

# SURVEILLANCE OF INFECTIOUS DISEASES

IN ANIMALS AND HUMANS IN SWEDEN 2022

*Chapter excerpt:  
Small ruminant lentiviruses*



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**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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# Small ruminant lentiviruses

## BACKGROUND

Small ruminant lentiviruses (SRLVs) include caprine arthritis-encephalitis virus (CAEV) and visna/maedi virus (VMV) in the retrovirus family. Maedi-visna (MV) is a globally distributed contagious disease in sheep, first described in Iceland in 1939. Caprine arthritis-encephalitis (CAE) and MV are common diseases in most goat and sheep producing countries all over the world. Transmission between animals occurs most commonly via the oral route (mainly via milk and colostrum) but may also occur via inhalation of infected aerosol droplets. The incubation period is long; often 4–5 years. Lentiviruses persists in the animal for life despite the presence of neutralising antibodies.

The first case of MV in Swedish sheep was officially reported in 1974. Fifteen years later, the flock-level seroprevalence was 8.2% as demonstrated by sampling of randomly selected sheep at abattoirs. The prevalence of CAE in Sweden is not known, but in a pilot study from 2018 30% of the herds were seropositive.

Voluntary control programmes for MV and CAE were launched by Farm & Animal Health (at the time called Svenska Djurhälsovården) in 1993 and 1999, respectively, and in 2005 an additional simplified version started, with single sampling of sheep and goats to identify diseased flocks and then in the next step enrol them into the control programme. From 2020, the simplified version is no longer available. The MV and CAE programmes were run in parallel, but from 2020, they are merged into one programme called the MV/CAE programme.

Data from all sampled and controlled flocks have been recorded since 1993.

## DISEASE

Only the maedi form of MV, a progressive viral pneumonia, is occurring in Swedish sheep flocks. The visna form, a central nervous system disease characterised by chronic wasting, is not, as far as we know, manifested in Swedish sheep. The disease typically remains latent in the flock for several years before appearing with clinical manifestations. In an advanced stage of the disease the typical clinical signs are severe emaciation and respiratory distress in older ewes. After the appearance of clinical signs, the outcome is always fatal within weeks to months. CAE occurs in four different forms: arthritis, nervous form, pneumonia, and mastitis. In Sweden, subclinical disease is probably most common.

## LEGISLATION

MV and CAE are notifiable diseases (SJVFS 2021:10). The control programme is regulated through SJVFS 2015:17 (K 152).



Figure 52: The purpose of the control programme is to eradicate maedi-visna (MV) and caprine arthritis-encephalitis (CAE) from Swedish sheep and goat flocks and to prevent introduction into free flocks. Photo: Ylva Persson.

## SURVEILLANCE

The purpose of the control programme is to detect and eradicate MV and CAE from Swedish sheep and goat flocks and to prevent introduction into free flocks. Documentation of the MV/CAE status in the flocks is essential. By identifying infected flocks and taking measures, the spread of MV/CAE stops, and eradication is possible. Prevention of introduction of MV/CAE into flocks is crucial.

The programme is based on individual serological testing of sheep and goats at farm level. A flock specific MV/CAE status is achieved by repeated blood sampling and testing. Participating farmers sign an agreement that all sheep and goats in the flock are individually identified (according to legislations) and recorded. Purchase of sheep and goats is only allowed from flocks with a similar or higher MV/CAE status.

Three consecutive serological tests are performed on all sheep and goats  $\geq 12$  months old with an interval of 12–16 months. All samples in each test must be negative for MV/CAE antibodies. Each test renders an MV/CAE status: M1/C1, M2/C2 and M3/C3. The M3/C3 status is replaced by the so-called MV/CAE free status following final tests with negative results carried out 24–28 months after gaining the M3/C3-status on all sheep/goats  $\geq 24$  months old. The MV/CAE free status is maintained by an assurance of the owner every second year, where they declare that their animal contacts are only with farms with M3/C3 or MV/CAE free status, i.e., without any additional testing. An indirect control of the M3/C3/MV/CAE free status holdings is performed by testing of sheep and goats from holdings entering the programme as these new animals are mainly bought from M3/C3 or MV/CAE free status flocks. In case of MVV/CAEV infection, either the whole herd is culled or other control and eradication measures including selective

slaughter is performed, depending on the prevalence of positive sheep and goats within the flock.

The programme is based on serological examination of blood samples for antibodies against MVV or CAEV with an ELISA test. In October 2021, the screening ELISA test was changed to an ELISA test with higher sensitivity, from IDEXX CAEV/MVV Total Ab (IDEXX Laboratories, Westbrook, Maine, United States) to ID Screen MVV/CAEV indirect (Innovative Diagnostics, Grabels, France). Samples with inconclusive or seropositive results are retested. Samples from sheep are retested using the same ELISA test, and if the results are still seropositive a confirmatory test is performed using agar gel immunodiffusion (Maeditect AGID, Alpha Scientific, Slough, United Kingdom). Samples from goats are retested with another ELISA test (IDEXX CAE/MVV Total AB Test) as a confirmatory test as this test has a higher specificity to CAEV antibodies than MVV-antibodies.

Post mortem examinations and histopathology are additional important tools to detect MV and CAE. Diagnostic testing is performed at the National Veterinary Institute (SVA). Serum samples collected in the MV-programme are also used for other active surveillance activities in sheep (e.g., Brucellosis).

## RESULTS

During 2022, approximately 7200 samples from sheep and goats were analysed in the MV/CAE control programme for antibodies against MVV/CAEV.

At the end of 2022, 3318 sheep flocks with 111 038 sheep and 269 goat flocks with 2212 goats were enrolled in the programme. This corresponds to about 42% of the Swedish sheep population, and about 11% of the goat population. Most of the flocks have achieved M3/C3 or MV/CAE free status. The rest of the flocks are somewhere in the process from unknown to free, which normally takes five years and four sampling occasions.

In 2022, 14 animals in two different flocks were considered MV/CAEV positive. The positive herds consisted of 2 goat flocks.

## DISCUSSION

It is now more than 25 years since the MV programme was launched. A series of measures have been taken to enrol the majority of Swedish sheep flocks as one of the main purposes of the programme is to reach freedom from disease. This has been hard to achieve despite of campaigns and economic support. A revision of the MV programme was made during 2013 by Farm & Animal Health and SVA. Since July 2014, the programme has been further refined to improve efficacy and efficiency, e.g., by increasing sampling in risk areas and higher risk flocks and reducing sampling in long-term MV free and well-documented flocks. In 2020, the CAE programme was merged with the MV programme into one programme called the MV/CAE programme, both to highlight the importance of CAE free goats but also to address the risk of disease transmission between sheep and goats. The programme was evaluated during 2020 for more cost-effective sampling, diagnostics, and control measures. Implementation of the recommended updates are in progress. In 2022, a PhD project called “Lenti free farm” was launched with the aims to recruit more goat and sheep farms to the control programme, to study the prevalence of SRLV in Swedish sheep and goat herds, to evaluate the most cost-effective sampling methods and to learn more about the epidemiology of SRLV in Sweden.

After a successful programme, Norway has declared most herds free from CAE, showing that it is possible to eradicate the disease.

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