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Dog-bites, rabies and One Health: Towards improved coordination in research, policy and practice

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Abstract
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Dog-bites, rabies and One Health: 
Towards greater coordination in research, policy and practice

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Abstract

Dog-bites and rabies are neglected problems worldwide, notwithstanding recent efforts to raise awareness and to consolidate preventive action. As problems, dog-bites and rabies are entangled with one another, and both align with the concept of One Health. This concept emphasizes interdependence between humans and non-human species in complex socio-ecological systems. Despite intuitive appeal, One Health applications and critiques remain under-developed with respect to social science and social justice. In this article, we report on an ethnographic case-study of policies on dog bites and rabies, and we focus on a Canadian municipality that is widely recognized as a leader in animal-control policies. Our analysis suggests that current policies on rabies prevention may come at the expense of a ‘bigger picture’ for One Health. In that ‘bigger picture,’ support is needed to enhance coordination between animal-control and public-health policies. Such coordination has direct relevance for the well-being of children, not least Indigenous children in Canada.

Keywords

Rabies, dogs, injuries, children, Indigenous health, veterinary public health, relational coordination, science and technology studies, Canada
Dog-bites, rabies and One Health: Towards a coordinated agenda for research, policy and practice

Highlights

- Links rabies and dog-bite injuries together, as dog-related problems
- Advances discussions regarding equity in public health and One Health
- Emphasizes that animal-related threats have socio-economic components
- Calls for coordination across disciplines, sectors and levels of government
Introduction

In this article, we point to a need for inter-sectoral and multi-jurisdictional coordination with respect to rabies and dog-bites. In doing so, we build on the observation that the social sciences remain under-represented in the One Health literature (Friese & Nuyts, 2017), even as this journal has played leadership roles in elevating social science in research for One Health. In general terms, One Health refers to interdependence between humans and non-human species in complex socio-ecological systems (Zinsstag et al., 2012). *Social Science & Medicine* first published contributions regarding One Health in 2009 (Rock et al., 2009; Singer, 2009), and a One Health special issue appeared in 2015 (Craddock & Hinchliffe, 2015). That special issue focused on efforts to halt the spread of zoonotic infections, reflecting a trend in current applications and critiques of One Health (Friese & Nuyts, 2017).

The present article expands the scope of social science contributions to One Health scholarship, by considering dogs, rabies, human injuries, and public policies as entangled phenomena. In other words, none of these things truly exists as discrete entities or variables, such that ‘life is the ongoing, dynamic result of human and nonhuman interactions over time’ (Nading, 2013, 60). Dog-bites can spread rabies and other zoonoses; dog-bites routinely cause injury; and the risks for rabies and for dog-bites are unevenly distributed, largely due to policy influences.

By implication, policies addressing dogs, rabies and dog-bites as a One Health problem ought to complement one another. Below, we present an ethnographic case-study on this topic. By attending to the current situation in Canada, we seek to illustrate the value of relational coordination (Gittell, 2011) with respect to the tasks entailed in rabies prevention and dog-bite prevention. We also call for ontological coordination (Mol, 2002), so that professional practice
and information systems duly reflect overlapping risks within living systems (Hinchliffe & Whatmore, 2006). But first, we provide some background information on rabies and dog-related injuries.

**Background**

Under the auspices of the United Nation’s Millennium Development Goals, infectious diseases such as HIV, tuberculosis and malaria have dominated global health policies and programs. As the United Nations has sought to reorganise its activities around the recently-ratified Sustainable Development Goals, ‘neglected diseases’ are now firmly on the agenda (UN, 2015). Accordingly, the WHO (2016a) recently endorsed a plan to eliminate human cases of rabies by 2030. And yet, given that rabies is a zoonotic disease, such a plan cannot be effectively deployed without drawing upon the One Health concept and without attending to the multi-species entanglements that surround rabies.

One Health has intuitive appeal, but applications will never be straight-forward. To date, most One Health applications have targeted non-human species, so as to reduce the incidence of infectious disease in human populations (Friese & Nuyts, 2017). Prevention of infectious diseases in people is complicated enough, but insufficient, both practically and ethically. Hence we extend the distinction in public health between ‘mere prevention’ and ‘health promotion’ to One Health. Unlike most efforts to stop people from developing zoonotic infections, One Health promotion entails policy-guided programs and services to alter interactions throughout complex systems, for mutual benefit amongst humans and non-human species (Anonymous, 2015a; Anonymous, 2015b). That said, a series of challenges beset coordination across academic disciplines, professions and policy realms in efforts to promote One Health (Degeling et al., 2015; Hinchliffe, 2015; Rock et al., 2009).
In keeping with conceptualizing One Health promotion in terms of complex systems, the WHO (2016a) has recommended improved coordination for the sake of rabies prevention. More specifically, the WHO (2016a) has pressed for concerted efforts to improve access to post-exposure prophylaxis (PEP), but also to decrease reliance on PEP by expanding the reach of programs to vaccinate dogs against rabies. A related WHO (2015b) report has endorsed dog-bite prevention as essential to rabies prevention. This latter report endorsed educational interventions as well as veterinary services, specifically rabies vaccinations and sterilization surgeries, to help with dog population control – an approach that we reference throughout the analysis that follows, by considering rabies and dog-bite policies in Canada. Our approach to One Health promotion, however, explicitly attends to animal welfare along with social welfare (Anonymous, 2015a; Anonymous, 2015b).

The World Health Organization (WHO, 2013a) justifiably characterizes rabies as a ‘neglected disease of poor and vulnerable populations.’ Globally, more than 55,000 people die annually from rabies (Hampson et al., 2015; WHO, 2013a). Rabies deaths are gruesome, and children represent about 40% of these deaths (WHO, 2016a). Worse yet, deaths from rabies represent needless suffering due to a lack of political will to invest in rabies prevention strategies, given that ‘[r]abies elimination is feasible by vaccinating dogs’ (WHO, 2013a). The WHO takes this stance on prevention because dog-bites almost always account for rabies incidence in people. In fact, dog-bites account for more than 99% of all instances of human exposure to rabies (WHO, 2013a).

Each year, more than 15 million people worldwide receive PEP following dog-bites as a measure to prevent rabies (WHO, 2016a). Post-exposure prophylaxis (PEP) for rabies is efficacious (Crowcroft & Thampi, 2015; Hampson et al., 2015), yet PEP is not always available
or completed, especially in low-income and remote settings (Hampson et al., 2015). Besides the expense of PEP supplies, PEP administration is time-sensitive and time-consuming for professionals, patients and families. The WHO (2013b) recommends immediate cleansing of the wound followed by vaccine therapy, then administration of rabies immunoglobulin; current standards call for at least four intramuscular doses to be administered by a trained professional over a period of four weeks. Patients, families and providers may feel distress during the course of post-exposure risk assessment and PEP administration (Cleaveland et al., 2006), adding to the reasons why systematic vaccination of dogs against rabies is preferable to systematic reliance on PEP to prevent rabies in people (WHO, 2013a). Furthermore, unvaccinated dogs suspected of rabies exposure, as well as dogs whose vaccination status is uncertain, may be killed to prevent further spread of the disease. Ethical questions regarding animal welfare and culling are therefore relevant to rabies control (Cleaveland et al., 2006; Degeling et al., 2016).

The WHO (2015a) estimates that dog-bites account for injuries in the tens of millions, year after year. And as with rabies, most dog-bite victims are children (WHO, 2015a). In biomedicine, the term ‘injury’ refers to energy transfers in amounts or at rates that exceed the threshold for tissue damage (Baker et al., 1992, v; Haddon Jr, 1980). We acknowledge, however, that this way of thinking about injury downplays psychosocial impacts (Langley & Brenner, 2004), which can be profound in dog-bite threats or injuries (Boat et al., 2012; Boyd et al., 2004). Nevertheless, dog-bite surveillance is so rudimentary that the WHO (2015a) cannot report on the global incidence of injuries from dog-bites, never mind point to policies and scalable programs to prevent their occurrence. By public health surveillance, we mean the ‘systematic ongoing collection, collation and analysis of data and the timely dissemination of information to those who need to know so that action can be taken’ (Last, 2001, 174). Accordingly, the WHO
(2015a) recommends initiatives to ‘determine the burden and risk factors’ for dog-bites, to strengthen ‘emergency response services,’ and to promote ‘research…on effective prevention interventions and populations most affected.’

Even in countries such as Australia and Canada, where the infrastructures to support healthcare and public health are sophisticated, dog-bite surveillance and research remain under-developed (Ozanne-Smith et al., 2001). Preventive education is routinely recommended to lessen the incidence and impact of dog-bites (e.g., WHO, 2015b), but evaluations have tended to be small in scale. A systematic review of educational interventions targeting children and youth identified only two studies that met the inclusion criteria on research design (i.e., randomized controlled trials or controlled before-after studies); and neither study measured dog-bite incidence as an outcome (Duperrex et al., 2009). The authors concluded, ‘Education of children and adolescents should not be the only public health strategy to reduce dog bites and their dramatic consequences’ (Duperrex et al., 2009, 2). Policy research and reforms also deserve consideration (Ozanne-Smith et al., 2001).

Methodology

This article derives from an ethnographic approach to case-study research on public policy (Agar, 2006; Wedel et al., 2005). By ‘public policy,’ we mean ‘a formal decision or plan of action that has been taken by, or has involved, a state organisation’ (Richards & Smith, 2008, 1). More specifically, we report on research that aimed to distil best practices for promoting One Health via animal-control policies. By ‘animal control,’ we mean efforts to regulate interactions amongst humans and non-human animals within a defined territory (Aronson, 2010).

Three cities and five towns in the Canadian province of Alberta participated in our study. Under provincial legislation, municipal councils may adopt and enforce bylaws on domestic
animals (Anonymous 2013). (In some places, such as the United States, bylaws are called ‘ordinances.’) Author 1 and Author2 examined bylaws on dogs and related policy documents for each municipality in our study (Altheide, 1987). Next, Author2 observed and informally interviewed front-line officers (n=8) during regular shifts (i.e., ride-alongs), and then Author2 scheduled a series of in-depth interviews with front-line enforcement officers and managers (n=13) in these municipalities (Spradley, 1979). Author2 personally conducted all of these interviews and documented them in fieldnotes (Emerson et al., 1995). The formal interviews with front-line officers and managers were digitally recorded, and then Author2 transcribed these recordings verbatim in a naturalistic style (Poland, 1995).

The importance of inter-sectoral and multi-jurisdictional coordination emerged early on in our study. Of particular relevance to this article, a dog unexpectedly tested positive for rabies in the research setting. Agar (2006, 64) calls situations like these ‘rich points’ in because they serve as a ‘signal of a difference between what you know and what you need to learn.’ By taking this incident seriously and investigating further, we gained a deeper understanding of animal-control policies and their significance for public health.

To learn more about inter-sectoral and multi-jurisdictional coordination in relation to animal-control policies, we expanded our protocol in several ways that pertain to this paper. Author1 and Author2 collected and examined local, provincial, national and international policies regarding animal welfare, animal bites and rabies prevention; Author1 and Author2 conducted in-depth interviews with physicians specializing in public health and preventive medicine, who assess rabies risk following animal bites in Alberta (n=2); Author1 interviewed an animal-control officer with expertise in assessing dog behaviour and risk to public safety, alongside this officer’s supervisor (n=2); and together, Author1 and Author3 carried out in-depth
interviews with veterinarians who have played leadership roles in expanding access to veterinary services for low-income communities, locally as well as in northern Canada (n=5). In other manuscripts, Author1 and Author2 examine inter-sectoral and multi-jurisdictional coordination as a protective factor for occupational health and safety amongst officers who enforce animal-related policies. In this article, we emphasize coordination between animal-control and public-health policies. To do so, we focus on the City of Calgary, a municipality of about 1.3 million people and 120,000 dogs (Anonymous, 2013). This city has earned a national and international reputation for leadership in animal-control policies (Caulfield, 2011; City of Calgary, 2009; Parliament of Victoria, 2016).

Our analysis, which proceeded in tandem with data collection, crystallized insights through immersion in the research setting and in the dataset (Borkan, 1999). We used NVivo® to assist with organizing our dataset, and we refined our understanding iteratively within the research team and directly with participants (Spradley, 1979). In addition, Author2 presented and discussed emergent findings at three conferences attended by officers who enforce a variety of bylaws, including animal-control bylaws, throughout Alberta. As with all ethnographic research, we continually engaged in processes of comparison and contextualization (Agar, 2006). The concepts of ‘relational coordination’ and ‘ontological coordination’ enriched our comparisons and our appreciation for contextual characteristics. The literature on ‘relational coordination’ suggests that communication between people whose roles depend on one another should be frequent, timely, accurate, and problem-solving in orientation (Gittell, 2011). Hence ‘relational coordination’ entails interpersonal interactions alongside a high-level view on priorities and processes, as people use technologies to perform tasks (Gittell, 2011). This emphasis on technological and task integration resonates with Mol’s (2002) conceptualization of ‘ontological
coordination’ in modern medicine and epidemiology. Because similar problems take different
forms across settings, such as homes, hospitals, and even databases, ‘[t]he drawing together of a
diversity of objects…involves various modes of coordination’ (Mol, 2002, 83, emphasis added).
In contexts where ‘relational coordination’ and ‘ontological coordination’ are lacking, policies
may be misconceived, or misalignment may characterize policy implementation.

Findings and Context

Animal-control policies pertain to the promotion of One Health, especially in contexts
where their implementation explicitly seeks to improve both human and non-human lives.
Historically, local governments’ animal-control policies stem from struggles to prevent the
spread of infectious diseases, notably rabies, and to protect the animals themselves from harm
(Beers, 2006; Pemberton & Worboys, 2013). During the twentieth-century, as rabies and other
infections declined in Western countries, local governments redirected their animal-control
policies toward the threat of dog-bite injuries, as well as toward public nuisances associated with
dogs, including barking, fouling and roaming (Aronson, 2010). As a result, animal-control
policies increasingly focus on dog-owners and their behaviour (Borthwick, 2009). Put simply,
people undergo regulation through policies on their pets.

The City of Calgary exemplifies these international trends (Anonymous 2013;
Anonymous 2015; Anonymous 2017). ‘Responsible pet owner regulations are necessary to
balance an individual’s right to own a pet with the responsibility to ensure that the pet does not
become a nuisance or danger in the community,’ or so states the City of Calgary’s Responsible
Pet Ownership Policy (2006, 1). To ensure that domestic animals do not become a public
nuisance or threat, the ‘Calgary model’ for animal-control policy emphasizes four domains and
synergies amongst them: 1) licensing and identifying pets; 2) meeting the emotional and physical
needs of pets; 3) procuring pets ethically; and 4) providing veterinary services to pets, especially sterilization surgeries (Anonymous 2015). The City pursues these One Health objectives through its Responsible Pet Ownership Bylaw (2016 [2006]). Implementation, we have learned, extends to coordination with governmental and non-governmental organizations, including the Calgary Humane Society and Calgary Police Services. We point to a few such examples below. Yet as discussed below, despite the City of Calgary representing a ‘best-case scenario’ when it comes to One Health promotion at the local level, we found little evidence of coordination with authorities in public health.

*Animal-control policies and dog-bite prevention*

Under the Responsible Pet Ownership Bylaw, dog-bites as well as being chased or struck by a dog are offences (City of Calgary, 2016 [2006]). Rules like these are typical features of animal-control policies (Aronson, 2010). What is unusual is that animal-control officers in Calgary systematically investigate and then classify dog-aggression incidents by severity, with reference to a rubric known as the Dunbar (2016) scale.

In incidents involving multiple punctures, or worse, animal-control officers with specialized training then assess the offending dogs’ behavioural tendencies. And whenever these officers deem that dogs cannot be safely returned to their owners, City staff strive to rehome these animals. As explained by an animal-control officer who specializes in behavioural assessments,

So, I mean one of the options we give is that they can transfer ownership to the City. If I can place it, I will. And I can show you the back of my office door, it's all of them. We call them “blue survivors” because they have survived the blue juice. They should’ve died but the stars aligned. And we’re able to take the
Border Collie that bites little kids when he gets out and put him on a sheep farm.

He's just fine. And those are the success stories. So to be able to sit here and say
that to a dog owner, honestly that if I can home your dog properly, I'll do it.

[Intv#14032016_01]

Euthanasia orders are rare, and the City routinely refers owners of aggressive dogs to
certified trainers at the Calgary Humane Society.

Fear of dog-bites can fuel conflicts while also deterring active lifestyles, amongst dog-
owners and non-dog-owners (Toohey & Rock, 2011; Westgarth et al., 2014), to an extent that
detracts from the realization of One Health (Anonymous 2015b). Indeed, the lowest level on the
Dunbar (2016) scale refers to incidents in which a dog may growl, lunge or snarl, but without the
dog’s teeth coming into contact with the target’s skin (see also: Wrubel et al., 2011).

Furthermore, intimidating behaviour in dogs may presage dog-bites (WHO, 2016b).

Accordingly, City officers investigate complaints about intimidating dogs, not just dog-bite
complaints. For example, during a ride-along, an animal-control officer described a memorable
case involving an aggressive dog ‘at large’ [FN_10062015_01]. The incident eventually involved
the deployment of two animal-control officers, eight police cars (each staffed by two police
officers), and a police helicopter to track down the dog. After one of the animal-control officers
discharged a CO₂ cartridge (using a device that resembles a fire extinguisher), the dog ran back to
the owner’s yard. There, the animal-control officers were finally able to contain the dog.

Under its Responsible Pet Ownership Bylaw, the City (2016 [2006]) may fine owners,
between CAD$200 and CAD$2,000, following the confirmation of any dog-aggression incident
on the Dunbar (2016) scale. Systematic investigation of dog-aggression complaints and ticketing
appear to be effective in reducing dog-bite incidence (Clarke & Fraser, 2013), and in Calgary,
complaints about intimidating dogs have declined precipitously since the 1980s. At the same
time, the size of the human and dog populations have grown exponentially (Anonymous 2013).
Put another way, statistical support for the City’s approach to One Health promotion has
accumulated for more than a quarter of a century.

When investigating dog-related complaints, the City’s database on dog licenses often
assists with efficient tracing. The Responsible Pet Ownership Bylaw stipulates that all dogs must
be licensed, and compliance is remarkably high, at about 90% (Anonymous 2013). To encourage
citizens to purchase and renew pet licenses, the City reinvests the revenue in ways that promote
One Health. Examples include: returning dogs ‘at large’ to their rightful owners by driving them
home right away; operating a modern shelter to house impounded animals; rehoming impounded
animals; educating the public; and subsidizing sterilization surgeries for pets belonging to low-
income citizens. Such services may help in minimizing stress levels amongst dogs, ensuring that
dogs are placed in homes that are appropriate to their needs, improving public awareness of dog-
bite risks and reporting, reducing the number of unwanted puppies, and ensuring that all puppies
receive proper care and socialization. In these ways, the animal-control services subsidized by
licensing fees may help to prevent dog-bites from occurring (Anonymous 2015).

Even as animal-control policies may promote One Health and avert dog-bite injuries, the
City of Calgary’s comprehensive data on dogs and dog-bites have yet to be closely compared,
nor linked, with data from Alberta Health Services on dog-related injuries. Nonetheless, Alberta
Health Services systematically collects data on treatment for dog-bites in Calgary and throughout
the province. Such data can be used for population health assessment, due to public insurance for
healthcare. In a related project, members of our research group examined treatment records for
We unearthed substantial differences in utilization of emergency services across the province. For example, the utilization rate for dog-related injuries was 64/100,000 in Calgary, versus 90/100,000 in Edmonton. Nevertheless, these cities closely resemble each other in population size and socio-demographic profile. Such differences merit further investigation, for example, in relation to municipal animal-control policies and dog-bite investigations in the City of Calgary and the City of Edmonton, respectively.

Overall, not just in Calgary and Alberta but throughout Canada, dog-bite surveillance remains under-developed, which detracts from One Health. To begin, Canada lacks basic statistics on dog-bite incidence. Based on telephone surveys, the annual incidence of dog-bites in the United States has been estimated at 1.5% to 2% (Gilchrist et al., 2008; Sacks et al., 1996), and according to the Canada Safety Council (2005), ‘Our problem is likely as serious as that of our southern neighbour.’ Across Canada, 43 people died from injuries caused by dog-bites between 1980 and 2002, with an adjusted mortality rate of 0.05/100,000 amongst children 1-4 years old (PHAC, 2005). And in 2002-2003, the adjusted hospitalization rate due to dog-bites was 1.57/100,000 for the Canadian population and 5.87/100,000 amongst children 1-4 years old (PHAC, 2005). Up-to-date information on dog-bite mortality and hospitalizations are not publicly available.

Detailed data on dog-bite injuries sustained by people are available through from the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP). CHIRPP tracks injuries treated in the emergency departments from a selection of paediatric and general hospitals. Together, these hospitals serve as sentinel sites for the purposes of public health surveillance. To capture information about what the patient was doing when injured, what went wrong, and the setting, both emergency staff and patients (or their care-givers) complete 1-page
questionnaires. CHIRPP personnel then enter the responses into a multi-site database (PHAC, 2016). Despite continual updating, CHIRPP data on dog-bites have not been released for over a decade (PHAC, 2005).

Between 1990 and 2003, a total of 17,745 dog-related injuries were entered into CHIRPP (PHAC, 2005, 2). Of these, 13,921 (78.4%) were dog-bites; the remainder resulted from being struck by a dog (PHAC, 2005, 2). During this time, dog-bites accounted for more emergency visits to CHIRPP hospitals (n=4,333) than did ice-hockey injuries (n=3,198) amongst children between 5 and 9 years old (PHAC, 2005, 9). Over the last decade, paediatric injuries in ice-hockey have become research and prevention priorities across Canada (e.g., Emery et al., 2010; McKay et al., 2014), partly in relation to CHIRPP data (Macpherson et al., 2006), and to an extent that paediatric dog-related injuries have not. Whereas dog-bites rank within the top-10 causes of injury in children and youth (PHAC, 2005), a 2010 Delphi study on priorities to prevent injuries in Canadian children did not even mention dogs (Pike et al., 2010).

The lack of coordination between animal-control services and health services is particularly concerning for Indigenous children, who live with higher risks for dog-bites than do their peers in Canada. Indeed, a 2014 Delphi study identified dog-bites as a top-10 priority for injury prevention amongst Indigenous children in Canada (Pike et al., 2014). Participants in this Delphi study also ranked animal-control services as a top-10 priority due to their potential value for injury prevention, as well as for the prevention of rabies and other infections (Pike et al., 2014, Appendix).

The likelihood of being bitten by a dog appears to increase with latitude in Canada, and Indigenous people comprise a greater proportion of the human population in northern Canada than in southern Canada, notwithstanding the politics of Indigenous status in statistical portraits.
An analysis of dog-bite hospitalizations in Manitoba found a north-to-south gradient (Raghavan et al., 2014). Similarly, our recent analysis of dog-bites treated in emergency departments across Alberta found a north-to-south gradient (Anonymous 2016). In addition, Health Canada (2014) has flagged dog-bites as a key concern for Indigenous people in Alberta.

Whereas improved coordination between animal-control policies and public health in places like Calgary would entail stronger relationships amongst protagonists, and might eventually extend to data-sharing agreements, animal-control services are absent altogether in many northern and Indigenous communities throughout Canada. The lack of investment in animal-control services is long-standing and the negative impacts are far-reaching. For example, partly due to ‘hundreds of stray dogs,’ government officials determined that a particular Indigenous community in the Northwest Territories ‘was not an appropriate site for the development of a school’ in the 1960s (Davison & Hawe, 2012a, 217). In response, government officials authorized the construction of a school outside the Indigenous community. Today, that distance represents a barrier to student attendance and engagement, while also impacting inter-generational contact and family ties within the community (Davison & Hawe, 2012b). In the words of one elder,

The school being out of the community, you know being 13 km away, is quite difficult.

The kids leave in the morning, it is dark, they come back and it is dark and their life is in the school (cited in Davison & Hawe, 2012b, 69).

At the time of writing, our team is adapting ‘the Calgary model’ for One Health promotion in collaboration with local communities, charitable organizations, and governmental agencies in the Northwest Territories. This initiative reminds us that ‘the Calgary model’ reflects urban
sensibilities and pivots on the Western notion that people should regard pets simultaneously as private property and as tantamount to nonhuman persons (Anonymous 2013, Anonymous 2015b). One Health may have global reach as a concept, but in practice, One Health promotion hinges on local knowledge, suppositions, and contingencies.

Animal-control policies and rabies prevention

Dog-related injuries remain far more common than rabies exposure. Indeed, more people died from dog-bite injuries between between 1980 and 2002 alone (n=43) than have died from rabies since 1924 (n=24) in Canada (PHAC, 2005, 2011). Hence we have felt discouraged by the extent of resources available for rabies prevention, compared with dog-bite prevention. This disjuncture worries us because dog-bites remain the main vector of potential exposure to rabies in people. By implication, rabies policies tend to emphasize the prevention of human disease, rather than One Health promotion (Anonymous 2015a). More attention is being paid to protecting people from an infectious risk than to helping people to exercise a collective form of control over these risks, in accordance with their values. Nevertheless, the latter approach could augment well-being in a multitude of human and canine lives.

Throughout Canada, rabies is a reportable disease, and a federal agency must receive notification whenever rabies is suspected (Government of Canada, 1990 [2015], 1990 [2016]). Rabies investigations, however, fall under the jurisdiction of the provincial and territorial governments in Canada. As stated on its website, Alberta Health Services ‘provides follow-up for animal bites (dogs, cats, bats, and other animals) to make sure people don’t get rabies’ (2016, emphasis added). By implication, employees of Alberta Health Services do not aim to prevent dog-bites from occurring in future by collating ‘lessons learned’ in the process of rabies investigations. Moreover, Alberta Health Services does not operate a program to help ensure that
all dogs in the province receive rabies vaccinations, nor any other formal program to prevent
dog-bites. And in contradistinction to the ‘Calgary model’ for One Health promotion, which
explicitly melds canine and human well-being (Anonymous 2013a; Anonymous 2015b), Alberta
Health Services does not profess publicly to preventing rabies or unnecessary deaths in dogs.

Human exposure to the rabies virus has become uncommon in Canada, but vigilance is
still necessary. First, rabies remains endemic in several species of Canadian wildlife, notably
bats, racoons, skunks, and foxes (Tataryn & Buck, 2016). Whenever people report being bitten
by wildlife, public health authorities assess risk and, if warranted, they authorize PEP (Tataryn &
Buck, 2016). The significance of endemic rabies in wildlife for public health is illustrated by the
following example from Alberta. In 2007, a 73-old man died from rabies following a bat-bite
that occurred just outside Calgary (Johnstone et al., 2008). This individual did not seek medical
treatment until he became symptomatic, many months later. Contact-tracing identified nineteen
people at risk. They each received PEP, with the exception of a healthcare professional who
received booster injections to supplement prior vaccination (Johnstone et al., 2008).

A second reason for vigilance is that by coming into contact with wildlife, dogs may be
exposed to rabies (Tataryn & Buck, 2016). For example, the rabid bat whose bite ultimately
killed an Albertan near Calgary could have bitten someone’s dog, thereby exposing additional
people to rabies. In another Canadian example, drawn from southern Ontario, ‘two large dogs –
Lexus and Mr. Satan – got into a fight with a sick raccoon in the back of an animal services van’
(Casey, 2016). These dogs were inoculated and then quarantined as a matter of public safety
(Casey, 2016). This example from Ontario illustrates the pertinence of local governments and
their animal-control services for rabies prevention, along with dog-bite prevention.
A third reason for vigilance is that rehoming dogs may spread the risk of rabies. This risk is illustrated by a positive test result for canine rabies in Calgary, after a puppy was rehomed from northern Canada without being vaccinated against rabies (Mema et al., 2012). ‘The five-month-old puppy had come from Nunavut,’ CBC News (2013) reported. ‘Health officials say the incident is a good reminder to pet owners to keep vaccines up to date.’ A similar situation arose the following year, when a dog began exhibiting aggressive behaviour within an airplane bound for southern Canada (Curry et al., 2016). In both incidents, testing revealed the variant of rabies associated with Arctic fox (Curry et al., 2016; Mema et al., 2012).

In the Calgary incident, contact-tracing identified a total of 14 people who been in contact with the rabid puppy, and public health physicians determined that 8 of these contacts should receive PEP (Mema et al., 2012). The 8 contacts who received PEP included a veterinarian who had treated the puppy in Calgary (Mema et al., 2012). In addition, contact-tracing revealed that the rabid puppy had bitten an unvaccinated dog, whose owners opted for euthanasia over quarantining their pet for at least 6 months (Mema et al., 2012). Public health officials devised a communication strategy and handled media inquiries (Mema et al., 2012). This communication strategy did not include the City of Calgary and its animal-control managers, to the best of our knowledge. Indeed, media coverage of this incident did not quote animal-control managers, despite advising that off-leash dogs were at some risk for exposure to rabies from wildlife, such as bats (CBC News, 2013). Yet, dog-leashing rules and off-leash dogs in public parks fall under municipal animal-control policies, and both receive attention in the City of Calgary’s Responsible Pet Ownership Bylaw (2016 [2006]).

We interviewed the public health physician who led contact-tracking in Calgary, who reflected on the experience:
For a dog to have rabies is really not news. For a dog to have rabies in Alberta, it
is news. But the rescue piece, right, like this is a problem somewhere else, and
now we are seeing this welfare [issue] – animal welfare groups bringing dogs into
here. [Intv#04082015_01]

As implied by this quote, exposure to rabies is a daily possibility in northern Canada. There,
doctors tend to spend their lives outdoors, and contact with rabid wildlife is a perennial possibility.
In remote communities where veterinary services are inaccessible, which is the situation for most
of northern Canada, the federal government has waived the stipulation that rabies vaccination
must be performed by a licensed veterinarian (Curry et al., 2016). Nevertheless, uptake is far
from optimal.

For instance, when Calgary-based veterinarians began offering outreach clinics in a
handful of remote communities in the Northwest Territories, only 37% of the treated dogs had
previously received the rabies vaccine (Brook et al., 2010, 1120). Furthermore, these dogs
disproportionately belonged to professionals from southern Canada, such as teachers. Recently,
public health officials contacted the veterinarian who has spearheaded these outreach clinics,
after a rabid fox had been sighted near one of the communities. This veterinarian confirmed that
an exposed dog’s rabies vaccination was up to date. As a result, the dog’s life was spared, to the
relief of all concerned [FN#20161125_01]. This example highlights that rabies vaccinations not
only prevent the spread of rabies, but also the killing of dogs, and concomitant distress in people.
Hence policies and programs that enable widespread vaccination of dogs against rabies represent
instances of One Health promotion.

With respect to Canadian policy on rabies, representatives from multiple levels and
sectors of government, together with representatives from non-governmental organizations,
collectively developed a management plan that was released in 2009 (Tataryn & Buck, 2016). To incorporate some recent changes in federal policy along with ‘lessons learned’ about multi-jurisdictional coordination (Curry et al., 2016), an expert panel is revising Canada’s management plan for rabies (Tataryn & Buck, 2016). The key point is that despite low risk to humans in most places throughout Canada, any legitimate threat of rabies triggers coordination amongst officials and official records (as per Gittell, 2011; Mol, 2002). Nonetheless, these coordinated responses do not consistently involve local governments and their animal-control services.

In future, public health responses to rabies in the Calgary area might benefit from coordination with the City in contact-tracing as well as in strategic communications. Recall that 90% of all dogs in Calgary have been registered with the City, which means that the City maintains descriptive information for all these dogs along with mailing addresses and contact information for their owners in a searchable database. The City already uses this database to educate dog-owners about its *Responsible Pet Ownership Bylaw* and dog-bite prevention (Anonymous 2013). Furthermore, news stories concerning off-leash dogs and other dog-related issues in Calgary frequently cite animal-control managers, as a matter of public education (Anonymous 2015).

At the same time, local governments might do more to help in ensuring that all dogs receive vaccinations for rabies and other serious infections. Like many local councils (Aronson, 2010), the City of Calgary charges less to license sterilized dogs than to license intact dogs (2016 [2006]). The City also uses licensing revenue to subsidize veterinary sterilization of pets belonging to low-income owners (Anonymous, 2013). The City could consider extending such incentives and subsidies to vaccinations.
Discussion

Our ethnographic study of local governments paid close attention to the City of Calgary, as a ‘model city’ for animal-control policy and services. We sought to place this local governments’ contributions in the broader context of policies that could promote One Health. Rather than sterling examples of One Health promotion through inter-sectoral and multi-jurisdictional coordination, we found heavy reliance on PEP for rabies prevention, a weak commitment to systematic vaccination of dogs against rabies, and a relative neglect of dog-bites with respect to policy and practice within public health. Neglect of dog-bites and incomplete vaccination of dogs against rabies is particularly problematic in northern Canada, where residents tend to be Indigenous (Pike et al., 2014). Communities in northern Canada also face daunting challenges in recruiting, training, retaining and accessing personnel to assist them with the prevention of both rabies and dog-bites (Brook et al., 2010). Partly as a result, we noted movements of dogs to the south for rehoming, and movements of veterinary professionals to the north to help with animal-control and public-health mandates. These observations reflect documented trends (Brook et al., 2010; Curry et al., 2016).

Poor coordination with respect to rabies and dog-bites may stem partly from conceptualizing these problems in linear cause-effect terms, rather than as complex socio-ecological systems characterized by multi-species entanglements. Accordingly, to follow Mol (2002), dog-bites do not tend to ‘cohere’ with rabies in statistical portraits, nor in policy statements, nor in practical interventions stemming from policy statements. Furthermore, treating rabies and dog-bites as discrete problems extends into asymmetrical surveillance. Rabies prevention commands far more attention and resources than dog-bite prevention, even though these problems are inextricably linked in actual lives.
Based on participant-observation, interviews and policy-related statements in the Canadian context, we found evidence of relational coordination (as per Gittell, 2011) in assessing rabies risk and in administering PEP, but not in extending rabies prevention to encompass dog-bite prevention as a broader concern for One Health promotion. Rabies prevention and dog-bite prevention are separate enterprises – both organisationally and as institutional practices. Our research has led to speculations about ways to strengthen responses to dog-bites in research and policy, but our study did not involve quantifying relational coordination, nor concerted efforts to improve relational coordination (Gittell, 2011). That said, we believe that research and interventions to enhance policy alignment and task integration between animal-control and public-health services should be pursued.

**Conclusion**

Overall, we find that public health surveillance is lacking for dog-bites in Canada. Given the extent of resources that are already invested in rabies surveillance, and the potential for interventions targeting dog-bites to reduce reliance on PEP and associated costs for patients, providers and systems, we recommend that preventive programs for rabies should encompass vaccination of dogs as well as dog-bite prevention. Greater coordination is urgently needed to reduce the negative impacts of both dog-bites and rabies, especially in disadvantaged communities.
References Cited


Dog-bites, rabies and One Health: Towards a coordinated agenda for research, policy and practice


