An Advisory Committee Statement (ACS)
National Advisory Committee on Immunization (NACI)

Updated guidance on the assessment of exposure to a potentially rabid animal

PROTECTING AND EMPOWERING CANADIANS TO IMPROVE THEIR HEALTH

Public Health Agency of Canada
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Canada

TO PROMOTE AND PROTECT THE HEALTH OF CANADIANS THROUGH LEADERSHIP, PARTNERSHIP, INNOVATION AND ACTION IN PUBLIC HEALTH.

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Preamble

The National Advisory Committee on Immunization (NACI) is an External Advisory Body that provides the Public Health Agency of Canada (PHAC) with independent, ongoing and timely medical, scientific, and public health advice in response to questions from PHAC relating to immunization.

In addition to burden of disease and vaccine characteristics, PHAC has expanded the mandate of NACI to include the systematic consideration of programmatic factors in developing evidence-based recommendations to facilitate timely decision-making for publicly funded vaccine programs at provincial and territorial levels.

The additional factors to be systematically considered by NACI include: economics, ethics, equity, feasibility, and acceptability. Not all NACI statements will require in-depth analyses of all programmatic factors. While systematic consideration of programmatic factors will be conducted using evidence-informed tools to identify distinct issues that could impact decision-making for recommendation development, only distinct issues identified as being specific to the vaccine or vaccine-preventable disease will be included.

This statement contains NACI's independent advice and recommendations, which are based upon the best current available scientific knowledge. This document is being disseminated for information purposes. People administering the vaccine should also be aware of the contents of the relevant product monograph. Recommendations for use and other information set out herein may differ from that set out in the product monographs of the Canadian manufacturers of the vaccines. Manufacturer(s) have sought approval of the vaccines and provided evidence as to its safety and efficacy only when it is used in accordance with the product monographs. NACI members and liaison members conduct themselves within the context of PHAC's Policy on Conflict of Interest, including yearly declaration of potential conflict of interest.

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1. Context

In 2018, the World Health Organization (WHO) issued updated recommendations on rabies pre-exposure prophylaxis (PrEP) and post-exposure prophylaxis (PEP)[1]. This prompted Canada, as well as other countries, to re-assess rabies recommendations for their jurisdiction. On January 30, 2026, the National Advisory Committee on Immunization (NACI) released updated guidance on the use of rabies vaccine for pre-exposure prophylaxis (PrEP) along with PEP guidance for those who have previously received PrEP or at least one dose of rabies vaccine. The updated rabies PrEP statement also provides background information on rabies, rabies vaccines, and rabies epidemiology in animals and humans.

The purpose of this NACI Advisory Committee Statement is to present the collaborative work of the NACI Rabies Working Group and its Risk Assessment Subgroup in order to provide updated guidance on the assessment of exposure to a potentially rabid animal (i.e., whether and when to offer PEP). This NACI Statement does not address PEP regimens which will be reviewed in future NACI work. Current recommendations for PEP schedules and administration are outlined in the Rabies vaccines chapter of the Canadian Immunization Guide (CIG).

2. Introduction

Assessing the risk of an exposure to a potentially rabid animal is context-specific and requires collaborative decision-making amongst clinicians, public health officials and the person who was exposed, and may include consultation with a veterinarian to assess the animal. This statement provides a framework of factors to consider when conducting a risk assessment to inform whether and when to offer rabies post-exposure prophylaxis (PEP). It also offers recommendations and considerations for exposures to specific animal species and for specific situations. The framework, recommendations and considerations are based on deliberations by NACI and its Rabies Working Group and Rabies Risk Assessment Subgroup. Discussions by these groups were informed by an evidence review of specific research questions which are outlined in Appendix A. Jurisdictions can use this framework to create standardized recommendations for conducting risk assessments that account for their local/regional context (e.g., local rabies epidemiology, access to veterinary care, timeliness of animal rabies testing results).

The assessment of exposure to potentially rabid animals requires a One Health approach, with strong collaboration among those managing the exposed person (e.g., public health officials and clinicians) and those managing the animal (e.g., veterinarians and animal control officials). In addition to local animal rabies epidemiology, context-specific factors may affect jurisdictions in distinct ways (e.g., limited rabies surveillance; presence of free-roaming dogs; limited access to care for exposed people; limited access to veterinary

services; logistical challenges related to animal rabies testing). Integrating human, animal, and context-specific perspectives supports culturally safe, community-adapted responses to exposures to potentially rabid animals.

Note: This framework is focused on the risk assessment of animal exposures and does not address the risk assessment of human-to-human exposures or exposures in laboratory settings.

3. Framework for the assessment of exposure to a potentially rabid animal

3.1 Overview and risk assessment framework tables

A risk assessment should be conducted every time a human has been exposed to a potentially rabid animal in order to determine the appropriate management, including determining whether and when rabies post-exposure prophylaxis (PEP) is indicated. In evaluating each case of potential rabies exposure, local public health officials should be consulted as per provincial/territorial policies. The risk assessment should consider factors related to:

- the animal,
- local rabies epidemiology,
- the exposure, and
- the exposed person.

These factors along with additional considerations are outlined in Table 1a for mammals other than bats and Table 1b for bats.

When conducting a risk assessment, it is helpful to consider that the risk of rabies transmission to humans is the probability of several factors multiplied together, including the probability that:

- the animal has rabies (considering factors such as the species, including whether it is a domestic pet, stray animal or wildlife; local animal rabies epidemiology; the behaviour and history of the animal, including vaccination history if applicable);
- the animal is in its communicable period (which may vary by species); and
- the exposure was sufficient to transmit the virus and result in infection.

Although the above probabilities may not be known for certain, the closer one or more of these probabilities is to zero, the lower the risk of developing rabies from the animal exposure. There are two accepted methods to rule out that an animal was able to transmit rabies at the time of a human exposure: 1) a negative rabies test result from an appropriate animal specimen using World Organisation for Animal Health (WOAH)[2] and

World Health Organization (WHO)[3] recommended tests; or 2) observation of dogs, cats, and ferrets for 10 days after the exposure to ensure they remain alive and neurologically appropriate (i.e., normal or unchanged from their usual neurologic status). A 14-day observation period for livestock is also recommended in this document. This recommendation is a conservative extrapolation from the 10-day recommendation for dogs, cats and ferrets, and is supported by limited experimental evidence showing that the earliest infected livestock had rabies virus in their saliva was two days before onset of signs of rabies (refer to Appendix A, A.3.2 for additional details).

The risk assessment should be conducted as soon as possible after the exposure, and if PEP is determined to be indicated, it should be initiated as soon as possible, avoiding unnecessary delays. If reporting of the exposure is delayed, a risk assessment should still be conducted, as in rare instances the incubation period for rabies has been prolonged[4-8] (with 2 to 3% of cases having an incubation period of more than one year, based on information from the World Health Organization[3]) and it is possible that PEP may still be of benefit despite the delay.

Tables 1a and 1b: Frameworks for the risk assessment of exposure to potentially rabid animals

Tables 1a and 1b provide an overview of the factors to consider when conducting a risk assessment to determine whether and when to offer rabies post-exposure prophylaxis (PEP). Table 1a provides factors to consider for mammals other than bats, while Table 1b provides factors specific to bats. The tables and accompanying text are guides for management and do not replace clinical judgment. Please consult the Rabies vaccines chapter of the Canadian Immunization Guide for details on the rabies PEP regimens recommended by NACI. Please consult Section 7.3 for specific information on exposures occurring outside of Canada.

Table 1a: Framework for the risk assessment of exposure to mammals other than bats

Factors	Considerations	Further details
Animal		
Type of animal	Only mammals are capable of transmitting rabies Recommendations vary depending on the type of mammal, including for: • Dogs, cats and ferrets • Livestock • Rodents and lagomorphs • Other wild mammals (reservoir species and non-reservoir species) and exotic mammals	• Animals that are not mammals are not a risk for rabies transmission • Reservoir species[a] (in Canada these include bats, foxes, raccoons and skunks) pose a higher risk for transmission of rabies than other wild mammals • Small rodents and lagomorphs are unlikely to have rabies as they are often killed by larger animals that could have transmitted rabies to them Refer to the Section 6: *Recommendations and considerations regarding exposures to specific types of animals* for additional details
History of the animal *Note that the history of the animal may not be available in some circumstances, such as if it is a wild animal, stray animal or the owner is not known*	Consider the following regarding the history of the animal (if known): • Origin and travel history of the animal • Outdoor activities and whether the animal is alone or with a person while outdoors • Known encounters with potentially rabid animals • Vaccination status (licensed vaccines are available for dogs, cats, ferrets, horses, cattle and sheep)[b]	Higher risk if the animal: • Originated from, traveled to or lived in an area with higher rates of animal rabies in the 6 months prior to the exposure • Spends time outdoors unattended, including stray or free-roaming dogs or feral cats • Has had a known encounter with a mammal that could transmit rabies • Is unvaccinated, was vaccinated outside of North America, was vaccinated in an off-label manner, or was not up-to-date with rabies vaccination (as per the label instructions of their most recent vaccine) throughout the 6 months preceding the exposure
Behaviour of the animal	Is the animal behaving normally or unusually?	• Behaviour changes can be assessed in dogs, cats, ferrets and livestock which are owned/known to people • Behaviour of the animal can be challenging to assess for wildlife
Provocation	Did the person provoke the animal or was the exposure unprovoked? Provocation can include when a person: approaches the animal; attempts to feed the animal; enters into the animal's space; startles the animal; comes between the animal and its offsprings, food, toys or other valued items, or their owner or the owner's family	• An unprovoked exposure may suggest that the animal is abnormally aggressive which could be due to it having rabies • A provoked exposure does not rule out the possibility that the animal is rabid
Availability of the animal for observation and/or testing	Is the animal available for observation and/or testing?	• For dogs, cats and ferrets, it is widely accepted that animals that are alive and neurologically appropriate (i.e., normal or unchanged

Factors	Considerations	Further details
Note that the animal may not be available for observation or testing in some circumstances, such as if it is a wild animal, stray animal or the owner is not known	Observation periods are as follows and are only recommended if the animal appears neurologically appropriate (i.e., normal or unchanged from their usual neurologic status): • 10 days for dogs, cats and ferrets • 14 days for cattle, horses, sheep, goats and pigs For other animals for which a reliable observation period has not been defined (as per above), if the animal is available and a potential rabies exposure has occurred based on the risk assessment, public health officials and a veterinarian (if available) should be consulted. If deemed necessary, the animal should be euthanized and the appropriate specimen should be submitted for testing.	from their usual neurologic status) at the end of the 10-day observation period were not infectious at the time of the exposure • For livestock (i.e., cattle, horses, sheep, goats and pigs), the 14-day observation period is a conservative extrapolation from the observation period for dogs, cats and ferrets, and is supported by limited experimental evidence showing that the earliest infected livestock had rabies virus in their saliva was two days before onset of signs of rabies. • A negative rabies test result from an appropriate animal specimen using World Organisation for Animal Health (WOAH)[(2)] and World Health Organization (WHO)[(3)] recommended tests is very accurate at ruling out that an animal was able to transmit rabies at the time of the exposure For additional details, refer to Section 6: *Recommendations and considerations regarding exposures to specific types of animals* See Section 5: *Submission for animal rabies testing* for additional information on how to submit a specimen for testing
Rabies epidemiology in animals relative to where the exposure occurred or where the animal has been in the prior 6 months Refer to Section 3.2: *Additional epidemiologic considerations when conducting a risk assessment* for additional information, including the importance of considering the extent and type of surveillance to support understanding of animal rabies epidemiology in the area		
Species	What is the epidemiology of rabies in the species of animal that caused the exposure? Only mammals are capable of transmitting rabies.	• Bats, foxes, skunks and raccoons are reservoir species[a] for the rabies virus in Canada • Rabies epidemiology for skunks, foxes and raccoons varies across the country (see Section 3.3 *Sources of information about animal rabies epidemiology in Canada*). Other mammals can become infected by reservoir species, therefore the rabies epidemiology of all species of mammals in the geographic area needs to be considered • Bats, which can be infected with rabies in all parts of Canada, can infect other mammals, although spread of bat strains of rabies among other mammals and from other mammals to humans is very rare • Small rodents are very unlikely to have rabies as they will generally be killed by the attack from the rabid animal
Geographic area	**For domestic animals:** How likely is rabies to be circulating where the human exposure occurred or where the animal has been during the prior 6 months (if this type of information is available from the owner/caregiver)? **For wild animals:** How likely is rabies to be circulating in the geographic area where the human exposure to the animal occurred?	• It is important to assess the rabies epidemiology in surrounding areas, as well as the local area • If no local/regional information on animal rabies epidemiology is available, the possibility of rabies needs to be considered, along with information from surrounding areas and historical information
Time period since last animal rabies case	When were the last animal rabies cases identified?	Assuming sufficient surveillance, the longer the period where no animal rabies has been detected, the lower the risk that an animal involved in an exposure will have rabies. However, it is important to note that

Factors	Considerations	Further details
		introduction of rabies infected animals can occur at any time and may go unrecognized for some time
Quantity of rabies infected animals	What is the number and percent of submitted animals that have tested positive for rabies over time?	Assuming sufficient surveillance, the lower the number of animals that have tested positive and the lower the percent positivity in the area, the lower the risk that an animal involved in an exposure will have rabies. However, it is important to note that introduction of rabies infected animals and/or spread among rabid animals may go unrecognized for some time
Exposure		
Type of exposure	Exposure events that may transmit rabies virus from mammals other than bats are classified as either bites or non-bites[c] with the following exposures considered to pose a risk: • Bites; • Scratches from teeth; • Contamination of an exposed person's open wounds or mucous membranes with saliva or neural tissue/fluid from the animal. Scratches from claws would only pose a risk of rabies if the wound is contaminated by saliva or neural tissue/fluid from the animal	• Rabies virus is transmitted from exposure to saliva or neural tissue/fluid of an infected animal • Most rabies cases result from bite exposures, with cases of rabies much less frequently attributed to other types of exposures • Petting a rabid animal or handling its blood, urine or feces are not considered exposures, however such contact should be avoided. Being sprayed by a skunk is not considered an exposure
Location of the exposure on the body	The location of exposure on the body does not determine if rabies PEP should be offered, but rather can influence whether and how long it is reasonable to wait before initiating rabies PEP while investigating the exposure incident	• Exposures (as defined by "*Type of exposure*" in the row above) anywhere on the body can result in rabies • Exposures in highly innervated areas (i.e., head, neck, hands) require more rapid intervention, which may need to be initiated in advance of locating an escaped animal and/or while awaiting animal rabies test results
Severity of the wound(s)	Severity of the wound(s) is based on the number, size and depth of the wounds The severity of the wound(s) can influence whether and how long it is reasonable to wait before initiating rabies PEP while investigating the exposure incident	• More severe wounds could possibly be an indication that the animal was abnormally aggressive, which could be caused by onset of clinical rabies • Wounds of any severity can result in rabies infection. However, more severe wounds could result in more virus at the wound site(s) and reduced ability to mechanically remove the virus via wound flushing, and therefore may require more rapid initiation of PEP, which may need to be started in advance of locating an escaped animal and/or while awaiting rabies test results from the animal. Severe bites, particularly to the head, neck or hands, may warrant initiation of PEP even if the dog, cat, ferret or livestock is being placed under observation
Exposed person[d]		
Reliability of the history	The age, cognitive status, and other factors related to the exposed person may impact the reliability of the exposure history	• The history obtained from a child may be difficult to interpret and may be unreliable

Factors	Considerations	Further details
		• Assessment of the exposure may also be complex if a person has either sensory or cognitive impairment (either chronic or temporary) that affects their ability to assess or communicate if an exposure has occurred (e.g., intoxication, dementia)

[a] A reservoir species means that specific rabies variants can transmit among these animals

[b] Animal rabies vaccines licensed for use in Canada are known to be very effective when used according to the label instructions. Up-to-date vaccination given according to the manufacturer's instructions decreases, but does not eliminate, the risk of rabies in an animal. A list of animal rabies vaccines authorized in Canada can be found on the *Veterinary biologics licensed in Canada* webpage. Leave all the fields as "Select All" and click "Submit" and then on the next screen, enter "rabies" in the "Filter items" field.

[c] Other non-bite, non-bat exposures that rarely have caused rabies include organ transplantation and aerosol transmission in laboratories, but these exposure events are beyond the scope of this risk assessment guidance which is focused on animals as the source (not human source exposures or laboratory settings)

[d] Whether the individual is immunocompromised or taking chloroquine or hydroxychloroquine or has previously received rabies vaccination does not affect whether or when to offer rabies PEP but may affect the rabies PEP regimen. Refer to the Rabies vaccines chapter of the Canadian Immunization Guide for information on PEP regimens.

Table 1b: Framework for the risk assessment of exposure to bats (see Section 6.2 for additional details on the risk assessment for bat exposures). Please consult Section 7.3 for specific information on exposures occurring outside of Canada.

Factors	Considerations	Further details
Animal		
Type of animal	Bats are a reservoir species[a] for rabies. All bats found in Canada can be infected with and transmit rabies	The proportion of rabies in tested bats is approximately 5% or more
Availability for testing	The most accurate way to rule out rabies in a bat is a negative rabies test result from an appropriate specimen using World Organisation for Animal Health (WOAH)[(2)] and World Health Organization (WHO)[(3)] recommended tests	If a bat has been involved in a human exposure (see *"Type of exposure"* below) and is available, the bat should be euthanized and the whole bat should be submitted for testing[b] (see Section 5: *Submission for animal rabies testing*).
Rabies epidemiology in animals relative to where the exposure occurred		
Geographic area	All bats found in Canada can be infected with and transmit rabies	
Exposure		
Type of exposure	Exposure to a bat is defined as: • Direct contact between a person and a live bat, or, much less commonly, when saliva or neural tissue/fluid from the bat enters into an open wound or mucous membrane • Direct contact with a bat is defined as a contact between human skin and a live bat (i.e., a bat touching or	Even very minor or transient direct contact between a person's skin and a live bat is considered an exposure warranting intervention (i.e., testing of the bat and/or PEP) because bites inflicted by bats may not be felt and may leave no visible bite marks When a bat is found in a room with a person, including a sleeping person, this is only considered an exposure if it meets the exposure

Factors	Considerations	Further details
	landing on a person, or a person touching a live bat)[c]	definition (see left column), such as if there has been direct contact with the bat See Section 6.2 for additional details on bat exposures, including on a bat found in a room See Section 7.1 for additional details on exposure to dead mammals, including dead bats
Location of the exposure on the body	The location of exposure on the body does not determine if rabies PEP should be offered, but rather can influence whether and how long it is reasonable to wait before initiating rabies PEP	PEP for bat exposures should generally begin as soon as possible after an exposure. In some circumstances NOT involving the head, neck or hands, if the bat has been sent for rabies testing, the health care provider may decide to delay PEP by not more than 48 hours from the time of exposure while waiting for test results
Exposed person[d]		
Reliability of the history	The age, cognitive status, and other factors related to the exposed person may impact the reliability of the exposure history	• The history obtained from a child may be difficult to interpret and may be unreliable • Assessment of the exposure may also be complex if a person has either sensory or cognitive impairment (either chronic or temporary) that affects their ability to assess or communicate if an exposure has occurred (e.g., intoxication, dementia)

[a] A reservoir species means that specific rabies variants can transmit among these animals

[b] If a domestic animal has been exposed to a bat, the bat should be euthanized and submitted for testing unless, in consultation with a veterinarian, suitable post-exposure management can be implemented for the exposed domestic animal

[c] Rarely rabies has resulted from suspected aerosol exposures in caves with infected bats living in high density populations

[d] Whether the individual is immunocompromised or taking chloroquine or hydroxychloroquine or has previously received rabies vaccination does not affect whether or when to offer rabies PEP but may affect the rabies PEP regimen. Refer to the Rabies vaccines chapter of the Canadian Immunization Guide for information on PEP regimens.

3.2 Additional epidemiologic considerations when conducting a risk assessment

3.2.1 Epidemiology of animal rabies

There are a number of rabies virus variants (strains) (e.g., canine, skunk, fox, raccoon and bat rabies variants) that circulate long-term within their respective reservoir host populations. Spillover of these variants to other mammals, including humans, can occur[9]. In Canada, bats, skunks, foxes, and raccoons are the main reservoirs of rabies virus[10]. People in Canada can be exposed to rabies from infected reservoir animals or other mammals (e.g., dogs, cats, cattle) that have been infected by a reservoir species, including animals moving from other locations in Canada or, in rare situations, from an imported animal infected with rabies in its country of origin. Canine rabies virus variants, which are the predominant variants found in dogs in other parts of the world and are responsible for most human rabies cases globally, have been eliminated from Canada and the United States [11].

Only mammals can transmit rabies, therefore rabies is not a risk from non-mammals such as birds, snakes, fish, turtles, lizards and insects. While any mammal can be infected with rabies, rabies in small rodents and lagomorphs is rare as these animals are likely to be killed during the encounter with a larger animal that could transmit rabies to them. Human rabies has not resulted from consumption of raw meat[1]. Infectious virus has not been isolated from milk of infectious cows and raw milk has not been associated with any human cases of rabies[1]. Being sprayed by a skunk is not considered a rabies exposure.

3.2.2 Importance of surveillance in understanding animal rabies epidemiology

When conducting a risk assessment in mammals other than bats, the factors to consider are outlined in Table 1a. The epidemiology in the area where the exposure occurred (and also where the animal has been in the 6 months prior to the human exposure, if known) are important factors in the risk assessment. However, in assessing the local epidemiology it is important to consider the extent of surveillance for animal rabies. If no local/regional information on animal rabies epidemiology is available, the possibility of rabies needs to be considered along with information from surrounding areas and historical information. It is also important to understand the reasons animals are sent for rabies testing. Animals are primarily sent for rabies testing following exposure of humans and/or pets resulting in opportunistic/non-targeted testing, which may result in under-representation of wildlife. However, in some areas there may be targeted wildlife surveillance or specific rabies research projects that result in a more fulsome understanding of the epidemiology of rabies in wildlife in the area.

3.2.3 Additional factors regarding animal rabies epidemiology that may impact the risk assessment

As outlined in Table 1a, factors regarding animal rabies epidemiology, including the extent and type of surveillance in the area, need to be considered in the risk assessment for exposures to mammals other than bats. Additional factors for consideration include:

1) The possibility that there have been changes to local epidemiology (e.g., recent incursions) that have not yet been detected.
2) The possibility that the animal involved in the rabies exposure was not from the area where the exposure occurred (e.g., was recently translocated from an area with different rabies epidemiology, either intentionally or unintentionally).
3) The possibility that other mammals can become infected with a bat variant of rabies virus (as bats in all areas of Canada can carry the rabies virus) that could potentially result in transmission to humans, although transmission of bat variants from other mammals to humans has only been documented in rare instances and never in Canada (Refer to Appendix A, A.3.1 for additional details).

3.3 Sources of information about animal rabies epidemiology in Canada

The following sources may be used to inform assessments of the animal rabies epidemiology in the area in Canada where an exposure occurred and/or where the animal has been in the 6 months preceding the exposure (if known):

- The Canadian Food Inspection Agency (CFIA): Rabies in Canada
- Government of Canada, Rabies: For health professionals. Map of distribution of rabies variants in Canada
- Provincial/ territorial resources:
    - Alberta
    - British Columbia
    - Manitoba
    - New Brunswick
    - Newfoundland and Labrador
    - Northwest Territories
    - Nova Scotia
    - Nunavut
    - Ontario
    - Prince Edward Island
    - Quebec
    - Saskatchewan
    - Yukon

- Some provinces and territories also have designated consultants to assist with the risk assessment process who will be very familiar with the rabies epidemiology in their jurisdiction.
- Public health officials can obtain detailed information on rabies in Canada by subscribing to the Rabies Surveillance System on the Canadian Network for Public Health Intelligence (CNPHI).

4. First Nations, Inuit and Métis communities

A One Health approach is especially salient when working with First Nations, Inuit, and Métis communities as it broadly aligns with key Indigenous worldviews through its integrated focus on human, animal, and environmental health. Given the unique contextual challenges Indigenous communities experience across jurisdictions, it is essential to support community-led approaches. In some communities, challenges are directly related to the presence of free-roaming dogs, while in others, disproportionate emphasis on this issue, unsupported by epidemiological evidence, inadvertently perpetuates harmful stereotypes[12].

Program implementation warrants additional awareness to support cultural safety and prevent stigmatization. As guidance continues to evolve, Indigenous perspectives need to be integrated at all stages of the development process to address the ongoing impacts of colonization and systemic racism, and to advance Truth and Reconciliation by meeting Calls to Action. Autonomous decisions should be made by Indigenous Peoples with the support of culturally safe public health and health care partners in accordance with the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP)[13].

5. Submission for animal rabies testing

For animals requiring rabies testing, the animal should be humanely euthanized in a manner that does as little damage to the brain as possible and the appropriate specimen(s) should be submitted to a Canadian Food Inspection Agency (CFIA) rabies testing laboratory. The animal should be euthanized and submitted using appropriate protocols, including appropriate infection prevention and control precautions. If at all possible, the animal should be captured and euthanized by someone with suitable experience and/or training (e.g., animal control worker, wildlife worker).

- For most animals, submit the entire head. If the skull has been damaged (e.g., the animal was shot in the head), include the cervical spinal cord as well.
- For small animals (<500 g), submit the entire carcass to aid species identification (e.g., bats).
- For large animals (>100 kg) and all livestock, submit the entire brain and portion of cervical spinal cord. If the entire brain cannot be submitted, collect portions of brain tissue bilaterally from the cerebellum, hippocampus and brain stem.

Submission of specimens for animal rabies testing should be done according to provincial/territorial guidance.

6. Recommendations and considerations regarding exposures to specific types of animals

6.1 Dogs, cats and ferrets

6.1.1 Dogs, cats and ferrets available for observation

Dogs, cats and ferrets that appear neurologically appropriate (i.e., normal or unchanged from their usual neurologic status) should generally be observed for 10 days after a bite or other exposure that poses a risk for rabies transmission; this includes stray, unowned, and surrendered animals as well. If the dog, cat or ferret could have transmitted rabies at the time of exposure, it would typically show clinical signs of rabies or die within the 10-day observation period, as 10-days is the accepted maximum time period of communicability before onset of signs of rabies in these species. During the observation period, exposure should be limited to people who routinely care for or live with the animal. Care should be taken to avoid further salivary exposure to humans or other animals.

In general, rabies PEP is not initiated unless the animal begins to show signs of rabies. However, in some instances (e.g., severe wounds to the head, neck or hands, particularly in an animal assessed as being at increased risk of having rabies based on Table 1a), PEP can be initiated at the beginning of the observation period. If the animal remains alive and neurologically appropriate throughout the 10-day observation period, PEP may be discontinued or may be continued if needed for future pre-exposure prophylaxis, in consultation with local public health officials.

Local public health officials and a veterinarian (if available) should be consulted about the need for euthanasia and testing if: clinical signs suggestive of rabies exist at the time of

the exposure or develop during the observation period; observation is not possible or is not safe for people or the animal; or the animal requires euthanasia based on quality of life. If deemed necessary, the animal should be euthanized and the appropriate specimen should be submitted for testing as outlined in Section 5: *Submission for animal rabies testing.* Factors in Table 1a can assist with determining whether to administer PEP while waiting for test results. If PEP is started and the animal subsequently tests negative for rabies, PEP may be discontinued or may be continued if needed for future pre-exposure prophylaxis, in consultation with local public health officials.

The observation of a dog, cat or ferret that appears neurologically appropriate (i.e., normal or unchanged from their usual neurologic status) and has been involved in a bite or other exposure can take place at the owner's/caretaker's home, an animal shelter, or a veterinary clinic, depending on circumstances including: the reliability of the owner/caretaker; the ability to prevent the animal's escape; and the suspicion of rabies in the animal. The person responsible for observing the animal should notify public health officials immediately if the animal develops any new neurological signs, changes in behaviour, or escapes during the observation period. Depending on the risk assessment and provincial/territorial policy, the status of the animal at the end of the 10-day observation period can be confirmed by public health officials by any one of a variety of means, including: phone call; text message; electronic observation; or in-person visit. An unvaccinated animal should wait until the end of the observation period to be vaccinated or undergo any other elective care.

In some very low-risk scenarios, based on a risk assessment considering the factors in Table 1a, a decision may be made to forego a formal observation period of a dog, cat or ferret that is available for observation (e.g., an appropriately vaccinated domestic dog, cat or ferret in a low-risk area following a provoked bite, particularly if the animal remains within the household of the exposed person).

6.1.2 Dogs, cats and ferrets not available for observation

If the dog, cat or ferret has escaped, attempts should be made to find the animal and owner. A decision should be made regarding the need to initiate PEP or how long to wait to begin PEP while trying to find the animal, considering all applicable factors in the risk assessment (refer to Table 1a for additional details). Similarly, if the animal and owner cannot be located, the risk assessment as outlined in Table 1a should be applied to determine the need for PEP.

6.2 Bats

An exposure to a bat is considered to have occurred when there has been direct contact between a person and a live bat, or, much less commonly, when saliva or neural tissue/fluid from the bat enters into an open wound or mucous membrane. Direct

contact is defined as a contact between human skin and a live bat (i.e., a bat touching or landing on a person, or a person touching a bat). Even very minor or transient direct contact between a person and a live bat is considered an exposure warranting intervention (i.e., testing of the bat and/or PEP) because bites inflicted by bats may not be felt and may leave no visible bite marks. A bat caught in a person's hair should be considered an exposure as it would be difficult to ensure that direct contact with skin did not occur. When there is no direct contact between a person's skin and a bat and no exposure to saliva or neural tissue/fluid into an open wound or mucous membrane, rabies PEP is not recommended.

A bat landing on clothing would require an intervention (i.e., testing of the bat and/or PEP) unless the person (or accompanying adult for a child) is certain that the bat did not come into contact with skin (e.g., bat only landed on clothing not likely to be punctured by bat teeth, such as a thick coat) and there has been no saliva or neural tissue/fluid exposure to wounds or mucous membranes.

If there has been an exposure to a bat (as defined above) and the bat is available, it should be appropriately euthanized and submitted for testing (*See Section 5: Submission for animal rabies testing*). Given the proportion of tested bats determined to have rabies (approximately 5% or more), in general rabies PEP should begin as soon as possible after an exposure. In some circumstances NOT involving the head, neck or hands, if the bat has been sent for rabies testing, the health care provider may decide to delay PEP by not more than 48 hours from the time of exposure while waiting for test results. If the bat tests negative for rabies, PEP may be discontinued or may be continued if needed for future pre-exposure prophylaxis, in consultation with local public health officials.

Testing of a bat is not indicated when no human or domestic animal exposure has occurred. If a bat was sent for rabies testing with no human exposure having occurred (e.g., tested because of a domestic animal exposure), PEP for humans is not indicated regardless of the test result.

NACI has made no changes to its previous recommendations regarding a bat found in a room, with PEP indicated only if there has been an exposure, such as direct contact with the bat. Given the challenge of assessing direct contact when a bat is found in a room with a child or adult who is unable to give a reliable history, factors that may indicate that direct contact has occurred have been outlined (e.g., the individual suggests direct contact occurred or wakes up crying or upset while the bat was in the room, or an obvious bite or scratch mark is observed).

For exposures to a dead bat, refer to Section 7.1: *Exposure to dead mammals.*

6.3 Livestock

The risk of human rabies infection from exposure to livestock (e.g., horses, cattle, sheep, goats, pigs) is very low[14]. Human exposures to rabies from livestock are usually due to

salivary contamination of open wounds when a hand is inserted into the animal's mouth, although bites have been reported, particularly from horses and swine.

When a bite or contamination of an open wound from livestock (e.g., horses, cattle, sheep, goats, pigs) is reported, information should be collected to conduct a risk assessment according to the factors outlined in Table 1a. If there is concern about the animal's behaviour, health, or exposure history, a veterinarian (if available) should be consulted. Management of the animal and the need for rabies PEP should be determined in consultation with a veterinarian (if available) and public health officials.

If livestock (i.e., horse, cattle, sheep, goat or pig) appears healthy and neurologically appropriate (i.e., normal or unchanged from their usual neurologic status), it should be observed for 14 days. If possible, the animal should be kept in its usual environment to avoid causing behaviour changes related to altering the animal's environment and general management. During the observation period, precautions should be taken to ensure the animal does not escape and is not slaughtered. Exposure to people should be limited to those who routinely care for the animal, and care should be taken to avoid further salivary exposure to humans or other animals. The owner should be advised to consult with a veterinarian and inform public health officials as soon as possible if there is any change in the animal's behaviour or health.

The 14-day observation period is a conservative extrapolation from the period of communicability in dogs, cats and ferrets of up to 10 days before onset of signs of rabies and is supported by limited experimental evidence showing that the earliest infected livestock had rabies virus in their saliva was two days before onset of signs of rabies (refer to Appendix A, A.3.2 for additional details).

6.4 Rodents and lagomorphs

Squirrels, hamsters, guinea pigs, gerbils, chipmunks, rats, mice and other small rodents, as well as lagomorphs (such as rabbits and hares), are rarely found to be infected with rabies. Based on information up to 2018, human infection from rodents has not been reported globally[3,15]. It is believed that small rodents are likely to be killed by any larger mammal that could have potentially transmitted rabies to them. While these small animals can very rarely become infected by bat strains of rabies[16], no cases of transmission of bat strains of rabies from these animals to humans have been documented (refer to Appendix A, A.3.1 for additional details). Rabies in larger rodents such as groundhogs (woodchucks) and beavers can occur but is rare in Canada.

Because small rodents and lagomorphs are very unlikely to be rabid, PEP should be considered only if the animal's behaviour is highly unusual. For example, a bite from a squirrel while feeding it would not be considered unusual behaviour and so does not warrant PEP, based on this information alone. Exposure to larger rodents, such as groundhogs and beavers, requires a risk assessment considering the rabies

epidemiology in non-bat mammals in the area that could be a source of infection[17] and the circumstances of the exposure to determine the need for PEP (refer to Table 1a). If the rodent or lagomorph is available and rabies testing is deemed necessary, the animal can be euthanized and the appropriate specimen submitted to the laboratory (See Section 5: *Submission for animal rabies testing*).

6.5 Other wildlife susceptible to rabies and exotic animals (other than ferrets)

Foxes, skunks and raccoons are reservoir species for the rabies virus in Canada, meaning that species-specific variants of virus can circulate within each species. Rabies variants that circulate in foxes, raccoons and/or skunks are present in some parts of Canada. In these areas, reservoir species pose a higher risk for transmission of rabies than other wild mammals, however spillover of a specific variant can result in infection in other mammals (other reservoir species or non-reservoir species). In areas not known to be experiencing epizootics or ongoing transmission in wildlife, rabies in non-reservoir species is unlikely, but still possible from yet unrecognized incursions of the virus into the area or from infection from a bat to another mammal. For additional details, refer to Section 3.2: Additional epidemiologic considerations when conducting a risk assessment and Appendix A, A.3.1 .

Bites or other exposures that can result in rabies transmission from wildlife or exotic animals (other than ferrets, see Section 6.1 for ferrets) require a risk assessment considering the factors outlined in Table 1a. If the animal is not available for testing and the risk assessment indicates that rabies PEP is warranted, it should be initiated as soon as possible.

If the animal is available and a potential rabies exposure has occurred based on the risk assessment, public health officials and a veterinarian (if available) should be consulted. If deemed necessary, the animal should be euthanized and the appropriate specimen should be submitted for testing (See Section 5: Submission for animal rabies testing). A risk assessment based on factors in Table 1a can assist with determining whether rabies PEP should begin immediately while waiting for rabies test results from the animal, or if it is reasonable to delay until test results are available. Exposures to highly innervated areas such as the head, neck or hands and more severe bite exposures would generally be indications for initiating PEP as soon as possible while waiting for test results.

7. Other potential animal-related exposure situations

7.1 Exposure to dead mammals

While dead mammals cannot bite, touching a dead mammal can result in a scratch from a tooth, or saliva or neural tissue/fluid can enter an open wound or mucous membrane. Exposure to a dead mammal carries a very low risk of rabies transmission but requires a risk assessment given that infection is possible. The condition of the animal carcass can be considered as part of the risk assessment, given that the rabies virus is susceptible to sunlight, heat and drying (refer to Appendix A, A.3.5 for additional details). If an exposure is suspected, local public health officials should be consulted to support the risk assessment and coordinate rabies testing of the animal, if warranted. If testing is indicated, the appropriate sample can be submitted as per provincial/territorial guidance and processes, and the CFIA rabies laboratory will determine if the specimen is fit for testing (see Section 5: *Submission for animal rabies testing*).

7.2 Indirect exposures, such as to fur, surfaces or objects that may be contaminated with rabies virus

Rabies virus in saliva or neural tissue/fluid may contaminate an animal's fur (e.g., following an attack by a rabid animal), or saliva or neural tissue/fluid containing rabies virus could contaminate surfaces or objects. However, to result in an infection the rabies virus would need to remain viable outside of the body (it is susceptible to sunlight, heat and drying; refer to Appendix A, A.3.5 for additional details), and would need to be introduced into a person while viable via an open wound or mucous membrane. The very low risk of transmission from these types of indirect exposures is exemplified by the multiplication of probabilities. For example, the likelihood of transmission through contact with fur from an animal involved in a fight involves the multiplication of the following probabilities, with each multiplication lowering the risk of human infection to levels that are usually very low:

- Rabies infection in the attacking animal (considering the local rabies epidemiology and other factors in the risk assessment);
- The attacking animal is in the communicable stage of infection;
- Saliva or neural tissue/fluid containing the rabies virus ends up on the fur of the attacked animal;
- The virus on the fur remains viable until contact with a person;
- The rabies virus is introduced into an open wound or mucous membrane of a person;

- Sufficient virus is present to result in infection.

For these indirect exposures, a risk assessment is required to determine if any intervention is needed. Fur, surfaces, or objects cannot be sent for rabies testing.

7.3 Exposures that occur outside of Canada

Exposures that occur outside of Canada follow the same general risk assessment principles as outlined in Table 1a and Table 1b, with some notable exceptions. In some parts of the world that continue to have canine rabies (Asia, Africa and parts of Central and South Americas and Eastern Europe), the risk associated with an exposure may be substantially higher than in Canada. In these locations, medical assessment should be sought promptly and PEP should not be delayed to allow for an observation period or animal testing. To avoid delays, PEP should not be delayed until return to Canada. As per the World Health Organization (WHO) recommendations, PEP can be discontinued if a dog, cat or ferret is healthy at the end of the 10-day observation period, or if the animal tests negative for rabies[1]. However, while ensuring that a dog, cat or ferret is healthy at the end of a 10-day observation period may be possible in a foreign country, it can be challenging, and therefore in some instances it may be safest to complete the recommended PEP regimen.

Exposure to non-human primates is fairly common in some countries. Although non-human primates are not reservoir species for rabies, they can be infected and so exposure to these animals requires a risk assessment, which should conducted as soon as possible and should not be delayed until return to Canada[18]. Bats in Canada, the United States and Latin America can carry the rabies virus. In other regions, bats can be infected with other lyssaviruses that can also cause rabies disease.[(19)]

People exposed to potentially rabid animals outside of Canada should seek medical attention as soon as they return to Canada, and bring all documentation of vaccines and immunoglobulin received abroad.

Some resources describing rabies epidemiology in other parts of the world, in particular the presence/absence of canine rabies virus variants, are listed below:

- Government of Canada, Countries at high-risk for dog rabies
- Government of Canada, Travel advice and advisories by destination
- World Health Organization, The Global Health Observatory, Rabies
- Centers for Disease Control and Prevention, High-Risk Countries for Dog Rabies
- Centers for Disease Control and Prevention, Rabies Status by Country

8. Summary of recommendations and changes from previous NACI guidance

1. NACI has updated its framework for the risk assessment of exposure to potentially rabid animals (see Table 1a for mammals other than bats and Table 1b for bats), and has also updated the resources to assist in determining local rabies epidemiology (see Section 3.3: *Sources of information about animal rabies epidemiology in Canada*).

2. NACI continues to recommend a 10-day observation period for dogs, cats and ferrets that are available for observation and that appear neurologically appropriate (i.e., normal or unchanged from their usual neurologic status). (For details, see Section 6.1:Dogs, cats and ferrets).

3. NACI now recommends a 14-day observation period for livestock (i.e., cattle, horses, sheep, goats and pigs) that appear healthy and neurologically appropriate (i.e., normal or unchanged from their usual neurologic status). This is based on extrapolation from the observation period in dogs, cats and ferrets and limited evidence regarding the period of communicability before onset of clinical illness in livestock. (For details, see Section 6.3: *Livestock*))

4. NACI continues to recommend that a bat exposure generally requires initiation of post-exposure prophylaxis (PEP) as soon as possible. Bat exposure is defined as direct contact between human skin and a live bat (i.e., a bat touching or landing on a person, or a person touching a bat), or, much less commonly, when saliva or neural tissue/fluid from the bat enters into an open wound or mucous membrane. In some circumstances NOT involving the head, neck or hands, the health care provider may decide to delay PEP by not more than 48 hours from the time of exposure while awaiting test results. NACI has not made any changes with regard to the management of bats found in a room. (For details, see Section 6.2: *Bats*).

5. NACI recommends a risk assessment as per Table 1a to determine whether to offer PEP in the context of exposures to: dogs, cats and ferrets that are not available for observation (see Section 6.1: *Dogs, cats and ferrets*); rodents and lagomorphs (recognizing the risk is very low in most of these animals) (see Section 6.4: *Rodents and lagomorphs*); and other wildlife and exotic mammals (excluding bats, ferrets, rodents and lagomorphs) (See Section 6.5: *Other wildlife susceptible to rabies and exotic animals (other than ferrets)*).

6. In contrast to previous NACI guidance in the Canadian Immunization Guide[20] that recommended euthanasia after a human exposure to wildlife and exotic pets (other

than ferrets) that could potentially transmit rabies, updated guidance recommends a risk assessment and consultation with public health officials and a veterinarian (if available) to determine the need for euthanasia if the animal is available for testing. NACI also no longer specifies a maximum waiting period to begin PEP if these animals have been sent for rabies testing (which was previously less than 48 hours). A risk assessment based on factors in Table 1a can assist with determining whether rabies PEP should begin as soon as possible while waiting for rabies test results from the animal, or if it is reasonable to delay until test results are available. Exposures to highly innervated areas such as the head, neck or hands and more severe bite exposures would generally be indications for initiating PEP as soon as possible while waiting for test results. (See Section 6.5: *Other wildlife susceptible to rabies and exotic animals (other than ferrets)*)

9. Research, surveillance and evaluation needs and gaps

Rabies virus characteristics:

- Determine the period of communicability before onset of signs of rabies and before death in livestock, exotic animals other than ferrets and wildlife species to support recommendations on observation periods
- Conduct further research to monitor the ability of various rabies virus variants to survive under a range of environmental conditions outside of the living host

Surveillance of rabies in animals:

- Assess the effectiveness of animal rabies surveillance mechanisms to rapidly identify changes in rabies epidemiology within a range of geographic areas
- Determine the need for and mechanisms to monitor for rabies in wildlife to understand evolving epidemiology and support risk assessment
- Identify the infecting virus variants in rabid animals, where possible, to understand the sources of infection and inform subsequent management activities (e.g., scope of exposure investigation, need for wildlife control, public education focus)
- Determine mechanisms to efficiently and regularly disseminate information on rabies epidemiology in animals to support conducting risk assessments

Framework evaluation:

- Monitor provincial and territorial adaptation of the risk assessment framework, and tools and resource to support risk assessments in their jurisdictions

- Monitor educational initiatives to support the implementation of the framework, including information for health care providers, veterinarians and the public (including the general public and specific populations)
- Assess the percentage of people with exposures to potentially rabid animals who undergo a risk assessment
- Assess the percentage of people who seek a risk assessment who are recommended to receive post-exposure prophylaxis (PEP) and how the risk assessment framework informed the decision to recommend PEP, as well as compliance with the recommendation
- Evaluate if observation of pets after a human exposure in low rabies prevalence areas is necessary and cost-effective

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Appendix A – Research questions

A.1 Research questions

An evidence review on five topics of interest was conducted to inform discussion related to this statement:

1) Evidence of transmission of bat variants of rabies virus from mammals other than bats to humans
2) Period of communicability in dogs, cats, ferrets, wild animals and livestock before the onset of signs of rabies, and time from onset of signs of illness until death
3) Site of exposure on the body and its impact on development of rabies and incubation period
4) Risk of rabies following scratches from claws of mammals other than bats
5) Viability of the rabies virus outside living hosts, including in dead animals

A.2 Methods to address research questions

A narrative review of literature up to April 2025 was conducted to find the readily available studies related to the above questions. Artificial intelligence (AI) was used to assist in finding relevant articles and reference lists from relevant articles were also reviewed. Relevant articles provided by experts on the NACI Rabies Working Group and Rabies Risk Assessment Subgroup were also included. The free version of four AI platforms were used to research each question: **Elicit:** https://elicit.com/; **Ai2 Scholar**: https://scholarqa.allen.ai/; **Co-Storm**: https://storm.genie.stanford.edu/; **Co-Pilot**: Microsoft Copilot: Your AI companion. Article screening, data extraction and data synthesis were conducted by a member of the NACI Secretariat and not by AI. The results of the narrative review are briefly summarized below.

A.3 Implications and research findings

A.3.1 Evidence of transmission of bat variants of rabies from mammals other than bats to humans

Implications:

In areas where there are no known rabies cases in mammals other than bats, it remains possible for mammals to acquire rabies from bats. It is therefore important to understand the extent of transmission of bat variants of rabies virus from mammals other than bats to humans.

Research findings:

Bat variants of rabies virus can be found in mammals other than bats and in rare instances can spread among non-bat mammals (such as occurred several times in Arizona between 2001 and 2023, primarily among skunks and foxes)[21,22].

There have been only rare instances where bat variant viruses have been spread to humans through exposure to mammals other than bats: five cases of humans infected with variants of rabies virus found in vampire bats (*Desmodus rotundus variants*) were due to exposures to cats from 2001 to 2022 in Brazil[23]; in the Andean corridor of Columbia from 1990 to 2021, 12 human cases due to bat variants of rabies virus resulted from exposure to cats (two due to variants from insectivorous bats and 10 due to variants from vampire bats)[24]. It should be noted that all bat species in Canada are insectivorous.

A.3.2 Period of communicability in dogs, cats, ferrets, wild animals and livestock before the onset of signs of rabies, and time from onset of signs of illness until death

Implications:

The period of communicability before the onset of signs of rabies is important to determine the appropriate observation period following an exposure to a potentially rabid animal. If the period of communicability before the onset of illness is well established, an animal that is neurologically appropriate (i.e., normal or unchanged from their usual neurologic status) at the end of an observation period based on the period of communicability before onset of signs of rabies should not have been able to shed rabies virus, and therefore not have been able to transmit rabies virus, at the time of that exposure. If the period from onset of signs of illness until death is also short, many animals capable of transmitting rabies at the time of the exposure would also be dead by the end of the observation period.

Research findings:

Period of communicability before onset of signs of rabies

Two articles reported on experiments where dogs were injected with rabies virus and their salivary glands and saliva were monitored for rabies virus (N= 117[25] and 47[26] dogs injected with rabies virus). With the exception of one dog (that had virus isolated from its saliva on day 13 before onset of signs[26]), the earliest time that rabies virus was found in the saliva before onset of signs of rabies was 7 days (N= 54[25] and 39[26] dogs with rabies). Only one experimental study was found for cats which reported that the earliest viral excretion among 26 rabid cats occurred before onset of clinical signs of rabies was 1 day[27]. One experimental study of ferrets found no viral excretion in the saliva of 34 rabid animals and only one animal had virus in their salivary gland[28]. Two experimental studies in foxes showed viral excretion from 2[29] to 29[30] days before onset of signs of illness. No information was found regarding the period of communicability before onset of clinical

signs of rabies in livestock in the initial search, however the following studies were subsequently identified by a Working Group expert:

- Fifteen of 16 cows injected with street rabies virus into both masseter muscles developed rabies. Based on twice weekly saliva testing after injection, six animals had rabies in their saliva, with virus only found after onset of clinical signs of rabies[31].
- Five of 9 cattle developed rabies after injection of both masseter muscles with pooled brain material from cattle that died of vampire strain rabies. Based on daily sampling starting one week after injection, only one animal had rabies virus in their saliva, with the virus found two days before onset of signs of rabies[32].
- Five of 18 sheep developed rabies after injection into both masseter muscles with material from crushed salivary glands of rabid foxes. Based on twice weekly saliva testing after injection, only one animal had rabies in their saliva, with the virus found the day after onset of clinical signs of rabies[33].

Period from onset of signs of illness until death

Observational and experimental studies in dogs and cats found that the period between the onset of clinical signs of rabies and death was generally 10 days or less, with a median of 3 to 5 days for both dogs and cats[27,34,35]. Based on one observational study, the average period from onset of signs of illness to death was 2 to 3 days in cattle [36]. In experimental studies, the average period from onset of signs of illness to death was 3.7 days in cattle, 3.25 days in sheep[38] and 5.5 days in horses[38].

A.3.3 Site of exposure on the body and its impact on development of rabies and incubation period

Implications:

The site of exposure on the body is related to the likelihood of rabies occurring (noting that rabies can occur from exposure at any body site) and to the incubation period. Given that the rabies virus travels from the site of exposure to the brain through nerves, exposure at more highly innervated sites may increase the risk of rabies infection and shorten the incubation period (noting that the incubation period can also be influenced by distance from the exposure site to the brain).

Assuming that rabies antibodies from vaccines and rabies immunoglobulin are not effective once the virus has entered the peripheral and central nervous systems, exposures in highly innervated areas require more rapid initiation of post-exposure prophylaxis (PEP) (if PEP is indicated) to inactivate the virus before it enters the peripheral nerves.

Research findings:

The skin of the face and hands are both highly innervated areas of the body[39].

A study based on exposure to suspect rabid animals in Tanzania estimated that the probability of developing rabies following a bite was highest when the bite was to the head or neck at 55% (binomial confidence intervals [b CI]: 28 to 79%), followed by bites to the upper extremity at 22% (b CI 12 to 38%), then lower extremity 12% (b CI 6% to 23%) and trunk at 9% (b CI 0.5% to 38%)[40]. Similarly, a modeling study demonstrated that the highest probability of developing rabies was due to exposures to the head and neck followed by those to the upper extremities[41].

A review of cases from Mozambique indicated that among other factors, bites to the head were significantly associated with developing rabies[42] and a similar finding for the head and neck was noted from a study from Haiti[43]. In a study of 12 people attacked by a rabid wolf in India, only the three cases with wounds on the face developed rabies[44]. Rare cases of post-exposure prophylaxis (PEP) failure have also been reported with bites to highly innervated areas such as the head and hands[45].

A number of studies have shown that the shortest incubation period following exposures to humans are from bites to the head and neck following by the hands/upper limbs[46-49]. In a systematic review of 122 people whose rabies post-exposure prophylaxis failed to prevent rabies (approximately half of whom had wounds on the head, face or neck), the median time from exposure to onset of symptoms was 20 days, with an interquartile range of 16 to 24 days and a range of 9 to 61 days. The median time from exposure to post-exposure prophylaxis was 0 days, with an interquartile range of 0 to 2 days; the range was 0 to 65 days for rabies vaccine and 0 to 40 days for rabies immunoglobulin.[50]

A.3.4 Risk of rabies following scratches from claws of mammals other than bats

Implications:

Scratches from teeth result in saliva exposure and pose a risk of rabies. However, scratches from claws of non-bat mammals are much less likely to result in saliva exposure. The very low risk of rabies from scratches if there is no saliva exposure is an important factor to consider in the risk assessment.

Research findings:

The risk of acquiring rabies is estimated to be 50-fold lower for scratches (0.1 to 1%) compared to bites (5 to 80%) (as quoted in Fishbein et al. [52]). A case series by Feder et al. from 1900 to 1998 reported on non-bite exposures worldwide and noted only one case resulting from a scratch of normal skin[52]. A case series from India reported that 5 of 19 deaths over a 7-year period were from “scratches/abrasions without any bleeding”[53] and a case series from Central China from 2013 to 2018 reported that 15 of 164 cases (9.2%) were from scratches[54], although no further details were provided in either study. A case

series from the Philippines from 1987 to 2006 reported on 1,839 cases of rabies, most of which were said to be from bites or scratches, however the detailed list of exposure does not indicate any cases from scratches[46]. A systematic review by Whitehouse et al. over a 42 year periods (1980 to 2022) of 120 rabies infections in those who received post-exposure rabies vaccination with known exposure types found that 118 involved bites while two involved scratches, with the scratches described as: 1) from a dog on the head and neck of a 6-year-old and 2) from a deep scratch from a cat on the face of a 15-year-old[50].

A.3.5. Viability of the rabies virus outside living hosts, including on dead animals

Implications:

The viability of rabies virus outside living hosts is important as part of the risk assessment to determine whether post-exposure prophylaxis (PEP) would be necessary when exposures occur to virus on surfaces, objects or animal fur, or when contact occurs with an animal carcass.

Research findings:

Rabies virus survival outside a living host:

- Rabies virus does not survive well outside of its host (e.g., in secretions) as it is susceptible to sunlight and desiccation[55].
- In one experimental study[56]:
    - Rabies virus suspension from the salivary gland of an infected fox was tested for thermal inactivation. There was rapid inactivation at 20°C and 37°C within 24 hours, and complete inactivation by 96 hours.
    - Suspension was applied to substrate surfaces (glass, aluminum metal sheet, plant leaf) and tested at different temperatures (5°C, 20-21°C, 30-32°C, 30°C + sunshine). Results: longest virus survival was 144 hours/6 days at 5°C (glass, metal sheet, plant leaf); virus survived 42 hours (metal sheet) and 24 hours (glass, plant leaf) at 20°C; virus survived 1 hour (glass) to 1.5 hours (metal sheets, plant leaf) at 30°C plus sunlight; at 30°C without sunlight the virus survived on glass for 20 hours.

Rabies virus infectivity and detection in animal carcases or decaying brain tissue:

- Two experimental studies were found that showed that:
    - Rabies virus in mouse carcases may remain infectious for many days in colder temperatures (18 days at 4°C) and up to 3 days in warmer/hot temperatures (25°C and higher)[57].
    - Rabies virus may be viable in decaying brain tissue from dogs for 7 days but not beyond 15 days if at room temperature (20°C ± 2°C) and protected from light[58].

List of Abbreviations

ACS	Advisory Committee Statement
CFIA	Canadian Food Inspection Agency
NACI	National Advisory Committee on Immunization
PHAC	Public Health Agency of Canada
PEP	Post-exposure prophylaxis
PrEP	Pre-exposure prophylaxis
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
WHO	World Health Organization
WOAH	World Organisation for Animal Health

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