoor recreators.

- **Online platforms and social media:** Use online and social media platforms to disseminate information on the importance of Lyme disease prevention and vaccine efficacy. Educational quiz and vaccine information will be available via a government website and dedicated social media accounts. Engage influencers and organizations focused on outdoor activities to share content, such as information pages and education quiz games.

2. Accessibility and Affordability

- **Availability in pharmacies, clinics, and upon scheduling:** Enhance accessibility by leveraging existing healthcare infrastructure and provide individuals with the option to receive the vaccine during routine healthcare visits. Lyme disease vaccine will also be available at pharmacies via appointment. Scheduled group vaccination may be arranged for schools and workplaces to streamline the vaccination process in high-risk regions.

- **Subsidies for at-risk communities:** Facilitate partnerships between private corporations, NGOs, and government agencies to promote vaccine distribution efforts and to implement subsidies specifically targeted at communities and populations at high risk of encountering Lyme disease.

- **Tax credits for employers:** Introduce tax credits to incentivize companies to educate and proactively offer Lyme disease vaccinations to their at-risk employees, particularly in industries or geographic areas with a heightened risk of Lyme disease.

References

1. *O'Bier, N. S., Hatke, A. L., Camire, A. C., & Marconi, R. T. (2021). Human and veterinary vaccines for Lyme disease. Current issues in molecular biology, 42(1), 191-222. Feder, H. M., & MD, J. (2000). Lyme disease vaccine: good for dogs, adults, and children?. Pediatrics, 105(6), 1333-1334.*
2. *Shen, A. K., Mead, P. S., & Beard, C. B. (2011). The Lyme disease vaccine—a public health perspective. Clinical Infectious Diseases, 52(suppl_3), s247-s252.*
3. *Nelder, M. P., Wijayasri, S., Russell, C. B., Johnson, K. O., Marchand-Austin, A., Cronin, K., ... & Sider, D. (2018). Climate Change and Lyme Disease: The continued rise of Lyme disease in Ontario, Canada: 2017. Canada Communicable Disease Report, 44(10), 231.*
4. *Bézay, N., Hochreiter, R., Kadlecek, V., Wressnigg, N., Larcher-Senn, J., Klingler, A., ... & Bender, W. (2023). Safety and immunogenicity of a novel multivalent OspA-based vaccine candidate against Lyme borreliosis: a randomised, phase 1 study in healthy adults. The Lancet Infectious Diseases, 23(10), 1186-1196.*
5. *Aenishaenslin, C., Bouchard, C., Koffi, J. K., Pelcat, Y., & Ogden, N. H. (2016). Evidence of rapid changes in Lyme disease awareness in Canada. Ticks and tick-borne diseases, 7(6), 1067-1074.*
6. *Williams, C. J., Kranzler, E. C., Luchman, J. N., Denison, B., Fischer, S., Wonder, T., ... & Peck, J. F. (2023). The Initial Relationship Between the United States Department of Health and Human Services' Digital COVID-19 Public Education Campaign and Vaccine Uptake: Campaign Effectiveness Evaluation. Journal of Medical Internet Research, 25, e43873.*
7. *Ripoche, M., Irace-Cima, A., Adam-Poupart, A., Baron, G., Bouchard, C., Carignan, A., ... & de Montréal, D. D. S. P. (2023). Current and future burden from Lyme disease in Québec as a result of climate change. Can. Commun. Dis. Rep, 49, 446-456.*
8. *Hajdusek, O., & Perner, J. (2023). VLA15, a new global Lyme disease vaccine undergoes clinical trials. The Lancet Infectious Diseases, 23(10), 1105-1106.*
9. *Steere, A. C., Strle, F., Wormser, G. P., Hu, L. T., Branda, J. A., Hovius, J. W., ... & Mead, P. S. (2016). Lyme borreliosis. Nature reviews Disease primers, 2(1), 1-19.*
10. *Nigrovic, L. E., Thompson, K. M. (2007). The Lyme vaccine: a cautionary tale. Epidemiology & Infection, 135(1), 1-8.*