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Case 12 : Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

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CASE 12

Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

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Blake O'Neil sat down at her newly located desk, now three pods from her previous cubicle and directly across from Brock Jansen's cubicle. She started her desktop computer, logged into her Government of Canada public servant account, and opened her email inbox. She clicked on the most recently received email.

SUBJECT: Weekly Update
Sent: 04-29-2019 0823
From: Connor Jack
To: PHAC-CFEZID

Dear Colleagues,

Please see below the updates and reminders for this week at the Centre for Food-borne, Environmental, and Zoonotic Infectious Diseases (CFEZID). Additionally, I am excited to announce some of the changes occurring at CFEZID this spring.

First, CFEZID's theme for the upcoming season is "Climate Change and Human Health". Therefore, any new projects, presentations, or educational sessions produced by CFEZID should consider incorporating this theme. Please see our editorial team's most recent edition of the *Canada Communicable Disease Report*, which contains peer-reviewed articles related to the new theme. Additionally, feel free to walk around the Centre and check out the informational posters on display that reflect the theme. Thank you to our creative design and strategic communications teams for their hard work on this project!

Second, I would like to officially announce the addition of a new department within CFEZID – the Health Professionals Guidance Unit (HPGU), which will be located at our Ottawa site. Blake O'Neil, one of our very own nurse consultants, will be transitioning from her position with the Creutzfeldt-Jakob Disease Surveillance System to the HPGU. Brock Jansen, a medical advisor with the Outbreak Management Division, will also be accompanying Blake in the transition. Together, Blake and Brock will be initiating an emerging and re-emerging non-enteric zoonotic infectious disease (zoonoses) prioritization exercise to determine what we should all be most afraid of next. As time progresses, new zoonoses come to the forefront in the media, in our projects, in our healthcare systems, and in our personal lives, much like Canadians' response

Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

during the surge of the West Nile Virus in 2002. However, with the results of this prioritization exercise, we will have the advantage of knowing which zoonoses we need be most prepared for. Further, they will be developing tools and guidance documents to assist Canadian health professionals in the prevention, early diagnosis, and clinical management of the identified priority zoonoses. Thank you both in advance for your contributions to the HPGU and CFEZID!

Third, please be mindful of the upcoming federal election. Candidate campaigning is expected to begin late summer and continue through the fall. To ensure our public resources are not used for partisan advantage, any stakeholder engagement will need to be paused until a Prime Minister has been elected and the Senate and House of Commons resume their work. Please be alert and prepare your stakeholders for any changes to your projects. For more information on this, please refer to the *CFEZID Policies and Procedures Manual*, section 14, subsection 11.

Fourth, a friendly reminder that *Aedes albopictus*, the mosquito species typically known for carrying the Zika, Chikungunya, and Dengue viruses, has been isolated in Windsor, Ontario. Therefore, our colleagues working with the Canadian Notifiable Disease Surveillance System will be extremely busy in the upcoming spring and summer months. If you happen to be walking in that area of the Centre, please keep the noise to a minimum.

Fifth, there will be server updates occurring this Friday between 0800 and 1000 at our Guelph and Ottawa locations. Expect some delays when sending or receiving your emails and accessing the intranet. Please refrain from scheduling any video conferences at this time.

Regards,

Dr. Connor Jack, BSc, MD, CCFP, MPA

Director General | Directeur general

Centre for Food-borne, Environmental, and Zoonotic Infectious Diseases |

Centre des maladies infectieuses d'origine alimentaire, environnementale et zoonotique

Public Health Agency of Canada | Agence de la santé publique du Canada

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After reading Connor's email, Blake felt a sense of satisfaction with her newly accepted position. Not surprised by the recently isolated *Aedes albopictus*, she was reminded how pertinent her work was for protecting the health of Canadians. She was aware of the large amount of effort that would be required to have the project running smoothly before the fall federal election. Therefore, she began writing her project task list for the upcoming month. Blake started every month with a task list to help her remain organized while carrying out her daily activities. She knew the most difficult task ahead would be selecting the prioritization criteria that would be applied to a list of emerging and re-emerging non-enteric zoonotic infectious diseases. These criteria will be crucial when determining which diseases are of highest priority while developing guidance documents and tools for health professionals. Knowing this, she wrote a task list to help manage her time:

1. Review previous internal and external prioritization exercises.
2. Discuss the need for stakeholder consultation within the prioritization exercise.
3. If there is a need for consultation, create a list of potential stakeholder organizations and personnel to be included and contacted.

Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

4. Decide on a prioritization exercise format and which zoonotic infectious diseases to include or exclude.
5. Develop and test the prioritization criteria to be used in the exercise.

BACKGROUND

Centre for Food-borne, Environmental, and Zoonotic Infectious Diseases

CFEZID is a division of the Infectious Disease Prevention and Control Branch at the Public Health Agency of Canada (PHAC). CFEZID offices are located in two different cities – Ottawa and Guelph, Ontario. Between the two locations, and across the province, teams work to meet CFEZID's priorities through policy integration, surveillance, research, outbreak management, program planning, knowledge mobilization, emergency preparedness, and now the development of health professional guidance under the HPGU. CFEZID (2018b) is mandated to "Improve the health of Canadians by monitoring and managing infectious diseases arising from food-borne, water-borne, environmental, and zoonotic illnesses in Canada."

Employees of CFEZID work to reduce the transmission of Canadian and international infectious diseases from food, water, animals, or the environment to humans (Government of Canada, 2013). To reduce international transmission, CFEZID collaborates with the World Health Organization, the European Centre for Disease Prevention and Control, the United States Centers for Disease Control and Prevention (CDC), and the Pan American Health Organization (Government of Canada, 2013). CFEZID's main activities include collecting, appraising, and distributing information about zoonoses; investigating the incidence and distribution of zoonoses; developing national guidelines to reduce to the risk of zoonoses; identifying and developing new tools to predict the impact of climate change on emerging and re-emerging zoonoses; defining the link between humans, animals, and the ecosystem; and providing travel health recommendations and information (Government of Canada, 2013; CFEZID, 2018b). The outputs from the work conducted at CFEZID are used by the federal, provincial, territorial, and local governments to aid in evidence-based policy and program development (Government of Canada, 2013).

Health Professionals Guidance Unit

Canada is subject to an increase in transmissibility and incidences of emerging and re-emerging non-enteric zoonotic infectious diseases (CFEZID, 2018a). This is attributable to globalization, travel, climate change, and shifts in human demography and behaviour (CFEZID, 2018a). However, as a result of competing expenditures, there are an extremely limited number of health professional resources that provide education and awareness with respect to zoonoses prevention, diagnostics, and clinical management (CFEZID, 2018a). In addition, because of the lack of guidance provided by the federal government, inconsistencies in evidence review and data collection exist across the provinces and territories (CFEZID, 2018a). With these limitations in mind, members of the HPGU have envisioned that: "Health professionals have timely access to evidence-informed guidance to inform public health practice and action in order to protect the health of Canadians from emerging and re-emerging infections" (CFEZID, 2018a).

The purpose of the HPGU is to strengthen CFEZID's current approach to developing and providing Canadian health professional guidance documents and tools while ensuring the priorities of the PHAC and the Government of Canada have been met (CFEZID, 2018a). Guidance documents and tools refer to educational materials, tool kits, fact sheets, professional guidelines, standards, protocols, and advisories pertaining to emerging and re-emerging non-enteric zoonotic infectious diseases. In turn, guidance documents and tools developed by the HPGU aim to inform health professional practice, ultimately protecting the health of Canadian

Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

residents through prevention activities and accurate diagnosing (CFEZID, 2018a). To do this, the HPGU has two objectives: support strategic decision-making for CFEZID's health professional guidance work and communicate protective actions against emerging and re-emerging non-enteric zoonotic infectious diseases to associated stakeholders and Canadian residents (CFEZID, 2018a). With these objectives in mind, actionable items required by Blake and Brock to accomplish this include (CFEZID, 2018a):

- Determine the priority zoonoses and assess the need for health professional guidance;
- Identify timelines for modifying current, or creating new, documents and tools;
- Participate in outreach activities and stakeholder engagement to promote HPGU products; and
- Provide educational awareness communication to health professionals.

SPECIFIC AREA OF INTEREST

Climate Change and Emerging and Re-Emerging Non-Enteric Zoonotic Infectious Diseases

Approximately 60% of all known infectious diseases are zoonotic, with 75% of emerging or re-emerging agents being zoonotic in nature (Kulkarni et al., 2015). Zoonotic infectious diseases are those that can be transmitted from vertebrate animals to humans under natural conditions (Kulkarni et al., 2015). Causal agents for zoonotic infectious diseases include viruses, parasites, bacteria, fungi, and prions (Kulkarni et al., 2015; CDC, 2017). Emerging infectious diseases are those that have been recognized as new infections as a result of an evolving pathogen and its change in host, pathogenicity, range, vector, or strain and have increasing incident cases (Vallat, n.d.). Whereas, re-emerging zoonotic infectious diseases are considered 'already known' and have an increase in prevalence through their expanding geographical host or vector range (Vallat, n.d.; Kulkarni et al., 2015). Non-enteric zoonotic infectious diseases refer to the diseases that do not cause gastrointestinal illness as result of contaminated food or water consumption (Kulkarni et al., 2015). Non-enteric zoonotic infectious diseases may be vector-borne (e.g. Lyme disease or West Nile virus), environmentally mediated (e.g. Anthrax or Leptospirosis), or directly transmitted (e.g. Rabies or Hantavirus) (Kulkarni et al., 2015).

The rising rate of zoonotic infectious disease emergence and re-emergence is attributable to increased travel, changes in human demographics and behaviour, evolving agricultural practices, alterations in land use, and animal habitat encroachment (Kulkarni et al., 2015). In addition, the rate of emergence and re-emergence may be partly an artefact of an increased situational awareness of zoonoses (Kulkarni et al., 2015). However, environmental and socioeconomic shifts, such as climate change and urbanization, have further created particularly favourable conditions for zoonotic pathogens (Kulkarni et al., 2015).

Of greatest concern to CFEZID and the HPGU is the relationship between emerging and re-emerging non-enteric zoonotic infectious diseases and climate change. During the period between 1880 and 2017, the overall annual air temperature increased by nearly 1°C globally (Ogden & Gachon, 2019). More specifically, the past three decades have been warmer than any other decades since 1850 (Ogden & Gachon, 2019). Unfortunately, the Arctic and sub-Arctic regions of Northeastern Canada are experiencing faster and greater warming as a result of melting snow and ice (Ogden & Gachon, 2019). It has been predicted that by the 2070s, most of Canada will be 5°C warmer than the period between 1971 and 2000, leading to an increase in precipitation and heat waves (Ogden & Gachon, 2019). Such environmental changes act as direct drivers for non-enteric zoonotic infectious disease emergence or re-emergence. Climate change affects a pathogen's survival ability; arthropod vector reproduction cycles; the

Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

abundance of hosts or reservoirs; and the biodiversity of pathogen, reservoir, or host ecosystems (Ogden & Gachon, 2019).

Climate change also indirectly drives non-enteric zoonotic infectious disease emergence or re-emergence. For example, climate change may negatively influence a country's economy by limiting the number of exports grown or produced within the country (Ogden & Gachon, 2019). This can trigger conflict and refugee migration, which can prompt reduced use of infection control practices and an increased number of infectious diseases being imported into another country (Ogden & Gachon, 2019). Together, these direct and indirect effects of climate change stimulate non-enteric zoonotic infectious disease emergence and re-emergence through an increased introduction and/or endemic transmission of exotic infectious diseases, an increased spread of diseases endemic in southern areas to northern regions, and an increased number of cases of diseases already endemic to the geographic area (Ogden & Gachon, 2019). Furthermore, climate change poses a significant risk for non-enteric zoonotic infectious disease emergence or re-emergence in Canada (Exhibit 1).

Prioritizing Emerging and Re-Emerging Non-Enteric Zoonotic Infectious Diseases

The prioritization of emerging and re-emerging non-enteric zoonotic infectious diseases plays a key role in the HPGU's contributions to public health as a whole. The prioritization exercise will provide a short, targeted list of non-enteric zoonotic infectious diseases for developing health professional guidance documents and tools. This will also alert health professionals and other public health practitioners to which zoonoses are the biggest threat to the health of Canadians. With an increased awareness of priority zoonoses, behavioural changes and preventative measures can be implemented, and resources can be effectively allocated to limit the impact or spread of infectious diseases. The prioritization exercise will be constructed to ensure replicability. This will allow for a list of priority zoonoses to be produced as required and that best reflects novel pathogen mutations and an ever-evolving climate. By completing the prioritization exercise and subsequently developing educational resources, the HPGU aims to build public health capacity and strengthen collaboration among health-related sectors.

As Blake and Brock perform the prioritization exercise, Blake maintains a weekly activity log to track the progress of the project. The weekly activity log ensures that she manages her time effectively for particular tasks and recalls the tasks required to meet process outcomes from the project's start to finish.

Blake's Weekly Activity Log

Week 1	<p>We conducted an environmental scan to determine whether any internal or external prioritization exercises have been completed. To date, only the National Microbiology Lab (NML) in Winnipeg, Manitoba has conducted an internal prioritization exercise. The NML is an affiliate organization to the PHAC. The NML specifically prioritized vector-borne infectious diseases most likely to surge in Canada due to the current and projected climate. I found a contact name for the NML project. I contacted Jane Murphy, a Risk Assessor for the NML, via email. Jane agreed to provide consultation while we conduct our prioritization exercise.</p> <p>Externally, the CDC and the Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA), in collaboration with the University of Guelph, have conducted prioritization exercises. We were unable to find contacts for these exercises. Consultation was not confirmed with the CDC or the OMAFRA. We reviewed the</p>
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Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

	<p>methodology of the three projects. It was noted that each project had varying prioritization criteria.</p> <p>I scheduled a teleconference with Jane and Brock for next week and a meeting agenda has been circulated to both attendees.</p>
Week 2	<p>I had a consultation with Jane and Brock – it sounded promising. Jane has provided next steps for the prioritization exercise:</p> <ol style="list-style-type: none"> 1. Conduct a literature review focusing on only non-enteric zoonotic infectious diseases; compile a list of all of the non-enteric zoonotic infectious diseases pertinent to the health of Canadians 2. Assemble an advisory committee to review the list of zoonoses before prioritization occurs and ask the committee to provide their expert opinion 3. Create the prioritization criteria; consider the literature review, the advisory committee’s expert opinion, and the needs of Canadian health professionals; we should have small number of criteria that best fit the project goals 4. Schedule another consultation with Jane to discuss the future steps for data collection, weighing criteria, and zoonoses scoring <p>Brock and I created a list of 10 potential external and affiliate organizations whose expert opinion would be highly valued during the prioritization exercise (Exhibit 2). We chose organizations from different health-related specialities. The NML was included in the advisory committee to assist in directing the focus during group discussions. Brock found contact information for all of the organizations. Brock and I emailed the organizations to express our need for advice with prioritization and the opportunity for collaboration. We suggested that we have a teleconference in two weeks for those interested in discussing the expectations of the advisory committee and the direction of the prioritization exercise. I explained the short timeframe we have for stakeholder engagement due to the upcoming federal election campaigning.</p>
Week 3	<p>Brock and I performed a literature review to determine which zoonoses should be included in the prioritization exercise (Exhibit 3). We included zoonoses identified in only Government of Canada and other Canadian literature sources. Enteric zoonoses, duplicates, or diseases that were not specified in Canadian literature sources were excluded. A total of 62 zoonoses were retained after the literature review. We received responses from all 10 stakeholder organizations and confirmed a teleconference date and time with the respondents. Brock and I distributed the list of zoonoses “retained” and “not retained” for the prioritization exercise. We encouraged stakeholders to review the list prior to the meeting and to bring forth any suggestions for the removal or addition of zoonoses from the lists. Also, we asked stakeholders to brainstorm potential prioritization criteria which could be used for scoring the zoonoses. The meeting agenda was distributed to all prospective attendees.</p>
Week 4	<p>The teleconference with the advisory committee went well. All 10 stakeholder organizations participated. There was consensus between the stakeholders that Mayaro virus should be moved from the “not retained” list to the “retained” list because of its mode of transmission and relationship with the climate. Otherwise, the stakeholders were satisfied with the lists. We discussed the potential for another meeting after the prioritization criteria have been confirmed.</p>

Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

<p>Brock and I approved the list of “retained” zoonoses (Exhibit 4) and “not retained” zoonoses (Exhibit 5).</p> <p>I discussed the development of prioritization criteria with Brock. We agreed five criteria for the exercise would be appropriate and would maintain simplicity. However, we were unable to come to consensus on what the five criteria would be. We did decide to measure incident cases within Canada for each zoonoses as a criterion for the exercise. We will use the following formula:</p> $Incidence = \frac{\# \text{ of new cases during a specific time interval}}{\text{the population at risk during the time interval}} \times \text{multiplier}$ <p>We did not reach a conclusion on what the value of the multiplier should be or what the time interval should be when measuring incidence. Brock suggested that the time interval should be longer than two years.</p> <p>Brock and I discussed using the severity of illness as another criterion. However, we would need to clarify what the severity of illness would entail and how it would be measured. We both agree severity of illness is an extremely challenging criterion to define.</p> <p>We still need to identify and define other measures or units of analysis that could be used as prioritization criteria.</p>
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SPECIFIC PROBLEM OF DECISION

Prioritization Criteria

Time is quickly running out. Blake and Brock are feeling the pressure as a result of the need to complete the project prior to federal election campaigning. They are both aware that they will have to end their interactions with the advisory committee relatively soon. However, Blake and Brock feel the advisory committee’s advice would be an asset when developing health professional guidance documents and tools after the priority zoonoses list is generated. Therefore, it is imperative that they choose and define the prioritization criteria.

To determine which emerging and re-emerging non-enteric zoonotic infectious diseases are of the greatest threat to the health of Canadians, the diseases need to be scored using explicit and appropriate prioritization criteria. Blake and Brock have unanimously agreed that five prioritization criteria would be effective while maintaining feasibility. However, before they can move any further with the prioritization exercise, or begin developing health professional guidance documents and tools, within the next week they will need to determine the three additional prioritization criteria, aside from incidence and severity of illness. They must then define what each criterion entails and how each criterion will be measured.

In terms of severity of illness, Blake and Brock need to further discuss the definition and which units will be used to measure it. In addition, they must identify a multiplier and time interval for incidence. The prioritization criteria must complement and consider CFEZID’s mandate, the needs of Canadian health professionals, the relationship between emerging and re-emerging non-enteric zoonotic infectious diseases and climate change, and the working objectives of the HPGU. The criteria should include measures that can be repeated in future years because the

Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

epidemiology of the zoonoses will evolve with climate change and globalization. Once the remaining three criteria have been identified, the severity of illness has been defined, and the incidence formula has been tailored, Blake and Brock can move forward with the project. The steps following the initial prioritization exercise have not yet been determined.

CONCLUSION

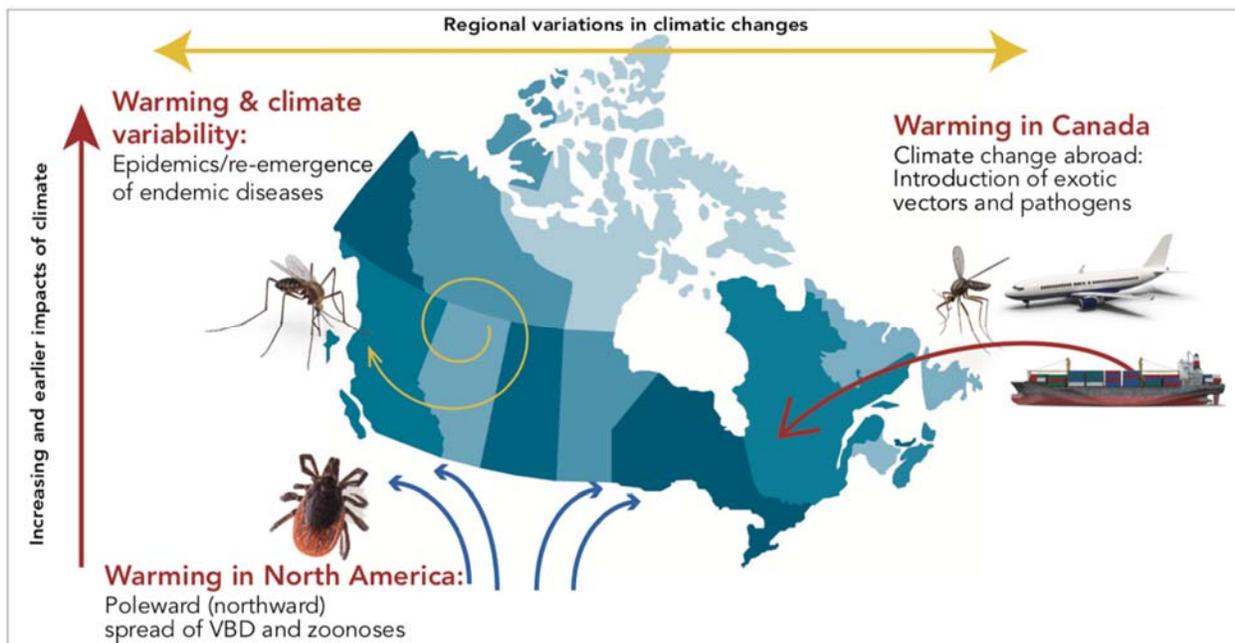
Blake and Brock have recently transitioned to new positions with the HPGU. They are working together to develop health professional guidance documents and tools which will aid in the prevention, early diagnosis, and clinical management of various emerging and re-emerging non-enteric zoonotic infectious diseases in Canada. To maintain efficiency and add value for health professionals, Blake and Brock have commenced a prioritization exercise to determine which emerging and re-emerging non-enteric zoonotic infectious diseases are of greatest threat to the health of Canadians. To date, they have reviewed previously conducted internal and external prioritization exercises, received consultation from the NML regarding the methodology, undertaken a literature review exploring zoonoses relevant to the Canadian context, and facilitated the development of an advisory committee. With the advice and feedback they have received from various stakeholder organizations, Blake and Brock have confirmed a list of non-enteric zoonotic infectious diseases to be included in the prioritization exercise (Exhibit 4).

Consequently, due to the upcoming federal election, Blake and Brock have a limited timeframe for engaging with stakeholders external to the PHAC. Prior to the election, Blake and Brock must produce a list of priority emerging and re-emerging non-enteric zoonotic infectious diseases so they can begin developing health professional guidance documents and tools. The pair has only been able to identify two prioritization criteria thus far: measuring the number of incident cases within Canada for each zoonosis and measuring the severity of illness associated with each zoonosis. However, because severity of illness is relatively challenging to define, the pair continues to search for a unit of analysis that adequately represents the criterion. In addition, they must tailor the incidence formula to sufficiently capture the status of each zoonosis in Canada. Blake and Brock are now at a standstill in terms of identifying three additional prioritization criteria, defining what each criterion entails, and how each criterion will be measured.

Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

EXHIBIT 1

A summary of climate change effects on infectious disease risk for Canada¹



Source: © All rights reserved. CCDR Volume 45-4: April 4, 2019 – Climate changes and infectious diseases: What can we expect? Public Health Agency of Canada. Adapted and reproduced with permission from the Minister of Health, 2020.

¹ Vector-borne diseases (VBD) are those that are transmitted to humans or animals through the bite of an infected arthropod species such as a mosquito, tick or fly (European Centre for Disease Prevention and Control, 2019).

Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

EXHIBIT 2 Prioritization Exercise Advisory Committee Organizations²

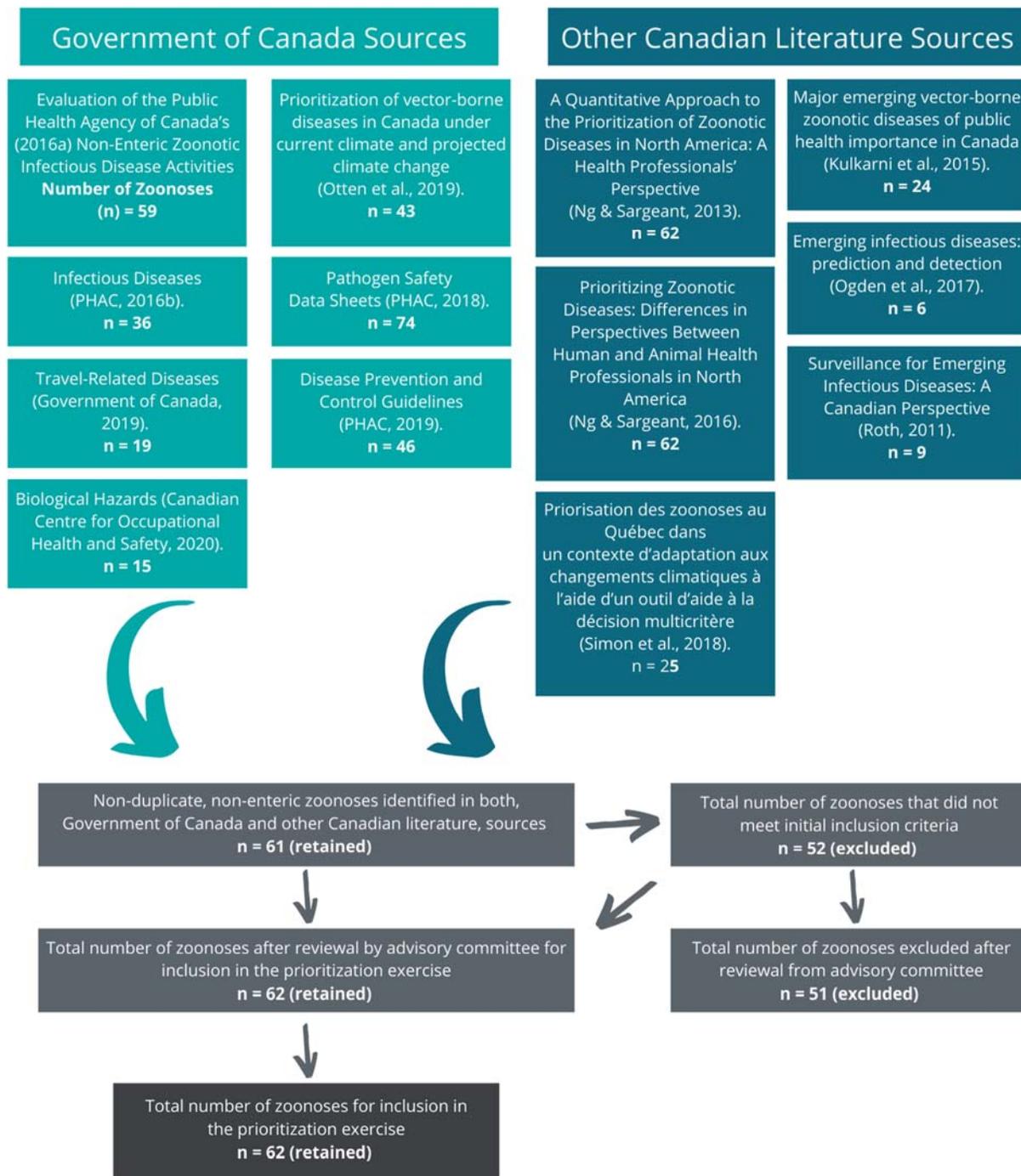
National Microbiology Lab	Association of Medical Microbiology and Infectious Diseases Canada
Canadian Nurses Association	College of Family Physicians Canada
Canadian Paediatric Society	Public Health Physicians of Canada
The Society of Obstetricians and Gynecologists of Canada	Canadian Notifiable Disease Surveillance System
Canadian Society for Epidemiologists and Biostatistics	Canadian Foundation for Infectious Diseases

Source: Author created.

² The author acknowledges that the advisory committee organizations listed in the case do not precisely reflect those used in the PHAC's consultations and the work to date on this project.

Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

EXHIBIT 3 The Inclusion and Exclusion of Zoonoses for Prioritization³



Source: Thériault & Ahmad, 2019.

³ The sources used in the literature review to collect zoonoses for prioritization have been included in the list of references located at the end of the case.

Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

EXHIBIT 4

List of zoonoses retained for prioritization after reviewal from the advisory committee

Anthrax	Cutaneous larva migrans	Lyme disease	Snowshoe hare virus
Argentine hemorrhagic fever	Cyclosporiasis	Malaria	Saint Louis encephalitis virus
Avian influenza virus type A	Dengue viruses (1,2,3,4)	Marburg virus disease	Tick-borne encephalitis virus
Babesiosis	Eastern equine encephalitis virus	Mayaro fever virus	Toxocariasis
Bartonellosis	Ebola virus	Middle Eastern respiratory syndrome coronavirus	Toxoplasmosis
Bovine tuberculosis	Echinococcosis	Monkeypox virus	Tuberculosis
Brucellosis	Ehrlichiosis	Nipah virus	Tularemia
Cache valley virus	Hantavirus	Plague	Murine typhus (endemic typhus)
California encephalitis	Hendra virus	Powassan virus	Venezuelan equine encephalitis virus
Chagas disease	Human granulocytic anaplasmosis	Psittacosis	West Nile virus
Chikungunya virus	Jamestown canyon virus	Q fever	Western equine encephalitis virus
Coccidioidomycosis	Japanese encephalitis virus	Rabies	Yellow fever virus
Creutzfeldt-Jakob disease	La Crosse encephalitis virus	Rickettsialpox	Zika virus
Crimean–Congo hemorrhagic fever	Lassa hemorrhagic fever virus	Rift Valley fever virus	Zoonotic diphtheria
Cryptococcosis	Leishmaniasis	Rocky mountain spotted fever	Leptospirosis
Cryptosporidiosis	Louse-borne relapsing fever		

Source: Thériault & Ahmad, 2019.

Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

EXHIBIT 5

List of zoonoses not retained for prioritization after reviewal from the advisory committee⁴

<i>Actinobacillus spp.</i>	Herpesvirus simiae	Omsk hemorrhagic fever virus	Schistosomiasis
African trypanosomiasis	Histoplasmosis	Onchocerciasis	Scrub typhus
Bolivian hemorrhagic fever	Ilheus virus	O'nyong-nyong fever virus	Semliki Forest fever virus
Borrelia relapsing fever	Kyasanur forest disease	Orf virus	Seoul virus
Bovine spongiform encephalopathy	Legionellosis	Oropouche fever virus	Simian foamy virus
<i>Capnocytophaga spp.</i>	Louping iLL virus	Paracoccidioidomycosis	Sindbis virus
Colorado tick fever virus	Lymphatic filariasis	Rat-bite fever	Sporotrichosis
Cuevavirus	Lymphocytic choriomeningitis virus	Ringworm	Trench fever
<i>Chlamydophila abortus</i>	Mediterranean spotted fever	Ross River virus disease	Usutu virus
Epidemic typhus	Melioidosis	Roundworm	Valley fever
Erysipeloid	Murray valley encephalitis virus	Sabia virus	Venezuelan hemorrhagic fever virus
<i>Fusobacterium spp.</i>	Naegleria fowleri	Sandfly fever	Vesicular stomatitis virus
Glanders	Nontuberculous mycobacteria		

Source: Thériault & Ahmad, 2019.

⁴ Listed in italics are the names of zoonotic organisms or species that can cause illness but may not be associated with one specific and/or identified disease process.

Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

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Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

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INSTRUCTOR GUIDANCE

Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

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BACKGROUND

As time progresses, new zoonoses make their way to the forefront in the media, in healthcare systems, in government projects, and in the daily lives of Canadians. Prioritization exercises carried out by public health experts can provide an indication for which zoonoses we should be most afraid of next, and ultimately most prepared for, especially in light of impending changes in climate. Blake O'Neil and Brock Jansen have recently transitioned to new positions with the Health Professionals Guidance Unit at the Centre for Food-borne, Environmental, and Zoonotic Infectious Diseases. Together, they plan to develop health professional guidance documents and tools to aid in the prevention, early diagnosis, and clinical management of various emerging and re-emerging non-enteric zoonotic infectious diseases. To maintain efficiency when creating guidance documents and tools, Blake and Brock have commenced a prioritization exercise to determine which emerging and re-emerging non-enteric zoonotic infectious diseases are of the greatest threat to the health of Canadians as a result of climate change.

To date, Blake and Brock have reviewed previously conducted internal and external prioritization exercises; received consultation from the National Microbiology Lab in Winnipeg, Manitoba; undertaken a literature review to explore zoonoses relevant to the Canadian context; and organized an advisory committee composed of external stakeholders from various health-related specialties. With the results from the literature review and the input from various stakeholder organizations, Blake and Brock have developed a list of zoonoses to be included in the prioritization exercise. The upcoming federal election tenders a very constrained timeframe for Blake and Brock, specifically for engaging with stakeholders external to the Public Health Agency of Canada. As public servants, Blake and Brock need to ensure government resources are not used for partisan advantage. Therefore, any stakeholder engagement would need to be paused when electoral campaigning begins until a Prime Minister is elected and the Senate and House of Commons resume.

Furthermore, prior to the federal election, Blake and Brock must produce a list of priority emerging and re-emerging non-enteric zoonotic infectious diseases so they can begin developing health professional guidance documents and tools. The pair has only been able to identify two prioritization criteria thus far: measuring the number of incident cases within Canada for each zoonosis and measuring the severity of illness associated with each zoonosis. However, because severity of illness is relatively challenging to define, the pair continues to search for a unit of analysis that adequately represents the criterion. In addition, they must tailor

Prioritizing Emerging and Re-Emerging Non-enteric Zoonotic Infectious Diseases: What Should we be Afraid of Next?

the incidence formula to sufficiently capture the status of the zoonoses in Canada. Blake and Brock are now at a standstill in terms of identifying three additional prioritization criteria, defining what each criterion entails, and how each criterion will be measured.

OBJECTIVES

1. Define, list, and explain basic epidemiology terms and concepts relevant to the case (i.e., case definition, risk and protective factors, prevalence, incidence, and health-related states and events).
2. Define and apply epidemiological units of analysis relevant to the case (i.e., incidence, mortality rate, case fatality rate, life expectancy at birth, years of life lost, etc.).
3. Recall the indications for a prioritization exercise and the process required to determine a list of priority zoonotic infectious diseases.
4. Explain the current and predicted relationship between climate change and human health.
5. Discuss the relevance of the social, cultural, political, and economic determinants of health with respect for the indirect effects of climate on emerging and re-emerging non-enteric zoonotic infectious diseases.

DISCUSSION QUESTIONS

1. Why did Blake and Brock choose disease incidence as a definite prioritization criterion?
2. Is there something Blake and Brock should do before calculating the incidence rates for each retained zoonosis?
3. How should Blake and Brock define severity of illness and what measures, or units of analysis, should be included for this?
4. Drawing from your previous experiences or from other course material, describe different measures or variables that could be used as prioritization criteria in the exercise.
5. How would changes in the current and projected climate impact endemic versus non-endemic zoonotic infectious diseases? Describe the relationship between climate change, disease transmission, and the risk to human health.

KEYWORDS

Climate change; current and emerging public health issues; infectious disease prioritization; measures of occurrence; severity of illness; emerging and re-emerging non-enteric zoonotic infectious diseases; units of analysis; stakeholder engagement.