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CANADA COMMUNICABLE DISEASE REPORT

RABIES

Editorial

Is rabies on the rise in Canada? 118

Overviews

Arctic fox rabies in the north 121

Racoon rabies in the south 125

Research

An innovative approach to minimize rabies among dogs in the north 130

Guest editors: Dr. Erika Bontovics and Dr. Catherine Filejski

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CANADA COMMUNICABLE DISEASE REPORT

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CANADA COMMUNICABLE DISEASE REPORT

RABIES

INSIDE THIS ISSUE

EDITORIAL

The changing face of rabies in Canada 118

Filejski C

OVERVIEWS

Translocated dogs from Nunavut and the spread of rabies 121

Curry PS, Kostiuk D, Werker DH, Baikie M, Ntiamoah W, Atherton F, Enns A, Opondo J, Guirgis H, Mema S

Preparing for and responding to recent incursions of racoon rabies variant into Canada 125

Stevenson B, Goltz J, Massé A

IMPLEMENTATION SCIENCE

Northern innovation in rabies prevention and control: The Weeneebayko Area Health Authority (WAHA) dog population management pilot project 130

Lidstone-Jones C, Gagnon R

COMMENTARY

The Canadian Rabies Management Plan: An integrated approach to the coordination of rabies activities in Canada 135

Tataryn J, Buck PA

ID NEWS

Outbreak of Elizabethkingia in Wisconsin 137

Confirmed cases of Elizabethkingia in western Michigan 137

Human rabies - Missouri, 2014 138

EDITORIAL

The changing face of rabies in Canada

Filejski C[1*]

Abstract

Rabies prevention and control programs in Canada have proven highly successful in past decades and have significantly reduced both terrestrial animal and human rabies cases. Successful management and prevention of rabies to date have not, however, eliminated our need for ongoing rabies prevention and control programs.

This issue of the *Canadian Communicable Disease Report* (CCDR) provides an overview of recent and emerging rabies trends and challenges in Canada and examines the rationale to maintain our rabies programs and further supplement them with new and innovative approaches. The articles in this issue cover a broad range of topics including the preparation for, and response to, renewed incursions of the raccoon rabies variant of the virus, how to address the problem posed by the movement of dogs from northern to southern Canada and how the *Canadian Rabies Management Plan* is being revised and updated to respond to these issues.

Rabies in Canada is changing, but it is not disappearing. The same needs to be said of our rabies prevention and control policies and programs.

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Introduction

After decades of success in preventing human rabies cases and significantly reducing rabies in terrestrial mammal populations in Canada, questions have begun to surface about the real value and utility of continuing our rabies prevention and control programs. In an era of fiscal restraint and competing infectious disease priorities, do we really need to continue to investigate all bites and exposures which may result in the transmission of rabies to humans? After all, human rabies cases are exceptionally rare in Canada—in the first decade of the twenty-first century, there were only three domestically acquired cases, all due to bat strains of rabies (1). On the wildlife front, Ontario (the province once known as the "rabies capital of North America") had successfully eradicated the raccoon strain of rabies from its eastern regions in 2005; was declared "raccoon rabies free" in 2008 (2); and reported only two cases of terrestrial rabies due to fox strain rabies in 2011 (3). In many circles, complacency about rabies prevention and control was beginning to set in.

New trends and challenges

Unfortunately, by 2012, new threats and challenges in rabies prevention and control in Canada began to emerge and today, the face of rabies in Canada is far less rosy than it appeared to be four years ago. This special rabies-themed issue of the *Canada Communicable Disease Report* (CCDR) explores recent changes and new trends in rabies risk across a number of provinces.

Raccoon rabies strains return

Rabies continues to pose a significant risk to both public and animal health in Canada for a number of reasons. Firstly, although prevention and control efforts in wildlife have dramatically decreased the number of animal cases in southern Canada, rabies remains a significant problem in the United States (US) and the threat of rabies virus incursions over the border into Canadian provinces remains real and constant. In this issue, Stevenson et al. report on three renewed incursions of the raccoon rabies strain which has found its way back into New Brunswick, Quebec and Ontario over the past two years (4).

Arctic fox rabies strains remain

Despite the low number of terrestrial rabies cases in southern Canada, the Arctic fox variant strain of rabies remains endemic in northern Canada and there are no real prospects for its elimination. In the north, Arctic fox populations tend to cycle through rabies outbreaks which can become significant enough to spill over and affect both dog populations in northern communities and red fox populations in the south. Movement of the fox rabies virus strain between various animal populations has, in fact, had significant consequences in the past. In the mid-1950s, the spillover of an Arctic fox rabies outbreak in the north into more southern red fox populations led to the movement of fox rabies into southern Ontario and Quebec (5).

The trouble with translocation

More recently, in the winter of 2011–2012, events linked to a significant Arctic fox rabies outbreak in northern Quebec (Nunavik) and western Labrador led to the identification of a new and growing rabies concern in Canada—the introduction of rabies into highly-populated urban areas due to translocation (rapid movement across large distances) of dogs from the north. In the midst of the 2011–2012 rabies outbreak, an animal protection organization was rescuing stray dogs from northern Quebec and finding them new homes in the south. The result of these activities was the translocation of rabid puppies from Nunavik to Montréal in January of 2012 (6). Rather than being an isolated incident, this initial case was the first indication of trouble brewing on the horizon as a growing flow of unowned dogs were moved from remote northern communities to new adoptive homes in the south. In the second article in this issue, Curry et al. report on two subsequent cases involving translocation of rabid dogs into two different provinces (7).

A global problem

The importation or translocation of rabid dogs has also occurred in the US and Europe and has generated increased concern from public health authorities. Requirements for rabies vaccination certificates for dogs crossing international borders (as a means of preventing the spread of rabies) are being sabotaged. In January 2014, the National Association of State Public Health Veterinarians urged the United States Centers for Disease Control and Prevention (US CDC) to revise and expand existing importation regulations for dogs, which dated back to the 1950s because they did not "adequately reduce the risk that a rabid animal will enter the US" (*Personal correspondence from National Association of State Public Health Veterinarians, Inc. (NASPHV) President and NASPHV Rabies Compendium Committee Chair to the Director of the US CDC, January 14, 2014. http://tinyurl.com/lpmou79*). In May 2014, the US CDC issued a *Health Alert on Imported Dogs with Questionable Documentation* noting reports of questionable vaccination certificates for an increasing number of dogs who had been imported into the US from rabies-endemic countries (8). Their concern proved warranted—in May 2015, a dog imported into the US from Egypt was diagnosed with rabies and found to have entered the US with a falsified rabies vaccination certificate (9). Growing concerns about the risks of importation (or even translocation) of domestic animals that have not been adequately vaccinated against rabies are now increasingly being voiced not only in Canada and the US, but also Europe and the United Kingdom (10).

Innovative approaches

Canada faces similar issues regarding the importation of dogs across our borders. And, as Curry et al. illustrate, translocation poses an additional problem because animal transportation within country borders does not require rabies vaccination certificates. Reducing the risk of rabies due to translocation of dogs from the north to the south within Canada will require innovative solutions to control dog population numbers (i.e., slowing the flow of dogs or stopping it altogether) and to improve canine rabies vaccination rates in remote northern communities. Lidstone-Jones and Gagnon report on an innovative approach to dog population management which is being piloted along Ontario's James Bay and Hudson Bay coastlines, using injectable contraceptive in female dogs (11). While not traditionally considered a rabies prevention and control measure, it is becoming increasingly clear that effective and sustainable dog population management strategies in the north are an important component of rabies prevention for both northern and southern Canadian communities.

Interjurisdictional coordination

It is likely that bat rabies will remain endemic in Canada for the foreseeable future. This fact, as well as the re-appearance of raccoon rabies in New Brunswick, Quebec and Ontario, the growing numbers of translocated rabid dogs and the dog overpopulation challenges faced by our remote northern communities in Canada all serve to emphasize the importance of continued vigilance in rabies prevention and control.

The complexity of successfully managing rabies on a national scale was reflected in the development of the *Canadian Rabies Management Plan*. The Plan was initially signed by the Canadian Food Inspection Agency and the Public Health Agency of Canada in 2009 and provides an overview of rabies-related roles, responsibilities and activities across the country. However, federal rabies program changes implemented in 2014 have significantly altered those roles, responsibilities and activities in Canada. In the last article of this issue, Tataryn and Buck provide a brief overview of how the *Canadian Rabies Management Plan* is being revised and updated to reflect not only those changes, but also the new challenges Canada faces with respect to rabies prevention and control (12).

Conclusion

The new reality is that translocation of animals, whether wild or domesticated, can drastically change an area's local rabies risk picture from one day to the next. This means that traditional measures of rabies risk, based exclusively on local rabies case counts, need to be balanced and supplemented by other considerations, including animal movement into and out of a region. Fresh approaches are needed to address the new reality of rabies in Canada, such as new oral rabies wildlife vaccines, more efficient interjurisdictional collaboration and innovative northern dog population management strategies. Rabies in Canada is changing, but it is not disappearing. The same needs to be said of our rabies prevention and control policies and programs.

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Conflict of interest

None.

References

1. National Advisory Committee on Immunization (NACI). Rabies vaccine. In: Canadian immunization guide. Ottawa: Public Health Agency of Canada; 2014. http://www.phac-aspc.gc.ca/publicat/cig-gci/.
2. Ontario Ministry of Natural Resources. Rabies reporter, Summer 2008. MNR Publication 51709, Vol 19(2), 2008.
3. Ontario Ministry of Natural Resources. Rabies reporter, Oct–Dec 2011. MNR Publication 51709, Vol 22(4), 2011.
4. Stevenson B, Goltz J, Massé A, et al. Preparing .for and responding to recent incursions of raccoon rabies variant rabies into Canada. Can Comm Dis Rep 2016;42:125-9.
5. Lagacé F. Historique de la rage au Québec de 1958 à 1997. Le Médecin Vétérinaire du Québec 2008;28(3).
6. Ministère de la Santé et des Services sociaux du Québec. Vigie-interventions : Rage chez des chiots. Flash Vigie Feb 2012;7(2).
7. Curry P, Kostiuk D, Werker DH, Baikie M, Ntiamoah W, Atherton F, et al. Translocated dogs from Nunavut: The spread of rabies. Can Comm Dis Rep 2016;42:121-4.
8. CDC warns of flawed rabies certificates. JAVMA Jul 2014;245(1). https://www.avma.org/News/JAVMANews/Pages/140701k.aspx.
9. Sinclair D, Wallace RM, Gruszynski K, Bibbs Freeman M, Campbell C, Semple S, et al. Rabies in a dog imported from Egypt with a falsified rabies vaccination certificate: Virginia, 2015. MMWR Dec 2015;64(49).
10. Ford E. Government urged to review rabies risk. BBC News. 2013 Oct 20. http://www.bbc.com/news/uk-24569593.
11. Lidstone-Jones C, Gagnon R. Northern innovation in rabies prevention and control: The WAHA Dog Population Management Pilot Project. Can Comm Dis Rep 2016;42:130-4.
12. Tataryn J, Buck PA. The Canadian Rabies Management Plan: An integrated approach to the coordination of rabies activities in Canada. Can Comm Dis Rep 2016;42:135-6.

Translocated dogs from Nunavut and the spread of rabies

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Abstract

Background: Investigations of rabid animals that cross provincial/territorial boundaries are resource intensive and complex because of their multi-jurisdictional and multi-sectoral nature.

Objective: To describe the multi-jurisdictional responses to two unrelated rabid puppies originating from Nunavut.

Methods: A descriptive summary of the investigations following the identification of a rabid puppy in Alberta (August 2013) and another in Saskatchewan (December 2014).

Results: These investigations involved public health and agriculture authorities in five provinces/territories, as well as the Canadian Food Inspection Agency (CFIA). In Alberta, a puppy who became ill after being transported by air from Nunavut was euthanized and diagnosed with rabies (Arctic fox variant). Eighteen individuals were assessed for exposure to rabies; nine received rabies post-exposure prophylaxis (RPEP). An exposed household dog that tested negative was electively euthanized. In Nunavut, the rabid puppy's mother and litter mates were placed under quarantine. In Saskatchewan, another puppy became ill during transit by air from Nunavut. It was subsequently euthanized and diagnosed with rabies (Arctic fox variant). Two of three Saskatchewan individuals, including a veterinary technician, received RPEP. Two Nova Scotia residents were exposed to the puppy while in Nunavut and received RPEP. One household dog received booster vaccination, was quarantined for 45 days and remained asymptomatic. In Nunavut, the rabid puppy's mother and litter mates were not identified. In both cases, exposure to an Arctic fox was the probable source of rabies in the puppies.

Conclusion: Translocation of dogs from the north where Arctic fox rabies is endemic poses a risk to human and animal health and may negatively impact control of rabies in Canada. There is currently no national framework to prevent inter-jurisdictional movement of potentially rabid animals in Canada.

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Introduction

Between 2013 and 2014, two unrelated puppies, both less than one year old, were separately adopted and transported from Nunavut (NU) and diagnosed with rabies after arrival in their new home provinces. One puppy arrived in Calgary, Alberta (AB), via Edmonton, AB, in August 2013 and the other arrived in rural Saskatchewan (SK), via Yellowknife, Northwest Territories (NT) and Edmonton, AB in December 2014. The investigations of both animal and human exposures collectively involved five provincial/territorial jurisdictions—NU, NT, AB, SK, as well as Nova Scotia (NS)—and the Canadian Food Inspection Agency (CFIA). Two residents of NS were exposed while working in NU. This outbreak report illustrates the complexity of these investigations due to their multidisciplinary nature and number of investigative partners, and highlights the challenges and gaps in national rabies control and prevention.

Methods

Two public health investigations were triggered by the diagnosis and notification of two confirmed rabid puppies that required trace backs and assessments of possible exposures of humans and animals to rabies. The purpose of these investigations was to prevent the spread of rabies to humans and animals. CFIA was responsible for animal investigations up to March 21, 2013, and was involved in the AB investigation. The SK Ministry of Agriculture was responsible for the animal investigation in SK. CFIA or territorial public health authorities were responsible for the animal investigations in NU and NT and the regional, provincial and territorial public health authorities were responsible for all human health investigations.

Regional/provincial/territorial public health and agriculture personnel who were directly involved in these two investigations reviewed their records and provided summaries that were compiled into this report by three authors (PSC, DK, DHW). A previously published report on the Alberta puppy (1) was updated by information obtained from NU and a review of AB records. The descriptive summaries were then reviewed for accuracy by the investigative team.

Results

Alberta 2013

In June of 2013, a Calgary resident working in a remote community in NU witnessed a family of puppies scavenging for food in the area where she worked. She wanted to bring one puppy home but was unable to as the puppies were too young to leave their mother. A few weeks later, a friend went up to the community and brought back a puppy for the Calgary resident. The puppy, a five-month old husky, was transported by air to Calgary from NU, via Edmonton.

The puppy was seen by a veterinary clinic in Calgary shortly after it arrived for first examination and vaccination on July 9, 2013. The owner reported that the puppy was doing well and acting like a normal puppy who had been rescued from a homeless situation.

The puppy was taken to the veterinary clinic for its second set of puppy vaccinations on August 8, 2013, and the decision was made to delay the rabies vaccine because the puppy needed a Bordetella vaccination. The puppy was adjusting well to its new life and the owner reported that it was happy, calm and quickly becoming housetrained.

The owner brought the puppy to the veterinary clinic four days later on August 12, 2013, because it had begun vomiting and attacking and biting the other dog in the household. The puppy had also bitten the owner's roommate on the back of the leg, but this was not a full epidermal thickness bite. It was howling intermittently and could not be soothed by the owner. The puppy was brought to the clinic in a carrier and was removed from the carrier using a rabies pole to muzzle and subsequently euthanize it. The veterinarian did not do a clinical exam on the puppy at this point as rabies was strongly suspected based on presenting clinical signs. The veterinarian consulted with the CFIA district veterinarian who explained that an unvaccinated dog suspected of having rabies would have to undergo a six-month quarantine period or be euthanized and tested for rabies. The owner elected to euthanize the puppy and test for rabies.

CFIA submitted the samples to the Rabies Laboratory in Lethbridge, AB on August 15, 2013. A positive fluorescent antibody test (FAT) was reported. On subsequent typing, the virus was found to be the Arctic fox variant of the rabies virus.

CFIA was also consulted regarding the management of the one-year-old dog in the household that had been bitten by the puppy. This dog had been vaccinated for rabies as a puppy but had not yet received the one-year booster vaccination and so was classified as a primary vaccinate animal. It was recommended that this dog either receive a booster vaccination immediately and then undergo a 45-day observation period, or be euthanized as per CFIA protocol. The owner elected euthanasia and the dog was tested for rabies; test results for this dog came back negative.

The CFIA Edmonton District office, which was responsible for reportable animal diseases in NU, contacted the owner of the puppies and placed a quarantine order on the remaining live puppies. Two of the puppies were destroyed for unrelated reasons shortly after the quarantine was issued. Both were healthy at the time of destruction. The mother and two remaining puppies remained healthy after the six-month quarantine ended. There was no report from the owner of an Arctic fox interacting with the dogs but they were housed outdoors and there had been an Arctic fox found to be positive in the community that winter.

Public health officials in AB and NU assessed the exposures of 18 individuals who had contact with the puppy; nine were considered to have high-risk exposures and were given rabies post-exposure prophylaxis (RPEP). Four household members received RPEP, as well as four out of 12 acquaintances of the puppy's owners and one of the veterinarians that dealt with the puppy. One person received his/her last dose of rabies vaccine in NS.

Saskatchewan 2014 to 2015

A husky-like puppy, which was less than one year old, had wandered into a construction work camp in a remote NU community in early December 2014. It was apparently healthy and had been taken into the compound and nurtured by several of the workers at the camp. One of the workers decided to adopt the puppy and take it back to SK. On December 16, 2014, the puppy was transported on a flight from NU to Yellowknife, NT and then on another flight to Edmonton, AB. The owner then travelled by private vehicle to a rural community in the Saskatoon Health Region.

The puppy became progressively ill enroute with marked changes in its behaviour and bit a family member. The following day, the owner took the puppy to a local veterinary clinic. The veterinarian reported that the puppy's eyes were glazed, it was salivating heavily, was quite dysphoric, crying and throwing its head back and forth. As rabies was considered in the differential diagnosis, the puppy was euthanized and the head was sent to CFIA laboratory for testing. A public health investigation was initiated.

The veterinarian notified the Rabies Risk Assessment Veterinarian (RRAV) with SK Ministry of Agriculture about the possibility of the puppy being rabid. The RRAV notified public health in Saskatoon Health Region and the Ministry of Health and the Ministry of Agriculture of a possible rabid animal. The Saskatoon Health Region conducted a preliminary risk assessment of human exposures. Two co-workers of the owner had been exposed to the puppy at the camp in NU and had returned to NS. The bite to the family member resulted in puncture wounds of the arm, which received appropriate wound care at a physician's office. A veterinarian technician, who had previously received pre-exposure rabies vaccination, was cut with the knife used to decapitate the puppy's head after the knife had been immersed in a bleach solution.

CFIA reported that the FAT was positive for rabies on December 19. The RRAV notified public health officials and the Ministry of Agriculture of the positive test results. Subsequent typing confirmed Arctic fox variant rabies virus.

Both SK Ministry of Agriculture and SK Ministry of Health notified authorities in AB about the rabid puppy on December 19. SK Ministry of Health also notified public health authorities in NU, NT and NS. As the owner of the puppy had already informed co-workers about the dog's illness, the co-workers had presented to public health in NS and had already been started on RPEP.

The family member bitten by the puppy was assessed as having been exposed to rabies and received RPEP. Since this person proceeded with pre-arranged travel plans, the final fourth dose was administered in Ireland (these arrangements were facilitated through the International Health Regulations National Focal Point in Ireland). Two other family members were assessed as not having been exposed to rabies. The veterinary technician received two booster vaccinations. Blood samples from all clinic staff were taken to determine rabies titres.

Public health in AB and NT investigated airport workers who might have come into contact with the puppy during transportation from NU. The puppy had been crated for the flights. There were no occupational exposures. AB public health authorities also confirmed that there were no exposures to humans during the puppy's road trip from Edmonton to its new home in SK.

Public health in NU investigated all individuals with potential exposure in the community. No one was offered RPEP. A public service announcement provided information to the community of the rabies situation and advice to avoid stray dogs and to report any dogs with unusual behaviour.

Since there are no veterinary or agricultural services in NU, public health authorities conducted the animal investigation. The rabid puppy's mother and litter mates in NU were not identified. However, on December 25, 2014, a young husky dog, foaming at the mouth, was found wandering around the same community. The dog was shot, sent for testing and was positive for Arctic fox variant rabies. Around the same time a fox was shot near the same community and also tested positive for Arctic fox variant rabies. There were no known human exposures to this animal.

The owner of the rabid puppy had another dog at home who had been exposed. This dog had been previously vaccinated against rabies but was not up-to-date. The SK Ministry of Agriculture required that the dog receive a rabies vaccine booster and be quarantined for a 45-day period by the owner. The dog remained well during the quarantine period and no further follow-up was required.

Investigations did not identify any other animals that were exposed to the rabid puppy.

In both events, human infections were prevented and there was no further spread of rabies to domestic animals, beyond the two puppies. Arctic fox variant rabies is endemic in many far northern communities. Dogs are exposed through contact with rabid Arctic foxes or other animals that have been infected by rabid Arctic foxes.

Approximately 25 public health and agriculture staff were directly involved in each of these investigations. This does not include resources that were required for human and animal health care services, laboratory testing or operational and public communications across the involved sectors.

Discussion

These two investigations constitute the second and third reports of translocation of rabid dogs within Canada. Similar incidents were reported in Quebec in 2012 (2). These cases highlight the risk that translocation of puppies from the north (where Arctic fox rabies is endemic) poses to human and animal health and its potential to negatively impact the control of rabies in Canada. These two investigations also demonstrate that the high risk of rabies in dogs from NU and other northern areas in Canada may not be appreciated by those living in other areas of Canada, where rabies is more commonly reported in skunks, bats and raccoons. In 2013 and 2014, 23% and 27% of the rabid animals identified from NU and NT were domestic dogs (3).

Unvaccinated dogs from NU and NT should be considered at high risk of having rabies, and humans identified through investigations to have significant exposures to these animals should be offered RPEP without waiting for test results. The relatively long (and variable) incubation period of rabies in dogs (on average three to 12 weeks) can lead to infected dogs appearing entirely healthy at the time of transportation out of the region (4,5). Puppies represent a particular risk because they are desirable for adoption by humans at a time when they have not yet been vaccinated against rabies (6). In both of these investigations, domestic animals were also exposed, although none were infected. However, it should be noted that one of these dogs was euthanized possibly during the incubation period and may have developed rabies if it had lived. Furthermore, movement of these stray puppies to areas also inhabited by red foxes poses a risk of (re-)introduction of the Arctic fox rabies variant to wildlife in these areas.

When rabid animals cross jurisdictional boundaries, the complexity of investigations increases, which in turn may decrease the timeliness of interventions to prevent and control the spread of rabies. As CFIA no longer has responsibility for rabies risk assessment of animals and collection of animal specimens for rabies laboratory testing, each province and territory has developed its own rabies program resulting in a patchwork of programs without any clearly established operational protocols for coordinating trans-jurisdictional investigations. The absence of a standardized, national protocol may create delays in notification to other jurisdictions resulting in delayed identification and risk assessment of human or domestic animal exposures, actions that are critical to rabies prevention and control. The SK puppy investigation prompted the provincial Ministry of Health to develop a process map of investigations of animals at risk of having rabies, establish triggers for urgently reporting rabies events to the Ministry and implement a standard inter-jurisdictional referral form for animal exposure incidents (7).

A proof of recent rabies vaccination is required for exotic or domestic animals imported into Canada from other countries (8). However, there is currently no vaccination requirement to prevent inter-jurisdictional movement of potentially rabid animals within Canada. Such a framework could help prevent situations such as these two animal cases of translocated rabies. The framework could include a combination of legislation/regulations, policies, or guidance for domestic animals that travel across provincial/territorial boundaries to be vaccinated against rabies.

Collaboration and commitments from diverse stakeholders including the airline industry and transportation sector, the tourist industry, park authorities, trapping, hunting and outfitting associations and animal rescue groups, could inform the development of policies and communication materials supporting adherence to vaccinated animal movement. For example, animal rescue agencies could develop policies that rescued dogs be vaccinated and screened by a veterinarian before approving them for adoption. In addition, to protect both northern and southern residents, interventions are needed to improve vaccination coverage of domestic dogs in the north, such as paying lay vaccinators to conduct intensive vaccination clinics or drives, expanding the lay vaccinator program to other areas and supporting expanded vaccination clinics utilizing veterinarians from other jurisdictions. This would not only reduce the risk of translocation of rabies to southern regions, but would also bolster rabies prevention and control in northern Canada.

Conclusion

Inter-jurisdictional movement of humans and animals within Canada can easily result in the spread of rabies to areas where the disease is less common. A national program could incorporate the requirement for rabies vaccination for animals crossing provincial/territorial borders within Canada, best management practices and increasing awareness among Canadians of endemic rabies in the north. Without such a program, Canada may remain vulnerable to the spread of rabies across jurisdictions.

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Conflict of interest

None.

References

1. Mema S, Friesen B, Desai S, Rock M, McIntyre L. Rabies in a Cagary puppy adopted from the Arctic. Can J Public Health; 104(7)e510.
2. Abedelaziz N, Gravel G, Markowski F, Leblanc MA. Vigie – Interventions : Rage chez des chiots. Flash Vigie 2012; 7(2):Fév 2012. (Available only in French)
3. Canadian Food Inspection Agency (CFIA). Rabies in Canada. Ottawa ON: CFIA; 2016. http://www.inspection.gc.ca/animals/terrestrial-animals/diseases/reportable/rabies/rabies-in-canada/eng/1356156989919/1356157139999.
4. Greene CE, Rupprect CE. Rabies and other Lyssavirus infections. In: Greene CE, editor. Infectious diseases of the dog and cat. Philadelphia: WB Saunders; 2006. p. 167-183.
5. Fekadu M. Canine rabies. In: Baer GM editor. The natural history of rabies. Boca Ratton: CDC Press: 1991. p. 368-375.
6. White J, Wolfram KL, O'Connor B. Rabies in a 10-week old puppy. Can Vet. J 2007;48(9):931-934.
7. Saskatchewan Ministry of Health. Inter-jurisdictional referral following an animal exposure. In: Section 4: Vector-borne and zoonotic disease. Regina SK: Government of Saskatchewan; 2014. http://www.ehealthsask.ca/services/manuals/Documents/cdc-section-4.pdf#page=26.
8. Canadian Food Inspection Agency (CFIA). Import and travel requirements. Ottawa ON: CFIA; 2016. http://www.inspection.gc.ca/animals/terrestrial-animals/imports/policies/live-animals/pets/eng/1326600389775/1326600500578CFIA.

Preparing for and responding to recent incursions of raccoon rabies variant into Canada

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Abstract

By the late 2000s, Canada had successfully eliminated the incursion of racoon rabies from the south and remained free of this rabies variant from approximately 2009 to 2014. However, new incursions of raccoon rabies variant have recently been detected in three Canadian provinces: Ontario, Quebec and New Brunswick. Actions to address previous and current incursions of this rabies variant include enhanced surveillance programs, a point infection control strategy to respond to cases, a trap-vaccine-release program and oral rabies vaccination campaigns in targeted areas to prevent further cases and spread. It is hard to predict when and where new incursions will appear because of the ecological adaptability of raccoons and the significant risk associated with inadvertent translocation events by vehicles, trains and ships and raccoon movements across bridges. To date, no cases of raccoon rabies variant have been detected in domestic animals in Canada. However, until racoon rabies can be pushed back from the Canadian border, it is important to remain prepared for the reappearance of this disease.

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Introduction

Ontario, Quebec and New Brunswick are the only three provinces in Canada to have experienced an incursion of raccoon rabies variant from the United States (US). The first incursions in the late 1990s and early 2000s were successfully eliminated in all three provinces by 2009 and Canada remained free of this rabies variant until 2014. Since then, racoon rabies has reappeared in Ontario, Quebec and New Brunswick, and is now present in a larger geographical area than previously. The objective of this paper is to describe how the initial incursion of racoon rabies was successfully addressed, its recent re-emergence in these three provinces and why it is important to manage this growing risk.

Background

In the early 1990s, Canadian jurisdictions had been closely following the northern spread of raccoon rabies variant in the US from the state of West Virginia (1). Once raccoon rabies entered New York State in 1990 and Maine in 1994, the spread of this novel variant into Canada seemed inevitable.

Prior to its arrival in Canada, Ontario, Quebec and New Brunswick all created multi-agency committees or task forces and contingency plans and implemented enhanced surveillance which included intensified public awareness communication campaigns with toll-free numbers for reporting rabies suspect animals. Enhanced surveillance was developed to test for rabies in wildlife behaving abnormally or found dead, for incidents in which there was no known contact with humans or domestic animals. This surveillance was meant to complement ongoing rabies passive surveillance involving animal testing at the Canadian Food Inspection Agency's Centre of Expertise for Rabies when human or domestic animal contact had been reported.

In Ontario, the Ministry of Natural Resources and Forestry developed a point infection control (PIC) strategy to respond to the first case of raccoon rabies (2) and began a proactive trap-vaccinate-release (TVR) program in the areas bordering New York State, where raccoon rabies was expected to spread into Canada. Quebec conducted successive oral rabies vaccination (ORV) campaigns close to its southern border and New Brunswick developed plans to create a wildlife rabies vaccination zone along the southwestern border.

Despite these efforts, raccoon rabies variant was first detected in southeastern Ontario in July 1999, in southwestern New Brunswick in September 2000 and in southern Quebec in June 2006.

First incursions of raccoon rabies

Ontario

In July 1999, the first case of raccoon rabies was confirmed in southeastern Ontario near the St. Lawrence River. The Ministry of Natural Resources and Forestry immediately responded by implementing the PIC strategy which involved localized euthanasia of rabies vector species, TVR surrounding the population reduction zone and ORV surrounding both of those zones (3).

From 1999 to 2005, Ontario had 132 confirmed cases of raccoon variant rabies (130 raccoons and two striped skunks) before it was successfully eliminated from the province (4). The outbreak was contained to two localized areas and spread approximately 2,000 km^2 from 1999 to 2005. The second incursion occurred on Wolfe Island in the St. Lawrence River in the winter of 1999-2000 (5). That outbreak was quickly thwarted through enhanced rabies surveillance, TVR and aerial baiting with RABORAL V-RG®.

After elimination, the Ministry of Natural Resources and Forestry continued enhanced surveillance in the areas bordering New York State since rabies cases were still occurring throughout this state and the eastern US. The Ministry continued TVR in the St. Lawrence and Niagara areas of Ontario to create a buffer of vaccinated raccoons until 2007 and 2008 respectively (4) when TVR was replaced with aerial baiting using a new vaccine (ONRAB®) which was effective at immunizing raccoons, skunks and foxes. Since that time, ORV has been conducted in the Niagara Peninsula between the Welland Canal and the Niagara River and in a selected area along the St. Lawrence River in eastern Ontario adjacent to locations where rabies is occurring in New York State, especially near bridgeheads where it is easier for raccoons to cross the St. Lawrence River.

New Brunswick

In September 2000, the first case of raccoon rabies was confirmed in southwestern New Brunswick in a road-killed striped skunk, causing speculation that rabies may have been present for some time. From September 2000 to May 2002, a total of 64 rabid wild animals (55 raccoons and nine striped skunks) were confirmed in the same general geographic area.

Measures to control the spread of rabies in the key wildlife rabies vector species (raccoons, striped skunks and red foxes) were employed, including population reduction and TVR (using IMRAB®3 vaccine), in late September of 2001 using a cadre of local trappers under the direction and leadership from the Department of Health. Feral cats (defined as cats with no identification or collars) were also vaccinated when captured in live traps. Only three rabid animals were detected in 2002 and the last one was confirmed in May of that year.

Additional components of New Brunswick's response included enhanced rabies surveillance, targeted awareness campaigns for health care and veterinary health care professionals, and a public awareness campaign that promoted safe enjoyment of wildlife from a healthy distance, encouraged the public to report animals exhibiting strange behaviours, and promoted pet vaccination.

New Brunswick continued its TVR activities through the fall of 2007, then did one year of ORV using ONRAB® in 2008. Maine and New Brunswick collaborated on control activities for several years toward the end of this time period, with complementary activities on both sides of the border in the geographic areas of highest risk. During this time, Maine conducted an ORV program with RABORAL V-RG®. After 2008, New Brunswick discontinued its wildlife rabies prevention and control measures and reduced surveillance activities, since the raccoon rabies variant had been successfully eliminated from the province but also as a result of changing mandates.

Quebec

The first case of raccoon rabies in Quebec was confirmed in June 2006 in a road-killed raccoon located in Dunham (Montérégie region) about 10 km north of the Quebec-Vermont border. Following that discovery, emergency actions were put into place and a PIC strategy was implemented. Aerial vaccination using RABORAL V-RG® around the PIC zones was also conducted.

From 2006 to 2009, a total of 104 raccoon rabies cases (89 raccoons, 14 striped skunks and one red fox) were confirmed in southern Quebec, in the Montérégie region. During the first two years of the outbreak, control measures focused primarily on the PIC strategy (population reduction, TVR and ORV). However, since the infected zone covered more than 1,500 km^2 by 2007, it became unrealistic to continue PIC operations so subsequent operational strategies focused mainly on ORV.

Raccoon rabies elimination was accomplished in a relatively short period (four years) as a result of consistent teamwork and research collaboration. This success was likely due to a management program that included these key measures:
1) enhanced rabies surveillance that involved technicians patrolling roads along the QC-US border and responding to reports by citizens of dead or strange acting animals (6);
2) the use of ONRAB® vaccine baits for ORV operations (7,8);
3) combined aerial and hand baiting depending on the landscape and habitat composition; and 4) adapting bait distribution and densities to focus on raccoon and skunk habitat.

Since 2010, even though Quebec was considered raccoon rabies free, the threat of a new introduction from the US was still real and of management concern due to the absence of natural barriers and the occurrence of several raccoon rabies cases in states close to the Quebec border. Consequently, the province has continued its raccoon rabies management program for ten consecutive years, including spring and late summer ORV along the QC-US border (about 700,000 ONRAB® baits distributed annually over 6,900 km^2), enhanced surveillance (between 800 and 1,000 animals tested for rabies per year over an area of 11,300 km^2) and communications encouraging public awareness.

Recurrence of raccoon rabies

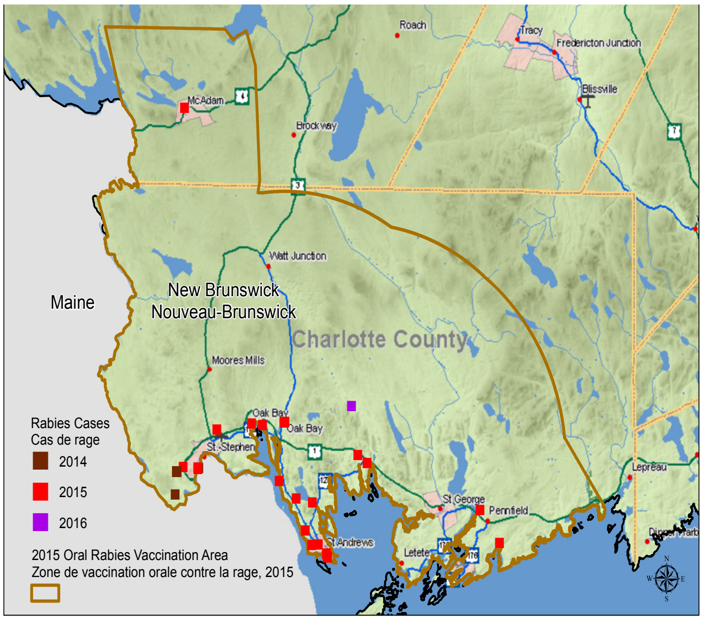
New Brunswick

No cases of raccoon rabies variant were detected in New Brunswick from May 2002 until late May 2014, when a family in St. Stephen, in southwestern New Brunswick, arrived home to see their two dogs circling a raccoon in its back yard. The raccoon was killed and buried. Because of the abnormal behaviour of the racoon, its body was later exhumed and tested positive for rabies. A rabid striped skunk was detected in the same general area in October 2014 and 25 additional rabid animals (24 raccoons and one striped skunk) were subsequently detected in southwestern New Brunswick between mid-January 2015 and mid-March 2016 (**Figure 1**).

In August 2015, New Brunswick hired a provincial rabies coordinator. Later that month, the province implemented an ORV program, under the leadership of the Department of

Agriculture, Aquaculture and Fisheries, in an area of about 3,000 km² in the southwestern part of the province (Figure 1) using ONRAB® rabies vaccine baits. A total of 206,000 vaccine baits were distributed: 153,000 by plane (thanks to assistance from the Ontario Ministry of Natural Resources and Forestry air crew), 36,000 by helicopter and 17,000 by hand.

Figure 1: Raccoon rabies variant cases in New Brunswick in 2014 and 2015 and oral rabies vaccination (ORV) zone of response in 2015



Since the winter and spring of 2015, New Brunswick has conducted enhanced surveillance for rabies in the southwestern portions of the province. Most specimens are also checked for other diseases such as canine distemper.

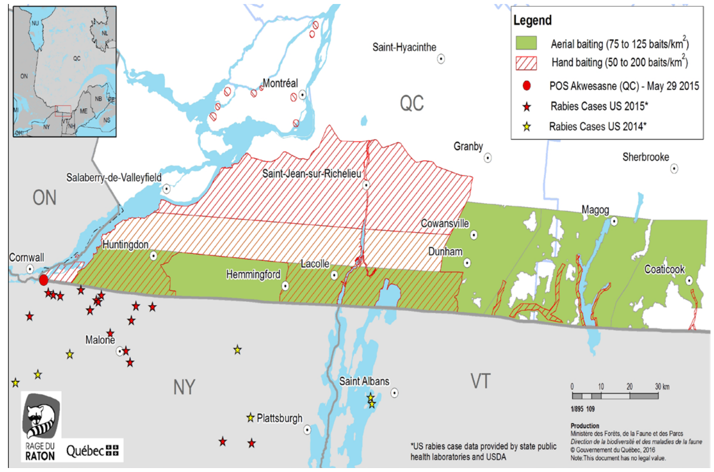
In 2016, New Brunswick plans to expand its ORV zone and area of enhanced surveillance, to conduct wildlife rabies vector population density research and to secure funding for PIC responses to address any rabies cases that are detected beyond the current control area.

Quebec

Since the spring of 2015, the Quebec government has enhanced its surveillance and control activities following the discovery of rabid raccoons in Franklin County, New York State, a few kilometers south of the Quebec border. On May 29, 2015, a case of raccoon rabies was confirmed in the Quebec portion of the Akwesasne First Nations reserve, where no vaccination campaign to immunize wild animals against rabies had ever been conducted previously (**Figure 2**).

Following the discovery of this case, 2,100 ONRAB® vaccine baits were distributed by hand in mid-June and late August in collaboration with the Akwesasne and Ontario authorities. Although this was the first raccoon rabies case in Quebec since 2009, it did not pose a more important threat to the rest of Quebec than the current Franklin County, New York outbreak (15 cases within 15 km of Quebec), since the habitat between Akwesasne and the Montérégie region is not suitable for raccoon

Figure 2: Oral rabies vaccination (ORV) operations and positive raccoon rabies case in Quebec in 2015



and skunk movements. Nevertheless, there is now a real risk of raccoon rabies spreading into Quebec, so in 2015, surveillance was intensified in areas located near Franklin County to rapidly detect any new cases and react promptly. Vaccination operations were also adjusted in these areas, through increased baiting density and an expanded baiting zone, to reinforce immunity of raccoons along the border and to help make sure raccoon rabies does not spread into Quebec again. About 690,000 ONRAB® baits were distributed in 2015, 330,000 by hand over 3,900 km² and 360,000 by plane over 4,000 km² (Figure 2). Enhanced surveillance and control operations will be conducted in 2016 and will be adapted to the current epidemiological situation in Quebec and neighbouring US states.

Ontario

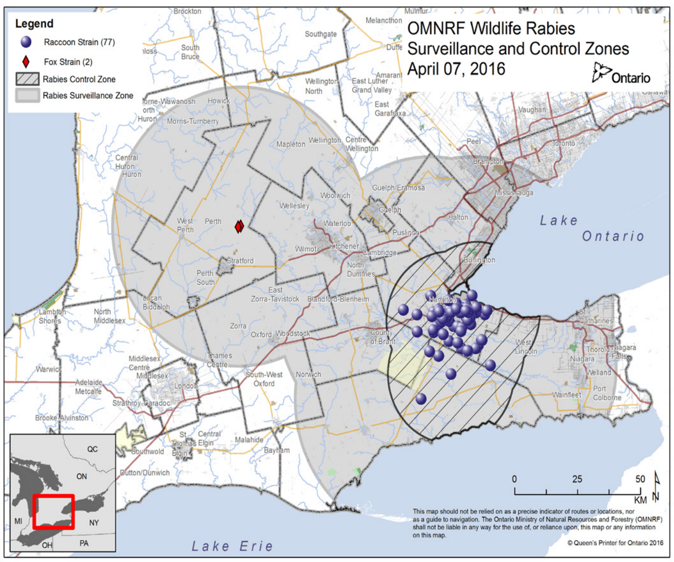
On December 4, 2015, Hamilton Animal Control picked up a sick raccoon and two dogs. Although initially confined to individual holding cages, one dog and the raccoon managed to escape their cages and get into a fight. The raccoon was submitted for rabies testing and raccoon rabies variant was once again confirmed in Ontario. This time it was in the "Golden Horseshoe", a highly populated area inhabited by over 8 million people at the western end of Lake Ontario, posing a greater human risk than in the more rural area where the 1999 outbreak occurred.

Despite the time of year, the mild temperatures associated with El Niño made it prudent for rabies control measures to be implemented immediately as raccoons had not entered their typical winter denning and periods of inactivity which would normally help slow the spread of rabies.

Within days of receiving confirmation of the variant type, the local health unit issued a news release about the case discovery and planned baiting operations and the Ministry of Natural Resources and Forestry staff began distributing baits throughout the urban areas by hand and helicopter. As additional cases were confirmed, baits were distributed in a 25 km radius around all of the existing confirmed cases in hopes that this vaccination zone would cover the extent of the disease. Approximately 220,000 ONRAB® baits were distributed in urban, suburban and rural areas surrounding the cases within three weeks.

As of April 7, 2016, 77 cases (53 raccoons and 24 stripped skunks) have been confirmed over approximately 600 km^2 (**Figure 3**), suggesting that the disease had been established in the area for some time. A surveillance zone was established within a 50 km radius of all confirmed cases to determine the extent of the spread and what resources would be required to contain it. Almost 2,000 raccoons and skunks have been tested through enhanced surveillance since December 2015 using direct Rapid Immunohistochemical Test for Rabies (dRIT) [9]. ORV will be conducted in summer 2016 in a 50 km radius around all confirmed cases (Figure 3).

Figure 3: Rabies cases and surveillance and control zones in Hamilton area, Ontario as of April 2016



Discussion

Previous incursions of raccoon rabies variant in Canada have been successfully eliminated, but all three provinces where it has previously occurred are now dealing with new incursions.

It is challenging to predict when or where new incursions of racoon rabies will appear. This is due in part to surveillance gaps, but also because of the ecological adaptability of raccoons and significant risk associated with their translocation by vehicles, trains and ships, as well as movement across bridges. Ontario's recent epizootic in the Hamilton area was initially obscured by an outbreak of canine distemper occurring in the same geographic area and causing similar clinical signs among raccoons and other susceptible species. New Brunswick's current epizootic covers a much broader geographic area than the previous outbreak, likely reflecting gaps in surveillance and delays in response. Unlike the US, no cases of raccoon rabies variant have yet been detected in domestic animals in Canada.

Until raccoon rabies can be pushed back from the Canadian border, it will be important to prepare for the reappearance of the disease and to ensure that resources and knowledge are available to respond to the threat. Without control measures or natural geographic barriers, raccoon rabies advances approximately 40 km per year (1). In order to protect against the threat of re-incursion, raccoon rabies must be pushed back at least 40 km from the border, although there is still the need to be alert for "hitchhiking raccoons" (i.e. raccoons getting on boats or vehicles).

The *North American Rabies Management Plan* (10), signed in 2008 by Canada, the US, Mexico and the Navajo Nation, outlines strategies for collaboration and coordination of control measures to stop the northward and westward spread and eventual elimination of raccoon rabies. Although some headway has been made, real long-term progress toward raccoon rabies elimination has been limited and continues to prove challenging.

Despite having the knowledge and tools available to successfully contain, control and eliminate rabies from each of the individual provinces, there is a need to maintain and advance our capacity to promptly detect the re-emergence of rabies and to respond quickly when it occurs. It is important to maintain surveillance efforts and not lapse into a false sense of security simply because rabies was successfully eliminated in the past. If left unchecked, there is a risk that the re-emergence of racoon rabies could have a significant economic impact due to increased costs associated with the need for additional post-exposure prophylaxis. It could also have a negative effect on local wildlife populations and increase public anxiety about the possibility of people and pets contracting this fatal disease (11). Agencies must also continue to collaborate at the municipal, provincial, national, and international level in order to stay abreast of current research and the current status of rabies in neighbouring areas. Excellent communications and networking among governments, fur harvesters, animal control, wildlife rehabilitators, First Nations and other non-governmental agencies will advance our capacity to respond to future rabies incidents.

Acknowledgements

The authors thank all those who have worked diligently to prevent, detect and respond to rabies in Canada for their hard work and willingness to share expertise and provide advice.

Conflict of interest

None.

References

1. Jenkins S, Winkler W. Descriptive epidemiology from an epizootic of raccoon rabies in the middle Atlantic states, 1982–1983. Am J Epidem 1987;126:429-437.
2. Rosatte R, MacInnes C, Williams R, Williams O. A proactive prevention strategy for raccoon rabies in Ontario, Canada. Wildlife Society 1997;25:110–116.
3. Rosatte R, Donovan D, Allan M, Howes LA, Silver A, Bennett K et al. Emergency response to raccoon rabies introduction into Ontario. J Wildl Dis 2001;37:265–279.
4. Rosatte R, MacDonald E, Sobey K, Donovan D, Bruce L, Allan M, et al. The elimination of raccoon rabies from Wolfe Island, Ontario: Animal density and movements. J Wildl Dis 2007;43:242-250.
5. Rosatte R, Donovan D, Allan M, Bruce L, Buchanan T, Sobey K, et al. The control of raccoon rabies in Ontario Canada: Proactive and reactive tactics, 1994–2007. J Wildl Dis 2009;45:772–784.
6. Rees E, Bélanger D, Lelièvre F, Côté N, Lambert L. Targeted surveillance of raccoon rabies in Quebec, Canada, J Wildl Manage 2011;75:1406–1416.
7. Mainguy J, Rees E, Canac-Marquis P, Bélanger D, Fehlner-Gardiner C, et al. Oral rabies vaccination of raccoons and striped skunks with ONRAB® baits: Multiple factors influence field immunogenicity. J Wildl Dis 2012;48:979–990.
8. Mainguy J, Fehlner-Gardiner, C, Slate, D, Rudd, R J. Oral rabies vaccination in raccoons: comparison of ONRAB® and RABORAL V-RG® vaccine-bait field performance in Québec, Canada, and Vermont, USA. J Wildl Dis 2013;49:190–193.
9. Lembo T, Niezgoda M, Velasco-Villa A, Cleaveland S, Ernest E, Rupprecht C. Evaluation of a direct, rapid immunohistochemical test for rabies diagnosis. Emerg Infect Dis 2006;12:310–313.
10. North American rabies management plan: A partnership for effective management. Riverdale Park, MD: APHIS; 2008. https://www.aphis.usda.gov/wildlife_damage/oral_rabies/downloads/Final%20NARMP%209-30-2008%20(ENGLISH).pdf.
11. Shwiff S, Aenishaenslin C, Ludwig A, Berthiaume P, Bigras-Poulin M, et al. Bioeconomic modelling of raccoon rabies spread management impacts in Quebec, Canada. Transbound Emerg Dis 2013;60:330–337.

Northern innovation in rabies prevention and control: The Weeneebayko Area Health Authority (WAHA) dog population management pilot project

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Abstract

Background: Remote northern communities in Ontario face unique challenges in rabies prevention and control. With large, free-roaming dog populations at high risk of exposure to rabies from wildlife, and a lack of regular access to veterinary services and vaccinations, these communities run a higher risk of human exposure to rabies than southern regions of the province.

Objective: To provide the baseline data on a novel approach to controlling the dog population in the Weeneebayko Area Health Authority (WAHA) in northern Ontario, implemented as part of a sustainable, humane and cost-effective pilot project to manage dog population numbers and improve public safety.

Intervention: In 2015, WAHA launched a large-scale two-year regional project that involved microchipping all dogs in the region to quantify and monitor population levels, vaccinating them with canine core vaccinations (including rabies) and piloting the use of an injectable gonadotropin-releasing hormone (GnRH) agonist contraceptive implant in female dogs. The Project's objectives included control of dog population numbers, reducing aggressive behaviours in community dogs, reducing the risk of rabies in communities, improving the health of community dogs and educating community members about the importance of dog population control.

Outcomes: In 2015, 513 dogs were microchipped and vaccinated as part of the WAHA Project: 211 females and 301 males. Seventy-six intact, free-roaming females were given the contraceptive implant, 113 females were identified as previously spayed and only 22 females were either too young or too small (toy breeds) to receive an implant.

Conclusion: While the final outcomes of the WAHA Project are still pending, preliminary findings, including dog population demographics and observed dynamics, support the feasibility of contraceptive implants in female dogs as a primary intervention to quickly and cost-effectively reduce dog population numbers in remote northern regions and reduce the risk of rabies transmission.

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Introduction

The need to advance rabies prevention and control programs in remote northern Ontario communities came to the fore in the spring of 2013, when a puppy on the Kashechewan First Nations reserve was diagnosed with the Arctic fox strain of rabies, which is endemic in the region.

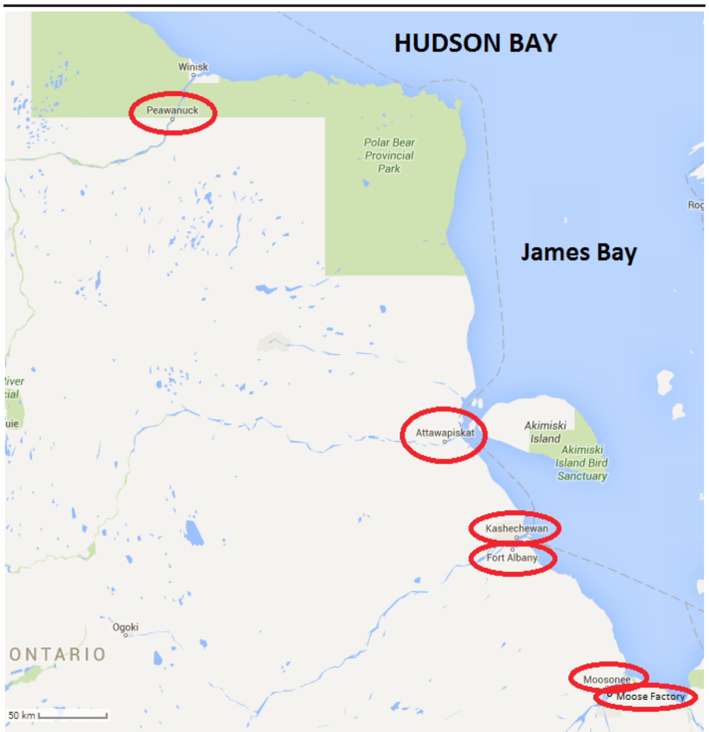
Kashechewan is a fly-in community located on Ontario's James Bay coastline, served by the Weeneebayko Area Health Authority (WAHA).

WAHA oversees medical services and facilities for four communities of Ontario's James Bay and Hudson Bay coastal regions, including Moosonee, Moose Factory, Fort Albany and Attawapiskat, and provides clinical support to the Kashechewan and Peawanuck Health Canada Nursing Stations. Prior to the incident with the puppy, WAHA had identified the need to address dog overpopulation and reduce zoonotic disease risks as a priority in its integrated model of public health service delivery.

In 2013, a routine response to the identification of the rabid puppy in Kashechewan proved extremely difficult. This was due to a lack of veterinary resources and rabies vaccinations, coupled with the absence of sustainable dog population management strategies. It was further complicated by lack of access to reliable information on the size of the dog population at risk. Additional challenges included reliably identifying, confining and monitoring dog contacts of the rabid puppy in Kashechewan, as well as ensuring that all other community dogs were vaccinated to prevent any further spread of the disease.

These challenges served to bring together a number of key government and animal health partners to collaborate on an innovative regional solution. The WAHA Dog Population Management Pilot Project (WAHA Project) came into being as a partnership between WAHA, each of the individual communities of the region, the Ministry of Health and Long-Term Care, Health Canada, the Porcupine Health Unit and Dogs With No Names, a pioneer organization in the use of alternative approaches to canine contraception in Canada. WAHA's region spans the entire western coastline of James Bay, as well as a portion of the Hudson Bay coast as far as Peawanuck (Winisk), with communities scattered along the coastline, as shown in **Figure 1** below, and a human population of approximately 11,860.

Figure 1: Map of Ontario's Hudson Bay and James Bay coastal region, with communities served by Weeneebayko Area Health Authority indicated with red circles



In planning an intervention designed to address the particular challenges faced by remote northern communities, it was clear that an integral component of rabies prevention programs was a sustainable means of controlling dog population numbers. Initial estimates of a total dog population of about 1,330 in the WAHA region were generated by Health Canada nurses in each community in 2013, based on their observations and input from community members.

Prior to 2015, the six remote communities in the WAHA Project had varying access to only occasional surgical spay/neuter fly-in programs over the years which were delivered by various veterinary clinics and/or organizations. However, the lack of a consistent regional approach, with little or no information sharing between groups or individuals providing veterinary assistance to the region, poor survival rates of surgically spayed/neutered dogs within the communities and extreme costs associated with conducting animal surgeries in the region had resulted in limited success for controlling dog populations overall.

Surgical sterilization of free-roaming dogs in this region poses several significant challenges, many of which are insurmountable. Transportation of surgical and anaesthetic equipment to and within the region is logistically difficult and expensive and not all communities have facilities for an effective surgical spay/neuter clinic setup. The communities are only connected by ice roads which are open for two to three months over the winter, so movement between most communities is limited to air travel for most of the year. In addition, the northern climate poses its own challenges: shaved abdominal areas and recuperation from anaesthetic agents involved in spaying/neutering procedures result in high post-operative morbidity and mortality rates in free-roaming dogs at sub-zero temperatures in the winter and can be highly uncomfortable in the summer months due to mosquitoes and other biting insects.

Dogs With No Names' previous experience on other First Nations communities in Alberta and Labrador had found that there is commonly a 2:1 ratio of males to females among free-roaming community dogs. This appears to occur for two reasons: decreased survival of pregnant and lactating females (due to higher energy requirements for survival) and active discrimination against ownership/care of female dogs due to challenges in dealing with litters and/or heat cycle problems. The average lifespan of female dogs in this setting is estimated to be only three years (*Personal communication. Dr. Judith Samson-French, Doctor of veterinary medicine, April 04, 2014*).

Because of the limited number of available free-roaming female dogs, those that go into heat tend to create chaos in the community, with packs of male dogs trying to breed them all at once. This engenders aggression between dogs and redirected aggression toward people, posing a serious safety issue for communities.

As a result, the most (cost-)effective solution to both overpopulation and the aggressive pack behaviours associated with free-roaming dogs in northern communities is to prevent heat cycles in female dogs by sterilization (either surgical or using contraceptive implants). This prevents both problematic pack behaviours and breeding. Male dogs can also be sterilized to reduce population numbers, but targeting females is more practical and effective. Furthermore, a recent study examining the effect of both surgical and chemical sterilization on behaviours of free-roaming male dogs in Chile found that while surgical castration resulted in no reduction in aggression or sexual activity, chemical sterilization actually led to an increase in dog-directed aggression of male dogs and produced no change in sexual activity (1).

A number of studies have examined the measurement and control of dog populations in regions where canine rabies is endemic, such as India and the Phillippines (2,3). Despite significant environmental differences likely to have an impact on canine population demographics in northern regions (e.g., the northern climate with harsh winters), an important lesson learned from previous studies in other parts of the world is the importance of understanding the population dynamics of dogs in a specific setting (including life expectancy at birth and early life mortality rates) to the effective management of free-ranging dogs (4). An understanding of dog population dynamics is clearly integral to both guiding the development of interventions in northern remote communities and assessing their effectiveness.

However, there is little in the way of published scientific information or guidelines about effective strategies available for a northern Ontario context, where large free-roaming dog populations are not themselves the rabies reservoir species, but pose a significant risk because they regularly come into contact with wildlife reservoir species in the region.

After extensive consultation and careful consideration, the WAHA Project was designed around five objectives:

1. Humanely stabilizing dog populations on and around First Nations communities to manageable and sustainable levels;
2. Reducing aggression in dogs and the resulting risk of injury to community members;
3. Reducing the risk of rabies and other disease transmission from owned and/or free-roaming dogs to community members;
4. Improving the overall health of community dogs; and
5. Educating community members about the importance of dog control and the impacts on public health for the whole community.

Following the initial round of field operations in 2015, this article presents the initial WAHA Project findings with respect to the baseline dog population numbers and basic canine demographic information for the region and represents the first published information about northern Ontario dog populations in the Hudson and James Bay coastal region.

Intervention

The population control approach chosen for the WAHA Project involved the use of 9.4 mg Suprelorin® (deslorelin acetate), a non-surgical GnRH contraceptive implant. Brought in from Australia through Health Canada's Emergency Drug Release program, the implant temporarily suppresses the female reproductive endocrine system and prevents production of pituitary and gonadal hormones for 12 to 18 months at a time. The effects of the implant are similar to those seen following a spay surgery, but are reversed after the deslorelin content of implant is depleted. However, given the expected short lifespan of most female free-roaming dogs in the north, the duration of the implant's effectiveness would sterilize a female dog for most of its lifespan, particularly if administered for two years in a row.

As the WAHA communities are all remote, the influx of additional dogs from other regions is limited. Thus, use of injectable contraceptives for two consecutive years aims to stabilize and reduce dog populations by the third year of the program to the point where surgical sterilization interventions on older female dogs with proven survival rates are more effective due to fewer dogs requiring surgery.

The use of a non-surgical contraceptive implant in female dogs presents unique advantages including expediency, minimal handling of dogs, the potential for year-round use, marginal cost and no post-operative complications. The Suprelorin® implants used in the WAHA Project have been widely used as a contraceptive in many zoo and wildlife species and shown to be effective in reproductively active female dogs in the past (5).

In the weeks leading up to the arrival of the WAHA Project field team in each community in 2015, a public outreach and education campaign was launched, using direct mail to community members, posters in the community, Facebook postings and radio and television announcements. A two-pronged approach was used to gain access to dogs, beginning with community members bringing dogs to a centrally located "processing station", followed by "door-to-door" and "street-by-street" mobile approaches for the remainder of the dogs in the community, with the team working out of a vehicle to capture free-roaming dogs. Written permission and informed consent for the handling of each dog was obtained from nearby house occupants for owned dogs and from the Chief and Council for unowned free-roaming dogs. Effectiveness of the public education campaigns year over year will be assessed by comparing the proportion of community residents willing to bring their dogs in to the centrally located "processing station" rather than requiring the Project field team to go door-to-door in 2016.

Each free-roaming dog encountered in the community was restrained safely and fed canned food containing a dewormer. A local anaesthetic (0.5 mL Carbocaine™) was injected into the subcutaneous tissue between the dog's shoulder blades, followed by administration of rabies and distemper, adenovirus-2, parvovirus and parainfluenza (DA2PP) vaccinations in the dog's hindquarters, while the local anaesthetic was allowed to take effect. Following vaccination, a microchip was injected between the shoulder blades with a 14-gauge needle. If the dog was female, a Suprelorin® 9.4 mg contraceptive implant was also injected between the shoulder blades. Successful microchip insertion was confirmed with a microchip reader. The entire procedure from start to finish, once the dog was caught, required no more than five minutes per dog.

Full information on each dog handled by the Project team was entered into a microchip-based community dog registry. To assist with ease of visual identification of free-roaming community dogs already handled by the Project, all microchipped and vaccinated dogs had a highly visible rabies tag attached to a collar, which also allowed for estimation of the number of dogs in each community that were not handled in 2015.

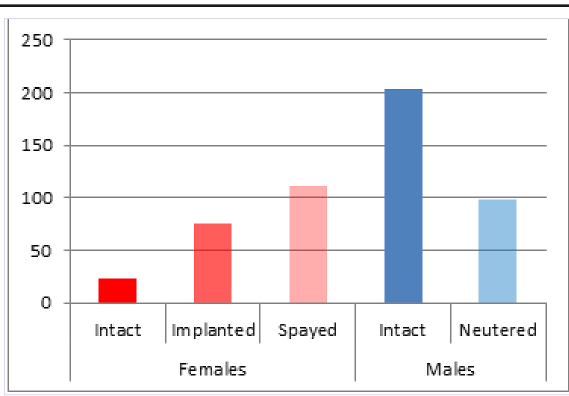
The 2016, field operations will begin with scanning each dog presented or captured for a microchip to determine its identity, reproductive and vaccination status. Each dog previously handled in 2015 will be followed up again in 2016 and revaccinated for rabies with a three-year rabies vaccine which will significantly reduce the risk of rabies transmission in the region. Any new dogs in 2016, and those not already previously handled by the field team in 2015, will also be microchipped, vaccinated and (if female) implanted in the second year of the Project.

The reduction of the number of female dogs going through heat cycles (as a result of receiving a contraceptive implant) is expected to reduce the amount of aggressive pack behaviour in male dogs within the communities. The effectiveness of this strategy in reducing aggression and improving public safety will be assessed on the basis of reports generated by Nishnawbe-Aski Police Services (NAPS) for each of the First Nations communities, summarizing the number of dog-related calls (e.g., aggressive packs, dog attacks, dog fights, etc.) received by NAPS on an annual basis from 2014 to 2017.

Outcomes

Of approximately 850 dogs determined to actually be in the region in June and July of 2015, by the field team, 513 (60%) were handled, microchipped and vaccinated, creating microchip-based dog registries for each of the communities. The results of the 2015 intervention for the region as a whole are shown in **Figure 2** below. Of the 513 dogs handled, 211 (approximately 40%) were female, while 301 (approximately 60%) were male. Of the 211 females, 113 (54%) had been previously spayed and 98 (46%) were intact. Seventy-six (76%) of these intact females were given a contraceptive implant. The remaining 22 intact females were either too young (less than eight weeks old) or too small (e.g., toy breeds kept indoors permanently) to receive an implant. Most female dogs were under three years of age, while most males were under six years of age. All 513 dogs handled in 2015 were vaccinated against rabies and no cases of rabies were identified in any community dogs since 2013.

Figure 2: Number of dogs handled in Weeneebayko Area Health Authority communities, 2015



For each dog handled, a dog registry and medical record was created and linked to its microchip number, including information on breed type, gender, age, reproductive status, body condition score, approximate weight, any known history and vaccines/dewormers administered. All dog information collected was provided to each community in both electronic and hard copy format, with back-up copies of data stored by WAHA. Community dog density maps were also generated, indicating lot numbers and areas where dogs reside, to inform and facilitate both WAHA Project and community interventions in 2016 and beyond. Each community was also provided with a microchip reader, enabling them to scan, identify and determine the rabies vaccination status of all microchipped dogs whenever needed.

Discussion

The WAHA Project successfully reached 60% of the dog population in the Weeneebayko region in 2015. Rabies and DA2PP vaccines were administered to all dogs and almost 80% of intact female dogs received the injectable contraceptive with a 12-month duration.

Data collected by the WAHA Project in 2015 also found significant differences in dog populations between individual communities in the region, reflecting their degree of access to spay/neuter services prior to 2015. A majority of the dogs found to be previously sterilized (72% of spayed females and 51% of neutered males) were found in the southernmost communities, which have had greater access to spay/neuter clinics. These communities also tend to have higher numbers of small breed indoor dogs (e.g., Chihuahuas, Pomeranians, etc.) that do not contribute to the dog overpopulation and public safety issues. It is important to note, however, that communities which had some sterilized animals resulting from occasional access to spay/neuter services (provided only on an ad hoc basis and without coordination or longer-term planning), were not generally found to have fewer dog overpopulation issues than communities that had never had access to spay/neuter services. This appears to be due to a number of factors, including the fact that spay/neuter clinics generally do not proactively go out to systematically capture all free-roaming dogs, but rather depend on community members bringing dogs to a central location for surgery; and no prioritization of female spay surgeries over male neuters.

This perspective was further supported by one WAHA community which constitutes a notable exception in the region. This community had already implemented a consistent approach to unowned roaming dogs over three years, including repeated spay/neuter clinics targeting female dogs and the capture of dogs and removal of puppies from dens on the outskirts of the community for adoption out of the region. All female dogs in this community were found to be spayed and only a handful of males had not been neutered. Anecdotal information initially provided by local NAPS officers in this community indicated a significant decrease in dog-related calls to police, temporally associated with the successful sterilization of the majority of female dogs in the community.

The logistical challenges of conducting any dog population control project in any remote and isolated region are significant and require substantial resources to enable qualified personnel to travel to the region and ship all necessary equipment. The use of injectable contraceptives in female dogs as a population-stabilizing mechanism reduces the amount of veterinary equipment requiring shipping to a bare minimum, which is a definite strength of this approach. In addition, injectable contraceptives do not require veterinary follow-up in the same way that spay/neuter surgeries often do. In consulting with its communities prior to deciding on an approach for the WAHA Project, the Project team found that medical staff in most communities often reported concerns about the aftermath of spay/neuter clinics and community nursing stations are often asked to deal with veterinary post-operative complications such as surgical site infections in dogs, which they are neither equipped nor trained to treat. This, in turn, also contributes to the reluctance of some dog owners to have their dogs undergo surgery.

While the temporary nature of injectable contraceptives may be perceived as a weakness of this approach, the authors would argue that this is only true if all that is being considered is a single intervention, rather than a multi-year coordinated plan, as is the case with the WAHA Project. Administering implants to female dogs for two years in a row provides for infertility in the female dogs for up to three years, which currently covers most of the lifespan of intact female dogs in the region. Female dogs that survive more than three years in the north are better candidates for surgical spay interventions. Following the second year of contraceptive implant use in the region in 2016, next steps for the WAHA Project will include overall data analysis of dog population dynamics over the two years of the Project. The final data from the Project will inform the consideration of cost-effective options for a potential coordinated surgical spay/neuter plan and/or ongoing contraceptive implant use in female dogs in WAHA communities in the future.

The baseline 2015 findings of the WAHA Project support the feasibility of the use of contraceptive implants as an innovative primary intervention to prevent reproductive cycles in female dogs in remote northern regions where regular access to veterinary services is not available. Unless most female dogs in the community can be spayed at one time, ongoing reproduction in the background will ensure that there is a continual growth in population over the longer term, despite spay/neuter efforts. While final outcomes are still pending, data collected by the Project in 2015 has also indicated that unless the overall population is under control, spayed/neutered animals do not remain in the community for long. This, coupled with the time and cost limitations in making spay/neutering accessible in the region, extreme weather conditions, as well as lack of access to veterinary care to deal with post-operative complications such as surgical site infections all support the use of contraceptive implants as a better approach than surgical spay/neuter in the region as a primary intervention. Contraceptive use should later be followed by surgical spay/neuter approaches in a two to three-year timeframe, once background population growth has slowed considerably, or stopped.

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Conflict of interest

None.

References

1. Garde E, Perez GE, Vanderstichel R, Dalla Villa PF, Serepell JA. Effects of surgical and chemical sterilization on the behavior of free-roaming male dogs in Puerto Natales, Chile. Prev Vet Med 2016 Jan 1;123:106–20.
2. Totton SC, Wandeler AI, Zinsstag J, Bauch CT, Ribble CS, Rosatte RC, McEwen SA. Stray dog population demographics in Jodhpur, India following a population control/rabies vaccination program. Prev Vet Med 2010 Oct 1;97(1):51–7.
3. Childs JE, Robinson LE, Sadek R, Madden A, Miranda ME, Miranda NL. Density estimates of rural dog populations and an assessment of marking methods during a rabies vaccination campaign in the Philippines. Prev Vet Med 1998 Jan;33(1-4):207–18.
4. Paul M, Sen Majumber S, Sau S, Nandi AK, Bhadra A. High early life mortality in free-ranging dogs is largely influenced by humans. Sci Rep 2016 Jan 25;6:19641.
5. Alliance for Contraception in Cats & Dogs (ACC&D). Contraception and fertility control in cats and dogs: A report of the Alliance for Contraception in Cats & Dogs. Portland OR: ACC&D; 2013. https://www.acc-d.org/docs/default-source/Resource-Library-Docs/accd-e-book.pdf?sfvrsn=0.

The Canadian Rabies Management Plan: An integrated approach to the coordination of rabies activities in Canada

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Abstract

Although human cases of rabies are exceptionally rare in Canada, rabies remains endemic in some animal populations thus creating the need for ongoing vigilance. Rabies has always been a shared responsibility among local, provincial/territorial and federal authorities, as reflected in the *2009 Canadian Rabies Management Plan*. Since 2009, a number of changes in rabies management have occurred, including the development of new tests, an oral rabies vaccine for wildlife, lessons learned from recent animal cases and changes in federal, provincial, and territorial responsibilities in 2014. Federal departments and agencies continue to support rabies management through a number of activities. As the rabies landscape continues to evolve, so too must the strategies and frameworks required to manage this disease. As a result, the *Canadian Rabies Management Plan* and the *North American Rabies Management Plan* are being revised.

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Introduction

Rabies remains a formidable public health threat in many parts of the developing world. Despite the availability of tools and strategic approaches to eliminate human rabies transmitted by dogs, the disease kills tens of thousands of people each year (1). In contrast, human cases have been exceptionally rare in Canada during recent decades, due to successful collective efforts by human, wildlife and domestic animal health partners.

Despite these successes, rabies continues to pose an ongoing threat to both public health and animal populations in Canada, and our work to manage rabies is far from over. Canada continues to have regions where bat rabies remains endemic and some regions are experiencing new incursions of terrestrial rabies. New anthropogenic challenges such as translocation of animals and the effects of globalization have added to the age-old complexities of rabies transmission dynamics in the ecosystem. Translocations of rabid animals can quickly result in both national and international incidents that require timely communication and coordination between a broad number of stakeholders to effectively manage the issue and protect the public.

Other significant challenges to rabies prevention and control in Canada are the lack of access to veterinary services in the north, the effects of climate change, and changing ranges and interactions of sylvatic (wildlife) populations. Overcoming these challenges will require the collective and coordinated efforts of dedicated representatives from human, wildlife and domestic animal health sectors.

A shared responsibility

Rabies has always been a shared responsibility among local, provincial/territorial and federal authorities. In 2009, public health, agriculture and provincial/territorial wildlife agencies, the Public Health Agency of Canada (PHAC), the Canadian Food Inspection Agency (CFIA), Environment Canada and key non-government organizations collectively developed the *Canadian Rabies Management Plan* which laid out a national strategy for the management of rabies. The Plan covered disease surveillance, prevention, response and control strategies for both terrestrial and bat-associated rabies virus variants in Canada.

In 2014, federal, provincial and territorial roles and responsibilities changed, specifically for the collection and submission of samples, along with investigation and quarantine of suspect domestic animals (2). In addition to assuming these responsibilities, provincial and territorial authorities will continue to be responsible for the management of rabies and human health. Federal departments and agencies continue to support rabies management through key activities such as testing, vaccine approval and procurement, human serology testing, guidance on vaccination and treatment in humans, key prevention messages and national reporting. Other partners remain integral to the prevention and management of rabies, including non-government wildlife organizations, private veterinarians, the communities that are impacted by rabies and the general public.

New developments

New rabies-control tests and technologies have been developed, such as an oral rabies vaccine which is effective in skunks and raccoons, and lessons have been learned from recent outbreaks. As a result, the *Canadian Rabies Management Plan* is being updated by a working group composed of federal, provincial and territorial public health, agriculture, and wildlife authorities and stakeholders from non-government organizations. Collectively, members represent a broad range of disciplines including policymaking/regulation, epidemiology, ecology, infectious disease surveillance/control and laboratory diagnostics. Led jointly by representatives from PHAC and the Ontario Ministry of Health and Long-Term Care, the goal of this process will be to ensure the Plan reflects advances and changes in Canada and includes new insights and details on multijurisdictional coordination during national incidents. The target date for completion of the updated plan is fall 2016.

The updated Plan will reflect current practices and *Canadian Rabies Management Plan* will also provide important Canadian context for the revision of the *North American Rabies Management Plan* (NARMP) [3], which is also underway. The 2008 NARMP established a protocol for rabies management in North America and has played a key role in facilitating mutual cross-border planning, communication, and response in recent years. It has also supported rabies prevention and control within each respective country and North America overall.

Conclusion

The effective management of rabies in Canada and across North America involves an integrated and collaborative approach between partners in human and animal health. As the rabies landscape continues to evolve, so too must the strategies and frameworks that manage this disease. The *Canadian Rabies Management Plan*, and associated collaborative efforts, are positioned to support these evolving challenges in the coming years.

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The authors would like to acknowledge the many partners and stakeholders involved in rabies surveillance, prevention, education, research, response and control across Canada.

Conflict of interest

None.

References

1. World Health Organization. Rabies. World Health Organization. http://www.who.int/rabies/en/.
2. Canada Food Inspection Agency. Rabies Program Adjustments April 2014. http://www.inspection.gc.ca/animals/terrestrial-animals/diseases/reportable/rabies/2014-03-31/eng/1396281140496/1396281190676.
3. North American Rabies Management Plan: A Partnership for Effective Management. 2008. https://www.aphis.usda.gov/wildlife_damage/oral_rabies/downloads/Final%20NARMP%209-30-2008%20(ENGLISH).pdf.

Outbreak of Elizabethkingia in Wisconsin

Source: Wisconsin Department of Health Services. ***Elizabethkingia anophelis* - USA (09): (Wisconsin) fatal, community acquired** - ProMED-mail post, http://www.isid.org. Date: Fri 8 Apr 2016.

The Wisconsin Department of Health Services (DHS), is currently investigating an outbreak of bloodstream infections caused by Elizabethkingia. The majority of patients are over the age of 65, and all have a history of at least one underlying serious illness. At this time, the source of these infections is unknown.

Case counts between 1 Nov 2015 and 6 Apr 2016:

Confirmed - 57
Under investigation - 1
Possible cases - 4
Deaths - 17

As a reminder regarding antimicrobial sensitivities of the outbreak strain: Although Elizabethkingia are multidrug-resistant bacteria, antimicrobial susceptibility testing (AST) conducted at Wisconsin clinical microbiology laboratories of recent isolates of Elizabethkingia demonstrated most of the isolates tested are susceptible to fluoroquinolones, rifampin, and trimethoprim/sulfamethoxazole. The medical literature suggests combination treatment with these agents may be more effective than monotherapy. Whenever possible, treatment should be guided by AST.

The organism was first characterized in 2011.

Confirmed cases of Elizabethkingia in western Michigan

Source: Detroit News (edited). ***Elizabethkingia anophelis* - USA (05): (Wisconsin, Michigan) fatal, community acquired** - USA ProMED-mail post, http://www.isid.org. Date: Fri 18 Mar 2016.

Health officials have confirmed that a western Michigan resident died after contracting a bloodstream infection matching a Wisconsin outbreak. The Michigan Department of Health and Human Services said Thursday, 17 Mar 2016, that it was notified 11 Mar 2016 by the CDC of the match. The person was described as an older adult with underlying health conditions. Officials were trying to determine where the infection was contracted.

In Wisconsin, 17 people with infections caused by Elizabethkingia bacteria have died since November (2015). The outbreak is the largest recorded in published literature, officials have said.

Wisconsin health officials said on their website earlier this week that the total number of reported cases stood at 54. Infections were centered in the heavily populated southeastern quarter of the state, including the Milwaukee area and surrounding suburban counties.

The bacterium is named for Elizabeth O. King, a CDC bacteriologist who studied meningitis in infants. The organism is common in the environment, including water and soil, but it rarely causes infections.

The Michigan case has the "same genetic fingerprint" as the ones in Wisconsin, CDC spokeswoman Melissa Brower told The Associated Press on Thursday, 17 Mar 2016. "We really don't know how this person in Michigan may have contracted it," Brower added. But "it shouldn't be assumed that this person has been in Wisconsin because it's the same geographic region" as Michigan, she said.

The majority of the Wisconsin patients infected are 65 or older with a history of at least one underlying serious illness, Wisconsin's health department said. Those who died all tested positive for the infection, but it's not known if Elizabethkingia caused or contributed to their deaths.

Human Rabies — Missouri, 2014

Source: Pratt PD, Henschel K, Turabelidze G, *et al*. **Human Rabies — Missouri, 2014**. MMWR Morb Mortal Wkly Rep 2016;65:253–256. DOI: http://dx.doi.org/10.15585/mmwr.mm6510a1.

On September 18, 2014, the Missouri Department of Health and Senior Services (MDHSS) was notified of a suspected rabies case in a Missouri resident. The patient, a man aged 52 years, lived in a rural, deeply wooded area, and bat sightings in and around his home were anecdotally reported. Exposure to bats poses a risk for rabies. After two emergency department visits for severe neck pain, paresthesia in the left arm, upper body tremors, and anxiety, he was hospitalized on September 13 for encephalitis of unknown etiology. On September 24, he received a diagnosis of rabies and on September 26, he died. Genetic sequencing tests confirmed infection with a rabies virus variant associated with tricolored bats. Health care providers need to maintain a high index of clinical suspicion for rabies in patients who have unexplained, rapidly progressive encephalitis, and adhere to recommended infection control practices when examining and treating patients with suspected infectious diseases… This case is the second case of human rabies in Missouri in 6 years; during this time, specimens from six humans were referred from the Missouri State Public Health Laboratory to CDC for antemortem rabies testing. In 2008, a male aged 55 years died of rabies in Missouri after being bitten on the ear by a bat; before this, the last Missouri rabies case was reported in 1959. During 2008–2011, a total of 11 human rabies cases were reported in the United States and Puerto Rico, including five cases with infections acquired overseas. Among the six domestically acquired cases, five were associated with bat variant rabies viruses; in three cases, a confirmed bat bite was reported. In Missouri, bats and skunks are principal reservoirs of rabies. Given that wild animals might not display obvious signs of rabies illness, it is important that, whenever possible, all bats and wild terrestrial carnivores implicated in a potential rabies exposure be euthanized and tested for rabies.

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