

SURVEILLANCE OF INFECTIOUS DISEASES

IN ANIMALS AND HUMANS IN SWEDEN 2022

*Chapter excerpt:
Porcine reproductive and respiratory
syndrome*



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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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Porcine reproductive and respiratory syndrome



Figure 31: After the successful eradication of porcine reproductive and respiratory syndrome virus (PRRSV) following an outbreak in 2007, annual surveillance shows that Sweden has remained free from the PRRSV since 2008. Photo: Magnus Aronson/SVA.

BACKGROUND

Porcine reproductive and respiratory syndrome (PRRS) is a disease of domestic pigs caused by an enveloped RNA-virus belonging to the family *Arteriviridae*. The disease was first described in the USA in 1987 and the virus (PRRSV) was subsequently identified in 1991. PRRSV has since become endemic in most pig populations of the world and is considered one of the most economically important viral diseases affecting pig production globally. PRRS is highly contagious and is transmitted between pigs through both direct and indirect contact. Sero- and virus-positive feral pigs and wild boars have been described but there is no evidence that they serve as a reservoir for PRRSV.

Sweden has had an active PRRSV surveillance programme since 1998, with Farm & Animal Health collecting samples that are analysed by the National Veterinary Institute (SVA). In July 2007, the first case of PRRS in Sweden was detected through this active surveillance programme.

Until then, Sweden had been one of only a few countries to declare itself free from PRRSV. At the time of detection, the disease was not widespread, so a decision was made to control the outbreak through a modified stamping out procedure. The actions taken to eradicate the disease proved to be effective as, following extensive surveillance during the fall of 2007, Sweden was once again declared free from PRRSV with a high probability by the beginning of 2008. Despite extensive investigation, the source of the outbreak could not be established.

After the outbreak in 2007, the surveillance programme was revised in order to enable even earlier detection of an introduction of PRRSV. The programme underwent revision again in 2012 following extensive changes in the pig production system in Sweden.

DISEASE

Infection with PRRSV causes varying clinical signs depending on factors such as virulence of the particular strain of PRRS virus, age of the infected animals, presence of other disease agents in the herd and herd management practices. The incubation period is 2–7 days and, in adult pigs, the clinical signs are often mild, consisting of fever, lethargy and inappetence, although certain strains of PRRSV can cause severe disease, including high mortality, in adult animals. The most obvious clinical signs of PRRSV infection in this category of animal are typically reproductive problems including abortion, mummified foetuses, small litters, weak-born piglets, high piglet mortality and increased incidence of non-pregnant sows. The primary clinical signs in weaned and fattening pigs are fever, respiratory signs, reduced growth and increased mortality.

LEGISLATION

PRRS was included in the Swedish Act of Epizootic diseases in 1999 (SFS 1999:657 with amendments) and is consequently notifiable on suspicion. Notification leads to further investigation. PRRS is a listed disease (categories D and E) in the Animal Health Law, (EU) 2016/429. SJVFS 2021:24 (K29) complements the AHL with provisions as regards measures to prevent the spread of PRRS in Swedish pig establishments.

SURVEILLANCE

The purpose of the surveillance is to document freedom from PRRSV and to detect introduction of the virus before it becomes widespread in the population. Tests to detect both viral genome and antibodies against PRRSV are used in the surveillance. All samples are analysed at SVA. To detect antibodies against PRRSV, a commercial ELISA method

Table 16: Number of samples and herds tested in the active surveillance for porcine reproductive and respiratory syndrome 2010-2022 in relation to the number of registered swine herds.

Year	Field sampling		Abattoir sampling			Total number of samples	Number of registered swine herds in Sweden ^A
	Number of samples	Number of sampled herds	Number of samples	Number of sampling occasions	Number of sampled herds ^B		
2010	2012	126	4424	1475	931	6436	1695
2011	1240	78	2308	770	700	3548	1297
2012	1055	66	2145	717	623	3200	1113
2013	1024	64	1548	516	488	2572	1281
2014	912	57	2028	676	537	2940	1282
2015	824	52	2382	780	521	3206	1228
2016	875	60	2446	815	506	3321	1252
2017	826	54	2625	875	546	3451	1272
2018	784	54	2707	903	514	3491	1346
2019	647	42	2550	851	506	3197	1089
2020	601	43	2410	806	468	3011	1146
2021	626	41	2175	726	433	2801	1190
2022	480	36	2353	787	445	2833	1173

^A Jordbruksverket statistikdatabas (statistik.sjv.se/pxweb).

^B Some herds were sampled more than once.

(IDEXX PRRS X3 Ab Test, IDEXX Laboratories, Westbrook, Maine, United States) is used. Samples testing positive for PRRSV antibodies by ELISA are sent to the Danish Technical University for confirmation testing using an immunoperoxidase monolayer assay (IPMA). Analysis for the presence of PRRS viral genome is done using an in-house PCR method (modified from Kleiboeker et al., 2005).

Passive surveillance

PRRS is notifiable on clinical suspicion by both veterinarians and farmers and cases with suspect clinical signs are investigated following notification to the Swedish Board of Agriculture. The investigation may include sampling of sick or dead animals, examination of the herd for the presence of clinical signs and analyses of production results. During the investigation the farm is placed under restrictions.

In addition, PCR analysis for the presence of PRRSV genome is included in the enhanced passive surveillance of aborted foetuses (see chapter on “Examinations of abortions in food producing animals” on page 146).

Active surveillance

Within the active surveillance programme, which has been running in its current, revised form since 2013, all Swedish nucleus herds, multiplying herds and sow pools are sampled twice a year. Eight samples per herd are collected on each sampling occasion. In addition, pigs from randomly selected production herds are sampled at slaughter throughout the year at the 9 largest Swedish abattoirs which slaughter approximately 99.5% of Sweden’s pigs. Three samples per herd are collected on each of these sampling occasions.

The revised programme was designed to take into consideration an increased risk of PRRSV introduction and changes in the structure of Swedish pig production, as well as to keep the probability of freedom from PRRS at the same level as it was after demonstration of freedom following the

outbreak in 2007. To achieve this, the programme was designed using a between-herd design prevalence of 0.5%, a within-herd design prevalence of 40% and a risk of introduction of 1 in 5 years. The number of samples needed is calculated yearly taking the outcome of the surveillance in previous years into account. For 2022, the calculated number of samples required was 2400 from the abattoir sampling in addition to the field sampling described above.

RESULTS

Passive surveillance

Five investigations following clinical suspicions of PRRS were conducted in 2022. In four herds, reproductive problems such as abortion, low conception rate, and weak-born and stillborn piglets were the primary clinical signs. In one herd, bluish skin discolouration and increased mortality among sows lead to the clinical suspicion of PRRS. This herd was also investigated for African swine fever and Classical swine fever and found to be negative for these diseases (see chapter on “Classical swine fever”). The number of animals sampled and the methods used during the PRRS investigations varied and were dependent on factors such as the nature of the suspicion, the clinical manifestation and how widespread the clinical signs were in the herd. All samples taken during the course of the investigations were negative and all herds were subsequently declared negative for PRRSV.

Within the programme for enhanced passive surveillance of aborted foetuses, 15 pig foetuses from 10 herds were examined for the presence of PRRSV genome and all samples were negative.

Active surveillance

In 2022, 480 samples from 36 nucleus herds, multiplying herds and sow pools were analysed. In the abattoir sampling, 2353 samples originating from 445 herds on 787 sampling occasions (some herds were sampled more than once during the year) were analysed. For comparison, the number of samples tested per year since 2010 is given in Table 16. All samples tested were negative for antibodies against PRRSV. Taking the surveillance outcome from previous years into account, the probability of freedom based on the surveillance during 2022 was >95%.

DISCUSSION

Before the outbreak of PRRS in 2007, the active surveillance programme was based on field sampling in all nucleus herds, multiplying herds, sow pools and 50 production herds once a year, usually clustered in time. This surveillance design had the drawback of being expensive, having a low sensitivity and a risk of poor timeliness. After the outbreak, the surveillance was further developed by employing continuous abattoir sampling and more effective field sampling in nucleus herds, multiplying herds and sow pools to improve early detection of a PRRSV introduction and to increase the sensitivity of the surveillance. The evaluation of the programme in 2012 indicated that the probability of freedom and the sensitivity of surveillance were declining over time and the changes that were suggested aimed at breaking this trend. The main reason for the declining probability of freedom was a decreasing number of samples tested. During recent years, the Swedish pig industry has undergone substantial structural changes leading to a rapidly declining number of herds and extensive changes in the market and in the habits of farmers. These changes emphasise the need for continuous monitoring of surveillance performance over the year and a yearly evaluation of performance and design. The present design, with continuous sampling and testing over the year in combination with the clinical surveillance, increases the probability of early detection compared to the strategy used before the outbreak.

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