

# SURVEILLANCE OF INFECTIOUS DISEASES

IN ANIMALS AND HUMANS IN SWEDEN 2022

*Chapter excerpt:*  
*Tularaemia*



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**Cover:** A cultivation of *Salmonella* at the Public Health Agency of Sweden.

Photo: Nicklas Thegerström/DN/TT. Cover design by Rodrigo Ferrada Stoehrel.

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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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# Tularaemia

## BACKGROUND

The bacterium *Francisella tularensis* is the causative agent of tularaemia, a disease affecting many animal species, including humans. Although many different animal species can be infected, tularaemia is typically found in hares and small rodents. There are several subtypes of *F. tularensis* of variable virulence. *F. tularensis* subsp. *holoarctica* (type B) is the main subspecies responsible for human and animal infection in Europe. *F. tularensis* is capable of surviving for weeks at low temperatures in water, moist soil, or decaying plant and animal matter.

Humans become infected through a variety of mechanisms such as bites of infected insects or other arthropods, handling infected or dead animals, ingesting contaminated food or water, and inhaling aerosols of bacteria. Clinical

disease is variable and dependent on the route of transmission. The age group of 40–79 years is the most affected in both sexes. Tularaemia may occur during the whole year, but elevated number of cases are commonly seen during late summer and early autumn.

Hares and other animals are probably infected by the same routes as humans even if it is difficult to prove. Lesions in the skin are difficult to find in furred animals, but in some hare cases the infection sites have been confirmed by finding still attached ticks and pathology corresponding to tularaemia. In hares with pneumonia a respiratory route might be suspected. In wildlife species that are more resistant to developing disease upon infection, e.g., carnivores and omnivores, *F. tularensis* has been found in lymph nodes in the jaw region suggesting infection through contaminated food or water.



Figure 59: Dead European brown hare reported by the public. In 2022, *Francisella tularensis* was detected in 5 European brown hares and 3 mountain hares. Photo: Anonymous.

Sweden has reported cases of tularaemia in humans and animals since 1931. Ever since the first Swedish tularaemia case was reported, endemic areas have been identified in northern and central Sweden.

The mountain hare and the European brown hare are the animal species in which tularaemia has most frequently been identified. Diseased animals have been found in the traditionally endemic areas in northern and central Sweden, as well as in regions south of these areas.

The annual numbers of reported human cases range from a few cases to more than 2700 cases in 1967.

## DISEASE

### Animals

In Swedish hares, and in many rodent species that die of tularaemia, a common pathological presentation of the disease is a disseminated multi-organ septicaemia. Some of the hares have lesions corresponding to a somewhat more prolonged course of disease, but ultimately the infection resumes a more acute course ending in septicaemia. Carnivores and omnivores are animal species that develop no or mild disease. Studies of several wild carnivore and omnivore species in Sweden and other countries have detected antibodies but no signs of disease.

### Humans

Tularaemia can be manifested in different forms depending on the route of transmission and on the virulence of the organism. The ulceroglandular form is the most commonly diagnosed form and is more frequently seen than the typhoidal form. The pneumonic, oculoglandular and oropharyngeal forms are rarely diagnosed. In the ulceroglandular form, a local ulcer usually appears at the site of infection and the adjacent lymph nodes are enlarged. The general symptoms of tularaemia are high fever, headache and nausea.

## LEGISLATION

### Animals

Tularaemia is notifiable in animals (SJVFS 2021:10).

### Humans

Tularaemia has been a notifiable disease since 1970 according to the Communicable Disease Act (SFS 2004:168 with the amendments of SFS 2022:217).

## SURVEILLANCE

### Animals

Surveillance in animals is passive. It is based on voluntary submission of animals found dead or euthanised by hunters and the general public. Detection is based on PCR or immunohistochemistry of the animal sample. Laboratories are required to report identified tularaemia cases in animals to the authorities.

### Humans

Notification of human cases is mandatory and surveillance is 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. For laboratory verification of the infection, serology, PCR and isolation of the bacteria are used.

## RESULTS

### Animals

In 2022, 22 European brown hares, 6 mountain hares, 3 red squirrels and 8 dogs were investigated. The number of reported dead hares and the number submitted for examination was lower than in the previous year and lower than in the outbreak year 2019. *F. tularensis* subsp. *holarctica* was detected in 5 European brown hares, 3 mountain hares and 3

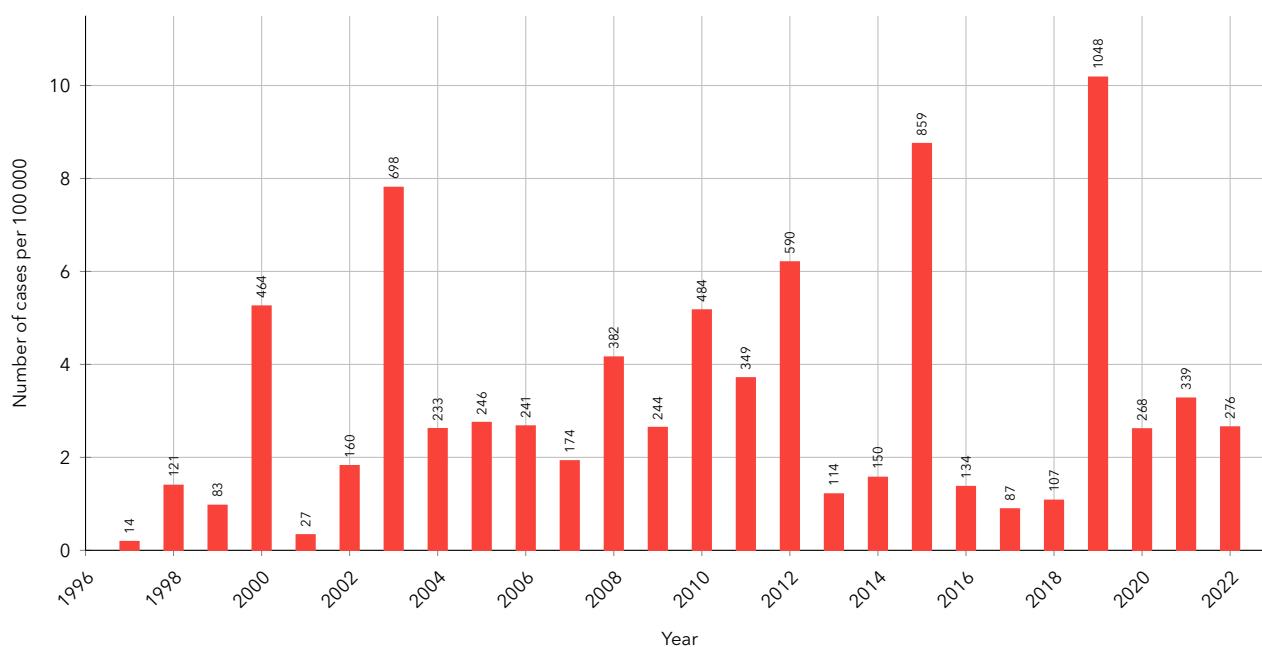


Figure 60: Incidence of notified human cases of tularaemia in Sweden 1997–2022. Bars indicate the incidence per 100 000 inhabitants and adjacent numbers the total number of cases reported.

red squirrels. Tularaemic hares were found in four counties (Västerbotten, Dalarna, Uppsala and Stockholm). The number of positive hares per county ranged from one to three. The 3 positive red squirrels were found in Västerbotten in connection with tularaemic hares. Three investigated dogs were serologically positive for tularaemia.

### Humans

In 2022, 276 human cases of tularaemia were reported, which is a similar number of cases as seen over the last three decades (Figure 60). Of the cases for which the country of infection was known, the vast majority (99%) were reported as infected in Sweden. For the population as a whole, the incidence was 2.6 per 100 000 inhabitants. However, as in previous years, there were considerable regional differences with a larger proportion of cases in the central and northern parts of the country (Figure 61). During 2022, the incidence was highest in the county of Västerbotten with 41 cases per 100 000 inhabitants, followed by the county of Jämtland with 19 cases per 100 000 inhabitants. The reasons behind the annual and regional fluctuations observed are not known.

More men (63%) than women were reported to be infected in 2022, which is in accordance with previous years. The incidence of tularaemia was highest in the age group 40 years and older, which is also similar to previous years. The uneven distribution among age groups and sexes might partially be attributed to the demographic distribution of people who work or practice leisure activities outdoors in high-risk rural areas.

As in previous years, the number of cases started to increase in July and peaked at the end of August and in September.

### DISCUSSION

Tularaemia has been endemic in northern and central Sweden at least since the early 20<sup>th</sup> century with a marked annual variation. Years with high numbers of cases are often followed by periods when the disease is virtually absent. There is no obvious explanation for these fluctuations. Probably, variations in population sizes of host animals and insect vectors that can transmit infection to humans play a major role which in turn is influenced by factors such as predators, diseases, weather and climate.

During the last two decades, the epidemiology of tularaemia has changed and the number of reported cases in humans and animals, mainly hares, infected south of the previous endemic region is increasing. Since the information on diseased and dead hares is dependent on voluntary reporting and submitting animals for investigation the true numbers are not known.

The reservoir for the bacterium between outbreaks has not been clearly identified. In some countries, outbreaks of tularaemia in animals have been associated with a rise in rodent and hare populations, but this has not been confirmed in Sweden. The epidemiological role of the hare as a possible carrier of *F. tularensis* is unclear.

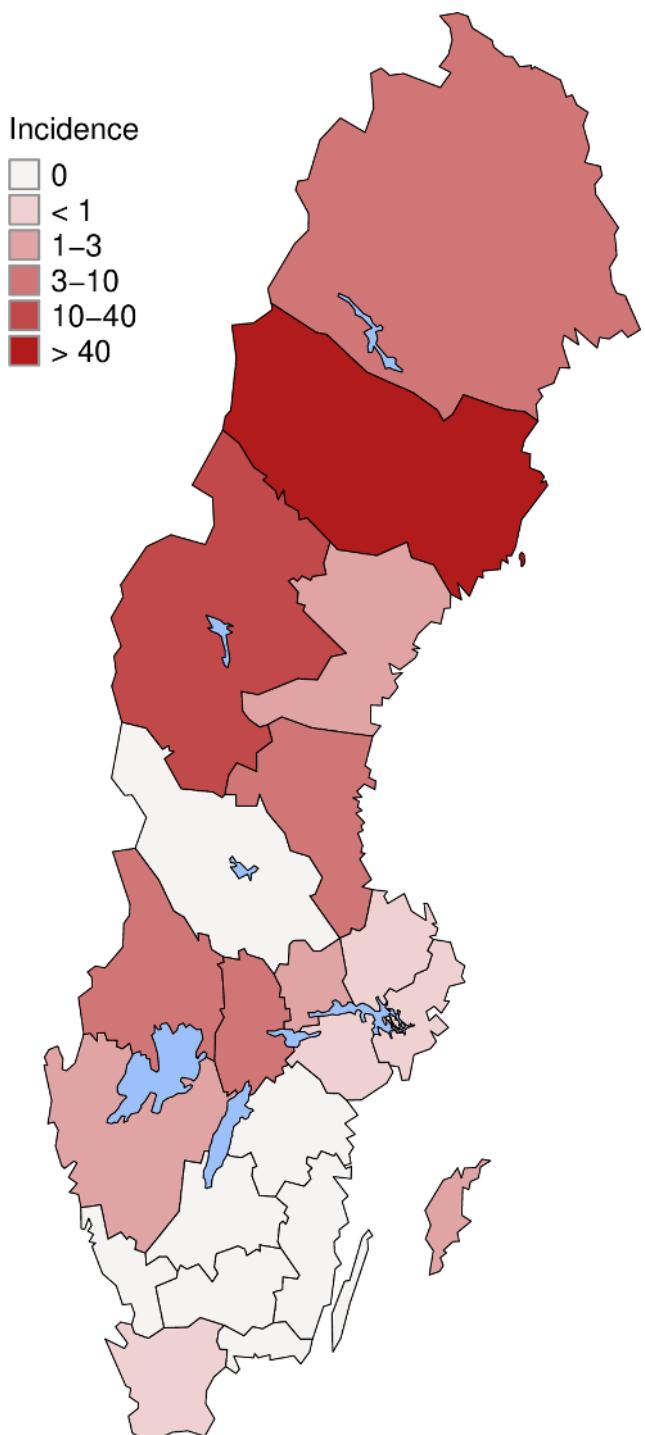


Figure 61: Incidence of reported human tularaemia cases in Swedish counties 2022. The colour scale represents the number of cases per 100 000 inhabitants.