SURVEILLANCE OF INFECTIOUS DISEASES IN ANIMALS AND HUMANS IN SWEDEN 2019

Chapter excerpt -
Campylobacteriosis

SVA NATIONAL VETERINARY INSTITUTE
Jordbruksverket Swedish Board of Agriculture
Folkhälsomyndigheten PUBLIC HEALTH AGENCY OF SWEDEN
Livsmedelsverket Swedish Food Agency

Editor: Karl Ståhl
Department of Disease Control and Epidemiology, National Veterinary Institute (SVA), SE-751 89 Uppsala, Sweden.

Authors: Charlotte Axén, Mia Brytting, Ioana Bujila, Erika Chenais, Rikard Dryselius, Helena Eriksson, Pernille Etterlin, Eva Forsgren, Malin Grant, Gittan Gröndahl, Gunilla Hallgren, Anette Hansen, Gete Hestvik, Marika Hjertqvist, Mia Holmberg, Cecilia Hultén, Helena Höök, Cecilia Jernberg, Jerker Jonsson, Ulrika König, Elina Lahti, Emelie Larsdotter, Mats Lindblad, Anna Lundén, Emma Löf, Hans-Olof Nilsson, Oskar Nilsson, Maria Nöremark, Anna Ohlson, Ylva Persson, Karin Persson-Waller, Thomas Rosendal, Karl Ståhl, Robert Söderlund, Kaisa Sörén, Magnus Thelander, Karin Troell, Anders Wallensten, Per Wallgren, Stefan Widgren, Ulrika Windahl, Beth Young, Nabil Yousef, Siamak Zohari, Erik Ågren, Estelle Ågren, Elina Åsbjer

Cover Photo: Anders Lindström

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.

Print: TMG Tabergs AB.

Suggestion citation: Surveillance of infectious diseases in animals and humans in Sweden 2019, National Veterinary Institute (SVA), Uppsala, Sweden. SVA:s rapportserie 64 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 **fax.** +46 18-30 91 62
e-mail. sva@sva.se **web.** www.sva.se

Campylobacteriosis

In 2019, the prevalence of *Campylobacter* in chicken slaughter batches was lower than in previous years which was accompanied by a lower domestic incidence of campylobacteriosis in humans. Photo: Bengt Ekberg/SVA.

BACKGROUND

Thermophilic *Campylobacter* species (spp.) are the most common cause of human bacterial gastroenteritis in many countries. A majority of infections are caused by *C. jejuni*, followed by *C. coli* and a few by other *Campylobacter* spp.

Birds are considered the principal reservoir, although *Campylobacter* can colonise the intestinal tract of many other animals. The bacterium is excreted in faeces. *Campylobacter* spp. are fragile organisms but can survive in freshwater for longer periods. The infectious dose for humans is low. Most European countries have a seasonal peak of *Campylobacter* prevalence in the summer months, both in chickens and humans. Risk factors for infection include consumption or handling of undercooked contaminated meat products (especially poultry), consuming contaminated unpasteurised milk and other dairy products, drinking from contaminated water supplies, travelling abroad and having contact with farm animals and pets.

During the last two decades, the incidence of human campylobacteriosis has varied between 67 and 110 cases per 100 000 inhabitants (Figure 5). Most cases are infected abroad, but in 2014–2018 the proportion of domestic infections increased due to several major outbreaks caused by domestically produced chicken meat.

DISEASE

Animals

Asymptomatic carriage of thermophilic *Campylobacter* is common in several animal species, including poultry, cattle, pigs, sheep and dogs. The prevalence is higher in younger animals.

Humans

Campylobacteriosis is an acute, usually self-limiting enteric disease that resolves within a week. In some individuals, the symptoms last longer. The symptoms are mild to severe: diarrhoea, fever, abdominal pain, nausea and malaise. The infection can be complicated by reactive arthritis, irritable bowel syndrome as well as the neurological disorder Guillain-Barré syndrome.

LEGISLATION

Animals

Findings of thermophilic *Campylobacter* spp. in meat-producing poultry are notifiable in Sweden, according to SJVFS 2012:24. In addition, *Campylobacter fetus* subsp. *venerealis*, which causes bovine genital campylobacteriosis, is notifiable.

Food

Detection of *Campylobacter* spp. in food is not notifiable. From 2018 and onwards, food business operators at slaughterhouses are obliged to sample neck skins of broilers for analyses of *Campylobacter* according to regulation (EG) 2073/2005 on microbiological criteria for foodstuffs. As a minimum, the Swedish Food Agency requires that weekly samples are taken from June through September.

Humans

Infection with *Campylobacter* is notifiable according to the Communicable Disease Act (SFS 2004:168 with the amendments of SFS 2013:634). A laboratory confirmed case can also include cases with samples that are only positive by PCR i.e. where no isolate has been obtained.

SURVEILLANCE

Animals

The Swedish Poultry Meat Association has operated a monitoring programme for broiler chicken since 1991. The programme is mainly financed by the Swedish Board of Agriculture (SJVFS 2015:17, K152) and the goal is to achieve an overall annual *Campylobacter* prevalence of less than 10% in slaughter chicken. Prior to 2017, the goal was 5%. In 2017, the guidelines for the programme were reviewed.

The programme covers more than 99% of the broilers slaughtered in Sweden. Since 2006, sampling is performed by collecting intact caeca from 10 birds per sampled slaughter batch at the major slaughterhouses. In 2019, seven slaughterhouses delivered samples. When the flock is slaughtered at more than one time point and the time interval between the slaughter batches is longer than four days, samples are taken from both batches, otherwise only from one of the batches. The caeca are pooled into one composite sample per batch and analysed according to ISO-10272 part 1.

Since 2017, all *Campylobacter* isolates collected during two periods of 2.5 weeks, starting week 8 and week 31, have been subjected to whole genome sequencing (WGS). Those periods were chosen to precede the collection of human domestic isolates.

Food

No official surveillance programme exists for *Campylobacter* spp. in food. National and local authorities may perform sampling as a part of extended official controls or targeted projects.

Since 1 January 2018, slaughterhouses are obliged to sample neck skins from poultry carcasses for *Campylobacter* analyses using a culture-based method (ISO 10272-2 or alternative methods), according to regulation (EC) No. 2073/2005. A limit of 1000 CFU/g applies to a set of 50 pooled samples derived from 10 consecutive sampling sessions. In 2019, the regulation allowed up to 40% of the samples to exceed the limit.

Figure 5: Incidence (per 100 000 inhabitants) of notified human cases of campylobacteriosis in Sweden, 1997–2019. Travel-associated cases are those where the patient has reported travel to another country during the incubation period prior to clinical presentation. Domestic cases are patients that have not recently travelled outside Sweden.

IN FOCUS: Comparing human and retail chicken isolates using whole genome sequencing reveals high degree of clustering

In 2017 when the Public Health Agency of Sweden began its microbial surveillance programme for *Campylobacter* spp, there was a large ongoing outbreak in Sweden caused by domestically produced chicken meat. In conjunction with this, the Swedish Food Agency began to sample and analyse chicken retail meat to investigate occurrence and levels of *Campylobacter* spp. in meat from different slaughterhouses and to compare meat isolates to isolates from humans using WGS. After the outbreak, retail sampling as well as comparison of isolates from humans and chicken meat was repeated each August (high season) three years in a row (2017–2019). The aim was to understand the frequency and distribution of clustering isolates from humans and chicken meat in a non-outbreak situation. In total, 302 human and 167 chicken retail isolates were sequenced. The human isolates showed a high degree of clustering where 40 to 54% clustered with one or more isolate collected during the same time period (Table 7). Almost all clusters identified included human isolates from more than one county, indicating geographically dispersed sources of infection. Some isolates also clustered between the sampling years, indicating a reoccurring source of infection. Approximately one third of the human isolates clustered with chicken meat isolates. This pattern was observed in all three sampling periods. The majority of the chicken meat isolates that clustered with human cases originated from the largest poultry slaughterhouse in Sweden. A limited number were from other conventional Swedish, organic or foreign slaughterhouses.

These findings show that campylobacteriosis is not foremost a sporadic disease during high season but constitutes clusters with cases geographically distributed across the country. The clustering strains are often continuously replaced with new, however a few remain over the years. Overall, the comparison of human and retail chicken isolates indicates that if a reduction of *Campylobacter* in the chicken production is achieved, this will have a direct effect on the number of people who become infected by *Campylobacter*.

Table 7: Number of human and chicken meat isolates sequenced in August 2017, 2018 and 2019 as well as the proportions of human isolates clustering with other human isolates or chicken meat isolates.

	August 2017	August 2018	August 2019
Number of human isolates sequenced	92	98	112
Proportion of human isolates clustering with other human isolates	40%	44%	54%
Proportion of human isolates clustering with chicken meat isolates	33%	30%	33%
Number of chicken meat isolates sequenced	54	64	49

Humans

The surveillance in humans is based on identification of the disease by a physician and/or by laboratory diagnosis (i.e. passive surveillance). Physicians and laboratories are obliged to report to the regional and national level to enable further analyses and adequate intervention measures.

Since 2017, the Public Health Agency of Sweden requests isolates from all domestic cases reported during week 11 (low season) and week 34 (high season) for whole genome sequencing analysis. The periods for collection were chosen to reflect the diversity in different seasons. The aims of the typing are to assess the diversity of domestic strains and identify clusters. The long-term goal is to use the data to evaluate efforts to lower the level of domestic incidence of campylobacteriosis attributed to food borne sources.

In 2017–2019, the analysis of human isolates collected during high season has been preceded by analysis of *Campylobacter* in chicken meat from retail. Results from comparative investigations of human and chicken meat isolates are summarised in "In Focus".

RESULTS

Animals

In 2019, thermophilic *Campylobacter* spp. were detected in 230 (5.3%) of the 4363 broiler chicken batches tested at slaughter (Figure 6), which is less than in previous years. Among the slaughter batches at the four largest slaughterhouses, which cover 97.2% of the slaughtered chicken, *Campylobacter* spp, was detected in 4.3% of them. The monthly prevalence of *Campylobacter* in chicken slaughter batches varied between 0.3% and 13% with the highest prevalence in July. The prevalence of *Campylobacter* in incoming batches varied between slaughterhouses.

Food

In August 2019, a survey was performed by the Swedish Food Agency in which 100 samples of fresh chicken meat were collected at retail and analysed for *Campylobacter*. In the survey, *Campylobacter* was detected in 51% of the samples. *Campylobacter* levels exceeded 10 CFU/g in 13% of the samples.

In addition, 98 samples were taken by national and local authorities from different types of food. No sample was

positive. 51 of the 98 samples were taken from meat from broilers within the framework of a control project.

Food business operators at five slaughterhouses collected 419 pooled neck skin samples according to regulation (EC) No. 2073/2005. Test results at all slaughterhouses were satisfactory according to the legislation, and only seven (1.7%) of the 419 samples exceeded the limit of 1000 CFU/g.

Humans

A total of 6693 cases of campylobacteriosis were reported in 2019. Of the reported cases, 44% (2865 cases) were domestic. The incidence in domestic cases decreased by 22% from the year before to 27.4 per 100 000 inhabitants. Hence, the domestic incidence is back at the same level as in the first decade of the 2000s and well below the levels in 2014–2018 when several large outbreaks related to consumption of domestically produced chicken affected the incidence (Figure 5).

For the domestic cases in 2019, the median age was 47 years with a spread from 0 to 97 years. Like previous years, the domestic incidence was higher among adults than children and more men (56%) than women were reported with campylobacteriosis.

In the microbial surveillance programme at the Public Health Agency of Sweden, isolates from domestic cases were collected one week during low season (week 11) and one in high season (week 34). Of the 137 isolates, all but one was *C. jejuni*. Twelve clusters were identified that together contained 47% of the isolates. In August, isolates from the microbial surveillance programme and isolates from the survey performed by the Swedish Food Agency were compared by WGS. One third (33%) of the human isolates clustered with isolates from fresh chicken meat, mainly originating from large scale domestic production.

Human campylobacteriosis cases versus positive chicken slaughter batches

A comparison was made between the number of human domestic cases and the proportion of *Campylobacter* positive chicken slaughter batches during 2019. The comparison shows a clear covariation over the year with the highest number/largest proportion in the summer and the lowest number/smallest proportion in winter and spring (Figure 7).

DISCUSSION

The domestic incidence of campylobacteriosis was lower in 2019 compared with recent years. Most campylobacteriosis cases have been considered sporadic, but cluster analysis of isolates typed with WGS indicates that a large part of the cases could indeed be part of outbreaks. Many of these outbreaks appear genetically linked to isolates from retail poultry meat.

In 2019, the annual prevalence of *Campylobacter* in chicken slaughter batches was lower than in previous years (Figure 6). However, the high detection rate of *Campylobacter* in the survey of retail meat warrants stringent preventive measures. The correlation between human cases of campylobacteriosis and *Campylobacter*-positive broiler batches further underscores the need for preventive measures. *Campylobacter* prevalence varies considerably between slaughterhouses, with only a few findings at some and higher prevalence at others. During the last ten-year period, the Swedish chicken production has increased by approximately 30% and the share of fresh chicken meat has increased compared to frozen meat. This has led to a higher amount of potentially contaminated chicken meat at the market, because *Campylobacter* are sensitive to freezing and therefore more common in fresh than in frozen meat.

Sampling of the neck skin for analysis of *Campylobacter* according to regulation (EC) No. 2073/2005 functioned well in most of the slaughterhouses concerned. The results show that no slaughterhouse in Sweden had any difficulties in meeting the criterion in the regulation, which is set at a level that reflects the much higher prevalence of *Campylobacter* in broilers in many other EU member states.

Reducing *Campylobacter* prevalence at the farm level decreases the risk of human infection. Over the years, applying strict biosecurity measures has decreased the number of *Campylobacter*-positive broiler slaughter batches in Sweden. The outbreaks of recent years have demonstrated that failures in the production chain lead to an increase in human illnesses and illustrated the importance of biosecurity measures, not only at farm level but in the whole production chain. In 2019, no such failures were reported.

Broiler carcasses are easily contaminated at slaughter, which necessitates that consumers apply good hygiene practices. Strict hygiene in the kitchen is essential to avoid cross-contamination between contaminated raw meat and food that is ready to eat.

REFERENCES

Folkhälsomyndigheten (2019) Mikrobiologisk övervakning av campylobacter. https://www.folkhalsomyndigheten.se/mikrobiologi-laboratorieanalyser/mikrobiella-och-immunologiska-overvakningsprogram/overvakning-av-campylobacter/

Hansson I, Vågsholm I, Svensson L, Olsson Engvall E (2007) Correlations between *Campylobacter* spp. prevalence in the environment and broiler flocks. J Appl Microbiol 103:640–9

Lindqvist R, Lindblad M (2008) Quantitative risk assessment of thermophilic *Campylobacter* spp. and cross-contamination during handling of raw broiler chickens evaluating strategies at the producer level to reduce human campylobacteriosis in Sweden. Int J Food Microbiol 121:41–52

Livsmedelsverket, Folkhälsomyndigheten. Dryselius R, Jernberg C (2019) S 2019 nr 01: Campylobacter från butik och klinik. Livsmedelsverkets samarbetsrapport, Uppsala

Newell DG, Elvers KT, Dopfer D, Hansson I, Jones P, James S, Gittins J, Stern NJ, Davies R, Connerton I, Pearson D, Salvat G, Allen VM (2011) Biosecurity-based interventions

and strategies to reduce *Campylobacter* spp. on poultry farms. Appl Environ Microbiol 77:8605–8614

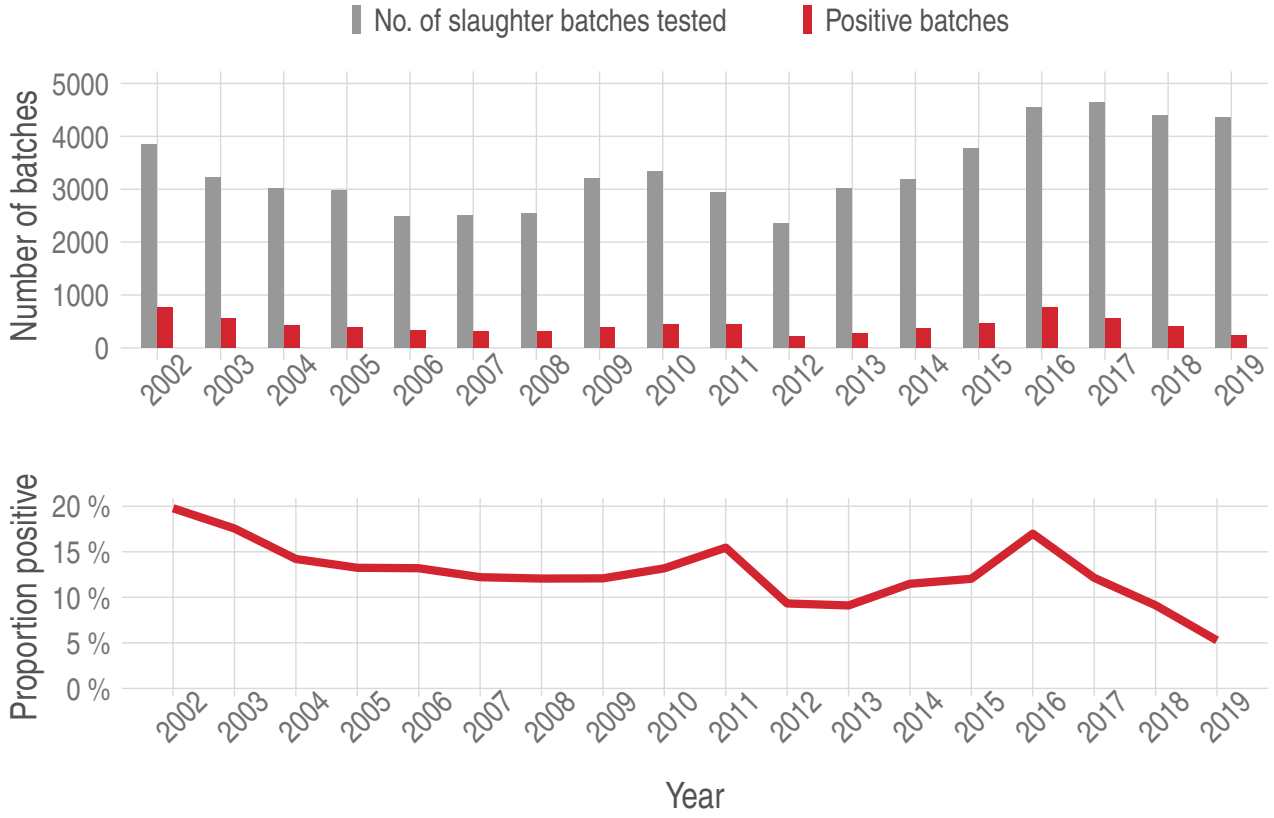

Figure 6: Prevalence of *Campylobacter* in slaughter batches of broiler chicken in 2002–2019.

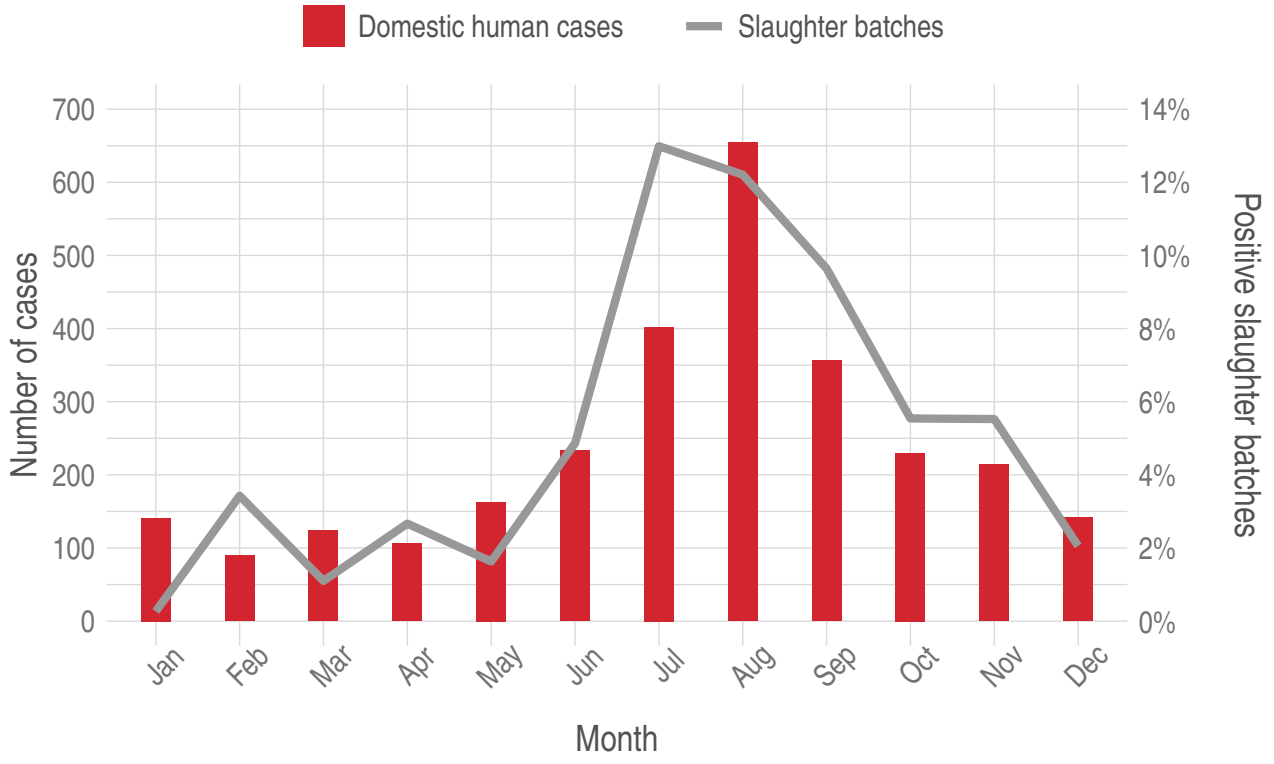

Figure 7: Number of notified domestic cases of human campylobacteriosis, along with the proportion of *Campylobacter*-positive broiler batches, broken down per month in 2019.