

# SURVEILLANCE OF INFECTIOUS DISEASES IN ANIMALS AND HUMANS IN SWEDEN 2020

Chapter excerpt -  
Antibiotic resistance in bacteria from animals and food



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**Cover:** Juvenile mink in hand. Photo: Elina Kähkönen

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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, produced by authors, 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 using pandoc and R to the LaTeX typesetting language. Most figures and maps are produced using the R software for statistical computing and the LaTeX library pgfplots. Development for 2020 has further improved the importing of content from Excel files to automatically build figures in the pgfplots LaTeX library. The tool is available as an R-package on GitHub (<https://github.com/SVA-SE/mill/>). The report generation R-package and process was designed by Thomas Rosendal, Wiktor Gustafsson and Stefan Widgren. In 2020, final typesetting was done primarily by Wiktor Gustafsson with contributions from the report authors.

**Print:** TMG Tabergs AB.

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**Suggestion citation:** Surveillance of infectious diseases in animals and humans in Sweden 2020, National Veterinary Institute (SVA), Uppsala, Sweden. SVA:s rapportserie 68 1654-7098.

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# Antibiotic resistance in bacteria from animals and food

## BACKGROUND

The National Veterinary Institute (SVA) has the mission to monitor and analyse the development of antimicrobial resistance in bacteria from animals and food of animal origin. This also includes implementation of the mandatory harmonised monitoring of antibiotic resistance in bacteria from food-producing animals and food thereof, dictated by EU legislation. The monitoring activities are carried out through the Swedish Veterinary Antibiotic Resistance Monitoring Programme (Svarm), which has been running since 2000.

The objectives of Svarm are to detect changes in trends in resistance and to provide a basis for recommendations on the use of antibiotics in animals. Three types of bacteria are monitored: zoonotic bacteria, specific animal pathogens and indicator bacteria from healthy animals and meat. In addition, both intestinal content from healthy farm animals and fresh meat are screened for *E. coli* producing extended spectrum beta-lactamases (ESBL), AmpC-enzymes and carbapenemases. The rationale for monitoring indicator bacteria, i.e. commensal *Escherichia coli* and *Enterococcus* spp. from the normal intestinal flora of healthy animals, is that resistance among these bacteria reflects the selection pressure caused by the use of antibiotics in an animal population. These commensal bacteria can also be a reservoir of mobile resistance genes that can reach humans through the food chain. Thus, the prevalence of resistance in bacteria that contaminate meat reflects the magnitude of the potential human exposure to such reservoirs in food-producing animals.

The Svarm programme conforms to directive (2003/99/EG) and subsequent decisions (2013/652/EU, from 2021 replaced by 2020/1729/EU). According to the directive, resistance in *Salmonella*, *Campylobacter jejuni* and indicator bacteria shall be regularly monitored in broilers, turkeys, pigs and cattle using harmonised methodologies. Briefly, for Sweden, this implies that each year, isolates of *Salmonella* from all notified outbreaks in food-producing animals, as well as 170 isolates of *Campylobacter* from either broilers or pigs, are tested for antibiotic susceptibility. Also, 170 isolates of *E. coli* from intestinal content of healthy broilers or pigs are tested each year. In addition, each year 300 samples of intestinal content and 300 samples of fresh retail meat from either broilers or from pigs and cattle are screened for ESBL/AmpC- and carbapenemase producing *E. coli*. Due to small production volumes, it is not mandatory for Sweden to investigate *Campylobacter* or indicator bacteria from healthy turkeys or cattle. It is not mandatory to screen for ESBL/AmpC- or carbapenemase producing *E. coli* in these animal categories either. However, sometimes such investigations are still performed, on

a voluntary basis. Starting from 2021, sampling of turkey meat and sampling of meat from countries outside EU at border control posts are also included in the monitoring.

In addition to the mandatory monitoring described above, Svarm is complemented with data on resistance in clinical isolates of bacteria from the routine testing of clinical submissions at SVA. Svarm is also complemented with data from research projects and specifically from the Svarm-Pat project focusing on resistance in animal pathogens from farm animals. SvarmPat is run in cooperation with Farm & Animal Health and is financed by the Swedish Board of Agriculture.

Sales of antibiotics for use in animals is also monitored. The primary data source is sales from pharmacies to animal owners (prescriptions dispensed) and to veterinarians (requisition for use in own practice). In Sweden, all veterinary medicinal products are sold by pharmacies and they are obliged to report all sales of medicinal and veterinary medicinal products to the eHealth Agency. Data on sales of antibiotics are calculated to kg active substance. For prescriptions, animal species is also recorded and can be included in the analyses.

Data on antibiotic resistance in bacteria from animals and food as well as data on sales of antibiotics for use in animals are presented in a yearly report together with corresponding data for human medicine compiled by the Public Health Agency of Sweden in an integrated report - Swedres-Svarm - available at [www.folkhalsomyndigheten.se](http://www.folkhalsomyndigheten.se) or at [www.sva.se/swedres-svarm](http://www.sva.se/swedres-svarm). The different data sources compiled in this report are illustrated schematically in Figure 42.

## LEGISLATION

As mentioned above, parts of the antibiotic resistance monitoring performed in Sweden are regulated by EU legislations (2003/99/EG and 2013/652/EU which from 2021 is replaced by 2020/1729/EU). Furthermore, there is also national legislation indirectly affecting the antibiotic resistance monitoring. More precisely, findings of carbapenemase producing Enterobacteriaceae (ESBL<sub>CARBA</sub>) and methicillin-resistant coagulase-positive staphylococci (e.g. MRSA and MRSP) in animals are notifiable in Sweden (SJVFS 2021:10 and previously SJVFS 2012:24 with amendments).

## SUMMARY OF RESULTS

From an international perspective, Sweden still has a favourable situation regarding antibiotic resistance in bacteria in humans and animals. This confirms that our strategies to promote the rational use of antibiotics and to limit the spread of antibiotic resistance are effective. In the last decades, the sales of antibiotics in Sweden have decreased

for both humans and for animals. In addition, the distribution between broad- and narrow-spectrum antibiotics has changed and the proportion of narrow-spectrum antibiotics has increased. Among bacteria from animals, the occurrence of resistance has generally been stable at low or moderate levels. For some substances and in some bacteria occurrence of resistance is even declining. One example of this is the occurrence of ESBL producing *E. coli* among broilers that has declined significantly. There are however exceptions, and for example resistance to ampicillin, sulphonamides, and trimethoprim has increased in indicator *E. coli* from both broilers and pigs.

### Antibiotic sales for veterinary use

In 2020, reported sales of antibiotics for animals were 9306 kg, of which 54% were penicillins with narrow spectrum. The corresponding figures for 2011 were 12 220 kg and 52%, respectively. Since the withdrawal of growth-promoting antibiotics from the Swedish market in 1986, the total sales of antibiotics have decreased by more than two thirds when

corrected for population sizes over time. During the 1990s, sales of veterinary products for medication of groups of animals decreased, and in the past decade there has also been a decrease in sales of products for use in individual animals. (Figure 43).

### Extended spectrum beta-lactamase (ESBL) producing Enterobacterales (previously Enterobacteriaceae)

ESBL-producing Enterobacterales (previously Enterobacteriaceae) are rare among animals in Sweden. Previously, the occurrence in intestinal samples from broilers was high but it has decreased in recent years. In 2020, the occurrence of ESBL-producing *E. coli* in intestinal samples from broilers and turkeys, as well as samples of broiler meat was investigated with screening methods. Such bacteria were isolated from 3 and 0% of the intestinal samples from broilers and turkeys respectively, and 2% of the broiler meat samples of Swedish origin. Bacteria that form ESBL<sub>CARBA</sub> have not been confirmed from animals in Sweden.

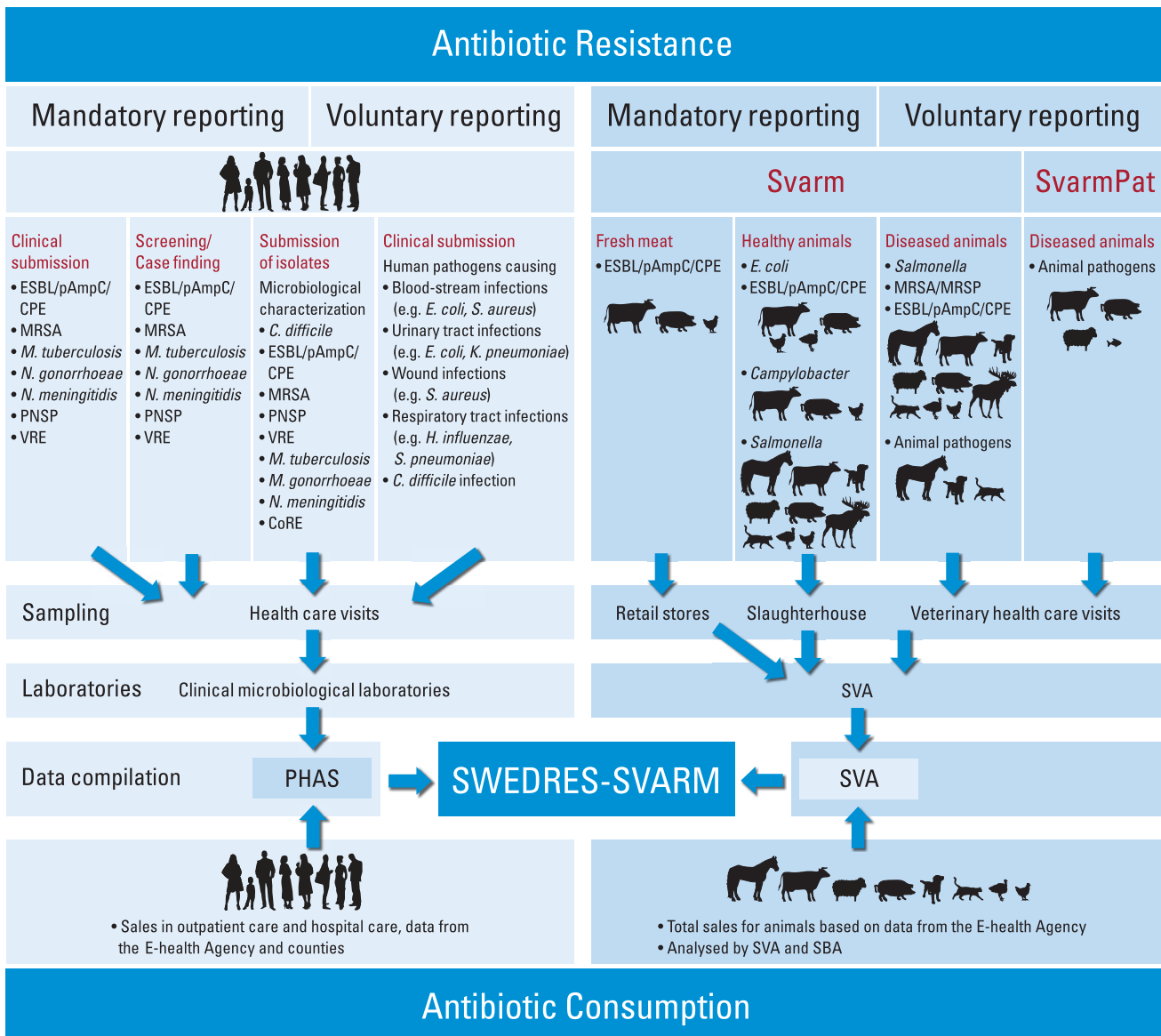


Figure 42: A schematic illustration of data included in the Swedres-Svarm report.

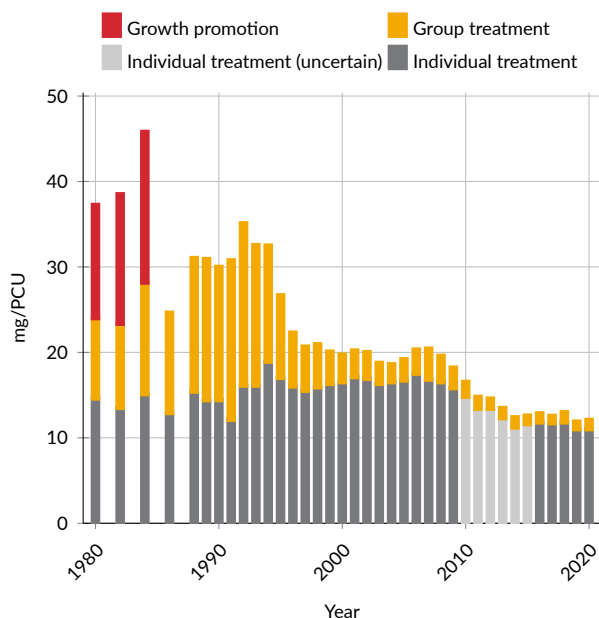


Figure 43: Sales of antibiotics for animals expressed as mg per population correction unit (PCU). Data from 2010–2015 are uncertain because of a lack of completeness mainly affecting injectable products (indicated in a lighter grey). In the present figure, all products (including tablets) are included while in data presented in the European surveillance of veterinary antimicrobial consumption tablets are excluded when calculating mg/PCU.

### Methicillin-resistant *Staphylococcus aureus* (MRSA)

The occurrence of MRSA in animals in Sweden is still low, which limits the spread from animals to humans. MRSA was found sporadically in horse, dog, and cat. However, the number of MRSA cases in horses was tripled in 2020, compared to earlier highest figure of nine cases in 2014. The increase could be explained by outbreaks in two equine hospitals with a total of 18 cases. In companion animals, the same types of MRSA as in humans dominate, indicating a human source of MRSA in these animals. In horses, livestock-associated MRSA clonal complex 398 used to be most common, but in 2020 *spa*-type t1971 dominated (14 of 27 cases). This variant is since 2019 a new finding in horses in Sweden.

### Methicillin-resistant *Staphylococcus pseudintermedius* (MRSP)

In 2020, the number of reported cases of methicillin-resistant *Staphylococcus pseudintermedius* (MRSP) in animals was around the same level as in previous years. In total 49 cases of MRSP were notified to the Swedish Board of Agriculture, and isolates from 47 cases from dogs were available for further investigations. All but two of the investigated isolates were resistant to three or more substances,

i.e. multi-resistant. The epidemiology of MRSP is more diverse compared to earlier years with several sequence types occurring.

### Vancomycin-resistant enterococci (VRE)

In 2020, the occurrence of vancomycin resistant enterococci (VRE) in intestinal samples from broilers was investigated with screening methods. Such bacteria were isolated from 6% of the samples. That shows that the decrease in occurrence of VRE among broilers in Sweden that has been since 2005 continues. All the isolates belonged to the clone of *E. faecium* with *vanA* which is the most common VRE in broilers in Sweden.

### Resistance in zoonotic pathogens

*Salmonella* is rare in animals in Sweden. Furthermore, only a few of the incidents involve antibiotic-resistant strains. Resistance to fluoroquinolones is rare. Isolates from human invasive infections with *Salmonella* are markedly more resistant, probably due to the large proportion of cases acquired abroad.

*Campylobacter* from animals in Sweden are generally susceptible to relevant antibiotics, and resistance to erythromycin, for example, is most uncommon.

Infections, either in humans or in animals, caused by *Salmonella* and *Campylobacter* are usually not treated with antibiotics.

### Resistance in animal clinical isolates

Bacteria causing clinical disease in animals are mostly susceptible to antibiotics relevant for treatment. Respiratory pathogens from farm animals and horses are generally susceptible to benzylpenicillin, but penicillin resistance is common in *Staphylococcus pseudintermedius* from dogs and occurs in *S. aureus* from horses and *S. felis* from cats. Resistance in *E. coli* occurs in all animals but is most prominent in enteric isolates from young calves and pigs. Susceptibility testing for guidance in antibiotic therapy is warranted, especially for staphylococci, *E. coli* and, *Brachyspira* spp.

### Resistance in indicator bacteria from healthy animals

Antibiotic resistance in *E. coli* from the intestinal flora of healthy animals serves as an indicator for the presence of resistance in an animal population. The prevalence of acquired resistance in such commensal bacteria also indirectly indicates the magnitude of the selective pressure from the use of antibiotics in an animal population. The prevalence of resistance in indicator bacteria from animals in Sweden is low, and the situation is favourable in an international perspective.