SURVEILLANCE OF INFECTIOUS DISEASES

IN ANIMALS AND HUMANS IN SWEDEN 2022

Chapter excerpt:
Brucellosis

NATIONAL VETERINARY INSTITUTE

Jordbruksverket
Swedish Board of Agriculture

Folkhälsomyndigheten
PUBLIC HEALTH AGENCY OF SWEDEN

Livsmedelsverket
Swedish Food Agency

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 Stoehrel.

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

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.

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

Brucellosis

BACKGROUND

Brucellosis is caused by zoonotic, gram-negative bacteria belonging to the genus *Brucella*. Most human cases are caused by four species, each having a preferred animal host. *Brucella melitensis* occurs mainly in sheep and goats, *Brucella abortus* in cattle, *Brucella suis* in pigs and *Brucella canis* in dogs. The infection is transmitted by contact with placenta, foetus, foetal fluids and vaginal discharges from infected animals and may also be found in milk, urine, semen and faeces. *In utero* infections occur, but venereal transmission seems to be uncommon. Humans are usually infected through contact with infected animals or contaminated animal products, such as cheese made of unpasteurised milk. Brucellosis was eradicated from the Swedish cattle population during the last century. The last Swedish bovine case was recorded in 1957. Sweden is officially free from both *B. abortus* and *B. melitensis*. *B. suis* has not been reported from Sweden since 1957. Brucellosis in humans has been a notifiable disease in Sweden since 2004. Between 4 and 19 human cases have been reported annually, the majority of these cases are travel-associated or have acquired the infection via consumption of products from countries where brucellosis is endemic. Since 2010 there has been approximately one domestic case reported annually. Predominantly these cases have, or were suspected to have, consumed unpasteurised milk products from endemic countries.

DISEASE

Animals

In animals, brucellosis mainly causes reproductive disorders such as abortion, orchitis and epididymitis. Arthritis is occasionally seen in both sexes. Systemic signs and deaths are rare, except in the foetus or newborn animal. The period between infection and abortion or other reproductive signs is variable. Infected asymptomatic females may shed the organism in milk and uterine discharges.

Humans

B. melitensis is considered to be the most severe human pathogen in the genus. Brucellosis in humans is commonly characterised by fever periods that wax and wane (undulant

Figure 11: Unpasteurised dairy products from countries where brucellosis is endemic is the most common source of infection for brucellosis in Sweden. Photo: Erika Chenais.

fever) with headache, malaise and fatigue. Untreated brucellosis can continue for months and progress to meningitis, cardiac infections, bone and joint infections. If left untreated the mortality rate is around 2%.

LEGISLATION

Animals

Brucellosis caused by infection with *Brucella abortus, B. melitensis* or *B. suis* is a listed disease (category B, D and E in cattle, sheep and goats, and D and E in pigs and other cloven-hoofed mammals) in the Animal Health Law, (EU) 2016/429. Sweden is officially free from infection with *Brucella abortus, B. melitensis* or *B. suis* in cattle, sheep and goats in accordance with (EU) 2021/620, and surveillance to demonstrate freedom is implemented in accordance with (EU) 2020/689. Brucellosis (here defined as infection with *Brucella abortus, B. melitensis*, *B. suis* or *B. ovis)* in food-producing animals is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) and notifiable as described in SJVFS 2021/10 (K12). Brucellosis (also including infection with *B. canis)* in non-food-producing animals is not included in the Swedish Act of Epizootic diseases but is still notifiable.

Humans

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

SURVEILLANCE

Animals

The purpose of the surveillance activities is to document freedom from bovine and ovine brucellosis in Sweden in accordance with the EU legislation, and also to document freedom from the disease in the Swedish pig population. The Swedish Board of Agriculture finances the surveillance, which is planned and executed by the National Veterinary Institute (SVA). Since the start of the screenings, no samples have been confirmed positive. All diagnostic testing is performed at SVA. Bovine samples (serum and milk) are tested with an indirect ELISA (IDEXX Brucellosis Serum Antibody Test Kit, IDEXX Laboratories, Westbrook, Maine, United States), and porcine, ovine and caprine samples (serum) are tested with the Rose Bengal Test (RBT). In case of positive reactions in the ELISA or RBT, serum samples are confirmed with a complement fixation test (CFT). For positive bovine milk samples, serum samples are requested for re-testing with the ELISA.

Diagnostic tests for animals with clinical signs suggesting brucellosis or animals that are to be exported/imported will often be tested with the same diagnostic tests as used in the surveillance programme. Samples from animals (foetuses) included in the enhanced passive surveillance of aborted foetuses (see the chapter "Examinations of abortions in food producing animals" on page 146) are also tested for *Brucella* spp. by bacteriological culturing. Rapid slide agglutination test (RSAT) is the most common test for dogs. A positive case is defined as an animal from which *Brucella* spp. has been isolated, or in some cases an animal with a confirmed positive serological reaction.

Humans

Diagnosis of human cases is made by real-time PCR, serology and culture. Positive colonies are investigated by MALDI-TOF and always tested for antibiotic resistance with broth microdilution.

Passive surveillance

Animals

Suspicions based on clinical signs in food producing animals must be reported to the Swedish Board of Agriculture and will be subsequently investigated. In addition, culture for *Brucella* spp. is included in the enhanced passive surveillance of aborted foetuses of ruminants and pigs, see the chapter "Examinations of abortions in food producing animals" (page 146).

Brucellosis in dogs is not included in the Swedish Act of Epizootic diseases and the zoonotic potential of *B. canis* is considered to be significantly smaller than that of *B. abortus*, *B. melitensis* or *B. suis*. Nevertheless, confirmed (serology or bacterial culture) cases of infection with *B. canis* are notifiable and cases have also been investigated and put under restrictions by the Swedish Board of Agriculture.

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.

Active surveillance

Animals

Screening for *B. abortus* has been conducted regularly in Sweden since 1988, for *B. melitensis* since 1995 and for *B. suis* since 1996.

Serological testing of all susceptible species prior to export, and in bulls and boars at semen collection centres, adds to the active disease surveillance of *Brucella* spp.

Surveillance for brucellosis in cattle

Since 2010 this sampling is conducted every third year and was thus performed in 2022. From 1997 and onwards, the sampling has encompassed approximately 3000 samples (bulk milk and/or serum samples; each year 1997–2010, every third year from 2010 and onwards) for antibodies against *B. abortus*. Samples are selected by systematic random sampling of every second serum and milk sample collected in the surveillance programmes for bovine viral diarrhoea and enzootic bovine leucosis.

Sample size is calculated on a yearly basis to reach a probability of freedom of 99% at the end of the year for dairy cattle and beef cattle populations separately. To reach this target, 1000 bulk milk samples from dairy herds and 2700 serum samples from beef cattle herds are required.

Surveillance for brucellosis in sheep and goats

Serum samples are tested for antibodies against *B. melitensis*. The sheep serum samples are collected within the surveillance programme for Maedi/Visna and the goat serum samples collected within the Caprine Arthritis Encephalitis programme. The samples are selected by systematic random sample by collecting the first 5 samples submitted from each herd in these surveillance programmes.

The ovine and caprine brucellosis surveillance of 2022 was designed with a between-herd design prevalence of 0.2%, a within-herd prevalence of 40% and a risk of introduction of 1 in 25 years. Sample size is calculated on a yearly basis to reach a probability of freedom of 95% at the end of the year. To reach this target, 2000 samples (five samples per herd from 400 herds per year) is required.

Surveillance for brucellosis in pigs

From 1996 until 2008 approximately 3000 serum samples from pigs were tested for antibodies against *B. suis* each year. Beginning in 2009, serum samples are tested every second year, this sampling was not performed in 2022. Serum samples are collected at slaughter within the surveillance programmes for Porcine reproductive and respiratory syndrome and Aujeszky's disease. The samples are selected by systematic random sample by collecting the first sample submitted from each herd in this surveillance programme. Sample size is calculated on a yearly basis to reach a probability of freedom of 99% at the end of the year. To reach this target, 750 samples from 750 herds are required.

RESULTS

Passive surveillance

Animals

During 2022, four clinical suspicions of brucellosis were reported in food-producing animal species.

Within the surveillance of aborted foetuses, 20 bovine, 20 ovine, 3 caprine, and 15 porcine foetuses were examined for *Brucella* spp. All samples were negative.

Humans

In 2022, ten human cases of brucellosis were reported, which is comparable with the previous ten-year period. The age and gender distributions (median age 41 years, range 25–71 years, equal gender distribution) were also similar to previous years. Three of the cases formed a cluster and were reported to have been infected in Sweden by a goat cheese from Iraq. Six cases were reported to have acquired their infections in Iraq and for one case the country of infection was unknown. For a total of seven cases unpasteurised dairy products were indicated as the probable source of infection, which has been the most common source of infection for brucellosis in recent years. As in previous years, *Brucella melitensis* was identified in all cases. All of the isolates were sensitive to the antibiotics commonly used for treating brucellosis.

Active surveillance

Animals

During 2022, 2256 bovine serum samples and 1506 bulk milk samples were analysed for *B. abortus*. All these samples were negative, assuring sustained freedom from *B. abortus* in the bovine population. Analysis for *B. melitensis* was performed on 1998 ovine and caprine serum samples from 428 individual holdings. All these samples were negative, assuring sustained freedom from *B. melitensis* in the ovine and caprine population. All samples from the serological testing prior to export and from bulls at semen collection centres were also negative.

During 2022, 33 dogs tested positive for *B. canis* using serology. The majority of these dogs were imported or had contact with imported dogs.

DISCUSSION

In summary, *Brucella* infection was not detected in cattle, sheep, goats or pigs during 2022. The long standing and extensive serological screenings performed without finding any infection accompanied by the additional enhanced passive surveillance in aborted foetuses from food-producing animals and the very low number of human cases, only occasionally domestically acquired, confirms that *Brucella* is not present in Swedish food-producing animals.

An unknown number of stray dogs from countries where *B. canis* is endemic are brought into Sweden every year. It is important to be aware of the risk this group of dogs represents, for *Brucella* infection as well as for other diseases. Imported non-stray dogs, or dogs mated abroad are seen as a risk factor for introduction of *B. canis* into Sweden as well. During the years 2011–2021, seven dogs have tested positive for *B. canis* using bacterial culture and/or serology. The sharp increase in seropositive dogs in 2022 is associated with an increase in number of samples submitted for testing. In 2020 and 2021, 8 and 89 dogs were tested for *B. canis* respectively, compared to 149 in 2022 (the figures include testing for export, clinical suspicions and contact tracing of positive dogs). This increase could be due to an increase in cases with clinical signs raising suspicions of infection with *B. canis* or an increased incidence of *B. canis* cases, but also to increased awareness about *B. canis* among Swedish veterinarians in clinical practice.