

# SURVEILLANCE OF INFECTIOUS DISEASES

IN ANIMALS AND HUMANS IN SWEDEN 2022

*Chapter excerpt:  
Rabies*



**Editor:** Karl Ståhl

Department of Epidemiology and Disease Control  
National Veterinary Institute (SVA), SE-751 89 Uppsala, Sweden

**Authors:** Emmi Andersson, Märit Andersson, Charlotte Axén, Anna Bonnevie, Ioana Bujila, Erika Chenais, Mariann Dahlquist, Leigh Davidsson, Rikard Dryselius, Helena Eriksson, Linda Ernholm, Charlotta Fasth, Malin Grant, Gittan Gröndahl, Gunilla Hallgren, Anette Hansen, Marika Hjertqvist, Mia Holmberg, Cecilia Hultén, Hampus Hällbom, Helena Höök, Karoline Jakobsson, Désirée Jansson, Tomas Jinnerot, Jonas Johansson Wensman, Jerker Jonsson, Oskar Karlsson Lindsjö, Sara Kjellsdotter, Ulrika König, Elina Lahti, Emelie Larsdotter, Neus Latorre-Margalef, Mats Lindblad, Anna Lundén, Anna Nilsson, Oskar Nilsson, Maria Nöremark, Anna Omazic, Anna Ordell, Ylva Persson, Emelie Pettersson, Ivana Rodriguez Ewerlöf, Thomas Rosendal, Marie Sjölund, Karl Ståhl, Lena Sundqvist, Robert Söderlund, Magnus Thelander, Karin Troell, Henrik Uhlhorn, Anders Wallensten, Stefan Widgren, Camilla Wikström, Ulrika Windahl, Beth Young, Nabil Yousef, Siamak Zohari, Erik Ågren, Estelle Ågren

**Typesetting:** Wiktor Gustafsson

**Cover:** A cultivation of *Salmonella* at the Public Health Agency of Sweden.  
Photo: Nicklas Thegerström/DN/TT. Cover design by Rodrigo Ferrada Stoeהל.

**Copyright of map data:** ©EuroGeographics for the administrative boundaries

**Reporting guidelines:** Reporting guidelines were introduced in 2018 for those chapters related to purely animal pathogens. The guidelines build on experiences from several EU projects, and have been validated by a team of international experts in animal health surveillance. The aim is to develop these guidelines further in collaboration within the global surveillance community and they have therefore been made available in the form of a wiki on the collaborative platform GitHub (<https://github.com/SVA-SE/AHSURED/wiki>). Feel free to contribute!

**Layout:** The production of this report continues to be accomplished using a primarily open-source toolset. The method allows the source text to be edited independently of the template for the layout which can be modified and reused for future reports. Specifically, the chapter texts, tables and captions are authored in Microsoft Word and then converted to the LaTeX typesetting language using a custom package written in the R software for statistical computing. The package uses the pandoc document conversion software with a filter written in the lua language. Most figures and maps are produced using R and the LaTeX library pgfplots. Development for 2022 has focused on generalising the R package to accommodate conversion into formats other than LaTeX and PDF, with a focus on markdown files which can be published as HTML websites using the Quarto publishing system. The report generation R package and process was designed by Thomas Rosendal, Wiktor Gustafsson and Stefan Widgren.

**Print:** TMG Tabergs AB

Except where otherwise noted, the reuse of this document is authorised under the Creative Commons Attribution 4.0 International (CC BY 4.0) licence. This means that reuse is allowed provided appropriate credit is given and any changes are indicated. For any use or reproduction of photos or other material that is not owned by SVA, permission must be sought directly from the copyright holders.

**Suggestion citation:** Surveillance of infectious diseases in animals and humans in Sweden 2022, National Veterinary Institute (SVA), Uppsala, Sweden. SVA:s rapportserie 89 1654-7098

This report may be subject to updates and corrections. The latest version is always available for download at [www.sva.se](http://www.sva.se).

# Rabies



Figure 34: The raccoon dog is a reservoir species for rabies in endemic European countries. Photo: hannurama/iStock.

## BACKGROUND

Rabies is caused by a lyssavirus in the family *Rhabdoviridae*, which can infect all warm-blooded animals including humans. The disease occurs worldwide, with some exceptions. Rabies is transmitted through contact with saliva, typically via animal bites. Most human cases are caused by bites from infected dogs. The reservoir animal species for rabies in endemic countries are most notably among carnivores of the family *Canidae*. In Europe, the reservoir species are red foxes and raccoon dogs.

Bats in Europe may carry other types of lyssaviruses such as European bat lyssavirus (EBLV), which also can cause rabies-like disease in humans. Sweden has been free from classical animal rabies since 1886. Findings suggest that EBLV is present in Sweden, but virus has never been isolated.

## DISEASE

### Humans and animals

Rabies virus infects the central nervous system of humans and mammals. Early symptoms of rabies are non-specific, consisting of fever, headache, and general malaise. As the disease progresses, neurological symptoms appear and may include insomnia, severe anxiety, confusion, slight or partial paralysis, excitation, hallucinations, agitation, hypersalivation and difficulties in swallowing. The incubation period of rabies is usually 3–6 weeks but may vary from five days to one year.

There are still knowledge gaps on how EBLV infections affect bats. Experimentally infected bats have shown clinical signs as weight loss, disorientation, lack of coordination, muscle spasms and aggression. Some infected bats may still be normal in behaviour.

## LEGISLATION

### Animals

Rabies is a listed disease (category B, D and E) in the Animal Health Law, (EU) 2016/429. Sweden is officially free from

the disease in accordance with (EU) 2021/620. Rabies is notifiable on clinical suspicion as described in SJVFS 2021/10 (K12).

To prevent the introduction of rabies, dogs and cats must be vaccinated against rabies before entering Sweden. In addition, depending on the country of origin, some must have their antibody titre tested. The rules are set in SJVFS 2011:49 (with amendments of SJVFS 2014:47) and in the EU Regulation 576/2013.

### Humans

Rabies in humans is notifiable according to the Communicable Disease Act (SFS 2004:168 with the amendments of SFS 2013:634).

## SURVEILLANCE

### Animals

#### Passive surveillance

Animals with clinical signs where rabies cannot be excluded are euthanised and tested by fluorescent antibody test (FAT) and PCR.

#### Active surveillance

Some of the illegally imported pets that are detected and come from countries with endemic rabies are euthanised. They are examined for rabies using PCR to exclude the possible introduction of rabies in Sweden.

### Humans

The surveillance in humans is based on identification of the disease by treating physician and/or by laboratory diagnosis (i.e., passive surveillance). Contact tracing to find the source of a detected infection is mandatory in case of domestic transmission. Humans exposed to rabies virus will be evaluated for need of post-exposure vaccination and immunoglobulin treatment.

## RESULTS

### Animals

In 2022, eight dogs, two cats and one ferret were examined for rabies due to clinical suspicion. In addition, one cat originating from outside of Sweden were examined for rabies on request by the County Medical Officer due to human exposure through bites. Two dogs and two cats with foreign origin displaying unspecific clinical signs (not specific to rabies) were also examined for rabies to rule out the diagnosis.

Four dead bats were examined for rabies. The investigations were requested and paid for by different individuals. Two of the bats were kept in captivity in a tropical zoo.

In addition, 25 illegally introduced euthanised animals (24 dogs and one cat) were examined after decision by the Swedish Board of Agriculture. None of the animals had presented clinical signs associated with rabies.

In conclusion, all the above animals that were examined for rabies during 2022 tested negative.



## Humans

No human cases were reported during the year.

## DISCUSSION

During the last 50 years, two people have been hospitalised for rabies in Sweden, both of whom succumbed to the disease. In 1974, a Swedish man fell ill after having become infected in India. In 2000, a woman fell ill after a visit to Thailand. Both patients had most probably been infected by rabid dogs. Since Sweden is free from classical rabies, the risk of acquiring the disease from Swedish animals is negligible.

However, since 2004, there has been an increasing problem with illegal importation of pets, mostly dogs. Illegally imported dogs from endemic countries are probably the greatest threat to the rabies-free status of Sweden. This can be exemplified by a case reported in France 2022. A 4-year-old dog, presumably illegally imported from Morocco, developed clinical signs of rabies when in a shelter in France. After its death, it was confirmed to be infected by rabies virus. There was no further secondary transmission to other animals and all contact persons received post-exposure vaccination.

The greatest risk to people, however, is contact with dogs in countries with endemic dog rabies. In 2019 one woman in Norway died from rabies after having been exposed to a rabid puppy in the Philippines.

After the Russian invasion of Ukraine in February 2022, the EU Commission urged the Member States to make exceptions of the entry requirements for pets (dogs, cats, and ferrets) entering the EU with refugees from Ukraine. Dogs, cats, and ferrets entering Sweden from Ukraine were, under certain conditions, exempted from the requirements stated in the EU regulation 576/2013. The German National Reference Laboratory for rabies (Friedrich-Loeffler-Institute, FLI) performed a risk assessment, estimating the risk for a rabies-infected non-symptomatic pet to enter the EU to be 1:300,000. If previous rabies vaccination was documented and in line with the EU regulation, the pet was allowed to enter Sweden without prior notification. If the animal was claimed to be vaccinated but there were no supporting documents, the animal was placed in home isolation and antibody titres were tested. If titres indicated sufficient protection, the animals were released from home isolation. Otherwise, the animals had to stay in home isolation for a total of four months. In total, 384 animals (271 dogs, 112 cats and 1

unspecified species) were analysed at SVA during 2022 to assess the vaccination status.

The rabies situation in many countries, especially in the EU, is improving due to control and eradication programmes. In 2022, cases have only been reported in Hungary, Poland, Romania, and Slovakia. In Poland there was a resurgence of fox rabies in a previously free area close to the eastern border to Belarus and Ukraine in 2021. Vaccination campaigns of wild and domestic animals, and other control measures have been put in place by Polish authorities. During 2022, Polish authorities reported 32 cases of rabies in wildlife and four in domestic animals, mainly in dogs. In Romania, the 25 reported cases have all been in the border region to Ukraine and Moldova, and the two cases in Slovakia and the three cases in Hungary occurred close to the border to Ukraine. All countries in the EU are considered rabies-free or low-risk countries. EU co-finances control, eradication and surveillance programmes in member states as well as in some third countries adjacent to EU. Russia, Belarus, Ukraine, Moldova, and Turkey are considered high-risk countries with several rabies cases in wild and domestic animals each year.

From 1998 to 2016, an enhanced passive surveillance programme where dead bats were examined for the presence of rabies was implemented almost every year. In addition, from 2008 to 2013 an active surveillance programme for EBLV was performed in different regions in Sweden.

Antibodies to EBLV have been detected in specimens from live Daubenton's bats as part of the active surveillance programme, suggesting that EBLV is present in Sweden (Hammarin et al., 2016). Daubenton's bats (*Myotis daubentonii*), associated with EBLV-2, are common and may be found from the south up to the county of Ångermanland in the north. Six other *Myotis* species may also be found in Sweden. The Serotine Bat (*Eptesicus serotidatetimensis*), associated with findings of EBLV-1 in Europe, is found in certain habitats in the south of Sweden. The Northern Bat (*Eptesicus nilssonii*), which is related to the Serotine Bat, is the most common bat in Sweden, and may be found all over the country.

## REFERENCES

Hammarin AL, Berndtsson LT, Falk K, Nedinge M, Olsson G, Lundkvist Å. Lyssavirus-reactive antibodies in Swedish bats. *Infect Ecol Epidemiol.* 2016; 6: 31262. doi:10.3402/iee.v6.31262