SURVEILLANCE OF INFECTIOUS DISEASES IN ANIMALS AND HUMANS IN SWEDEN 2020

Chapter excerpt -
Listeriosis

SVA NATIONAL VETERINARY INSTITUTE
Jordbruksverket Swedish Board of Agriculture
Folkhälsomyndigheten PUBLIC HEALTH AGENCY OF SWEDEN
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Cover: Juvenile mink in hand. Photo: Elina Kähkönen

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 typsetting was done primarily by Wiktor Gustafsson with contributions from the report authors.

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Listeriosis

Gravad and cold-smoked fish products are well-known vehicles for food-borne listeriosis. Photo: istetiana/iStock.

BACKGROUND

The genus *Listeria* contains several species, but *Listeria monocytogenes* is the only zoonotic species and was first described in 1926. Previously, sporadic cases of listeriosis were reported, often in employees in contact with diseased animals but since the 1980s outbreaks and cases of listeriosis have been traced to food products.

Listeria bacteria are widely distributed in the environment, such as in soil, silage and water. They can survive for long periods in the environment and tolerate disinfection and also grow at refrigerator temperatures, in vacuum packed food and in modified atmospheres. These properties make elimination of *L. monocytogenes* difficult. *L. monocytogenes* and other *Listeria* species are often found as environmental contaminants in food producing establishments. However, it is only *L. monocytogenes* that is relevant regarding human health. The main sources of human listeriosis are contaminated food products, such as cold-smoked or gravad vacuum-packaged fish products, meat products and soft cheeses or other ready-to-eat foods with a long shelf-life. *L. monocytogenes* is destroyed by heating (pasteurisation or cooking).

The main sources of listeriosis for animals are feed or environment. To prevent listeriosis in ruminants it is essential to feed animals with a silage of good quality (low pH and without contamination with soil) as the less acidic pH enhances multiplication of *L. monocytogenes*.

In Sweden, during the last ten years approximately 50–120 human cases have been reported annually. Outbreaks have been associated with vacuum-packaged fish, with cheese made of unpasteurised milk, cold cuts, frozen corn and with convenience meals.

DISEASE

Animals

L. monocytogenes can infect a wide range of animal species, both domestic and wild. The clinical picture of the infection in animals varies from an asymptomatic infection to severe. Especially in sheep and goats, listeriosis manifests as an encephalitis, abortion, mastitis or septicaemia.

Humans

Listeriosis can be manifested either as a milder non-invasive form or as a severe invasive disease. The non-invasive form is generally presented as a febrile gastroenteritis. The severe form most often occurs in immunocompromised persons, newborns, pregnant women and the elderly. Symptoms of invasive listeriosis are septicaemia, meningitis and meningoencephalitis. For those with severe infection, the

case fatality rate is high (20–40%). The infection can lead to miscarriage, premature delivery or neonatal death.

LEGISLATION

Animals

Listeriosis is a notifiable disease in animals according to SJVFS 2013:23.

Food

Food safety criteria for *L. monocytogenes* are specified in the Commission Regulation (EC) No 2073/2005 on microbiological criteria for foodstuffs. Food business operators shall ensure that foodstuffs are in compliance with the regulation. Different criteria apply to ready-to-eat (RTE) foods in which growth of *L. monocytogenes* can occur and in RTE foods in which growth of *L. monocytogenes* will not occur during their shelf-life (see criteria 1.1 - 1.3 in Annex I to the regulation).

Humans

The invasive form of listeriosis has been a notifiable disease in Sweden since 1960. It is notifiable according to the Communicable Disease Act (SFS 2004:168 with the amendments of SFS 2014:1549).

SURVEILLANCE

Animals

Surveillance in animals is passive. Suspicions on listeriosis can be raised on clinical signs and/or laboratory analyses. The diagnosis is based on histological findings at post-mortem or by detection of the organism by cultivation methods using enrichment in selective broth followed by culture on selective and non-selective agar or by direct plating. Identification is made by mass spectrometry (MALDI-TOF). The Swedish Board of Agriculture can decide on epidemiological investigations if needed.

Food

No official control programme exists for *L. monocytogenes*. National and local authorities may perform sampling as part of extended official controls or targeted projects. Producers of ready-to-eat foods are obliged to take samples for analysis of *L. monocytogenes* as part of their self-controls, but the results are not normally reported to the authorities.

Humans

Notification of human cases is mandatory and surveillance is based on identification of the disease by treating physician and/or by laboratory diagnosis; both are obliged to report to the regional and national level to enable further analyses and adequate intervention measures. Isolates from human cases are sent to the Public Health Agency of Sweden for typing using whole genome sequencing (WGS) to determine molecular serotype and for cluster detection. As a conventional nomenclature tool, not only the serotype but also the Multi Locus Sequence Typing (MLST) type, i.e. ST-type, is defined by WGS.

RESULTS

Animals

In 2020, listeriosis was reported in 12 sheep, ten cattle, four horses, three goats, and in one cat.

Food

In 2020, 245 samples from different types of food taken by national and local authorities were analysed for presence

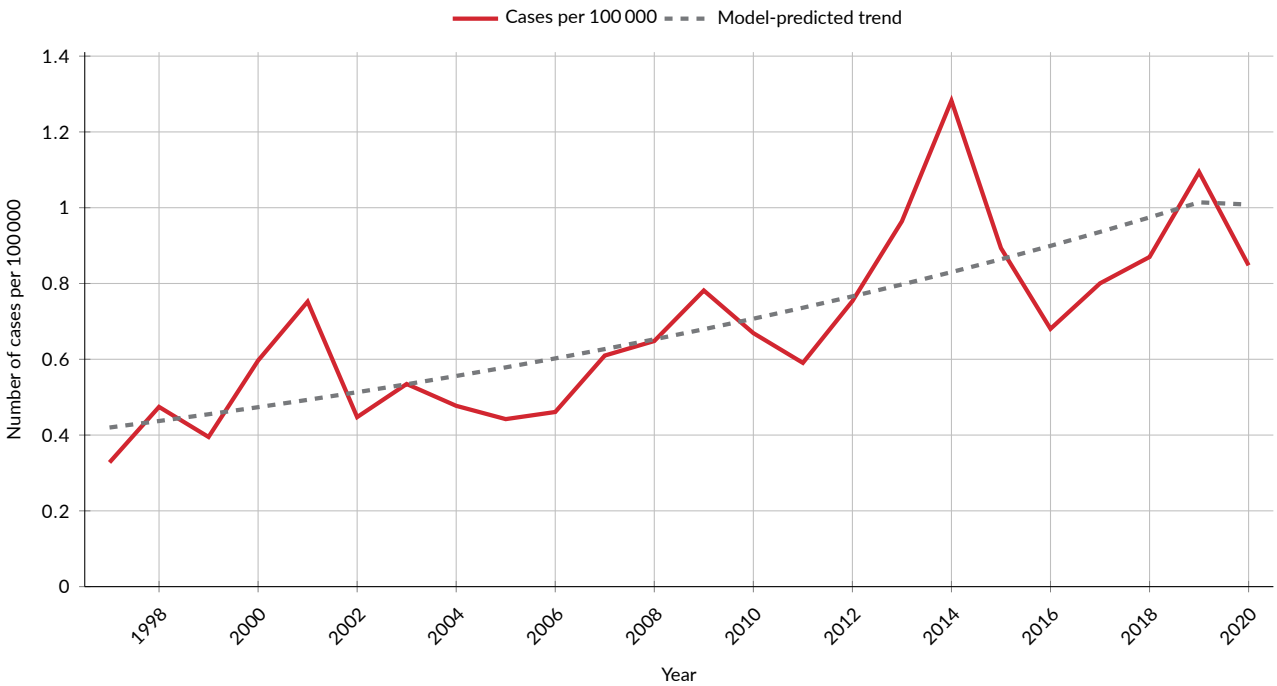

Figure 11: Notified incidence per 100 000 inhabitants of human cases of listeriosis in Sweden 1997–2020 and a model-predicted trend (negative binomial regression). The higher incidence in 2013–2014 is due to two larger outbreaks with in total 49 and 28 cases, respectively.

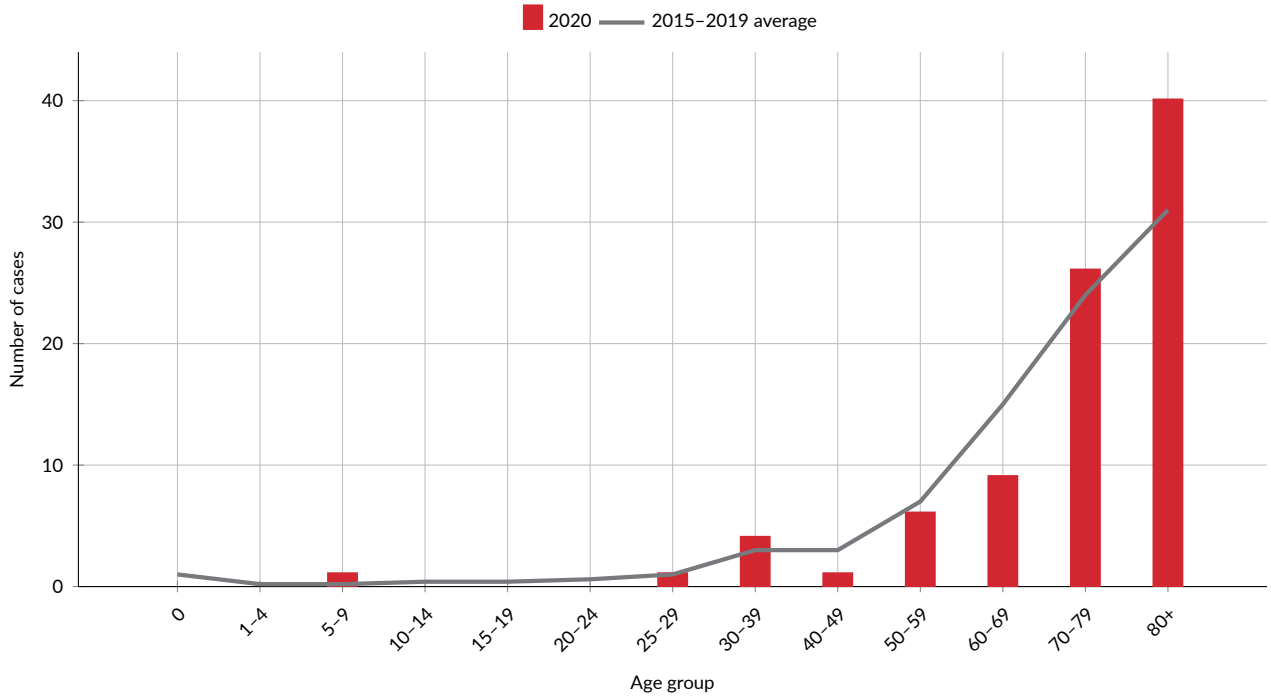

Figure 12: Number of notified human cases of listeriosis per age group in 2020 and annual average for 2015–2019.

of *L. monocytogenes* in qualitative analysis (presence or no presence). *L. monocytogenes* was detected in eight samples (Table 12). In addition, 14 samples were analysed in quantitative analysis (number of colony forming units per gram). The levels of *L. monocytogenes* in these samples were <10 cfu/g, except for two samples (a ready meal and a cheese) in which the levels were 260 cfu/g and >1000 cfu/g, respectively. Sequence types from most isolates from samples taken by competent authorities were identified by WGS. In addition, isolates from 14 samples taken by food business operators were sent to the Swedish Food Agency for typing on a voluntary basis.

Humans

During 2020 the incidence of listeriosis decreased slightly compared to 2019 but the overall picture shows an increasing trend of cases of listeriosis in Sweden (Figure 11). In total, 88 cases were reported compared to 113 cases in 2019 (incidence 0.8 cases per 100 000 inhabitants) (Figure 11). The majority of the cases reported with listeriosis belong to the older age groups. The median age was 79 years and as in previous years, most cases were reported in the age group over 80 years (Figure 12). Forty-eight cases were males and 40 were females. In total, 23 cases (26 percent of reported cases) died within one month from diagnosis. Listeriosis is most often a domestic infection and for 96 percent of the reported cases in 2020 Sweden was noted as the country of infection. In 2020 all but one (99 percent) of the human isolates were sent to the Public Health Agency of Sweden for typing. The most common molecular serotypes were as in previous years IIa (n=69) and IVb (n=16) while only one case each of IIb and IIc was reported. In addition to serotypes, sequence types (ST) are also identified by WGS. During 2020 the most common STs were ST8 and ST1. Two cases with ST1 had the same outbreak strain which caused an outbreak in 2018 linked to ready-to-eat meals. A more in-depth cluster analysis showed that the proportion of the isolates belonging to a cluster decreased compared to the years before (36 percent compared to an average of 52 percent in 2017–2019). In total, 14 different clusters were identified of which 13 contained identical or closely related isolates identified already before 2020.

Investigations of outbreaks and single cases of listeriosis

Two investigations involving a national cross-sectoral approach were conducted in 2020. The two persistent clusters of *L. monocytogenes* (ST155 and ST14) with in total 12 isolates during 2020, included isolates identified during a time period of up to ten years. This indicates that such strains may be established in production facilities and occasionally contaminate food products causing illness in patients during long time periods (Figure 13).

The cluster of ST14 includes 19 cases with identical or nearly identical isolates identified since 2014 of which eight cases were identified in 2020. The majority of cases (84 percent) are from two counties in the northern parts of Sweden which indicates that the source of transmission is a locally produced food product. Due to epidemiological information and earlier notification of positive sampling results from the producers, the Swedish Food Agency performed additional control and sampling measures at several producers in one of the northern regions. The outbreak strain could not be found in any sample. Additional communication efforts to the regional authorities have also been performed.

The cluster of ST155 includes 26 cases with identical or nearly identical isolates identified since 2011 of which four cases were identified in 2020. The outbreak strain was

Table 12: Results of analyses in 2020 for presence of *L. monocytogenes* in food samples taken by authorities.

Reason for sampling	No. of samples	No. of positive samples	Food in which *L. monocytogenes* was detected
Survey	7	0	-
Routine control	148	2	Ready meal
Suspected food poisoning or complaint	31	4	2 Cheese 2 Meat from pig (ham)
Other or not reported	59	2	2 Cheese
Total	**245**	**8**	

found in blue cheese and ham sampled from refrigerators of two cases in 2020, but the source of the outbreak is still unknown. The whole genome sequence of the outbreak strain was shared with other European countries within the ECDC network. No close match could be identified, which indicates that the source of transmission is a Swedish food product.

In addition, a rare strain of *L. monocytogenes* in Sweden, ST91, caused one case of listeriosis linked to a locally produced cheese. A sample of washed rind cheese was collected from the refrigerator of the case and found positive for the outbreak strain in microbiological analysis. The cheese was made from pasteurised milk, but analysis of environmental samples from the dairy showed that premises and equipment were contaminated by the outbreak strain.

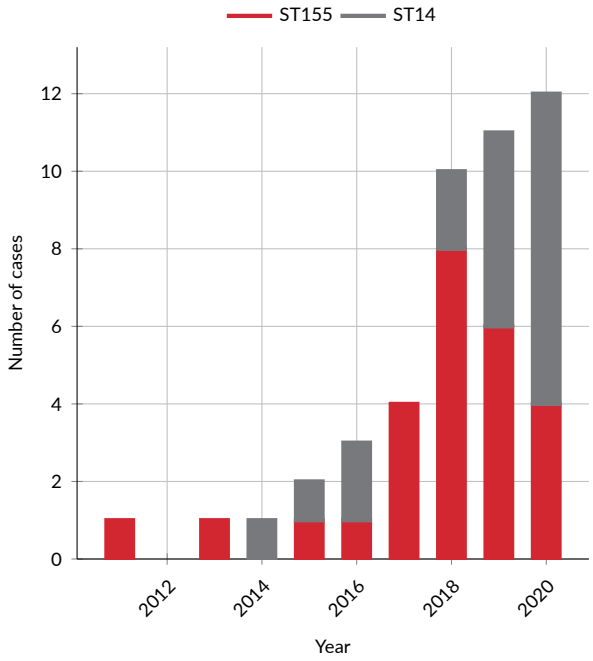

Figure 13: Number of human cases of listeriosis with isolates belonging to two persistent clusters of *L. monocytogenes* (serotype IIa) of sequence type (ST) 155 and 14 during 2011–2020.

DISCUSSION

During 2020 the incidence of listeriosis decreased compared to the year before but the overall picture shows an increasing trend of listeriosis. (Figure 11). The same trend has been observed in other European countries. The reasons for the increase remain unclear but are most likely related to the increased population size of the elderly and an increased proportion of susceptible persons within different age groups, possibly in combination with other factors such as preference changes to more ready-to-eat foods. The ECDC collaborates with the member states to strengthen the molecular surveillance and thereby facilitate detection of cross-border clusters and outbreaks of *L. monocytogenes*. This collaboration includes the EFSA and is essential for investigation of foodborne cross-border outbreaks in Europe.

In 2020 as in previous years, typing using WGS indicated that many of the linked cases were geographically dispersed and that the sources of infection had persisted for many years. Continued surveillance of *L. monocytogenes* in humans and in food and food processing environments is essential for understanding the sources for human infection and providing tools for prevention. For identification of possible links between human cases and food products, subtyping of isolates is essential.

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