SURVEILLANCE OF INFECTIOUS DISEASES IN ANIMALS AND HUMANS IN SWEDEN 2019

Chapter excerpt -

Antibiotic resistance in bacteria from animals and food

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Jordbruksverket Swedish Board of Agriculture
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Reporting guidelines: Reporting guidelines were introduced in 2018 for those 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. Development for 2019 has further improved the importing of content from Word to LaTeX. The method can now import text, tables and figure captions from Word, as well as the newly designed 'IN FOCUS' sections of some chapters. The tool is available as an R-package at GitHub (https://github.com/SVA-SE/mill/). This year the report was also built with a continuous integration pipeline on Microsoft's Azure DevOps platform, allowing every committed change to the content to be built and tested automatically. The report generation R-package and process was designed by Thomas Rosendal and Stefan Widgren. In 2019, figures and the final typsetting were done by Wiktor Gustafsson and Thomas Rosendal with contributions from the report authors.

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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 of 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). 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.

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 SvarmPat 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.

Results of Svarm, i.e. data on antimicrobial resistance in bacteria from animals and food, are presented in a yearly report together with data on sales of antimicrobials for use in animals. These results are published together with corresponding data for human medicine from the Swedres programme at the Public Health Agency of Sweden in an integrated report - Swedres-Svarm - available at www.folkhalsomyndigheten.se or at www.sva.se/swedres-svarm. The different data sources compiled in this report are illustrated schematically in Figure 36.

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). The latter of these is currently under revision and some changes to the monitoring within EU can be expected from 2021. Furthermore, there is also national legislation indirectly affecting the antibiotic resistance monitoring. More precisely, findings of carbapenemase producing Enterobacteriaceae ($ESBL_{CARBA}$) and methicillin-resistant coagulase-positive staphylococci (e.g MRSA and MRSP) in animals are notifiable in Sweden (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. Over the last decades, the sales of antibiotics in Sweden have decreased for both humans and animals. In addition, the sales of broad-spectrum antibiotics have decreased while the use of narrow-spectrum antibiotics has increased. Despite this, many of the monitored types of antibiotic resistance have continued to increase over the years, even if exceptions to these negative trends occur.

Antibiotic sales for veterinary use

In 2019, reported sales of antibiotics for animals were 9601 kg, of which 58% were narrow-spectrum penicillins. The corresponding figures for 2010 were 14 117 kg and 53%, respectively.

Since the withdrawal of growth-promoting antibiotics from the market in 1986, the total sales of antibiotics have decreased by around 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 37).

Extended spectrum beta-lactamase (ESBL) producing Enterobacteriaceae

ESBL-producing 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 2019, the occurrence of ESBL-producing *E. coli* in intestinal samples from pigs and broilers as well as samples of pork and beef were investigated with screening methods. Such bacteria were isolated from 3% of the intestinal samples from pigs and broilers respectively, and <1% and 0% of the pork and beef samples of Swedish origin. Bacteria that form $ESBL_{CARBA}$ have not been detected in animals in Sweden.

Methicillin resistant Staphylococcus aureus (MRSA)

The occurrence of methicillin-resistant *Staphylococcus* aureus (MRSA) in animals in Sweden is still low, which limits the spread from animals to humans. MRSA was found sporadically in dog, cat, horse, rabbit and goat in 2019, and MRSA with *mecC* was detected in samples from hedgehogs in a research project. 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 is the most common.

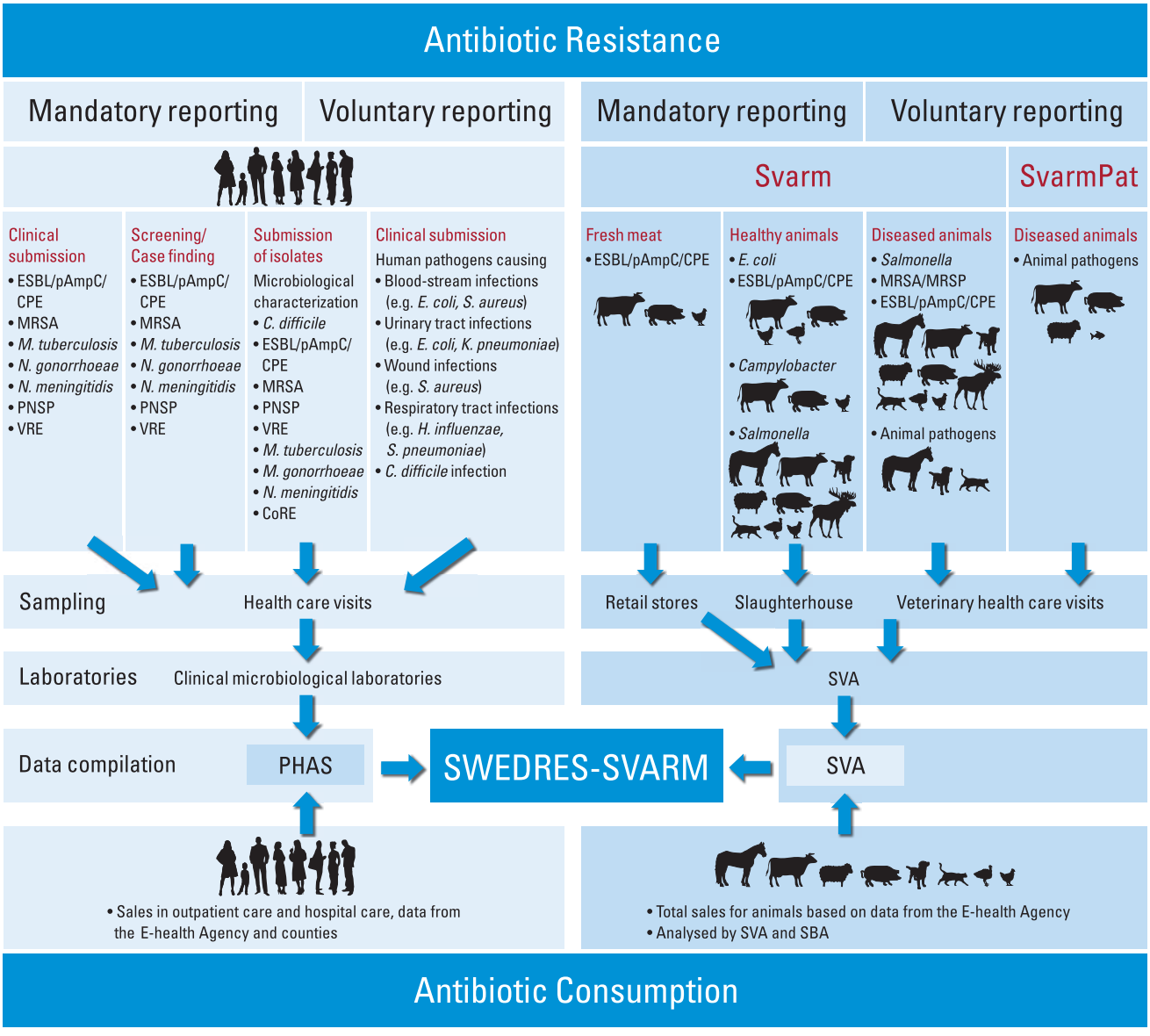

Figure 36: A schematic illustration of data included in the Swedres-Svarm report.

Methicillin resistant Staphylococcus pseudintermedius (MRSP)

In 2019, the number of reported cases of methicillin-resistant *Staphylococcus pseudintermedius* (MRSP) in animals was at the same level as in previous years. In total 48 cases of MRSP were notified to the Swedish Board of Agriculture, and isolates from 42 cases (38 dogs, 3 cats and 1 horse) were available for further investigations. All isolates were resistant to three or more substances, i.e. multi-resistant. The epidemiology of MRSP is becoming more diverse compared to earlier years with several sequence types occurring. MRSP in humans is not notifiable.

Resistance in zoonotic pathogens

Salmonella is rare in animals in Sweden, and few incidents involve antibiotic-resistant strains. Resistance to fluoroquinolones is rare and in 2019 a strain with ESBL resistance was for the first time detected, in an environmental sample from a farm. Isolates from human invasive infections with *Salmonella* are markedly more resistant, which makes animals in Sweden an unlikely source for these infections.

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 bensylpenicillin, 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 reflects 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 generally low, and the situation is favourable in an international perspective.

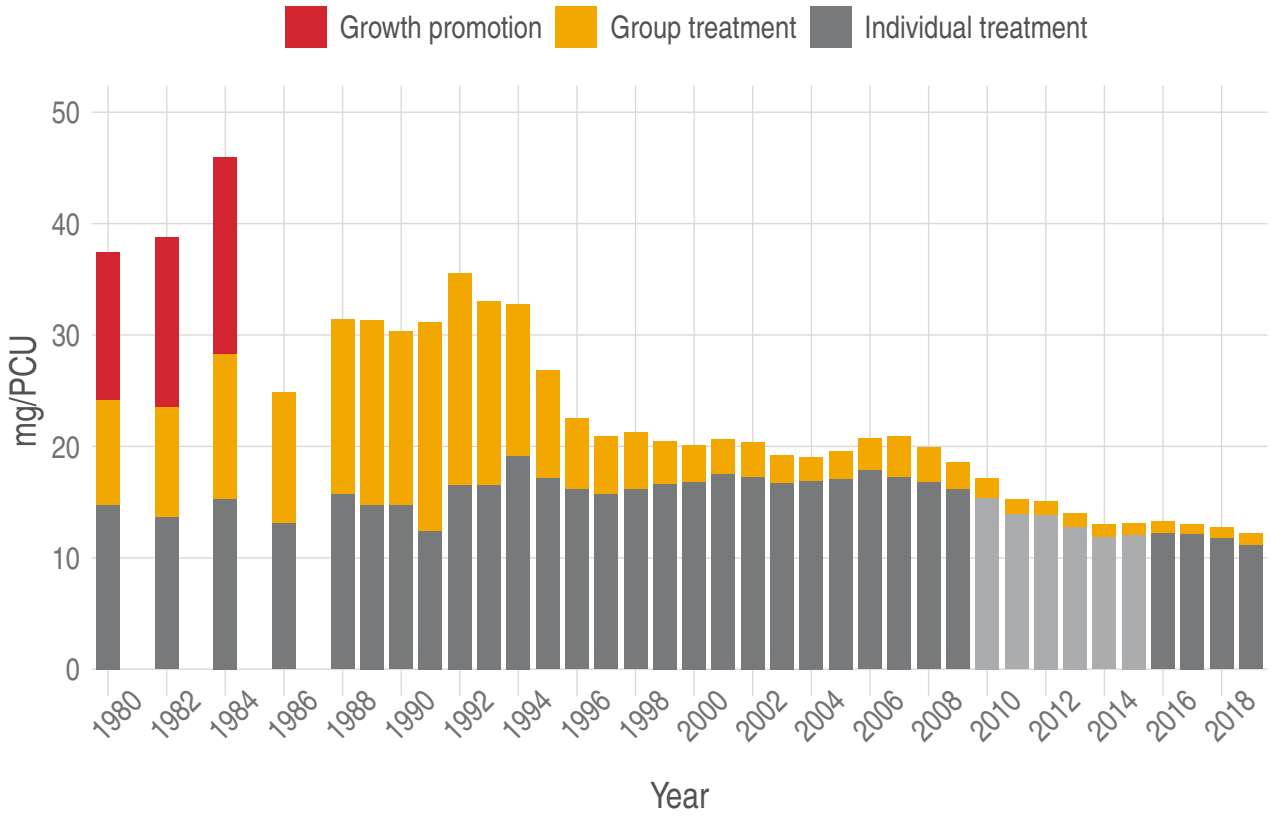

Figure 37: Sales of antibiotics for animals expressed as mg per population correction unit (PCU). Data from 2010–2015 are uncertain because of a lack of completeness mainly affecting injectable products (indicated in a lighter grey). In the present figure, all products (including tablets) are included while in data presented in the European surveillance of veterinary antimicrobial consumption tablets are excluded when calculating mg/PCU.