SURVEILLANCE OF INFECTIOUS DISEASES

IN ANIMALS AND HUMANS IN SWEDEN 2022

Chapter excerpt:
Tick-borne encephalitis

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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.
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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.

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SVA NATIONAL VETERINARY INSTITUTE

visiting address. Ulls väg 2B **address.** 751 89 Uppsala
telephone. +46 18-67 40 00
e-mail. sva@sva.se **web.** www.sva.se

Tick-borne encephalitis

BACKGROUND

Tick-borne encephalitis virus (TBEV) belongs to the genus flavivirus in the family *Flaviviridae*. TBEV is endemic in an area ranging from northern China and Japan, through far-eastern Russia to Europe. The virus can cause a neurological infection which may lead to long-term sequelae in the affected patients. The virus circulates in a cycle involving ixodid ticks, e.g., *Ixodes ricinus* (Sheep tick) and *I. persulcatus* (Taiga tick), and their vertebrate hosts, mainly small mammals. For example, wild rodents act as a natural reservoir for TBEV. The virus can also circulate in the tick population through transovarial transmission without involvement of vertebrate hosts. Large mammals, predominantly ungulates, are important for the maintenance of large tick populations. Humans are accidental hosts and do not contribute to the circulation of TBEV. Humans typically become infected via ticks, although unpasteurised milk and milk products have also been reported as sources. Vaccination of persons living, visiting, or working in endemic areas is recommended by the Communicable Disease Control Units in Sweden.

Three sub-types of TBEV are described: the European, Siberian and Far Eastern subtypes. So far, only the European subtype has been identified in Sweden.

The first human case of tick-borne encephalitis (TBE) infection in Sweden was reported in 1954. During the following three decades, 10–40 annual cases were reported. From the mid-1980s a clearly increasing trend has been observed. In recent years about 200–500 cases have been reported annually, with a peak in reported cases (n=533) during 2021. The majority of cases are infected in Sweden and most affected people have been infected on the east coast of Sweden and in the Stockholm archipelago. However, in recent decades cases have also been observed regularly on the west coast of the country and the infection occurs from Skåne in the south to Gävleborg and Dalarna in the north. The age distribution is wide but most of the cases are seen between the ages of 30 and 70 years. There is a slight over-representation of infected men. A majority of the patients are diagnosed between July to October.

DISEASE

Animals

In general, animals develop a subclinical infection. Confirmed clinical cases have been reported in dogs and was first reported in Sweden in 2019. Also, clinical confirmed cases in horses have been observed in Europe but our knowledge about the impact of TBEV infection in horse populations are scarce. Seroconversion has been demonstrated in grazing domestic animals such as goats, sheep and cattle as well as in wild ungulates. Ruminants may excrete the virus in milk. Wild rodents are considered the natural reservoir for TBEV but are not reported to contract the disease.

Figure 54: The tick-borne encephalitis virus is spread by ixodid ticks. The most common tick species in Sweden is the *Ixodes ricinus*. The photo shows an adult, female, *I. ricinus*. Photo: Anders Lindström.

Humans

In humans, a biphasic course of the disease is common. The first, viraemic phase lasts for about four days. After an interval of about a week, a meningoencephalitic phase appears in about one third of the patients. The symptoms may include fever, headache, nausea, cognitive dysfunctions or spinal paresis. The mortality is low for infection with the European subtype, about 0.5%. The incubation period of TBE is usually between 7 and 14 days.

LEGISLATION

Animals

TBE is not a notifiable disease in animals in Sweden.

Humans

TBE in humans is notifiable since 2004, according to the Communicable Disease Act (SFS 2004:168 with the amendments of SFS 2022:217).

SURVEILLANCE

Animals

The veterinary aspects of this zoonotic disease are little noticed since animals rarely show any clinical signs. However, serological testing of wild animals (e.g., moose and deer), and grazing domestic animals, as well as analysing colostrum from goat, sheep and cattle, has been suggested as an indicator of the circulation of the virus.

Humans

TBE is notifiable based on identification of the disease by a treating physician or by laboratory diagnosis. Both are obligated to report identified cases to the regional and national level to enable further analyses and adequate intervention measures.

RESULTS

Animals

No surveys on TBE in animals were performed in 2022. Nevertheless, results from a recently published study where dairy milk from cow and goat were tested revealed important information for identification of emerging TBE risk areas in Sweden. Factors such as consumption of unpasteurised milk, limited use of tick prophylaxis on animals and a moderate coverage of human TBE vaccination, was presented as possible risk factors for TBEV infection in Sweden.

Humans

In 2022, 467 cases of TBE were reported, which is a decrease compared with the previous year (n=533) (Figure 55).

More men (62%) than women were reported infected with TBE. The incidence was highest in the age group 40–79 years (median age 50 years, range 2–94 years of age). Normally, few young children are reported with TBE and this was also the case in 2022 with only four cases among children below the age of 5, despite the high total number of cases.

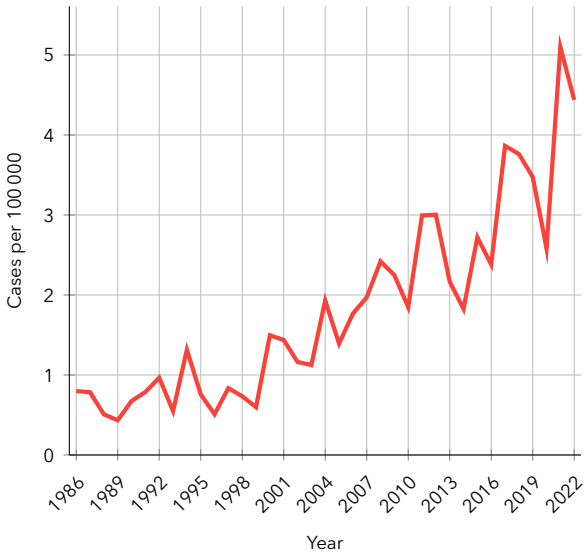

Figure 55: Incidence (per 100 000 inhabitants) of notified cases of tick-borne encephalitis in humans 1986–2022.

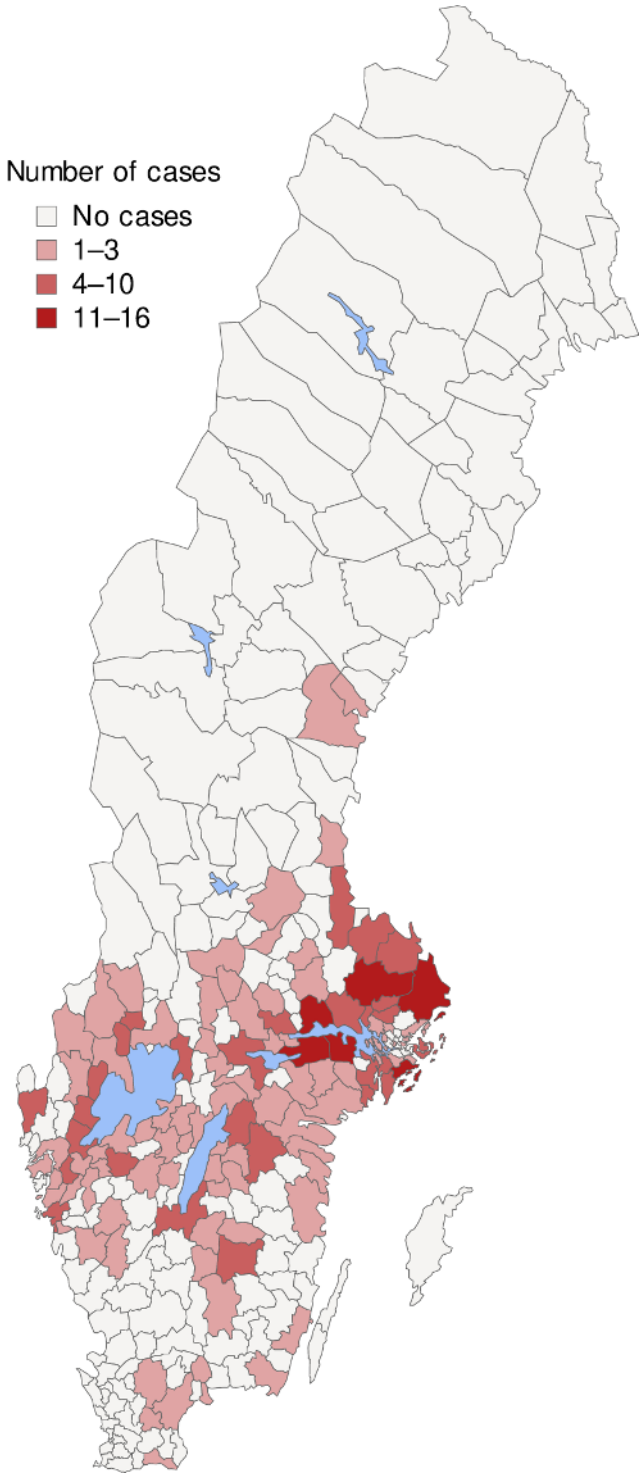

Figure 56: Geographical distribution of notified cases of tick-borne encephalitis in humans in 2022, based on the municipality of infection.

All except twelve cases acquired their infections in Sweden. Nine people were infected in Finland, two in Norway and one in Austria. TBE is spreading in the country and in 2022 the infection was reported from eleven municipalities that have previously had no cases (Figure 56). The first TBE case became ill in March and the last in November. Most cases were reported in August. Although the incidence decreased slightly in 2022 compared with the previous year, it was still at a higher level compared to all the years before 2021. This high incidence was probably due to several interacting factors, such as continued high densities of small rodents in 2021 and favourable weather for ticks as well as for people spending more time outdoors.

DISCUSSION

The overall picture shows a significantly increasing trend of the incidence since the reporting started.

Although most human cases acquire the TBEV infection via tick bites the infection can be food-borne. Outbreaks and clusters of cases of TBE caused by consumption of unpasteurised milk or milk products have been described in several European countries. National surveys recently performed in Sweden show that the virus circulates in the Swedish population of dairy cattle and sheep.

The peak in reported cases during 2021, and the long-term increase in TBE incidence is probably due to several interacting factors. The most important cause is presumably the very dense population of ticks, a consequence of a large roe deer population from the 1980s. This situation in combination with a high population of small host animals such as bank voles, and optimal weather for both virus spread and humans spending time outdoors, could explain the large number of cases reported. Milder winters with less snow cover, increased precipitation throughout the year, and prolonged vegetation period, especially in the southern parts of Sweden, have improved the survival and abundance of ticks and plays a potential role in the long term, enabling ticks to spread to new areas.

I. ricinus can transmit the European TBEV whereas *I. persulcatus* can harbour also Siberian and Far Eastern subtypes of TBEV that are associated with much more severe forms of the disease. At present, the two latter subtypes have not yet been identified in Swedish ticks. However, the risk of their appearance (likely to be followed by severe human cases of TBE) in the northern parts of the country now or in the near future has become real considering the ongoing spread of *I. persulcatus* along the northern coastline.

REFERENCES

Andersson E, Kendall A, Url A, Auer A, Leschnik M (2020) The first RT-qPCR confirmed case of tick-borne encephalitis in a dog in Scandinavia. Acta Vet Scand, 62:51, https://doi.org/10.1186/s13028-020-00550-2.

Blomqvist G, Näslund K, Svensson L, Beck C, Valarcher JF (2021) Mapping geographical areas at risk for tick-borne encephalitis (TBE) by analysing bulk tank milk from Swedish dairy cattle herds for the presence of TBE virus-specific antibodies. Acta Vet Scand, 63:16, https://doi.org/10.1186/s13028-021-00580-4.

Kunze M, Banović P, Bogovič P, Briciu V, Čivljak R, Dobler G, Hristea A, Kerlik J, Kuivanen S, Kynčl J, Lebech A-M, Lindquist L, Paradowska-Stankiewicz I, Roglić S, Smíšková D, Strle F, Vapalahti O, Vranješ N, Vynograd N, Zajkowska JM, Pilz A, Palmborg A, Erber W (2022) Recommendations to improve tick-borne encephalitis surveillance and vaccine uptake in Europe. Microorganisms, 10:1283, https://doi.org/10.3390/microorganisms10071283.

Omazic A, Wallenhammar A, Lahti E, Asghar N, Hanberger A, Hjertqvist M, Johansson M and Albihn A. 2023. Dairy milk from cow and goat as a sentinel for tick-borne encephalitis virus surveillance. Comp Immunol Microb, 95: 101958, https://doi.org/10.1016/j.cimid.2023.101958.

Wallenhammar A, Lindqvist R, Asghar N, Gunaltay S, Fredlund H, Davidsson Å, Andersson S, Överby A K., Johansson M (2020) Revealing new tick-borne encephalitis virus foci by screening antibodies in sheep milk. Parasites Vectors, 13:185, https://doi.org/10.1186/s13071-020-04030-4.