



CANADIAN  
PUBLIC HEALTH  
ASSOCIATION

The Voice of Public Health

# INFECTIOUS DISEASE AND CLIMATE CHANGE IN CANADA:

## Key informant interviews

Key Informant Interview Report | September 2021



# THE VOICE OF PUBLIC HEALTH

**The Canadian Public Health Association** is the independent national voice and trusted advocate for public health, speaking up for people and populations to all levels of government.

We champion health equity, social justice and evidence-informed decision-making. We leverage knowledge, identify and address emerging public health issues, and connect diverse communities of practice. We promote the public health perspective and evidence to government leaders and policy-makers. We are a catalyst for change that improves health and well-being for all.

We support the passion, knowledge and perspectives of our diverse membership through collaboration, wide-ranging discussions and information sharing.

We inspire organizations and governments to implement a range of public health policies and programs that improve health outcomes for populations in need.

## **OUR VISION**

A healthy and just world

## **OUR MISSION**

To enhance the health of people in Canada and to contribute to a healthier and more equitable world.

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For more information, contact:

## **Canadian Public Health Association**

404-1525 Carling Avenue, Ottawa, ON K1Z 8R9

T: 613-725-3769 | [info@cpha.ca](mailto:info@cpha.ca)

**[www.cpha.ca](http://www.cpha.ca)**

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## EXECUTIVE SUMMARY

With funding from the Public Health Agency of Canada, the Canadian Public Health Association (CPHA) is leading a three-year project on infectious disease and climate change in Canada. The project aims to build the knowledge and capacity of professionals and providers across Canada so they can inform and educate their communities, and respond to the increasing demands posed by climate change and infectious diseases. To scope the project's work and identify key issues, CPHA conducted 16 key informant interviews during the fall of 2020. This report summarizes our conversations with key informants. It describes what is currently happening in Canada with

respect to climate change and infectious diseases. It also highlights challenges and opportunities within this emerging field of inquiry. Focusing on the Canadian context, the report draws on interviews with key informants representing several sectors, including public health, climatology, environment, engineering, health care and planning. The perspectives summarized throughout this report will help to shape our project's knowledge exchange activities into 2023. Expertise shared by key informants will also form a foundation for future collaborative work in the field of infectious diseases and climate change in Canada more broadly.

# Infectious disease and climate change in Canada: Key informant interviews

In 2020, the Public Health Agency of Canada (PHAC)'s Infectious Disease and Climate Change Fund<sup>1</sup> supported a Canadian Public Health Association (CPHA) project titled "Creating a national forum for knowledge exchange, capacity building and collaboration to address infectious diseases and climate change." This project, which runs until 2023, aims to support public health professionals and health and social service providers as they respond to increased risks posed by climate-sensitive infectious diseases (CSIDs) in Canada. The project is mobilizing capacity-building tools and networks to help professionals and providers better predict and respond to climate change and infectious diseases, and guide clients and communities on this issue. Through forums, webinars, podcasts and other knowledge exchange activities, the project will bring new resources to several key audiences—public health professionals, front-line health and social service providers, planners, climate and environment professionals, policymakers and allied stakeholders.

To ensure CPHA understood professionals and providers' needs and how to best support capacity building and collaboration, CPHA sought input from key informants whose work focuses on climate change and/or infectious diseases. From August to October 2020, we conducted 16 semi-structured interviews with key informants to capture perspectives from health and environment sectors. CPHA intended for this scoping and engagement activity to uncover work already happening at the national, provincial/territorial, regional and local levels. We also aimed to learn more about the information, resources and capacity-building tools that public health professionals and health and social service providers are already able to access.

<sup>1</sup> The Public Health Agency of Canada's Infectious Disease and Climate Change Fund "addresses the impact of climate change on human health in Canada." Its priority funding areas are in monitoring and surveillance and education and awareness.

Interview questions sought to uncover key issues surrounding infectious diseases and climate change, and how service providers, researchers and policymakers are responding to these issues in Canada (Appendix A). We asked key informants to consider gaps in Canada's understanding of CSIDs and the challenges the country faces in addressing those gaps. We also asked key informants to discuss successes in research, funding, policymaking and/or knowledge exchange, along with opportunities for building Canada's knowledge and capacity in this area. The following report analyzes and summarizes key informant responses. It describes the issue of infectious diseases and climate change and highlights thematic gaps, challenges, successes and opportunities identified by key informants.

## WHAT ARE CLIMATE-SENSITIVE INFECTIOUS DISEASES?

Climate change is shifting the size and locations of Canada's animal populations. As our climate changes, animals are able to live in places that were previously unsuitable habitat. When animals move, they often bring bacteria, parasites and viruses with them. Animals can spread infectious diseases to humans through bites or waste contaminating food or water. For example, mosquitoes can carry viruses and parasites that spread to humans when they bite.

We call the resulting infectious diseases "climate sensitive." Small changes to climate impact where and how many people get these diseases. Climate-sensitive infectious diseases (CSIDs) are an important focus of this CPHA project. Some key informants we interviewed are involved in tracking CSIDs using surveillance, monitoring and modelling techniques. They are mapping how certain CSIDs, including Lyme disease, are spreading as our climate warms and changes.

## METHODS

CPHA's Infectious Disease and Climate Change project developed interview guides with questions designed to inform the project's direction. Infectious disease and climate change topics covered in the guide included current issues and actions, gaps in understanding, challenges faced by providers and resource needs. To identify potential interviewees, we conducted an initial search of stakeholders and invited them to participate. Additionally, we used a snowball sampling method, asking participants to identify their peers working in the field of climate change and/or infectious disease, to find more eligible participants. In total, we identified 81 potential participants and invited 30 of them to participate in an interview. Six declined and eight did not respond.

From August to October 2020, one CPHA staff member conducted semi-structured qualitative interviews with 16 key informants from 15 different stakeholder organizations. Key informants included representatives from climate action organizations, government agencies, Indigenous organizations, public health, universities and professional organizations. All interviews took place over the telephone due to pandemic-related travel restrictions. Interviewees had the opportunity to participate in either French or English. Fifteen chose English and one chose French. The same staff member conducted all of the interviews, which were recorded with the interviewee's consent. Interviews lasted an average of 40 minutes, with a range of 26 to 66 minutes. Following the interviews, CPHA staff reviewed and analysed the data for emergent themes, which we outline in this report.

## RESULTS: KEY ISSUES

*The following summarizes themes that emerged from our conversations with key informants.*

**Climate change is impacting the spread of infectious diseases already endemic to Canada.** Key informants identified a number

of climactic factors contributing to vector and disease spread. These factors include heat, lengthening of the summer season, changes to rainfall patterns and climate variation. Some climactic factors, particularly the warming effect of climate change, have been the topic of much scientific inquiry. But researchers understand some factors—such as the effects of precipitation, more extreme climate events and more variation in climate—less well. All of these climactic changes affect food and water-borne pathogens as well as tick, mosquito, rodent and other wildlife populations. This in turn impacts the incidence and prevalence of zoonotic, food and water-borne disease in human populations.

Many key informants raised the example of Lyme disease as both endemic to Canada and accelerating due to climate change. One key informant estimated the northward migration of blacklegged ticks to be spreading at 50 kilometres per year. Key informants who work in the field of Lyme disease research and knowledge translation emphasized that we know a lot about the lifecycle of the blacklegged tick in Canada. This has allowed for good modelling of blacklegged tick spread. Researchers are currently developing models to predict ongoing spread at a local scale, which can inform local risk assessments.

Climate change is affecting the spread of a wide variety of infectious diseases endemic to Canada, beyond just Lyme disease. But as key informants discussed, we have comparatively less scientific understanding of how this is happening. For example, in the Arctic, rabies is primarily spread by Arctic foxes. As climate change accelerates and the habitat of Arctic foxes shifts, human exposure to rabies is being affected. However, it isn't yet clear if climate-related factors will increase or decrease the incidence of rabies in this region. As for other climate-sensitive infectious diseases (CSIDs), we have some knowledge of how climactic events will affect spread but need to better understand the complicated mechanisms causing this to occur. Examples of areas for further research include heat and precipitation events increasing the incidence of seasonal food and water-borne diseases, and flooding causing leptosporidium outbreaks.

**Climate change is driving zoonotic diseases northwards into Canada from the U.S.**

As well as increasing the spread of CSIDs already endemic to Canada, climate change is moving zoonotic diseases northwards from the continental U.S. One key informant who works in Lyme disease research shared that, as warming drives blacklegged ticks northwards into Canada, we are seeing new tick-borne diseases migrate into our population. Canada is now experiencing more incident cases of viral-borne encephalitis and human granulocytic anaplasmosis (HGA). Babesiosis is not yet endemic in Canada but because it is found in the northeastern U.S., researchers expect it will spread here in the future. Lone Star ticks are making their way into Canada, and while we haven't identified diseases associated with these ticks yet, this is possible over the coming years. Key informants also predicted climate change will impact the introduction of mosquito-borne diseases such as La Crosse virus. As one key informant stated, "All we have to do is look south of the border and there is [sic] plenty of [vectors and diseases] in the U.S. that could end up here quite quickly."

**Climate change is contributing to the introduction of diseases from countries other than the U.S.**

Vectors may enter Canada from the U.S., but the diseases themselves originate elsewhere. One key informant explained that changes to climate in southern parts of Canada, and Ontario in particular, will support the invasion of exotic mosquito species that can transmit diseases such as vivax malaria, yellow fever, Chikungunya, Zika and Dengue fever. Key informants emphasized that Canada needs to prepare for the local transmission of exotic diseases—and also for novel viruses that develop due to climate change-related issues elsewhere in the world, an increase in vector-borne diseases globally, and more movement of people, including climate refugees. Several key informants warned that we are likely to experience more pandemics in the future due to destabilizing habitats.

**Secondary health effects of climate change also impact infectious disease spread.**

Beyond the direct impacts of climate change on zoonotic diseases, key informants also

described secondary impacts on some infectious diseases, including tuberculosis, COVID-19 and sexually transmitted and blood-borne infections (STBBIs). While these diseases are not directly sensitive to climate change, the effects of climate change on humans will likely impact their distribution and incidence. Key informants talked about the impact of more frequent natural disasters, including floods, wildfires and extreme weather events. These events displace populations, making people more vulnerable to infectious diseases due to crowded living conditions and trouble accessing medications and timely healthcare. For instance, in northern Canada where ice roads facilitate timely access to supplies, a shorter, warmer winter is reducing the days people can use these lifelines. As one key informant pointed out, when ice roads aren't open, communities have unpredictable access to healthy foods and medications. This increases vulnerability to infectious diseases. The natural disasters and economic changes climate change brings will impact human migration, both within Canada and due to immigration from economic, political and climate refugees—and human mobility is associated with the introduction and spread of infectious disease pathogens.

**CSIDs have a marginal research and funding profile.**

Key informants did note a growing interest in and awareness of these diseases, but stated that CSIDs only receive a small amount of overall research and healthcare funding and aren't widely regarded as a priority public health issue. One key informant noted that some CSIDs at risk of being introduced to Canada, such as babesiosis, La Crosse virus and human granulocytic anaplasmosis, are not on the list of notifiable diseases. While we are likely to see a growing number of cases in Canada in the years to come, it is not being tracked at a provincial or national level.

**Canadians will experience the health-related impacts of climate change well into the future.**

Key informants emphasized the longevity of climate change impacts. We are already experiencing the effects of climate change today and will continue to be impacted by these effects on a vast and long-term scale. As one key informant put it, "The impact of



climate change will be bigger than COVID-19 ... [because it] will be much longer lived . . . Even if we completely ground emissions to zero right now, we're still dealing with 500 years of legacy carbon in the atmosphere." Climate change will affect humans and all life on this planet for generations. Its effects on infectious disease will be long lasting and we need to prepare.

**We must address the health equity dimensions of climate change and infectious diseases.**

The disproportionate impacts of climate change on disadvantaged groups are well documented. The COVID-19 pandemic has recently highlighted health inequities in our communities. As we move forward with adapting to climate change and mitigating its health impacts, key informants stressed that we need to ground our efforts in health equity to ensure we don't leave vulnerable populations behind. One key informant spoke about creating healthy and resilient communities through systemic changes such as reducing poverty, addressing inequity and racism, and ending colonization. Another discussed ways to support the inclusion of marginalized peoples at decision-making tables. This key informant recommended we take time to build relationships with communities, develop appropriate ways of engaging and communicating, and invest in the capacity of people to be at the table. Taking a health equity approach also includes foregrounding Indigenous perspectives and valuing Indigenous knowledge as much as western science.

## RESULTS: CHALLENGES AND GAPS

*"The gaps are huge, because they are unfathomable."* –Key informant

### INHERENT COMPLEXITY AND UNCERTAINTY

The gap that key informants raised most is simple but profound: we don't have enough information to fully understand the impacts

of climate change on infectious diseases. Key informants explained that gaps in the current scientific understanding start with our incomplete picture of how climate change will affect ecosystems. The impacts of warming on ecosystems have been studied most. Changes in precipitation, more variable weather and extreme weather events will also impact ecosystems, though precisely how is less understood. The Arctic in particular is an area of concern in need of more scientific inquiry. One key informant pointed out that we have very little data on this region but it is warming at approximately triple the rate of the entire globe.

This gap in understanding extends to the impacts climate change will have on vectors such as mosquitoes and ticks, which inhabit these very ecosystems. Key informants stressed that vectors are already adapting to climate change by spreading into new regions that used to be unsuitable climactically. Because the effects of climate change will continue for generations, we should expect and be prepared for vectors' continued adaptation through geographic spread. As vectors move into new areas, Canada will need to study the impacts, such as emerging mosquito-borne viruses in the Arctic. Zoonotic disease, food-borne and water-borne diseases are all very sensitive to climate change. One key informant highlighted a further knowledge gap with these diseases, explaining there is very little funding available to research them. If we can strengthen our understanding of the ecology of pathogens and vectors, we will learn more about how they will affect human health.

Given the gaps in what we know about climate change's effects on ecosystems and disease vectors, we also need to learn more about how climate change will impact infectious disease in human populations. As one key informant said, "We lack a general approach to understanding how ecosystems respond to change in ways that impact health." We are starting to learn more about current and future impacts on some vector-borne diseases, such as Lyme disease and West Nile virus—but we know much less about other CSIDs due to less funding and scant literature. As we discuss in the Key issues

section above, key informants highlighted that climate change is impacting CSIDs by spreading endemic disease further into and within Canada. It is also introducing diseases previously not seen in Canada.

We know CSIDs are a growing threat and we need to take action. But key informants acknowledged it is difficult for public health and policy to anticipate, mobilize and adapt to the coming changes when there continues to be so much uncertainty about what will happen, and what we can do to prevent adverse health outcomes. As evidenced during the COVID-19 pandemic, public health cannot wait to have all the information in hand before acting to protect the health of the population. Key informants also cautioned that some climate change adaptation measures, such as urban greening, may have unintended consequences for the spread of infectious diseases. These measures could create suitable habitats for, and unintentionally increase human interaction with, infectious disease vectors. But again, experts aren't clear how or when this might happen.

## **DIFFICULTIES WITH MONITORING AND SURVEILLANCE**

Monitoring and surveillance is a crucial public health activity used to collect information on infectious diseases. Some key informants stated that we lack a strong monitoring and surveillance system for infectious diseases in Canada overall. In the case of climate change's impacts on infectious diseases, monitoring and surveillance is even more complex. We need to monitor several interconnected factors: changes to weather patterns, the state of ecosystems, where vectors live and are spreading, related incidence of certain infectious diseases and more. Key informants told us that monitoring and surveillance should focus not only on public health, but also geography, weather, infrastructure and other factors.

Key informants acknowledged current and planned surveillance efforts in Canada and mentioned field surveillance has improved in recent years. Field surveillance now considers

a much broader array of vectors and pathogens and studies how they occur in communities. The Climate Change and Innovation Bureau at Health Canada has a data division working to develop a national climate change monitoring and surveillance strategy. However, key informants noted that these activities are happening in the silos of their respective fields.

The resulting gaps make it difficult to do good predictive modelling of the type we would need to infer impacts on human health. Especially for CSIDs with marginal profiles, Canada has less surveillance infrastructure in place. We are not collecting information in a way that allows us to deduce the effects of climate change on how these diseases spread. Key informants also told us that since many CSIDs have a marginal profile, healthcare professionals are not recognizing them, leading to insufficient passive surveillance. In order to identify patterns, we need long-term surveillance in place to detect diseases and vector spread.

## **IMPLICATIONS FOR DATA**

Gaps in surveillance result in data gaps. Key informants brought up the fact that even when data exists, it can be difficult to find and collate. There is no central repository. Many different organizations and jurisdictions collect data, which creates inherent gaps in how data is reported, collated and managed. Accessing and sharing information isn't easy with data in silos. Because data is collected at the national, provincial, regional and municipal levels, we lack a single comprehensive place to get up-to-date data on infectious diseases and climate change.

Key informants noted that it is hard for groups to set evidence-based priorities for responding to the health impacts of climate change when they lack comprehensive data. The lack of data and problems with accessing existing data make it difficult for regions to complete climate change and health impact assessments. There is varying quality and breadth of data for different infectious diseases and climate change events, and the amount of data also varies from region to region, making it challenging to compare and set priorities.

As we discuss below, this negatively impacts our ability to do the predictive modelling required to plan for future impacts of climate change on human health. In some cases, data exists but is not designed with modelling in mind, making it more difficult to use. To improve our predictive modelling, we first need to conduct more surveillance and generate more useful data. Key informants said we should design future data-gathering efforts to facilitate modelling and assessment. Higher-resolution data would also be helpful for climate and disease modelling.

### **IMPLICATIONS FOR MODELLING**

Public health professionals often use mathematical modelling to help guide public health planning and infectious disease control. The field of climate science uses modelling to predict ways our climate might change in the future. Models are one of our best tools for predicting future effects. They can help us understand what might happen in certain scenarios. This helps us plan and act to achieve good outcomes.

Key informants pointed to limitations in Canada's capacity to model climate change and infectious disease spread. Climate change itself poses challenges with modelling because the complexity of climate scenarios and human behaviour are inherently uncertain. Key informants said certain aspects of climate change—for example, changing precipitation patterns—increase unpredictability, making it more difficult to accurately model how climate change will affect vectors and infectious disease in humans. One key informant broke this down further, explaining that we are attempting to understand a very complex system linked to ecology, epidemiology, climate change and changes in land use. Gaps in surveillance and data noted above feed gaps in modelling.

Another issue is that modelling some diseases is easier than others. One key informant discussed how our comprehensive knowledge of the blacklegged tick's lifecycle has allowed for good modelling of Lyme disease in Canada. Currently models are being developed to predict the ongoing spread of Lyme disease at a local scale in Canada. These models can feed local

risk assessments. But with many other CSIDs, we simply lack the data and surveillance to do equivalent modelling.

### **LACK OF RECOGNITION AND PRIORITIZATION**

Key informants were clear: climate change needs to be a top priority for Canada. We are already experiencing impacts that will only worsen over the coming decades, including on human health. Unfortunately more pressing issues—including the COVID-19 pandemic—are sidelining climate change, which is seen as a slower-moving, lower-priority crisis. One key informant further noted the lack of political will to prioritize a costly, complicated issue like infectious diseases and climate change. Lower levels of illness from CSIDs mean Canada simply isn't paying due attention.

One key informant raised the point that the topic of infectious diseases and climate change falls within the larger frame of where Canada positions the health of the planet and humanity in relation to economies and systems of power and governance. Tensions between health and economy are currently evident in how governments are formulating COVID-19 pandemic restrictions. Key informants stressed the need to make policy discussions based on the best available evidence, not economic considerations or politics.

### **IN HEALTHCARE SETTINGS**

Because climate change is impacting human health, it inevitably impacts our healthcare system as well. However, public health and healthcare haven't always led by example in prioritizing climate change. Key informants said climate change does not receive proper attention around decision-making tables in healthcare. They reflected that perhaps we fail to see climate change as a priority issue in healthcare because "we don't look at the bigger picture to focus on planetary health and its interconnections with human health."

As key informants further noted, our healthcare system needs to prepare for the effects of climate change. Practitioners will need training

on how to diagnose and treat emerging and exotic infectious diseases in Canada. The country will need to increase testing capacity to support diagnosis. Key informants also said we should be protecting our healthcare system's infrastructure from extreme weather events due to climate change. Ideally we need to design facilities that are equipped to cope with the increase in infectious diseases we expect to see in the future.

### **IN OTHER PROFESSIONAL FIELDS**

Climate change is even less of a priority outside the fields of health and environment—to the extent that it is still seen as a fringe issue and future problem within some professions. Key informants noted that we need more professionals to feel they are responsible for addressing climate change in their work. But they acknowledged it is difficult to mobilize for something you can't see, and even harder to act without concrete guidance on what to do.

### **AROUND DECISION-MAKING TABLES**

Although climate change is affecting the health of all Canadians, public health professionals typically do not sit at the decision-making tables that influence climate change. Instead, public health is tasked with addressing the health consequences of climate change after they emerge. Key informants described the need to have health professionals participate in decision-making about capital planning and infrastructure, ensuring a health perspective informs future planning. Without the public health perspective, decisions shift toward economics. One key informant told us Canada would benefit from federally mandating a “Health in All Policies” (HiAP)<sup>2</sup> approach. Key informants also noted that the COVID-19 pandemic has illuminated how many regional, provincial and federal jurisdictions make and

enact decisions about public safety measures. During the pandemic, how that power has been exercised varies considerably. This has led to mixed messaging and inconsistent policies. We can learn from this as we deal with climate change and infectious diseases in the future.

Key informants stressed how important it is for all professionals to incorporate climate change considerations in their decision-making processes. Too often a lone voice in the room brings up climate change, and too often climate change is treated as a future problem or a “special interest” topic.

### **IN PLANNING**

Land use and urban planning decisions have real impacts on human health. This includes influencing how vectors are distributed and how resilient we as humans are to climate change. Changing land use—turning forests to farms, or marshes to suburban developments—can either discourage or benefit the spread of vectors. Lately there is much talk about green infrastructure like sponge cities, but we aren't clear how these changes will impact vector spread and human exposure to CSIDs. Some land uses may favour certain species of mosquitoes over others. For example, suburban sprawl will favour habitats for increased West Nile virus spread. This is why planners should ideally incorporate a health lens.

Planners do consider climate change when developing adaptation plans for land use. But plans are generally focused on infrastructure, not people's health. Planners rarely consider health in their day-to-day work, except for needs like avoiding contaminating drinking water. Key informants told us planners would like to learn how to address health; however, it can be difficult to put this knowledge into practice. One barrier is that municipal councils with little or no health experience often make planning decisions. As one key informant said, “[i]t really has to be a brave council to say, okay ... we want to include this in our plan and we're going to enforce it.” Another suggested approaching local governments with a natural asset lens. According to this key informant,

<sup>2</sup> Health in All Policies (HiAP) “improves accountability of policy makers for health impacts at all levels of policy-making” and “includes an emphasis on the consequences of public policies on health systems, determinants of health, and well-being.” Some countries have already adopted this approach and the World Health Organization published a Framework for Country Action in 2014.

“asset management is the most strategic way to get local governments to tackle climate change.”

## CHALLENGES OF MULTISECTORAL WORK

Climate change is a far-reaching problem that affects all facets of society, and complex issues require collaborative solutions. Interview questions asked key informants to reflect on their experiences working in multisectoral partnerships to address infectious diseases and climate change. Key informants highlighted benefits but also challenges. One noted that linkages among public health, healthcare and other sectors could be stronger. Others acknowledged while various sectors do have overlap in their scope of work and overall goals, creating “healthy, sustainable and equitable conversations within a cross-sectoral or intersectional space” also comes with difficulty. For example, priority isn’t always based on merit—often we tend to “hear the loudest voice in the room.”

Key informants noted difficulty with identifying health-relevant adaptation policies in other sectors. “Getting health-relevant sectors to collaborate can sometimes be a challenge as they have competing priorities,” one explained. Another brought up the example of working with municipalities. In their experience, municipalities are willing to collaborate on more straightforward initiatives that impact health, such as encouraging active transportation. But they might get stalled on more complex issues, like addressing agricultural runoff into bodies of water. Municipalities could face pushback from property owners and businesses, and addressing health impacts might be viewed as less of a priority.

Even when other sectors do develop plans to address climate change, they often don’t go so far as to address human health, and certainly not infectious diseases. Public health needs to be able to offer solutions when other sectors identify vulnerabilities. Yet the actual capacity of experts who know about this topic is minuscule compared to the problem. Several key informants said it is hard to take

collaborative action in the absence of clear tools and instructions.

## OUTDATED BUILT ENVIRONMENT

The built environment has crucial impacts on a community’s resilience to climate change. We heard from key informants that it also has far-reaching impacts on human health, including infectious diseases. One key informant pointed out that we build urban structures to last a long time and therefore need to design them for projected climate change realities (for example, heat days in 2050 and beyond). However, key informants said the building code in Canada is very slow to change and provinces are also slow to adopt new codes. As a result, building codes simply aren’t keeping up with climate change.

Key informants touched on a few ways that outdated building codes relate to the spread of infectious diseases. Poorly designed HVAC can propagate infectious diseases. Putting in air filters to combat wildfire smoke also helps limit the respiratory impacts of climate change. But overall, current barriers in engineering and building limit our ability to mitigate the human health impacts of climate change by making our built environment more resilient. Present building codes do not adequately account for how the urban built environment may contribute to the spread of infectious diseases.

## PERCEPTIONS AND ATTITUDES

Risk perception and public understanding of climate change are also factors in how infectious diseases and climate change does or does not get prioritized.

### ***FAILURE TO SEE HUMAN AND ECOLOGICAL HEALTH AS INTERCONNECTED***

Human health is underpinned by the ecological determinants of health. Yet our current systems do not always take this into account. As climate change continues to affect the health of ecosystems, we can absolutely expect this will impact human health. Key informants talked about a fundamental disconnection: our

society tends to see human health as somehow independent from the health of the ecosystems in which we live. As discussed above, we don't fully know the impacts climate change will have on both ecological and human health, and this affects our ability to make informed decisions. However, as one key informant stated, “[w]e know from experience that when you disrupt ecological systems, there is usually a spillover effect with pathogens that ... makes human disease worse.”

Key informants spoke about adopting a holistic perspective. One key informant noted that when our ability to access healthy food, water and shelter is diminished, and we endure trauma from natural disasters and other disruptive events, this makes us more vulnerable to infectious diseases. These fundamental connections between human health and the health of ecosystems may be clear to many professionals in health and environment. But as a society we often fail to recognize how ecological health and human health are entwined.

### ***SKEWED RISK PERCEPTION***

When it comes to infectious disease, public sense of risk is often guided by perception, not what is scientifically established. For example, in Canada we have concentrated more public discussion and focus on Lyme disease and West Nile virus than on enteric disease, which affects more people. One key informant noted that the public perceives vector-borne diseases to pose more risk to health than food and water-borne diseases. This comes down to locus of control. This key informant explained that “[t]ypically people's perception of the risk is greater when the risk factors are not controllable.” People believe they can avoid enteric illness through their own behaviour and see being bitten by a tick or mosquito as more difficult to prevent. Key informants noted that the gap between perceived and actual risk influences policymaking as well as available resources for research, monitoring and prevention.

### ***CLIMATE DENIAL AND HESITANCY***

Climate change is a slow burn. It doesn't always manifest as an abrupt, noticeable or singular change in a local environment, and people don't always associate slow, ambient changes with climate change. The degree to which the public understands and accepts the realities of climate change affects the measures governments take to address its consequences.

Climate change skepticism and denial still exist in Canada. This affects our actions on personal, organizational and governmental levels. We heard from key informants that denial of anthropogenic climate change varies between provinces. British Columbia has a higher level of acceptance than the Prairie Provinces. Key informants directly equated differences in understanding with the level of action provinces take to address climate change. One noted that in British Columbia, professionals outside of the health and environment field—engineers, for example—are actively addressing climate change, but this isn't consistent across Canada. Another key informant summarized the tension between understanding and denial by saying that in Canada as a whole, there is still a cognitive dissonance between what we know about climate change and the actions we're taking to mitigate and adapt. Extrapolating this gap to climate change and infectious diseases, key informants noted that making connections between the two is difficult in the face of denial and hesitancy.

### ***GAPS IN PUBLIC HEALTH COMMUNICATIONS***

Key informants pointed to public health communication as an area we could improve. In recent years Canada has seen a rise in conspiracy thinking, skepticism and general disinformation, and the COVID-19 pandemic is further exposing a lack of trust in public health messaging. Using the pandemic as an example of how crucial it is to communicate successfully, key informants said public health professionals should be trying to improve communications between the governments, public health and the public. “One of the big challenges,” a key

informant told us, “is to figure out how to ... make sure those messages [land] early and reliably, in a way that is seen as trustworthy.” Key informants also acknowledged the difficulty of communicating with the public without being seen in an advocacy role.

As climate change accelerates the spread of vectors in Canada, communicating to the public about prevention measures will be increasingly important. Key informants said we should communicate the risk of emerging diseases in a way that motivates people to action. As one put it, “[c]ommunication with the public needs to teach them what to do in face of change, not just warn them of coming disaster.” Furthermore, key informants stressed that, for the public to take preventive action, public health must be a trusted source of clear information.

## RESULTS: SUCCESSES AND OPPORTUNITIES

### PLANETARY HEALTH PERSPECTIVES IN PROGRAMS AND POLICY

Addressing infectious diseases and climate change will require bold change and action from all levels of government, non-governmental organizations, public health and healthcare professionals. Key informants suggested we turn to ecologically minded health models for inspiration. One pointed to Indigenous governance models as protecting both ecological and human health and taking bold climate action. For instance, in the First Nations Health Authority—the first and only provincial First Nations health authority in Canada—the Indigenous Climate Health Action Program<sup>3</sup> is currently funding community-driven climate action projects with a focus on health and

wellness, including in food sovereignty and security, access to the land, mental health and traditional medicine and harvesting.

Another key informant discussed using a planetary health model to understand health. This model recognizes “the interconnectedness of human health with the state of all natural systems” (Lancet, 1472).<sup>4</sup> We are already seeing this shift among healthcare professionals and organizations in Canada and worldwide. In November 2020, The Lancet published “A pledge for planetary health to unite health professionals in the Anthropocene,” which proposes an interprofessional planetary health pledge. The pledge adds protecting planetary health to the fundamental commitments health practitioners make when they enter their profession. Recognizing this shift, the Canadian Medical Association’s 2020 strategic plan mentions environmental well-being. The Canadian Federation of Nurses Unions also recently published a discussion paper calling on nurses to educate patients and the public about climate science. Key informants applauded this leadership from within the healthcare professions as an ongoing success.

### EXISTING KNOWLEDGE TRANSLATION EFFORTS

It isn’t enough to monitor and assess CSIDs. We also need to translate knowledge to help professionals and providers improve the health of communities. Key informants highlighted existing knowledge translation initiatives as an important success. They spoke highly of the National Collaborating Centres’ work in translating science on CSIDs,<sup>5</sup> as well as work being done by PHAC’s knowledge translation team. One key informant noted that PHAC has published short guidance documents to help public health understand

<sup>3</sup> Indigenous Climate Health Action Program, First Nations Health Authority.

<sup>4</sup> “A pledge for planetary health to unite health professionals in the Anthropocene.” *The Lancet*. November 7, 2020.

<sup>5</sup> The National Collaborating Centre for Infectious Diseases’ project streams include emerging diseases and outbreaks, migration and mobility, and a notifiable diseases database.

methods of surveillance, prevention and control for emerging infectious diseases. Others talked about promising continuing education opportunities for healthcare professionals. For example, Queen's University has offered professional development days to help physicians diagnose and treat Lyme disease. Other organizations pursuing knowledge translation activities to enhance our understanding of certain CSIDs include the Canadian Association of Schools of Nursing, the Centre for Effective Practice and the Society of Obstetricians and Gynecologists.

Key informants suggested we further knowledge translation work in the field by using risk information generated by surveillance and modelling to develop local assessments of vulnerability to emerging diseases, along with adaptation plans.

## PROMISING COLLABORATIVE WORK IN HEALTH AND ENVIRONMENT

As discussed throughout this report, health and environment have often existed as separate professional fields. But key informants highlighted several promising examples of collaboration. They emphasized that we can build on these examples to address infectious disease and climate change. One example came from the coal phase-out in Ontario. Professionals from both public health and environment rallied around a shared purpose—putting pressure on governments to phase out coal-fired power plants. Although they had different end objectives, the two fields united around their goal. Collaborative work has also been done on heat days due to climate change. Public health has collaborated for years on a very successful heat alert project. A key informant suggested we take a similar approach in addressing other climate change effects, such as extreme weather and changes to precipitation. Using the model of this heat response work and communications, public health could help municipal decision-makers adopt best practices for mitigating climate change's effects on health.

Key informants shared other examples of promising collaborations from within federal and provincial governments and academia. Nationally, we are improving at working under a One Health<sup>6</sup> approach. The Canadian Arctic One Health Network and Canadian Lyme Disease Research Network are paving the way for collaboration, leading to an increase in surveillance projects. For the first time, we have standardized active surveillance of ticks in every province. The Canadian Arctic One Health Network is conducting monitoring and surveillance of zoonotic diseases in the Arctic, looking at emerging mosquito-borne diseases and parasitic zoonoses of wildlife. In Quebec, provincial climate and health initiatives have led to increased collaboration on climate change and infectious diseases. The Institut national de santé publique du Québec (INSPQ) and the Observatoire multipartite québécois sur les zoonoses et l'adaptation aux changements climatiques are actively mobilizing around these issues and conducting surveillance. Academia is also championing collaboration. Two key informants mentioned the work of Simon Fraser University's Adaptation to Climate Change Team (ACT),<sup>7</sup> a table of multisectoral partners working together on climate change issues. ACT is bringing experts from around the world together with industry, community and government decision-makers to explore climate change risks and sustainable adaptation.

## AVAILABLE FUNDING ENVELOPE

More funding for research and knowledge exchange increases the profile of climate change and infectious diseases. Several key informants cited PHAC's Infectious Disease and Climate Change Fund as beneficial for Canada's focus on this topic. One participant said they believe the fund has tripled the research and surveillance

<sup>6</sup> One Health is an approach to health programs, policy, legislation and research that emphasizes collaboration among sectors. The World Health Organization identifies One Health as particularly relevant for "the control of zoonoses [including] ... flu, rabies and Rift Valley Fever," among other multisectoral health issues.

<sup>7</sup> Research conducted by Simon Fraser's Adaptation to Climate Change Team (ACT) includes a core focus on health risks, including "the spread of new diseases such as the projected threat of yellow fever, cholera, malaria and other vector-borne diseases spreading northward due to warmer temperatures."



in their field, which has begun to fill existing gaps. More knowledge translation and research projects have also received funding in the past few years. Sustaining and increasing funding will provide further opportunities to address the challenges and gaps we discuss above.

## USE OF MAPPING AS A COMMUNICATIONS TOOL

Many key informants brought up mapping as a powerful way to communicate what is happening with CSIDs to the public and professions outside public health. Mapping helps people to grasp the scale of the problem and plan preventative action. As one key informant said, “[a]nything that is visual and sensory and hits people where they live ... really resonate[s].” Tying changes in vector spread to our changing climate and representing this visually tells a powerful story people can connect with. We do have data gaps in Canada’s climate record, so this won’t always be possible. But key informants felt visual mapping is worth prioritizing as a communications tool nonetheless. Researchers can start by creating maps of where disease coverage is today and where it will be based on modelling. The Prairie Climate Centre has done some of this mapping for Lyme disease risk.<sup>8</sup> Bishop’s University has created eTick.ca, a public platform for population monitoring of ticks in Canada, which includes a public tick map.<sup>9</sup> There is much potential to do this sort of mapping for other CSIDs as well.

## FEDERAL ASSESSMENT WORK

Recent assessment work in climate change and its impacts on infectious diseases was also a success raised by key informants. Health Canada’s HealthADAPT Program was designed

to “help the health sector prepare for and respond to the impacts of climate change.”<sup>10</sup> The program supports, develops, tests and carries local and regional climate change health adaptation plans with partners, and monitors and evaluates their effectiveness. Key informants talked about this program’s strengths and viewed it as a good example of federal assessment work on climate change and health. Health Canada is also leading the development of Health of Canadians in a Changing Climate: Advancing our Knowledge for Action, a report set for release later in 2021 that will include a section on infectious diseases.<sup>11</sup> This is Canada’s first federal assessment of how climate change risks are impacting the health of Canadians and the healthcare system.

## NEW CLIMATE EMPHASIS IN PLANNING

Recent high-level directions in planning are encouraging climate recognition and action. As a few key informants noted, Infrastructure Canada has introduced a requirement to incorporate a climate lens in all RFPs. This is a key example of federal leadership in climate change commitments. It mandates that planners acknowledge and address climate change in all federal infrastructure projects. Another key informant told us that Statements of Provincial Interest have the power to require land use planners and municipalities to incorporate an ecological perspective in their plans. While these measures don’t address CSIDs directly, they are untraditional areas for public health to focus on in the future in order to incorporate an environment and health lens into planning.

<sup>8</sup> The Prairie Climate Centre website includes information on monitoring and mapping the spread of ticks.

<sup>9</sup> The Public Tick Map is available in English and French at eTick.ca.

<sup>10</sup> HealthADAPT Program, Health Canada.

<sup>11</sup> More information on the development of this report, including a timeline for consultation and publication and list of key authors, is available at Health of Canadians in a Changing Climate.

## DISCUSSION

CPHA's Infectious Diseases and Climate Change Project completed 16 semi-structured interviews with key informants from within the public health, healthcare, environment and planning sectors, who are currently engaged in work on climate change and/or infectious diseases. The purpose of these key informant interviews was to determine current successes, identify gaps, and explore key issues with respect to infectious diseases and climate change in Canada. Key informants engaged in this project identified several common gaps and opportunities. We outline common themes below, along with key informant recommendations for future research, strategic policy and practice.

### SUMMARY OF THEMES AND RECOMMENDATIONS

- Key informants overwhelmingly identified a need to know more about climate change and infectious diseases. This includes the need to understand how climate change affects the location and spread of infectious disease vectors, and to learn more about climate-sensitive infectious diseases (CSIDs) themselves, especially those with a marginal research profile.
- Key informants identified systemic issues as a major challenge or barrier, particularly a lack of resources and disjointed monitoring and surveillance. Many key informants thought expanding or augmenting existing surveillance efforts was a good opportunity for improvement. Informants also identified a need for more accessible, well-coordinated data, which can support climate change health impact assessments and predictive modelling.
- Most key informants saw room to improve collaborative work between public health, healthcare, planning and environment sectors, and among researchers, providers and policymakers. Key informants saw collaboration and partnership as essential to our ongoing understanding of infectious diseases and climate change. One key informant stressed that Canada would benefit from mandating a Health in All Policies (HiAP) approach, to guarantee a public health perspective in climate-oriented policymaking.
- Key informants who do not work in public health expressed an interest in learning to incorporate a health lens in their work. Several key informants discussed the importance of knowledge translation initiatives addressing health and environment, including training and education opportunities within planning and primary healthcare, forums and conferences, and the development of resources and guides for professionals and providers.
- Awareness was another theme described by key informants—particularly the need to increase awareness of the interconnectedness of human and ecological health, including risks posed by CSIDs. Key informants did point to increased awareness of ecological habitat destruction and the spread of zoonotic diseases since the onset of the COVID-19 pandemic. But informants also identified persistent health and climate change disinformation as barriers to systemic change.
- Accordingly, as climate change accelerates the spread of vectors in Canada, key informants identified the role of clear public health communications as being crucial to motivating action and allaying disinformation. Key informants reinforced the need for public health to be a trusted source of clear, evidence-based information on climate change and infectious diseases.
- Key informants were clear about the importance of a health equity lens. As Canada adapts to climate change and mitigates its health impacts, several informants stressed that professionals and providers must endeavor to protect the most vulnerable. It also includes foregrounding Indigenous perspectives on ecological and human health.

## CONCLUSION

We heard from key informants that climate change and infectious diseases are interconnected in ways we do not yet fully grasp. The predominant theme raised by key informants was how much remains unknown. It can be difficult to predict how climate variations will affect future animal habitats and the spread of vectors like mosquitoes and ticks. Researchers are tracking and modelling climate-sensitive infectious diseases (CSIDs) already endemic to Canada, most prominently Lyme disease. But we need to know much more about other, lower-profile vector-borne and zoonotic diseases.

There is real urgency in recognizing and building capacity around the human health consequences of climate change, including the continued spread of CSIDs. Canada needs increased modelling and surveillance capacity, and coordinated data collection, to help us predict and mitigate the spread of infectious diseases caused by climate change. The COVID-19 pandemic has brought to the fore how ecosystem destruction and the push of deforestation can expose disturbed and displaced species to infectious diseases. As much as we need to build capacity, key informants emphasized that we can't wait to take action until we have all the information and evidence possible.

In terms of successes, key informants pointed to existing research and knowledge exchange initiatives on infectious diseases and climate change, including the Public Health Agency

of Canada's Infectious Disease and Climate Change Fund. Recent federal leadership and funding on health and climate is a positive development, and collaborative academic research linking ecological and human health is also promising. Key informants spoke about how important it is to mobilize evidence and knowledge to key audiences, including the public. For example, visual mapping that shows how climate change and CSIDs are linked is a helpful public communications tool. The Prairie Climate Centre is already mapping Lyme disease and there is huge potential to apply the same techniques to other CSIDs. Mapping can further inform future public health policies and strategies.

The interconnections among ecological and human health will continue to have far-reaching consequences for generations. Ultimately, addressing the issue of infectious diseases and climate change asks us to see human health as embedded within the more-than-human world. To better understand the nature and spread of CSIDs, we are being called upon to think holistically. We heard from key informants about the need to bring together professionals from sectors including public health, healthcare, planning and climatology. Key informants also called on us to foreground Indigenous knowledge, including of the intrinsic linkages among ecological and human health. As we continue building capacity to better respond to the impacts of climate change on human health and infectious diseases, we need to work collaboratively and keep a health equity perspective at the forefront.

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## APPENDIX A

### INTERVIEWER'S GUIDE

Creation of a National Forum to Address Infectious Diseases and Climate Change

### INTERVIEW QUESTIONS

We recognize that your responses to the questions below may be impacted by your professional designation, the setting in which you work, and/or the population(s) you serve. Thus, we invite you to provide examples based on your unique experiences.

1. Briefly, tell me a little bit about your role and recent projects.
  - a. For ID professionals: In what ways, if any, do the effects of climate change intersect with your work in infectious diseases?
  - b. For CC professionals: In what ways, if any, does the topic of infectious disease intersect with your work in climate change?
2. Based on your knowledge, what are the primary issues Canada is facing relating to climate change and infectious disease?
  - a. Currently?
  - b. In the future?
3. Climate change will affect infectious diseases in various ways. In your opinion, what do you think are the major gaps in our collective understanding of how climate change will impact infectious disease?
  - a. Research
  - b. Surveillance
  - c. Plain language content
  - d. Community-level
4. What are some of the current actions being taken to address the changes in the prevalence and distribution of infectious diseases due to climate change?
  - a. At the National level? Provincial level? Local level?
  - b. Prevention, mitigation, surveillance
  - c. Does the level of preparation/response vary by disease/vector?
5. In your opinion, what are some of the challenges public health professionals and health & social service providers experience in their work to address the impacts of climate change on infectious disease?
  - a. Key knowledge gaps
  - b. At the National level? Provincial level? Local level?
  - c. Engaging PH, urban planners, gov agencies, municipalities

6. What information, tools or resources do professionals/providers in Canada need in order to improve their understanding and response to the effects of climate change on infectious disease?
  - a. Surveillance
  - b. Reports
  - c. Training
  - d. Funding
  
7. Are there any other individuals/experts you feel we should be engaging with who could further assist us with this project?
  
8. Is there anything else you would like to add before we conclude?



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[www.cpha.ca](http://www.cpha.ca)