BC Centre for Disease Control
An agency of the Provincial Health Services Authority

BC Rabies Guidance for Veterinarians

April 2021

Table of Contents

1.0 Goal of British Columbia's rabies control program

Rabies is a serious zoonotic disease caused by the rabies virus, a lyssavirus in the Rhabdovirus family. In North America, distinct virus variants associated with specific wild reservoir species exist. Bats are the only reservoir for rabies in British Columbia (BC). Rabies is transmitted through saliva and cerebrospinal fluid from an infected mammal. Infection in humans and animals with rabies virus results in an acute, progressive viral encephalomyelitis and is uniformly fatal once clinical signs develop.

The goal of the provincial Rabies Control Program is to prevent the acquisition of human and animal rabies. Prevention of rabies is undertaken through:

- Evaluation of human and animal exposures for the risk of rabies transmission;
- Provision of post-exposure immunoprophylaxis to persons or animals exposed or potentially exposed to the rabies virus;
- Provision of pre-exposure immunization of persons at increased risk of exposure to rabies;
- Provision of pre-exposure immunization to domestic animals;
- Testing of suspect animals for rabies; and
- Collaboration and consultation with provincial and federal authorities regarding rabies incidence and control in British Columbia humans and in domestic and wild animals.

The intent of this guideline is to provide direction for BC veterinarians on:

- Risk assessment and risk management of domestic animals exposed or potentially exposed to rabies;
- Collection and submission of specimens for rabies testing; and
- Reporting of positive cases and potential human exposures to the rabies virus.

2.0 REGULATIONS AND REPORTING

Rabies is a reportable animal disease to the Chief Veterinary Officer (CVO) in BC under the Reportable and Notifiable Disease Regulation, pursuant to the BC Animal Health Act [2014]. The CVO shares reports of zoonotic diseases in animals with the Provincial Health Officer (PHO) under an Information Sharing Agreement.

Rabies is a reportable animal disease to the Canadian Food Inspection Agency (CFIA) under the federal Reportable Diseases Regulations, Health of Animals Act. Owners, veterinarians and laboratories fulfill their reporting requirements to the CFIA by submitting suspect animals for testing.

In British Columbia, the Reporting Information Affecting Public Health Regulation **requires veterinarians to report to a medical officer of health all known or suspected cases of a person exposed to rabies.**

3.0 RISK ASSESSMENT

Figure 1: Quick guide for veterinarians to assess risk and manage exposures. Supporting information follows.

3.1. Exposure assessment

Direct contact with a potentially rabid animal is necessary for transmission of the rabies virus. **A rabies exposure is defined** as any bite, scratch or other situation in which saliva or nervous tissue from a potentially rabid animal enters an open or fresh wound, abrasion or break in the skin, or comes in contact with a mucous membrane of another animal or person. Rabies virus becomes non-infectious when it dries out and when it is exposed to sunlight.

When assessing the risk of rabies in an animal, the following need to be considered:

- Animal species (Table 1, Section 3.1.1)
- Geographic location (Table 1 and Section 3.1.1)
- Animal behaviour (Section 3.1.2)
- Animal rabies vaccination status (Section 3.1.3)
- Type of exposure (bite vs. other) (Section 3.1.4)

Table 1. Criteria to determine if rabies exposure has occurred by species and location, assuming saliva or neural tissue from the exposing animal may have contaminated an open wound or mucous membranes

"Exposing" species	Geographic location of exposure	Likelihood of exposure
Bat	Globally	Consider rabies exposure unless bat is tested and shown to be negative
Domestic or wild terrestrial mammal	BC	Unlikely rabies exposure, unless animal: • demonstrated neurological behavior indicative of rabies or dies; if so, consider rabies exposure unless tested and shown to be negative • known to have contact with bat in last 6 months • imported from, or travel to, a rabies-endemic area in last 6 months
Skunk, raccoon, coyote, bobcat, fox, monkey and other wild animals	Outside BC (except in rabies-free countries)[a]	Consider rabies exposure unless tested and shown to be negative
Domestic animals	Enzootic areas outside BC	Consider rabies exposure unless animal tested and shown to be negative. The vaccination status of the 'exposing' animal should be considered.

a WHO rabies risk map
http://gamapserver.who.int/mapLibrary/Files/Maps/Global_Rabies_ITHRiskMap.png?ua=1
CFIA animal testing results: http://www.inspection.gc.ca/english/anima/disemala/rabrag/statse.shtml

3.1.1 Animal species and geographic location

3.1.1.1 In British Columbia

In BC, bats are the only known reservoir. Since 2014, approximately 8% of BC bats submitted for testing have tested positive for rabies[2]. Bats submitted for testing have a higher likelihood of being infected. The true prevalence of rabies in BC bats is likely lower. Active surveillance of bats collected randomly in Alberta between 1979-1983 found that 0.1% (1/769) of bats tested positive for rabies (Pybus et al, 1986).

In BC, terrestrial mammals are not known to be reservoirs of rabies. However, occasional spill-over of bat-variant rabies to other species has occurred in the following cases but there was no evidence of continued transmission within these species in BC:

- 2007 – a cat in Maple Ridge
- 2004 – 4 skunks in Stanley Park
- 1992 – 3 cats in Delta[3]
- Late 1980s – a beaver
- 1984 – a horse in the Sorrento area
- 1969 – a cat on Vancouver Island

In all geographic jurisdictions, squirrels, hamsters, guinea pigs, gerbils, chipmunks, rats, mice and other rodents, rabbits and hares are very rarely infected with rabies. These species are not known to have caused human rabies in North America.

3.1.1.2 Outside of British Columbia

In other parts of North America, bats, skunks, raccoons and foxes are reservoirs for rabies that can lead to spill-over events in other wildlife species. In developing countries, dogs are the primary reservoir and source of infection. Dog-mediated rabies is responsible for up to 99% of rabies deaths globally (WHO 2018).

Rabies is extremely rare in small rodents and lagomorphs (rabbits and hares). In most cases, no action is needed with exposure to these species, unless unusual behaviour of the animal warrants it. Exceptions include woodchucks found to be rabid in parts of the US in association with raccoon rabies expansion and the occasional report of an infected rodent in other parts of the world (Moro 1991, Childs 1997, Kamoltham 2002, Wang 2009). In tropical regions, monkeys may be infected with rabies and may transmit rabies virus to humans (Gautret 2014) and potentially to other animals.

Dog-variant rabies in enzootic in many developing countries. Dog bites provide the

[2] CFIA animal testing results: http://www.inspection.gc.ca/english/anima/disemala/rabrag/statse.shtml

[3] Skunk strain of rabies virus was recovered from one of the Delta cats and the beaver. A wildlife survey in Delta (prior to 1989) following the isolation of the skunk strain rabies in a beaver, and intensified testing of cats following the Delta incident, indicated that the skunk strain of rabies is not enzootic in BC. The skunk strain identification has never been fully explained, although a lab error is possible. Strain testing was not available for the 1969 cat case, but it was most likely due to bat strain of virus.

greatest risk of rabies transmission in enzoootic countries. Unvaccinated dogs imported into North America from high risk areas present a risk for rabies to people and other animals.

3.1.2. Animal behavior

The signs of rabies infection can vary considerably between species and individual animals. An animal exhibiting behaviour that is considered unusual for that particular species could potentially be rabid. Entering an animal's territory or close interactions, especially hand feeding, could be considered provocation. When an animal attacks for no known reason or has no history of aggression, it can be considered an unprovoked attack.

If an animal had physical contact with a rabid animal (e.g., a cat played/fought with a bat that is later determined to be rabid) and then had direct contact with an individual or another animal, it is unlikely that rabies would be transmitted. There are no known incidents of rabies transmission by such indirect contact. The minimum time for animal rabies to incubate is 2 weeks but is often much longer; transmission of rabies will not occur until the virus is being shed in the animal's saliva.

Many wild terrestrial animals may act aggressively when approached by a human or another animal, particularly if they are protecting their young, are food conditioned or habituated to humans or have no ability to escape the situation. Bites and scratches from these animal encounters are not rare in urban and suburban settings.

3.1.3. Vaccination status

A domestic animal that has been vaccinated against rabies routinely is likely protected from rabies. The majority of vaccinated domestic animals are considered protected. However, a small proportion (about 5%) are not protected or can become rabid through overwhelming viral challenge, incomplete vaccine efficacy, improper vaccine administration or host immunocompromise (NASPHV 2016, Murray 2009, Jakel 2008, Kennedy 2007).

However, if the animal behaviour is highly unusual, the animal may need to be observed or euthanized and tested for rabies regardless of vaccination status.

3.1.4. Type of exposure

In a potentially infected animal, the following body substances/tissues may be infectious:

- Saliva and salivary glands
- Neural fluid and tissue

As such, the highest risk exposure is from the bite of an infected animal that breaks the

skin. Scratches from an infected animal can theoretically introduce rabies virus if, for example, the animal had licked its nails prior to the scratch. This is a theoretical risk given that no cases have been reported from this type of secondary transmission pathway.

WHO categories of contact with suspect rabid animals (http://www.who.int/mediacentre/factsheets/fs099/en/)

- **Category I:** touching or feeding animals, licks on intact skin **Category II:** nibbling of uncovered skin, minor scratches or abrasions without bleeding
- **Category III:** single or multiple transdermal bites or scratches, licks on broken skin, contamination of mucous membranes with saliva from licks, [direct] contact with bats

Virus can rarely be found in urine, muscle and lungs. Contact with such materials has not been documented to lead to transmission of rabies. There is a theoretical risk of airborne transmission of rabies virus from bat feces (Brown, 1971, Heymann, 2008). As viremia has not been detected in infected animals, blood is generally considered non-infectious.

4.0 Rabies in animals

4.1. Virus characteristics

Rabies is caused by the rabies virus, a lyssavirus in the Rhabdovirus family. It is an enveloped RNA virus that survives in saliva and CNS fluid. The virus is inactivated when it dries out and when it is exposed to sunlight or UV radiation; it can also be inactivated by sodium hypochlorite, 45-75% ethanol, quaternary ammonium compounds, and iodine preparations and some detergents.

4.2. Clinical manifestations

All mammals are susceptible to infection. Clinical presentation can be quite variable. The initial clinical signs are often nonspecific. Animals may show behavioural changes: nocturnal species may be active in the day, calm animals may be excitable and timid ones may become vicious. After 2 to 5 days, these signs may be followed by a stage during which either the paralytic or the furious form of rabies predominates. “Furious” rabies is marked by aggression and a loss of fear of humans and other animals. The animal may attack suddenly and without provocation. There are seizures and loss of muscle coordination. Progressive paralysis results in death. In “dumb” or “paralytic” rabies, the throat and masseter muscles are paralyzed, resulting in excessive salivation and inability to swallow. The animal is generally passive and death results rapidly (<10 days) from progressive paralysis (CFSPH 2012, Tepsumethanon 2004).

4.3. Transmission

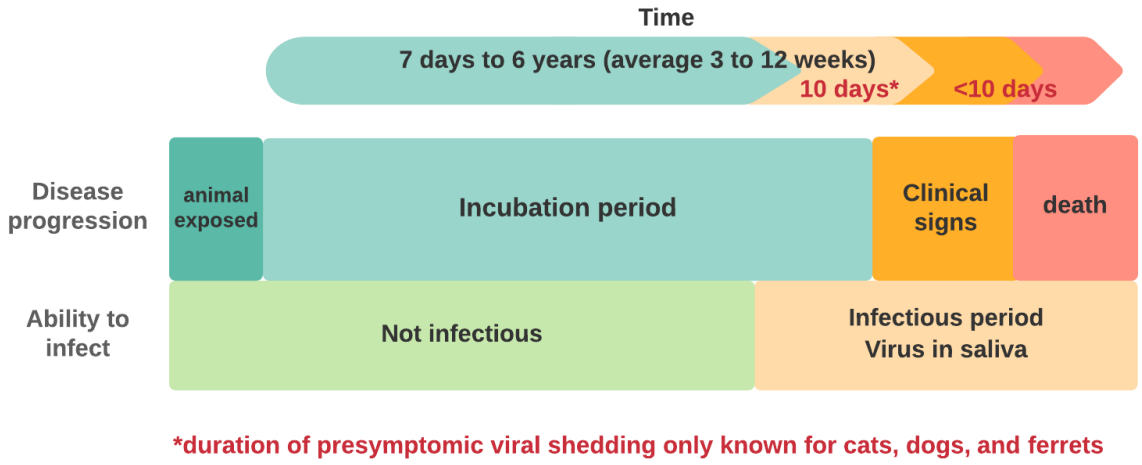
Infection occurs by percutaneous introduction of the virus-laden saliva or cerebrospinal fluid of a rabid animal through a bite or scratch, or into a fresh break in the skin, or by contact with intact mucous membranes. The virus travels via the peripheral nerves to

the spinal cord and ascends to the brain. After reaching the brain, the virus travels via peripheral nerves to the salivary glands. Involvement of the salivary glands and oral mucosa is responsible for transmissibility (CFSPH 2012).

4.4. Incubation

The incubation period in domestic animals (from initial exposure to clinical symptoms) may range from two weeks to many months (Figure 3). It can depend on a number of factors, including the variant of rabies virus, the amount of inoculated virus, and the anatomic location of the bite or introduction of the virus. The majority of dogs and cats that develop rabies do so within four months of exposure, a minority will incubate longer. It is important to note that animals may shed the virus in saliva and be able to transmit the disease several days before showing clinical signs. In cats, dogs and ferrets, this period is 10 days when infected animals can shed the virus before showing clinical signs (Vaughn 1963, Vaughn 1965, Niezgoda 1998). Only one study of dogs experimentally infected with rabies virus showed 1/16 dogs with viral excretion longer than 10 days prior to symptom onset (13 days prior) (Fekadu 1982).The duration of pre-symptomatic infectious period is unknown for other species.

Figure 3: Rabies progression in animals and infectious period



4.5. Case definition

Suspect case:

Any animal exhibiting non-specific central nervous system (CNS) clinical signs (ataxia, abnormal vocalization, biting and eating abnormal objects, aggression, etc.) that include rabies as a differential diagnosis should be considered a suspect rabies case, particularly where there is a supportive history of potential exposure and where the local geographic rabies epidemiology supports the possibility of rabies.

OR

Any animal with a positive screening test including:

- direct rapid immunohistochemical test (DRIT); or
- immunohistochemistry

Confirmed case:

Any animal whose CNS tissue tests positive for rabies in a Fluorescent Antibody Test (FAT).

5.0. RISK MANAGEMENT

5.1. Human exposure

Local public health authorities, under the direction of the MHO, are responsible for assessing risk in potentially exposed humans.

When a veterinarian becomes aware that a human has been exposed to a potentially rabid animal (domestic or wild) they will:

- explain that rabies is a serious, zoonotic disease; *and*
- encourage the client to consult their physician or local public health authority for further guidance; *and*
- report the potential human rabies exposure to the health authority where the exposed human resides (see Appendix A for contact information).

The *College of Veterinarian of BC (CVBC) Bylaws,* The *College of Veterinarian of BC (CVBC) Bylaws,* Part 4 – Ethics and Standards, s. 249 (4) (b), Access to information (CVBC) permits disclosure of information about an animal's health under certain conditions, including to an MHO, Environmental Health Officer (EHO), or communicable disease nurse. For further information see Appendix B: Disclosure of confidential patient information to BC public health authorities.

If human exposure has been identified, local public health authorities will perform a human risk exposure assessment and determine what actions are required, including if the animal specimen should be submitted to the CFIA laboratory for testing. Some health authorities may send an Environmental Health Officer to pick-up and submit the sample. If the local public health authority does not have a designated person to pick-up

and submit the sample, they may ask the private veterinarian to collect, package and submit the sample to CFIA. In cases of human exposure where public health asks a veterinarian to submit samples, the public health authority will provide reasonable compensation to the veterinarian for their work.

5.2. Concurrent human and domestic animal exposure

If there has been both potential domestic animal exposure and human exposure, the private veterinarian will:

- encourage the client to consult their physician or local public health authority for further guidance; *and*
- report of the potential human rabies exposure to the health authority where the exposed human resides (see Appendix A for contact information); *and*
- carry out an animal risk assessment and management measures (see 'Domestic animal exposure' below); *and*
- Vaccinate the exposed animal against rabies.

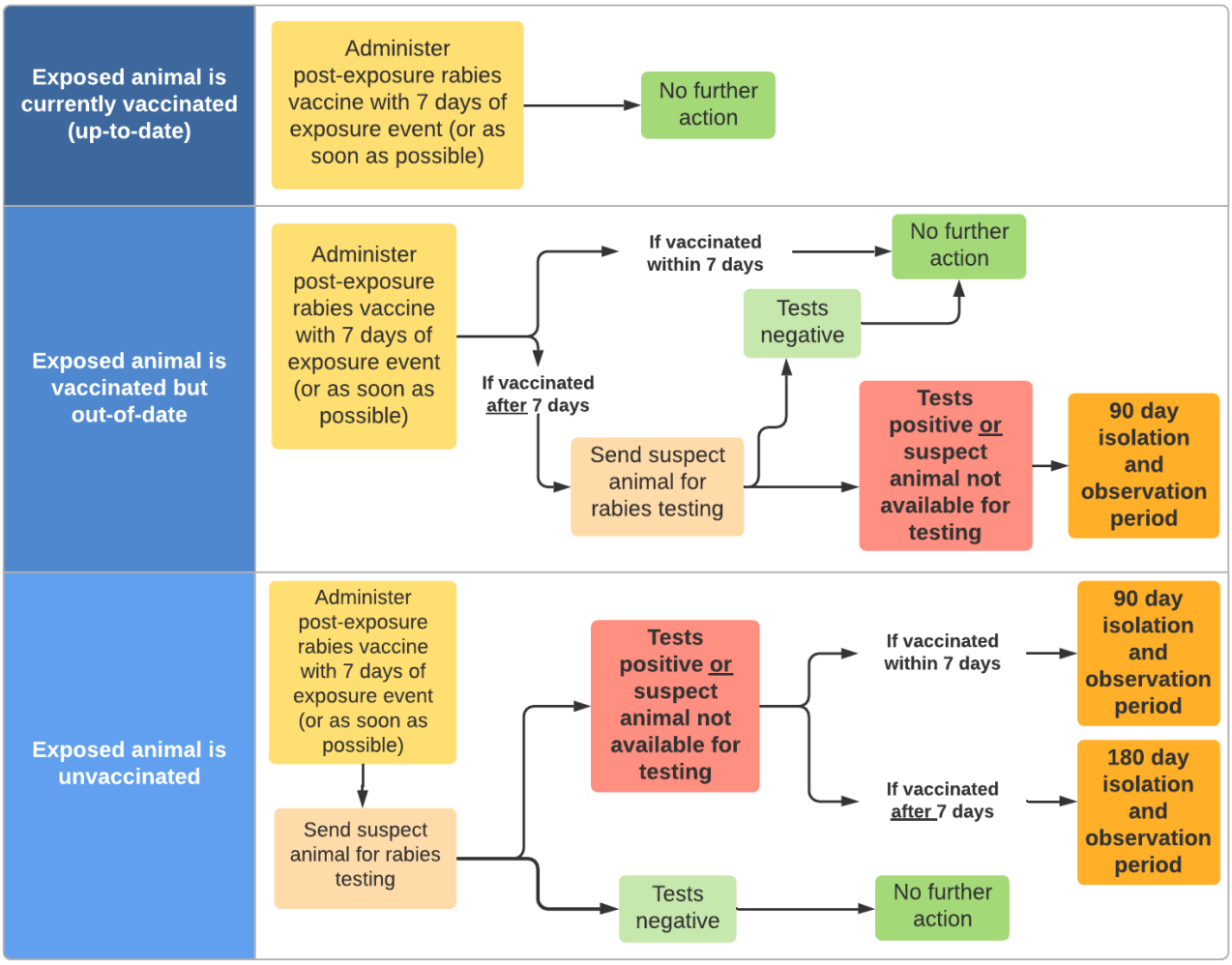
For situations of domestic animal exposure without concurrent human exposure, all veterinary fees (e.g. examination, vaccination, sample collection, packaging and shipping) are the sole responsibility of the client. If there is concurrent human exposure, public health authorities will work with the private veterinarian to coordinate sample collection and shipping, and fees for collecting, packaging and shipping the sample may be covered by the local health authority at their discretion.

Assistance with rabies risk assessment and management of domestic animals can be obtained from the BCCDC's public health veterinarian at 778-677-7790.

Advice regarding risk assessment of wild animals, and contacts for handling or management of wild animals can be obtained from BC's wildlife veterinarian (see contact information in Appendix A). In cases where a wild animal is available for testing and the risk assessment for humans and domestic animals does not support testing for rabies, laboratory submission of the wild animal for other purposes may still be appropriate. In these situations, please contact the BC wildlife veterinarian.

5.3. Domestic animal exposure 4,5

Figure 2: Quick guide for veterinary management of rabies exposures in animals



If a domestic animal may have been exposed to rabies, the private veterinarian will conduct an animal risk assessment. A domestic animal is deemed exposed if the exposing animal species:

- is known to carry rabies (see section 3.1.1) **OR** is behaving abnormally **AND**
- saliva or neural tissue from the exposing animal may have contaminated an open wound or mucous membranes (i.e. single or multiple transdermal bites or scratches,

4 Recommendations are based on the *Council of Chief Veterinary Officer Subcommittee for the management of potential domestic animal exposures to rabies,* literature review, expert opinion, and a local risk assessment taking into account the epidemiology of rabies in BC.

5 Livestock exposures should be discussed with the Ministry of Agriculture Public Health Veterinarian or Chief Veterinary Officer (see contact information in Appendix A).

licks on broken skin, or contamination of mucous membranes, nibbling of uncovered skin or minor scratches or abrasions without bleeding). See section 3.1.4.

For domestic animal exposures, the private veterinarian should classify the vaccine status of the pet as either 1) currently vaccinated (up-to-date) (see Section 5.3.1); 2) previously vaccinated but out-of-date (see Section 5.3.2); or 3) unvaccinated (see Section 5.3.3) and then follow the steps described in the relevant section. **In every scenario, administration of a post-exposure rabies vaccine with 7 days is indicated.**

There is no clear evidence to indicate the serum antibody level that is protective against rabies in animals. However, >0.5 International Units (IU) of antibody per milliliter (ml) of serum is defined as a protective response in humans and by analogy, in animals. In dogs and cats, antibody levels >0.5 IU/ml are expected to develop within 14 days after vaccination (Minke 2009, Manickam 2008). An animal is considered currently vaccinated if it has been administered a licensed rabies vaccine in accordance with the labelled directions and at least 14 days have elapsed since the animal's first (primary) vaccination (i.e. both primary and fully vaccinated animals are considered currently vaccinated), and when the exposure occurs within the labelled duration of protection for the vaccine. An animal is considered unvaccinated if it does not have documented proof of receiving an initial rabies vaccination at least 14 days prior to rabies exposure. An animal is considered previously vaccinated but out of date if it has been administered one or more doses of a licensed rabies vaccine in accordance with the labelled directions, but when the exposure occurs after the labelled duration of protection for the vaccine.

5.3.1. Exposed animal is currently vaccinated (up-to-date)

For domestic animal exposures assessed by the veterinarian to pose a risk of rabies transmission and in which the exposed domestic animal is currently vaccinated, the private veterinarian should provide a rabies booster vaccination to the exposed animal within a 7 day window of the exposure event. No further action is required.

In cases where a rabies booster vaccination is not administered within 7 days, a booster vaccination should still be administered as soon as possible after the exposure event. The private veterinarian, together with the PHV, will make decisions about further actions (e.g. need for isolation and observation) on a case-by-case basis based on the exposure event and age, health status and vaccination history of the exposed domestic animal. In most cases, an animal that is currently vaccinated at the time of exposure will not require isolation, even if administration of the post-exposure booster vaccination is delayed until after 7 days.

The decision to recommend isolation and observation is not without impacts on pet owners and animals, and, as such, should be based on a careful risk assessment. As the risk of rabies transmission from wild animals to domestic animals is very low in BC, there was consensus on the expert panel drafting the BC guidelines that recommending isolation in fully vaccinated animals (including those that did not receive a booster within 7 days) was unnecessarily restrictive and might lead to decreased uptake of

prophylactic rabies vaccination, as well as create a disincentive to reporting potential animal rabies exposures

For currently vaccinated animals, the main purpose of administering a rabies vaccination booster is to reduce the risk associated with a possible previous vaccine failure. Licensed vaccines must show protection of ≥88% of vaccinates in a challenge trial that kills 80% of controls. The rabies vaccine failure rate (titre <0.5 IU/ml) has been reported to be 0.01 to 8% (Berndtsson 2011, Kennedy 2007). A secondary purpose is to stimulate protective immunity in animals with partial but inadequate response to previous vaccinations. This reasoning is based on general vaccine theory, and there is no supporting evidence specific to licensed rabies vaccines in animals. Finally, there is evidence that in exposed animals that do go on to develop rabies, post-exposure rabies vaccination may reduce the incubation period and hasten death, and therefore serve to decrease the chance of an animal that is incubating rabies being lost to follow up (Wilson 2010, Hanlon 2002, Wilson 2001). For currently vaccinated animals exposed to rabies, there is no evidence to support a specific minimum interval from recent previous vaccination to administering a booster vaccination, therefore this decision will need to be made on a case-by-case basis.

5.3.2. Exposed animal is vaccinated but out-of-date

For animal exposures assessed to pose a risk of rabies transmission and in which the exposed domestic animal has been previously vaccinated, but out of date, the private veterinarian should:

1. Administer a rabies booster vaccination to the exposed domestic animal within 7 days of the exposure event. In cases where a booster vaccination is not administered within 7 days, a booster vaccination should still be administered as soon as possible after the exposure event.

2. If the suspect animal (e.g. the bat) is available, offer to have it tested. If testing is agreed upon, the private veterinarian coordinates the suspect animal's euthanasia (if required) (Appendix D), sampling (if required), packaging and shipment to the CFIA Rabies Laboratory in Lethbridge, Alberta (Appendices C and E).

    a. If the suspect animal tests negative, no further steps are recommended.

    b. If the suspect animal is unavailable or tests positive, the private veterinarian, together with the PHV, will make decisions about further actions (e.g. isolation and observation) on a case-by-case basis based on the exposure event and age, health status and vaccination history of the exposed domestic animal.

        i. **When the exposed animal is administered a booster vaccination within 7 days, no isolation and observation period is necessary**.

        ii. In cases **where a booster vaccination is <u>not</u> administered within 7 days,** the private veterinarian, together with the PHV, will make decisions about further actions (e.g. need for isolation and observation) on a case by case basis. **A 90-day isolation and observation period would be required in most cases.**

For previously vaccinated, but out-of-date animals, the main purpose of administering a rabies vaccination booster is to generate an anamnestic response and stimulate

protective immunity. There is evidence that most animals that are previously vaccinated, but out of date, develop an antibody titre >0.5 IU/ml by day 15 after being administered a booster and that the response is not inferior to currently vaccinated animals (Moore 2015). There is also evidence that in exposed animals that do go on to develop rabies, post-exposure rabies vaccination may reduce incubation times and hasten death, and therefore serve to decrease the chance of an animal that is incubating rabies from being lost to follow up (Wilson 2010, Hanlon 2002, Wilson 2001).

5.3.3. Exposed animal is unvaccinated (never vaccinated)

For animal exposures assessed to pose a risk of rabies transmission and in which the exposed domestic animal is unvaccinated, the private veterinarian should:

1. Administer a rabies vaccination to the exposed domestic animal within a 7-day window of the exposure event. In cases where a vaccination is not administered within 7 days, a vaccination should still be administered as soon as possible after the exposure event.

   Note: In some cases, the unvaccinated, exposed animal may be a puppy or kitten under the vaccine manufacturer's recommended age for vaccination. In these cases, the veterinarian may consider administering the vaccine to the puppy or kitten ("off-label use"), with re-vaccination once the animal has reached the age indicated by the vaccine manufacturer.

2. If the suspect animal (e.g. the bat) is available, offer to have it tested. If testing is agreed upon, the private veterinarian coordinates the suspect animal's euthanasia (if required) (Appendix D), sampling (if required), packaging and shipment to the CFIA Rabies Laboratory in Lethbridge, Alberta (Appendices C and E).

   a. If the suspect animal tests negative, no further steps are recommended.

   b. If the suspect animal is unavailable or tests positive, the private veterinarian will recommend:

      i. that the owner isolate and observe the domestic animal on the owner's property AND for the owner to consult their veterinarian immediately if the animal exhibits changes in behavior or health that indicate signs of rabies (Appendix F).

      The recommended isolation and observation period is:
      - **90 days for animals that receive a rabies vaccination within 7 days of the exposure event,**
      - **180 days for animals that do not receive a rabies vaccination, or that received a rabies vaccination more than 7 days after the exposure event.**

   Note: If there is any concern that the owner will not comply with the conditions of isolation and quarantine, then the veterinarian should inform

the public health veterinarian (778-677-7790) and/or the local health authority (see contact information in Appendix A).

OR

ii. euthanasia of the exposed domestic animal.

For unvaccinated animals, the main purpose of administering a rabies vaccination is to stimulate protective immunity for both the immediate exposure event, and potential future exposure events. There is equivocal evidence that vaccination soon after rabies exposure may decrease the likelihood of developing clinical rabies (Wilson 2010, Murray 2009, Leslie 2001). There is evidence that in exposed animals that do go on to develop rabies, post-exposure rabies vaccination may reduce incubation times and hasten death, and therefore serve to decrease the chance of an animal that is incubating rabies from being erroneously released from isolation (Wilson 2010, Hanlon 2002, Wilson 2001).

A 180-day observation period for unvaccinated pets exposed to rabid or suspect rabid animals has been the precedent and is based on the maximum reasonable incubation period for rabies in a dog or cat (Murray 2001). A 90 day isolation period for pets being administered a rabies vaccination is based on evidence that shows that in exposed animals that do go on to develop rabies, vaccination immediately after exposure may shorten the incubation period (Wilson 2010, Hanlon 2002, Wilson 2001). (See Section 4.0)

5.4. Domestic animal bites

Dog bites are not provincially reportable in BC. The situations listed below have been identified as elevated risk for rabies transmission. A veterinarian should immediately inform the local public health authorities if they are aware that a person has been bitten/scratched by a domestic animal in the following circumstances:

- the animal is exhibiting clinical signs compatible with rabies at the time of the bite/scratch; or
- the animal was imported from or travelled out of BC in the preceding 6 months; or
- the animal has been known to have had contact with a bat in the preceding 6 months; or
- the animal is not available for assessment and management (e.g. stray or feral).

In these situations, the public health authorities will assess the rabies risk and determine what actions are required, if any. Possible actions include the implementation of a 10-day observation period, euthanasia and testing of the animal and/or administration of rabies post-exposure prophylaxis to the exposed individual. The rationale for the 10-day observation period is that rabies virus is excreted in a rabid animal's (dogs, cats, ferrets) saliva for a few days prior to and during illness. If the animal is clinically well after 10 days, it was not shedding rabies virus and is deemed non-infectious at the time of the exposure and can be released from isolation and observation (see Section 4.0).

See Appendix A for contact information, and the public health veterinarian is available at 778-677-7790 for consultation as required.

6.0 COMMUNICATION WITH CLIENTS

Messages addressing the risk of disease in both animals and humans should include the following information, also found in the section below on Communication resources and in Appendix F:

- Epizoology and species of animal(s) which carry or could be affected by rabies.
- How to avoid risk of exposure:
  - Receive pre-exposure immunization if in a high risk occupation or area.
  - Vaccinate pets.
  - Avoid physical contact with suspect animals.
- What to do in the event of exposure:
  - First aid.
  - Seek medical attention, including rabies post-exposure prophylaxis.

6.1 Communication Resources

- BCCDC: http://www.bccdc.ca/health-info/diseases-conditions/rabies
- HealthLink BC: http://www.healthlinkbc.ca/healthfiles/hfile07.stm
- PHAC: https://www.canada.ca/en/public-health/services/diseases/rabies.html
- CFIA: http://www.inspection.gc.ca/english/anima/disemala/rabrag/rabragfse.shtml
- CVMA: https://www.canadianveterinarians.net/practice-economics/rabies-guidance

7.0 WORKPLACE SAFETY

Veterinary practice facilities that employ workers are required to be compliant with the WorkSafe BC Occupational Health and Safety Regulations. The OH&S Regulation requires that a risk assessment be conducted by the employer to determine if there is a potential for occupational exposure (to a biological agent) by any route of transmission and that workers be appropriately protected.

WorkSafeBC has published the reference document "Exposure Control Plan for Rabies Virus in Veterinary Practices." This document states "All staff who are at low, moderate, or high risk of rabies exposure (as determined by a risk assessment) will be offered the pre-exposure rabies vaccination at the employer's expense. Any staff members who refuse to be vaccinated will be given work that will not expose them to potentially rabid animals". As part of the risk assessment, recommendations from appropriate sources, such as the BCCDC, must be considered.

Veterinarians can consult their local public health authority or the BC Communicable Disease Control Manual for further advice. The BCCDC recommends veterinarians and their staff receive an initial series of rabies pre-exposure prophylaxis vaccination. A booster is only required following a rabies exposure. No serological testing is required, unless the worker is considered at moderate or high risk. If a decision is made to not provide veterinary staff with rabies vaccine, the employer should be able to provide a written rationale regarding their decision not to adopt the recommendations. Rabies vaccine can be purchased from, and administered in most travel clinics.

Veterinary staff may discuss with their physician the need to be immunized against rabies and the possibility of an adverse reaction. It is noted that vaccination of all staff at risk against rabies may be a significant cost to the employer.

8.0 REFERENCES

BCCDC. Rabies. 2021. Accessed March 30 2021. Available at: http://www.bccdc.ca/dis-cond/comm-manual/CDManualChap1.htm

BC Ministry of Forests, Lands and Natural Resource Operations and Rural Development. Standard Operating Procedure (SOP): Bat euthanasia. 2014. http://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/wildlife-health/wildlife-health-documents/bat_euthanasia_sop_july_2.pdf Accessed 31 March 2021

Berndtsson LT, Nyman AK, Rivera E, Klingeborn B. Factors associated with the success of rabies vaccination of dogs in Sweden. Acta Vet Scand. 2011. 53: 22.

Bonwitt J, Oltean H, Lang M, Kelly RM, Goldoft M. Bat rabies in Washington State: Temporal-spatial trends and risk factors for zoonotic transmission (2000–2017). PloS one. 2018 Oct 9;13(10):e0205069.

Brown RC. Pre-exposure prophylaxis in amateur spelunkers. JACHA 1971;20:132-4.

CFIA. Rabies in Canada. http://www.inspection.gc.ca/english/anima/disemala/rabrag/statse.shtml

CFIA. Rabies Testing at the CFIA: Packaging of Samples. 2014. Accessed 8 April 2021. http://www.canadianveterinarians.net/rabies/en/documents/3_packaging%20of%20samples%20v1%202014.pdf

CFIA. Module 3 – Rabies Post-Exposure Management of Domestic Animals. 2014. Accessed April 8 2021. http://www.canadianveterinarians.net/practice-economics/rabies-guidance

Center for Food Safety and Public Health. Rabies Technical Factsheet. 2012. Accessed March 30 2021. https://www.cfsph.iastate.edu/diseaseinfo/disease/?disease=rabies&lang=en

Childs JE, Colby L, Krebs JW, Strine T, Feller M, Noah D, Drenzek C, Smith JS, Rupprecht CE. Surveillance and spatiotemporal associations of rabies in rodents and lagomorphs in the United States, 1985-1994. J Wildl Dis. 1997 Jan;33(1):20-7.

College of Veterinarians of British Columbia. Bylaws and Policies. Accessed April 8 2021. https://www.cvbc.ca/resources/legislation-standards-policies/

De Serres G, Dallaire F, Cote M, Skowronski D. Bat rabies in the United States and Canada from 1950 through 2007: Human cases with and without bat contact. Clin Infect Dis 2008;46:1329-37.

Dodds WJ, Larson LJ, Christine KL, Schultz RD. Duration of immunity after rabies vaccination in dogs: The Rabies Challenge Fund research study. Canadian Journal of Veterinary Research. 2020 Apr 1;84(2):153-8.

Fekadu M, Shaddock JH, Baer GM. Excretion of rabies virus in the saliva of dogs. J Infect Dis. 1982;145(5):715-9.

Gautret P, Blanton J, Dacheux L, et al. Rabies in nonhuman primates and potential for transmission to humans : A literature review and examination of selected French national data. PLOS Negl Trop Dis. 2014;8(5): 1-7.

Gibbons RV. Cryptogenic rabies, bats, and the question of aerosol transmission. Ann Emerg Med. 2002 May; 39(5):528-36.

Hanlon CA, Niezgoda M, Rupprecht CE. Postexposure prophylaxis for prevention of rabies in dogs. Am J Vet Res. 2002. 63(8):1096-1100

Heymann, D.L. 2008. Control of Communicable Diseases in Man. 19th edition, American Public Health Association, Washington, D.C.

Humphrey GL, Kemp GE, Wood EG. A fatal case of racies in a woman bitten by an insectivorous bat. Public H Rep. 1960;75(4):317-25.

Irons JV, Eads RB, Grimes JE, Conklin A. The public health importance of bats. Tx Rep Biol Med 1957;15:292-8.

Jakel V, König M, Cussler K, Hanschmann K, Thiel H-J. Factors influencing the antibody response to vaccination against rabies. Dev Biol (Basel). 2008; 131:431-7

Kamoltham T, Tepsumethanon V, Wilde H. Rat rabies in Phetchabun Province, Thailand. Travel Med. 2002 Mar-Apr;9(2):106-7.

Kennedy LJ, Lunt M, Barnes A, McElhinney L, Fooks AR, Baxter DN, Ollier WE. Factors influencing the antibody response of dogs vaccinated against rabies. Vaccine. 2007. 25 (51): 8500–8507.

Leslie MJ, Jenkins SR, Auslander M, Conti L, Johnson RH, Sorhage FE. Committee thinks rabies post-exposure protocol raises public health concerns. J Am Vet Med Assoc. 2001. 218(9): 1413-1414.

Manickam R, Basheer MD, Jayakumar R. Post-exposure prophylaxis (PEP) of rabies-infected Indian street dogs. Vaccine. 2008. 26(51):6564-6568.

Minke JM, Bouvet J, Cliquet F, Wasniewski M, Guiot A L et al. Comparison of antibody responses after vaccination with two inactivated rabies vaccines. Vet Microbiology. 2009. 133: 283–286.

Moore MC, Davis RD, Kang Q, Vahl CI, Wallace RM, Hanlon CA, Mosier DA. Comparison of anamnestic responses to rabies vaccination in dogs and cats with current and out-of-date vaccination status. J Am Vet Med Assoc. 2015. 246(2): 205-211.

Moro MH, Horman JT, Fischman HR, Grigor JK, Israel E. The epidemiology of rodent and lagomorph rabies in Maryland, 1981 to 1986. J Wildl Dis. 1991 Jul; 27(3):452-6.

Murray KO, Holmes KC, Hanlon CA. Rabies in vaccinated dogs and cats in the United States, 1997-2001. J Am Vet Med Assoc. 2009. 235(6):691-695.

NACI. Rabies Vaccine. Canadian Immunization Guide. [https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-4-active-vaccines/page-18-rabies-vaccine.html Accessed Mar 30 2021.

National Association of State Public Health Veterinarians, Compendium of Animal Rabies Prevention and Control Committee, Brown CM, Slavinski S, Ettestad P, Sidwa TJ, Sorhage FE. Compendium of animal rabies prevention and control, 2016. Journal of the American Veterinary Medical Association. 2016 Mar 1;248(5):505-17. http://www.nasphv.org/Documents/NASPHVRabiesCompendium.pdf Accessed 1 April 2021

New Mexico Department of Health. Removing Animal Heads for Rabies Testing. 2011. Available at: http://nmhealth.org/publication/view/guide/950/ Accessed 1 April 2021.

Niezgoda M, Briggs DJ, Shaddock J, Rupprecht CE. Viral excretion in domestic ferrets inoculated with a raccoon rabies isolate. Am J Vet Res. 1998;59:1629-32.

Pybus MJ. Rabies in insectivorous bats of Western Canada, 1979 to 1983. J Wildlife Dis. 1986;22(3): 307-13.

Tepsumethanon V, et al. Survival of Naturally Infected Rabid Dogs and Cats, *Clinical Infectious Diseases*, Volume 39, Issue 2, 15 July 2004, Pages 278–280, https://doi.org/10.1086/421556

Vaughn JB, Gerhardt P, Paterson JCS. Excretion of street rabies virus in saliva of cats. JAMA. 1963;184(9):705-8.

Vaughn JB, Gerhardt P, Newel KW. Excretion of street rabies virus in saliva of dogs. JAMA. 1965;193(5):113-8.

Wang X, Werner BG, Konomi R, Hennigan D, Fadden D, Caten E, Soliva S, DeMaria A. J Wildl Dis. 2009 Apr;45(2):375-87. Animal rabies in Massachusetts, 1985-2006.

WHO Expert Consultation on Rabies. Technical Report Series 1012. 2018. Geneva: World Health Organization. https://apps.who.int/iris/bitstream/handle/10665/272364/9789241210218-eng.pdf?sequence=1&isAllowed=y Accessed 1 April 2021.

WHO Rabies map https://www.who.int/gho/neglected_diseases/rabies/en/ Accessed 30 Mar 2021.

Willoughby RE Jr, Tieves KS, Hoffman GM, Ghanayem NS, Amlie-Lefond CM, Schwabe MJ, Chusid MJ, Rupprecht CE. Survival after treatment of rabies with induction of coma. N Engl J Med. 2005 Jun 16;352(24):2508-14.
Wilson PJ, Oertli EH, Hunt PR, Sidwa TJ. Evaluation of a postexposure rabies prophylaxis protocol for domestic animals in Texas: 2000-2009. J Am Vet Med Assoc. 2010. 237(12):1395-1401.

Wilson PJ, Clark KA. Postexposure rabies prophylaxis protocol for domestic animals and epidemiologic characteristics of rabies vaccination failures in Texas: 1995–1999. J Am Vet Med Assoc. 2001. 218(4): 522-525.

APPENDIX A: CONTACT INFORMATION

For rabies exposures involving humans contact the Health Authority of residence of the exposed human. **If not sure who to contact, start with the BCCDC public health veterinarian at 778-677-7790.**

Agency	Position	Contact Number
Fraser Health Authority	Central Communicable Disease Intake Line - Health Protection	1-866-990-9941
	Medical Health Officer (MHO) on call after hours	604-527-4806
Interior Health Authority	Communicable Disease Unit	1-866-778-7736
	MHO on call after hours	1-866-457-5648
Island Health Authority	South Island Communicable Disease Hub	1-866-665-6626
	Central Island Communicable Disease Hub	1-866-770-7798
	North Island Communicable Disease Hub	1-877-887-8835
	MHO on call after hours	1-800-204-6166
Northern Health Authority	Northeast Manager	250-719-6500
	Northern Interior Manager	250-565-2150
	Northwest Manager	250-631-4249
	MHO on call after hours	250-565-2000
Vancouver Coastal Health	Communicable Disease Control	604-675-3900
	MHO on call after hours	604-527-4893
British Columbia Centre for Disease Control (BCCDC)	Physician epidemiologist lead on rabies	604-707-2558
	Public Health Veterinarian	**778-677-7790**
	Physician/nurse on call during and after hours	604-875-2161
BC Ministry of Forests, Lands and Natural Resource Operations and Rural Development (FLNRORD)	Wildlife Veterinarian	250-751-3234
	Wildlife Health Biologist	250-751-3219
BC Ministry of Agriculture, Food, and Fisheries	Chief Veterinary Officer	604-556-3013
	Public Health Veterinarian	778-666-0544
CFIA Rabies Laboratories	Rabies Unit, Ottawa Laboratory Fallowfield cfia.rabieseast-rageest.acia@canaca.ca	343-212-0340
	Rabies Unit, Lethbridge Laboratory cfia.rabieswest-rageouest.acia@canada.ca	403-382-5559

Appendix B: Disclosure of confidential patient information to BC public health authorities

Rabies, along with 13 other zoonotic diseases, is a reportable animal disease to the Chief Veterinary Officer (CVO) in BC under the Reportable and Notifiable Disease Regulation, pursuant to the BC Animal Health Act [2014]. The CVO shares these reports of zoonotic diseases in animals with the Provincial Health Officer (PHO) under an Information Sharing Agreement. The PHO shares the information with the BCCDC and with the Medical Health Officer (MHO) in the Health Authority of residence of the client.

On occasion, a practice facility may be contacted by a BC MHO who is seeking to obtain information in a client's medical record.

Public health authorities are responsible for assessing and protecting public health. They prevent, investigate and control infectious diseases (e.g. outbreaks), environmental health risks (e.g. toxic chemical spill), chronic diseases (e.g. cancer), among others. Medical Health Officers and Environmental Health Officers in BC have statutory authority under the Public Health Act to request and obtain any information necessary from anyone who may have it to help them investigate a potential human health hazard or infectious disease. Most such information is reported by laboratories, physicians and patients to Medical Health Officers. In some instances, veterinarians may have animal health information that could help public health authorities assess a public health risk.

The circumstances under which a practice facility may disclosure information in a client's record is provided in the *CVBC Bylaws,* Part 4 – Ethics and Standards, s. 249, Access to information (see end of article). Specifically, s. 249 (4) (b) permits disclosure of information about an animal's health under certain conditions, including to a Medical Health Officer or Environmental Health Officer. The practice facility designated registrant has the responsibility to determine whether the person representing themselves as a Medical Health Officer or an Environmental Health Officer is legitimate and that their request meets the requirements of the bylaws, s. 249 (4) (b). Public health authorities have the responsibility to ensure confidentiality of the information provided to them.

CVBC Bylaws, s. 249, Access to information:

Access to information
249(1) In this section, "**access**" includes the opportunity to examine or obtain a copy of a client personal information or medical information as recorded in a medical record.
(2) A registrant must allow a client access to their own personal information or their animal's medical information, except if there is a reasonable likelihood that such access may result in serious harm to a patient, client or a third person.
(3) A registrant must respond in a timely fashion to a client's request for access to their own personal information or medical information, by providing

(a) full access to the records, or

(b) written reasons for the refusal to provide full access to the records.

(4) Despite the above, a registrant must provide full access to client personal information or medical information or provide a copy of a medical record to:

(a) any party that has an urgent and compelling need for the information in order to ensure the well-being of an animal;

(b) any party that has an urgent and compelling need for the information in order to ensure the health or safety of the general public or a particular person;

(c) the college for the purpose administering the Act or bylaws;

(d) a government agency or its designate, as required or authorized by law;

(e) a party on the basis of a court order or subpoena.

APPENDIX C – INSTRUCTIONS FOR SHIPMENT OF A RABIES SPECIMEN TO THE CFIA RABIES LABORATORY

Planning (prior to an exposure event)

- Review CFIA guidance and review module 2 on sample collection and submission to the CFIA rabies packaging samples for rabies testing https://www.canadianveterinarians.net/practice-economics/rabies-guidance
- Order gloves and packing supplies include bags, boxes, labels, freezer packs and absorbent material
- Store freezer packs in freezer
- Preprint shipping labels
- As appropriate, ensure staff have training in Transportation of Dangerous Goods (TDG) (http://www.tc.gc.ca/eng/tdg/training-menu-266.htm).

Who can submit a sample to the CFIA Rabies Laboratory?

- Public health professionals or animal health professionals who are fulling their duty to respond to rabies exposures can submit samples to the CFIA Rabies laboratory
- Members of the public should be dissuaded from submitting samples directly to the lab as samples may be submitted incorrectly and inappropriate reporting of results may occur
- For animal only exposures, members of the public should be directed to take the specimen to a veterinarian
- For human exposures, members of the public should follow the instructions of their local health authority

Rabies testing is available on weekends and holidays for any samples that meet the established submission criteria and are identified to the laboratory in advance of weekend or holiday. Weekend or holiday testing only occurs at the CFIA's Ottawa Laboratory - Fallowfield. If requiring weekend or holiday testing, contact the Ottawa lab at cfia.rabieseast-rageest.acia@canada.ca or at 343-212-0340 during regular business hours. Note: CFIA rabies laboratory staff at both the Lethbridge or Ottawa labs **do not** carry cell phones on Friday evenings, Saturdays, Sundays, federal holidays, or evenings prior to a federal holiday.

Preparation (when a specimen needs to be submitted)

- Follow the CFIA information sheet "Rabies Testing at the CFIA: Packaging of Samples".
- Ensure animal is dead and sample is suitable[6]:
    - For most animals:
        - Submit entire head (Appendix E).

[6] Test sensitivity is decreased for decomposing samples. Samples exhibiting decomposition should still be submitted for testing following a suspected human/domestic animal rabies exposure – it may still be possible to get a definitive positive result.

        - Include cervical spinal cord if the skull has been damaged, e.g. shot in the head.
    - For small animals (<500g):
        - 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 the cervical spinal cord (Appendix E).
        - If entire brain cannot be submitted, collect portions of the brain tissue bilaterally from the cerebellum, hippocampus and brain stem.
- Ensure proper protective equipment is worn when collection the sample (i.e. disposable waterproof gloves, disposable mask, safety glasses or goggles, and coveralls and/or waterproof apron).
- Keep animal/sample in fridge prior to packaging. Avoid freezing the specimen as it may delay testing.

Sample preparation

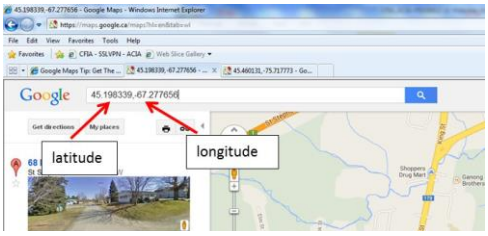
DOs	DON'Ts
• Ensure that animals are dead before packaging • Spray with insecticide, if infested with ticks or fleas • Remove maggots • Remove any needles or darts • Make level cuts during disarticulation • Leave the head intact and do not remove skin, ears or snout • Note quills, jagged bone fragments, possible bullets or shot on the submission form in "Submitter Comments" • Remove excess bags, or ones that are opaque, before packaging • Use absorbent material, such as newsprint, between primary and secondary package, and as cushioning in the outer container • Ship sample as soon as possible after collection	• Wrap brain with absorbent material or place into whirl-pak bags • Use gel sachets as absorbent material • Use wet ice, frozen water bottles, soft gel packs or dry ice for cooling sample • Use Styrofoam or other granular packing material

Temperature conditions

- Samples should be refrigerated, not frozen.
- Use ice packs to keep the sample cool during shipping according to outdoor temperature:
    - Winter (< 5^{o}C): DO NOT use ice packs.
    - Fall/Spring (5-30^{o}C): USE ice packs.
    - Summer (>30^{o}C): USE additional ice packs.

Completing the online Rabies Sample Submission form[7]

- The CFIA rabies submission form must be submitted electronically
- Each sample needs its own Rabies Sample Submission form
- Refer to the CFIA information sheet http://www.canadianveterinarians.net/documents/completing-the-electronic-submission-form
- The CFIA Rabies Sample Submission form can be found here: http://www.inspection.gc.ca/DAM/DAM-aboutcfia-sujetacia/STAGING/text-texte/c2908V1_re_1396296694437_eng.pdf
- Accessing the form:
    - You must have Adobe Reader version 9 or higher. Free download is available at: http://get.adobe.com/reader/otherversions/
    - Ensure your Adobe Reader is configured to open as a separate program and does not open directly in your internet browser
    - Download the form to your desktop
- Submission form check list:
    - Enter information into the mandatory fields and other fields as applicable
    - Assign the sample a unique Sample ID composed of the clinic name, current year and the sample number (eg. HappyVetClinic2015_1)
    - Latitude and longitude coordinates can be located in Google maps. Zoom to your location of interest on the map, right click the mouse and select 'What's here?' The latitude and longitude will be displayed in the search line.



    - Include the BCCDC email address (rabies@bccdc.ca) in the 'intermediary party' section
    - After pressing the 'Submit' button, a yellow box appears at the top of the form. Click on 'Options' and then choose 'Trust this document one time only'. Then a new box will appear. Select 'cancel', then click on 'Submit again. The data transfer will then proceed.
    - If data are successfully transferred, a pop-up box will be displayed that indicates that 'the rabies sample submission form has been successfully submitted'
    - Press 'OK' and the form will be populated with a unique Reference number
- The form has been submitted successfully if the reference number in the bottom right corner has been populated with a reference number (e.g. 2021REXS-00000123456-1) and an email is sent from "cfia.DoNotReply-NePasRepondre.acia@canada.ca" to the <SUBMITTER PRIMARY EMAIL ADDRESS>
- Include a printed copy of the electronically submitted form in package with the sample

Contact the rabies lab if you are unable to submit the form after repeated attempts or the email notification does not arrive at the submitter's primary email address. See contact information in Appendix A.

Packaging

- Keep the sample in a refrigerator prior to packaging. Freezing should be avoided as it may delay testing. If the sample is already frozen, ship it without ice packs
- **Primary packaging:**
  - Place the specimen in the first bag/container and close tightly. If possible, use two knots OR use a zipper bag and fold over and seal with tape to make leak-proof. Ideally, extracted brain tissue or bats should be placed into a screw-cap, leak-proof container.
  - Place first bag/container into a second bag and close tightly (tie knot OR zipper bag and fold over and seal with tape to make leak-proof
- Attach a label with the Sample ID to the primary packaging
- Wrapped the primary package in absorbent material such as newspaper.
- **Secondary packaging:**
  - Place the primary package into a single bag and close tightly (for air transport, this bag must be pressure compliant)
  - Secure completed rabies sample submission form to the secondary package with tape
- **Outer shipping container:**
  - Place bagged specimen into a shipping box and add absorbent material and rigid ice packs (in spring, summer and fall) to ensure the specimen remains cool for at least 48 hours
  - Add additional cushioning materials as needed
  - Seal box securely
  - Apply labels (see below)

Labeling

Addressee and shipper info needs to be on the box.

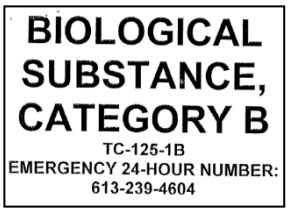
YOUR COMPLETE NAME
YOUR EMPLOYER
YOUR STREET ADDRESS
CITY, PROVINCE, POSTAL CODE
YOUR PHONE NUMBER

R-UNIT, LETHBRIDGE LABORATORY
CANADIAN FOOD INSPECTION AGENCY
TOWNSHIP ROAD 9-1
LETHBRIDGE, AB T1J 3Z4
(403) 382-5559

Label box with shipping type:

- Biological substance, Category B or
- Exempt animal specimen

If “Biological Substance, Category B”, apply both of the following labels to box:



Type of sample for shipping is determined on a case-by-case basis[8]

- **Most samples will be “exempt animal specimens”:** animal specimens not believed to contain infectious substances.
- If there is a very high likelihood of rabies, the sample should be considered “biological substance, Category B”: animal specimen believed to contain infectious substances.

Shipping

- Specimens can be shipped by courier (e.g. Purolator, Fedex), air, bus or medical laboratory transport. Verify that the shipper can deliver to the CFIA Rabies Lab within 48 hours.
- If submitting over the weekend or during holidays, verify that the shipper delivers during weekends and holidays.
- If shipping an exempt animal substance, the shipper’s waybill should indicate “Exempt Animal Substance”.
- If using Transportation of Dangerous Goods, verify that the shipper accepts infectious substances. The shipper’s waybill should indicate “Biological Substance Category B UN3373” and the shipper should be TDG certified.

[8] Based on expert opinion (21), a decision on type of sample should be made on a case-by-case basis. There are risks and operational issues to consider. The type of sample affects labelling and courier selection but does not affect packaging; packaging should always follow TDG standards. The risk of transmission from a packaged specimen is deemed very low; if exposure did occur, effective RPEP is available. Most samples submitted from BC for rabies testing are not infectious (only 3-10% of submitted BC animals test positive). In other settings, diagnostic specimens are shipped using the Exempt category. Occasionally, the suspicion of rabies is high enough to warrant Biological Substance labelling and transportation. Operational considerations include whether the available courier can transport Biological Substances and whether TDG training and annual certification is feasible. More information can be found: https://www.tc.gc.ca/media/documents/tdg-eng/TDG_BULLETIN___SHIPPING_INFECTIOUS_SUBSTANCES.pdf

Appendix D: Bat capture and euthanasia

Advice for the public about bat capture

In situations where a bat is acting strangely but there has been no human or domestic animal contact, do not attempt to capture the bat. Further advice, resources and professional assistance can be accessed by contacting the BC Community Bat Program at http://www.bcbats.ca.

Do not encourage someone who was not exposed to try and capture the bat, thus increasing their risk of exposure, since an attempt to capture a bat may increase the risk of direct contact.

If a person is already exposed and is willing, they should:

- Close all doors and windows in the area, put on a hat, leather gloves, a long-sleeved jacket and pants;
- Use a blanket, net, broom or towel to catch the bat (without touching it and while protecting any exposed area such as the face);
- Use tongs to put it in a container with air holes;
- Place the container in a cool, safe place away from human or pet contact;
- Not kill the bat;
- Bring the bat to the private veterinarian for euthanasia, packaging and shipping;
- Dispose of or disinfect and wash any tools/surfaces that had contact with the bat in a 10% bleach solution; and
- Wash clothing in hot, soapy water and dry in a hot dryer.

Advice for veterinarians about bat euthanasia

For instruction on euthanasia of bats see BC Ministry of Forests, Lands, Natural Resource Operations, and Rural Development Standard Operating Procedure (SOP): Bat euthanasia at:
http://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/wildlife-health/wildlife-health-documents/bat_euthanasia_sop_july_2.pdf

Appendix E: Removing head and extraction of a brain for rabies testing

Sample selection

For most domestic small animals including dogs and cats:

- Submit entire head
- Include cervical spinal cord if the skull has been damaged, e.g. shot in the head

For very small animals such as bats (<500g):

- Submit the entire carcass to aid species identification

For large animals (>100 kg) including all domestic large animals:

- Submit the entire brain and portion of the cervical spinal cord
- If entire brain can not be submitted, collect portions of the brain tissue bilaterally from the cerebellum, hippocampus and brain stem

Procedure

Purpose

- Submit a good specimen that will allow for accurate testing
- Prevent human infection

Supplies

- Sharp knife and sharpener
- Optional - sharp hacksaw, dehorner, lopping shears, pruning shears, or brush cutters
- Protective clothing:
  - Waterproof gloves (disposable)
  - Mask (disposable)
  - Safety glasses or goggles
  - Coveralls and/or waterproof apron
- Cleaning Supplies:
  - Detergent
  - Disinfectant
  - Paper towels
  - Plastic trash bags

Collecting the sample (Figure A)

These methods are suggestions where submission of a whole carcass is impractical. Use the technique with which you are most familiar and feel most comfortable.

Removal of the head (Fig. A): Used for domestic small and large animals

- Lay animal on its back and extend the head by pushing top of nose toward ground or bend neck back over edge of table.
- Locate the larynx. Immediately caudal to the larynx (see example that follows), using a sharp knife, make an incision through the skin and continue cutting down through the trachea and esophagus to the backbone.

- Identify the membrane covering the spinal cord between the first vertebrae (atlas) and the skull (occipital bone). The joint made by these two bones can be visualized and palpated as the animal's head is flexed and extended.
- Disarticulate the atlanto-occipital joint. It is possible to dissect the ligaments connecting this joint, but probably easier and faster to hyperextend the head and manually tear the ligaments. You will hear and feel a snap when this is accomplished.
- After disarticulation of the atlanto-occipital joint, the remaining muscle and skin can be cut with a knife to completely free the head from the body.
- Some individuals may prefer to cut through the vertebra instead of disarticulating the joint. After cutting down to the backbone, use shears or a hacksaw to cut through the first vertebra. DO NOT use an axe, hatchet or power saw because of the danger created by flying debris.
- Identify and package each animal individually as per previous instructions.

Extraction of a brain: Used for domestic large animals

- Secure head with dorsal aspect upright. A vice may be helpful for this.
- Skin head from neck to snout across the cranium.
- Make 3 cuts with a chisel or hand-saw such that they penetrate full depth of the cranium, and intersect above the eyes (Fig. B).
- Pry the cut piece of cranium free from the underlying brain.
- Extract the brain and spinal cord immediately distal to the brain stem (Fig. C).

Clean up

- Instruments and contaminated surfaces should be washed with detergent and water, and disinfected with a virucidal solution such as clorox (100 ppm), alcohol (40-70% ethanol), iodine (25 ppm), or quaternary ammonium (200 ppm) compounds.
- The body of the animal should be incinerated or properly disposed of according to local guidelines and regulations.

Figure A: Diagram showing positioning of domestic animal cadaver for removal of head for submission for rabies testing

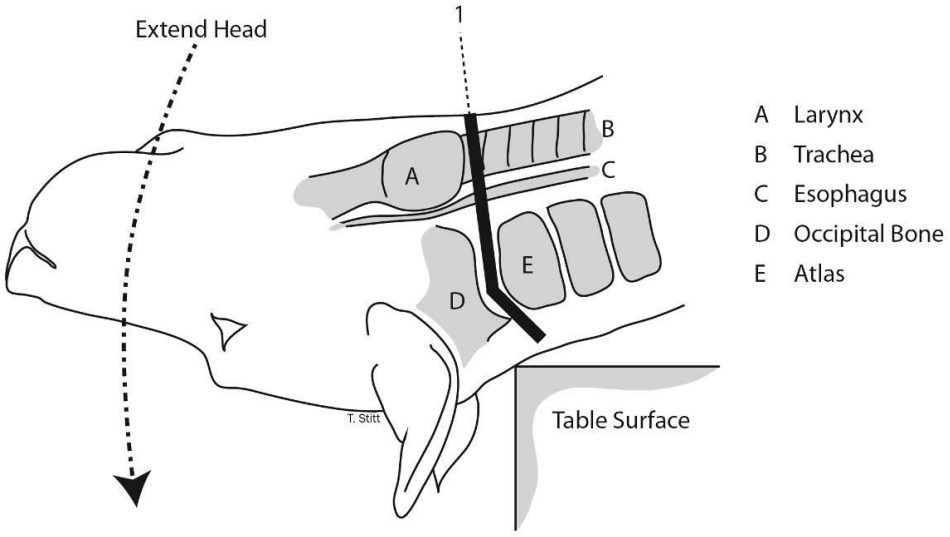


Figure B: Diagram showing location of cuts required to open cranium for removal of brain (large animal rabies suspect)

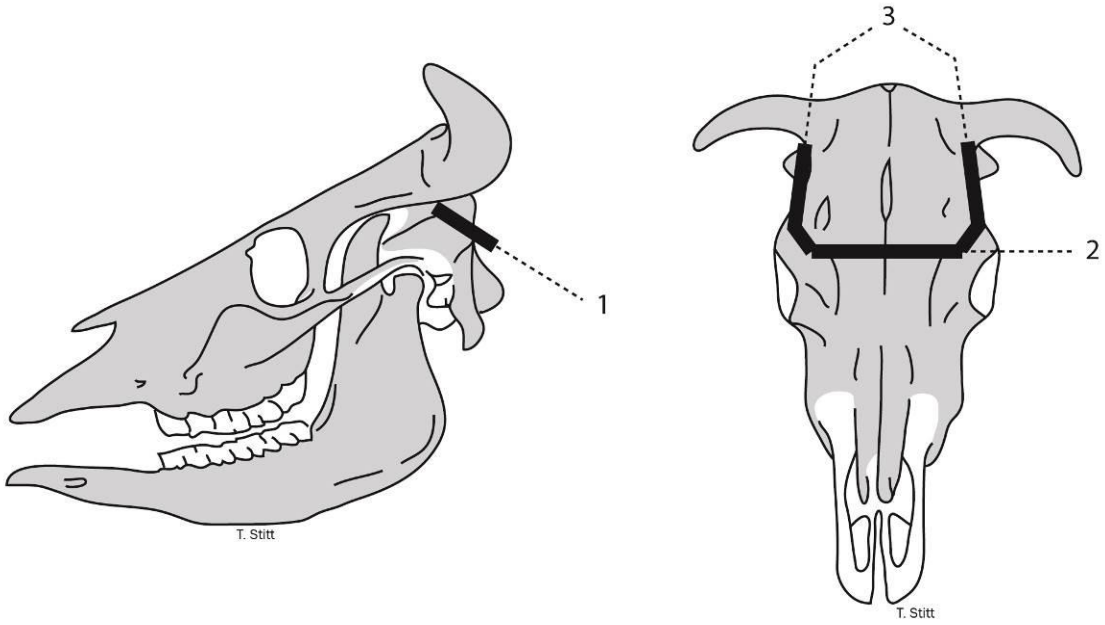
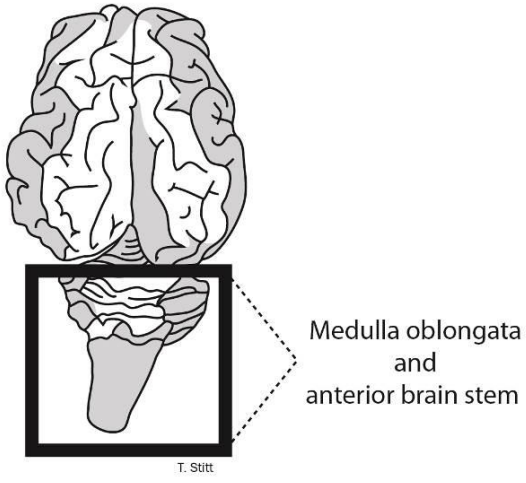


Figure C: Areas of brain (medulla oblongata and brain stem) most critical for rabies testing



Appendix F: Recommendations for animal isolation and observation by owners of a domestic animal that has been exposed to a rabid or potentially rabid animal

The private veterinarian should provide the following information to the owner of an unvaccinated or vaccinated but out-of-date domestic animal that has been exposed to a potentially rabid animal that is either unavailable for testing or tests positive.

- The exposed animal should be isolated and observed for the period of time recommended by the veterinarian in accordance with these guidelines.
- There is a risk of zoonotic transmission of rabies should their animal be infected.
    - The incubation period (from initial exposure to clinical symptoms) may range from two weeks to many months. It is important to note that they may be able to transmit the disease up to 10 days before showing clinical signs (see Section 4.0).

Isolation and observation scenarios may include:

- Pet exposed to an animal that tested positive for rabies
- Pet exposed to a potentially rabid animal and owner declined to submit the specimen for testing (no human contact)
- Pet exposed to a potentially rabid animal and specimen was not available for testing.

If the private veterinarian does not think that the owner will comply with the recommendations for observation and there is a high risk exposure (e.g. pet was exposed to an animal that tested positive for rabies) or there is an imminent public health risk, the private veterinarian should consult the BCCDC public health veterinarian (PHV) at 778-677-7790. The PHV will conduct a risk assessment including a possible discussion with the client. If the PHV feels there is a public health risk that cannot be mitigated, the PHV will inform the relevant Health Authority for further assessment and management.

Provide owners with a take-home copy of the information below: “Instructions for Owners: Isolation and observation protocols after rabies exposure in a pet”.

Instructions for Owners: Isolation and observation protocols after rabies exposure in a pet

Your pet may have been exposed to the rabies virus. Rabies is a very serious disease that can be transmitted between animals, and from animals to people, through bites and/or scratches. The virus infects the brain and nervous system of animals. It is fatal for unvaccinated animals, and also in humans unless preventive treatment is taken immediately after exposure.

It is very important that you follow the protocol described below in order to protect the health of people and animals that might come into contact with your pet. The isolation period is 3-6 months (depending on your pet's vaccination status) because rabies can take this long to become apparent following exposure. Your pet is only at risk of transmitting rabies if it is showing signs of the disease or up to 10 days before it shows signs of rabies.

Contact your veterinarian immediately if there is any change in your pet's behaviour or if you observe other signs consistent with rabies. Dogs, cats and ferrets with rabies may show a variety of signs including lethargy, nervousness, loss of appetite, excitement, wanting to be alone, fearfulness, aggression, excessive drooling, difficulty swallowing, staggering and seizures.

Isolation and observation protocols after rabies exposure in a pet:

- Identify an age-appropriate person(s) to be responsible for the pet during the observation period.
- Vaccinate all pets against rabies as soon as possible, recommended within 7 days of the exposure event.
- Confine all pets indoors - in your residence only – and **observe it for a period of ___ months**, ending on _____ (*fill in date*).
    - If a cat, this includes moving your cat's litter box indoors.
    - If a dog, keep the dog on-leash/harness and under the control of the identified-responsible person when taking it outside to go to the bathroom.
- Close all windows that are not completely screened and seal any openings your pet may use to gain access to the outdoors.
- Secure your pet in a room with the door shut or in a pet carrier when you are opening a door to areas not within your residence (i.e. outside or a hallway in an apartment building).
- Limit potential exposures to any visitors to your home by securing your pet in a room with the door closed or within a pet carrier while visitors are present.
- It is not recommended to acquire any additional pets during this confinement and observation period, and you are not to permit pets of others to have access to your pet.
- Should you need to have your pet cared for by someone other than yourself, either make arrangements for your pet to be boarded at your veterinarian or care is to be provided in your home.
- Inform any other person caring for your pet temporarily that your pet has been exposed to rabies and the conditions of the observation. They should also be informed of their personal risk, of what signs and symptoms they should watch for in your pet and to whom they should report any changes in your pet's behaviour.
- Keep a list of any person(s) that is/are exposed to your pet either while caring for it, or through accidental exposure.
- Make your pet available for observation/assessment by your veterinarian or public health official periodically upon request.

Appendix G: CLINICAL PRESENTATION IN HUMANS and EPIDEMIOLOGY

This section is included for background knowledge only. Veterinarians are advised to direct anyone with questions about human rabies to speak directly with their physician or local public health authority (see contact information in Appendix A).

Clinical description: The first signs of illness are non-specific and include fever, anxiety, and malaise. Often there is tingling and severe pruritus at the site of the animal bite. After 2 – 10 days, frank neurological signs appear, ranging from hyperactivity to paralysis. The disease is divided into encephalitic ("furious rabies") and paralytic ("dumb rabies") forms:

- In the encephalitic form, signs of irritation of the CNS predominate, including agitation, confusion, hydrophobia, aerophobia, hyperventilation, hypersalivation, priapism, and convulsions. After a few days to a week, the person may experience a stage of excitement that lasts only a few days before the person lapses into coma and death.
- The paralytic form of rabies differs in that the person does not experience a stage of excitement, but retreats steadily and quietly downhill, with some paralysis, to coma and death.

Once the virus enters the nervous system, treatment rarely affects the rapid progression to death. In 2004, a teenager who had not received RPEP developed rabies disease but survived following aggressive treatment (Willoughby 2005). This is the only known instance of survival following disease.

Incubation period: After inoculation, the virus may persist and replicate at the inoculation site for hours to weeks before progressing to nerve endings at the site of the bite. As the virus does not travel through the bloodstream or lymph system, it does not readily induce an immune response prior to entering the nerves. Once the virus enters the nerves, it is virtually impossible to treat it. The virus slowly travels up the nerves to reach the CNS where it replicates and then disseminates through nerves to many body sites including the cornea, hair follicles, and salivary glands where there is further replication.

The incubation period is usually 3 – 8 weeks, rarely as short as a few days or as long as several years. The length of the incubation period depends on the severity of the wound, site of the wound in relation to the richness of the nerve supply and its distance from the brain, and the amount and strain of virus introduced (Heymann 2008).

Infectious agent: The rabies virus is a rhabdovirus belonging to the genus *Lyssavirus*.

Mode of transmission: Infection occurs by percutaneous introduction of the virus-laden saliva or CFS of a rabid animal through a bite or scratch, or into a fresh break in the skin, or by contact with intact mucous membranes. Transmission has been reported through the transplantation of organs taken from persons who died of undiagnosed rabies. Also, wild animals may bite and infect domestic animals which in turn may infect humans.

Airborne transmission has been reported in 2 instances in a laboratory setting, where there was significant aerosolization and possible lack of personal protection. Also, there have been 2 reports of rabies acquired in a bat infested cave attributed to aerosol transmission, but there is no proof in either case that a bite or wound contamination did not occur (Irons 1957, Humphrey 1960). No well-documented natural transmission of rabies by aerosols has occurred (Gibbons 2001).

Human epidemiology: In Canada, there have been 26 human cases reported since 1924 and 3 of these occurred in BC. Among them, a 25 year old male, Alberta resident was infected by a bat while in Alberta and died in BC in 1983, a 60 year old male BC resident was infected by bat variant rabies virus in BC and died in 2003 and a 21 year old male BC resident was infected following bat exposure in BC and died in 2019.